PRODUCTION AND MARKETING MANAGEMENT OF MARINE FISHERIES IN TAMILNADU

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CHAPTER I

INTRODUCTION

INTRODUCTION

Marine fisheries form an important sector of the Indian economy. Fish as a food item is relished by more than 60 per cent of the people of India. Both as a food item for internal consumption and as a commodity that can earn foreign exchange the importance of fish is great indeed. Further, marine fishery is a powerful income and employment generator for the large mass of backward and economically weaker sections of rural community as it stimulates the growth of a number of subsidiary industries. With rising pressure on food producing land resources due to population explosion, an increasing share of future food supply needs, especially of developing countries like India , may have to be met from fisheries.

The Indian Ocean including Antarctica has an area of about 75 million square kms which is roughly one fifth of the total area of the world oceans(Nair and Pillai, 1983). But the fish production from this ocean is only about 4 million tonnes i.e. about one twentieth of the world annual catch. Among the countries bordering the Indian Ocean, India is the largest and it contributes to about 45 per cent of the fish production from the region. There are about 2 million sq.kms of marine water spread under the control of India as against its land area of about 3.2 million sq.kms.

Fisheries resources have certain special features which have implications for development and management. The marine fishery has to be considered differently from agriculture or mining industry, in relation to resources and their utilization

(Chidambaram, 1983 and Subba Rao, 1985). Agriculture deals with many varieties of crops of different nature to be handled in a known area, where the progress of growing crops can be watched regularly and continuously and adequate precautionary measures can be taken, on the standing crops if required. In the case of mineral resources, the production (mining), after the estimation will be a question of tapping the known and fixed resources. But fish is wet and highly perishable. It is a common property resource and the methods of estimation, capture and availability of different varieties of fish is of a different nature as the resources are mostly moving, invisible although renewable. The raw materials, viz., the living resources like fish, shell fish, shrimps etc., though caught in different waters have to be brought to the few selected centres, either on the coast (fishing harbours) or on the seas (factory ships) for handling and utilizing them in different ways.

As a human food, fish is considered exceptionally valuable from the nutritional point of view primarily because it contains a high percentage of readily digestible animal proteins. Since proteins cannot be stored in body, like fats and carbohydrates, food containing protein has to be taken daily. But the biggest problem in our country is the explosion of population and deficiency of protein and both of which incidentally go hand in hand. The problem of protein deficiency becomes more serious in proportion to the increase in population. Malnutrition is a serious problem for which the development of unexploited and underexploited marine fisheries resources offers a promising solution.

Surrounded by sea on three sides of the mainland, India has a vast potential in terms of living and non-living marine resources. The length of the Indian coastline is about 7100 Kms and the exploitable resource potential in this area is estimated around 4.57 million tonnes(George et.al. 1977 and James 1988). From a modest marine fish landings of about 0.6 million tonnes in the early fifties, the contribution of marine fishery sector in India rose to 0.78 million tonnes in the sixties, to 1.12 million tonnes in the seventies and to 1.7 million tonnes in the late eighties. At present about 2.5 million people depend on marine fishing and related activities for their livelihood.

The foreign exchange earnings of fishery sector have increased from Rs.4.6 crores in 1960-61 to Rs. 839.37 crores during 1990-91. The marine products of India has attracted many new customers in foreign markets and brought about a new era of hope and optimism to the fishing community. The intense activities of fishermen on the arrival of boats in a harbour is depicted in Plate I. The fisherfolk got better prices for their catches and gained respect and recognition in society as primary producers of raw materials for marine export industry. India is now aiming at an export target for marine products worth Rs. 2000 crores by the turn of the century. This is an incredible growth, but the very fabric of the industry has undergone a rapid transformation over the last three decades which can contribute substantially to the economic development of our country.

Although the level of exploitation of the fishery resources in our country, in general, is far below the optimum level there is much concentration in certain areas and in respect of

certain varieties, which is a reflection of the lack of proper fishery management policies and their implementation. The ultimate aim of marine fishery management is to make full use of the available fish resources without endangering their renewability. But, as nature would have it, the quantum of resources amenable for exploitation, which is called as the 'maximum sustainable yield', appears to be more or less fixed. The primary task of management is to determine the effort needed to exploit the permissible level of resource.

In the matter of exploitation of resources there is an implicit conflict of interests between the different production sectors and within each sector between the end users. For example, in agriculture, there is a conflict between different crops for the available land. In the fishery sector also the conflict manifests itself between the inland and marine sector; within the marine sector between the modern sector and the traditional sector; and within the traditional sector between the motorised and non-motorised sectors. In the market, there is conflict between the potential demand and the potential supply as determined by the 'maximum sustainable yield'. The function of fishery management is to resolve this conflict and ensure maximum social gain in terms of production, marketing for consumption and employment.

Production and marketing problems of marine fisheries are interdependent and an integrated approach, at the regional level, is quite essential for suggesting management strategies. The sustenance of different harvesting techniques of capture fisheries depends upon its profitability which in turn depends

upon the market demand and unit price of the produce. Vladimir-Baum (1973) rightly indicated that the sectoral approaches which have so long dominated both national and international dealings with the sea do not meet the requirements of the present or of the future. Khorshid and Morgan (1990) state that the experience gained from fisheries development programmes in many regions, has led to the now widespread understanding that fisheries development depends initially on detailed estimation of the fish resources and the way they respond to changes in fishing methods. The broader function of fisheries development also requires data on marketing and infrastructural aspects to analyse the multi-input multi-objective problems of ocean fisheries (David Cushing 1975 and Vito Blomo *et.al.* 1978).

In our country not much research work has been done in the field of Fisheries Economics (Selvaraj *et.al.*, 1988). Most of the contributions have come up only recently and are on different areas of specific problems relating to economics of different fishing methods, impact of mechanisation, marketing problems etc. Some micro-level studies on the costs and earnings of different craft-gear combinations indicate that the introduction of mechanised fishing boats like trawlers, gillnetters and purse-seiners along our coast has had positive economic impact. However, later investigations were skeptical about this and point out various conservation problems and negative effects of mechanisation. Further, the costs and earnings of the same type of craft-gear combination differ considerably between regions. With regard to marine fish marketing, a few studies conducted at the national and regional levels (Anon 1984, Saxena 1983, Rao

1983 and Panikker *et.al.* 1990) failed to integrate the production sector in order to give meaningful suggestions for coordinated and overall management. Hence the present investigation to study the production amd marketing aspects together is a pioneering attempt in the marine fisheries sector in India.

Tamilnadu ranks third among states in India in the contribution of marine fish landings. There are about one lakh fishermen households residing along the 1000 Km coastal belt of Tamilnadu. Among the total fishermen population of about 5 lakhs, 1.1 lakhs are depending on active fishing. There are about 2500 mechanised boats, 2800 motorized crafts and about 36500 country crafts operating along the Tamilnadu coast.

Objectives

In view of the importance of marine fishery in the economy of Tamilnadu, the present study is carried out setting forth the following objectives.

(i) To examine the recent developments in fishing techniques, production trend and variation in the composition of marine fish catch over the years.

(ii) To evaluate the costs and earnings of the different craft-gear combinations in marine fishing operations.

(iii) To study the marine fish marketing problems to determine price spread of different varieties and to assess the share of fishermen and middlemen in consumer's rupee

(iv) To suggest management measures to enhance the level of production and to increase the

profitability of different types of fishing units and to improve marketing efficiency of marine fishery resources and

(v) To make a brief evaluation of government policy and recommend changes.

Hypotheses

In spite of the enormous scope and potential of marine fisheries, majority of fishermen who depend on this industry, still live under the low income trap due to various production and marketing problems. The present study attempts to identify the major problems and prospects in the marine fisheries industry of Tamilnadu. The practical utility of this investigation is that it will be highly helpful to evolve appropriate production and marketing management strategies in future to increase the productivity of capture fisheries and efficiency of marketing system in Tamilnadu. The present study attempts to test the following hypotheses.

1) Indigenous low-cost fishing units cannot survive in the long run and all out mechanisation is the only remedy for optimizing the marine fish production.
2) Motorization of country craft helped the fishermen to improve their living condition.
3) The shrimp catch per unit effort of trawlers is continuously declining due to overfishing, consequently its sustenance is being threatened.
4) In marine fishery, fishermen use factors of production in a rational way and
5) Lesser the number of intermediaries in the fish

marketing chain higher is the share to fishermen in the consumer's rupee.

Limitations

The study pertains to the year 1989-90 and values of input and output are subject to change. The returns in terms of total catch and species-composition of the catch, price of different varieties of fish often show wide fluctuations. This is the major limitation of any study on costs and earnings or marketing in marine fishery.

Innumerable types of fishing techniques are adopted by fishermen all along the coast. There is lot of regional differences. It is very difficult to cover all the centres or all types of fishing methods in the entire coast. However maximum care has been taken to include all important types of craft-gear combinations at representative centres to arrive at general conclusions.

Layout of the study

Chapter II consists of the review of relevant literature and its applications to the present study.

Chapter III deals with the materials and methods. It gives an account of the sources of data collected, sampling design of primary data collection and the tools applied for analysis.

Chapter IV consists of general profile, fishery resources and production trend in Tamilnadu.

Chapter V discusses the various technological options for fishing available to the fishermen and their capital requirements. The technical details about the craft and gears are also briefly indicated.

Chapter VI encompasses the costs and earnings of different types of fishing units operating along Tamilnadu coast.

Chapter VII analyses the input-output relationship for some of the selected craft-gear combinations using the Cobb-Douglas production function model. To bring out the comparative economic efficiency of different craft-gear combinations, a set of key economic indicators have been listed for all types of fishing units operating at different centres.

Chapter VIII deals with the fish marketing, price structure and profit margins. Further the inter-relationship of landing, wholesale and retail prices have been discussed in detail for all commercially important fishes.

Chapter IX contains the summary of findings, conclusion and policy implications.

CHAPTER II

REVIEW OF LITERATURE

REVIEW OF LITERATURE

The oceans are considered as an unfailing source of food, minerals and energy. The exploitation of marine resources in the form of fish, oil, sand and gravel, desalinated water, aquaculture, phosphorite and manganese nodules and placer minerals is already possible with the available technology. India is lagging behind in the sphere of exploitation of ocean resources because a national policy is still to take concrete shape and the technological build up is not yet systematically designed and properly supported (Kohli, 1978). Fisheries resources are living and self-renewing in nature. Marine fishery is concerned with rational exploitation of aquatic production (Subba Rao 1986).

Most countries in the world depend on fisheries as a source of protein rich food supply. Studying the scope of protein availability from the sea, Menon (1970) concluded that the sea and sea alone is the ultimate answer to the problem of protein deficiency, if it has to be tackled from the natural sources. Qasim (1972) indicates that if the ocean harvest is to be realized fairly rapidly to meet the increasing demand for protein food, some radical changes are necessary in developing a complex technology by which the cost of marine protein to the consumer is substantially reduced.

Saxena (1983) stressed the need for more widespread use of economic tool in formulating Indian fishery policies. He observed that there were very few studies on the economics of

different types of fishing methods and economic status of fishermen. The paucity of such studies has resulted in ineffective fishery policies in the country. He further indicated the lack of systematic collection of economics-oriented fishery statistics regarding investments, returns, marketing costs and margins of different intermediaries in marine fisheries sector.

The size of investment in marine fisheries has been so modest that it can be said to be insignificant as compared to other sectors (Kalawar 1985 and Chua Thia-Eng 1986). In all the Five year and Annnual plans the share of the fishery sector never exceeded 0.50 per cent on an average. The capital investment in fishing industry trailed behind all the other sectors of Indian economy particularly when compared with agricultural investment (Rao & Rao 1989). The extent of Exclusive Economic Zone (EEZ) available for fishing exploitation is equal to two thirds of the land area of the country. Reviewing the present status and role of small-scale fisheries of India, Bapat and Kurian (1981) pointed out that land is definitely going to be a limiting factor in increasing food production. Abdul Hakim (1979) studying the export-oriented growth of fisheries in India concluded that any amount spend on fisheries development is justifiable as it touches some of the basic national goals. Therefore, investment on development of marine fisheries in India should be stepped up substantially after evolving an appropriate marine fisheries management policy.

The need for fishery management assumed importance in recent years on account of the uncontrolled or rather reckless

exploitation of resources in many countries leading to depletion of stock (Mac Lenman 1981 and Courtland 1990). Although according to available information, the level of exploitation of the fishery resources in India in general, is far below the optimum, there seems to be too much concentration in certain areas and in respect to certain species which perhaps is a reflection of the lack of fishery management policies or their implementation (Govindan 1983 and Choudhury 1986). The prevailing situation in the fisheries sector in many countries of the world can be briefly stated as (i) insufficient information of fish resources, (2) diminishing stock and (3) conflicting uses of coastal areas and types of fishing.

Global fisheries and diminishing returns

The extension of fishery jurisdiction by most of the coastal states was the dominant event in global fisheries during the seventies. These extensions changed the open access regime to an extended jurisdiction of fisheries management. World fisheries have changed drastically since the 1960, when annual landings and fishing industries were growing rapidly. Now, growth appears to be virtually stagnant, despite dramatic changes in coastal state jurisdiction (FAO 1981). Under the open access regime, the coastal states had little management control over the stocks of fish. Fishing was accompanied by considerable economic waste, many stocks were overfished or depleted to historically low levels of abundance, fishing in the distant waters of coastal states diverted economic benefits away from those states, and hence the capability and effectiveness of fishery management organisations became a matter of global concern.

In 1970 the annual increases in the global fish catches that had been obtained in earlier years had diminished considerably. Brain (1983) points out that the stabilization of the global catch required the notion, that those stocks that comprised the catch had to be utilized with greater efficiency than they had in the past. The efficiency could only be increased through improved management of the extended jurisdiction region. However the anticipated benefits could not fully be realized. To be sure, distant water fishermen were driven from their traditional grounds off the coastal states or charged fees for the right to fish in the extended jurisdiction zones, but other than this, wherever active management was attempted, it did not appear to work well; many of the old problems of management under the open access region remained and new ones were developed. He further indicates that in the absence of hard data on the economic performance of management, people haggled over boundaries, over objectives, over quotas, over the right to fish, over what optimum yield meant, over data and even over whether fishery management was a worthwhile enterprise. Further, the applicability of standard management procedures, particularly to multiple-species fisheries was challenged, and it became apparent to many that traditional approaches to enforcement of regulations was not cost-effective (Barber and Taylor 1990).

It was usually assumed that catching more fish was all that was needed, and ~~and~~ if a defined objective was needed, then maximum sustainable yield (MSY) was good enough. More recently the weaknesses of MSY has been pointed out, at first mainly by

economists, who stressed the importance of looking at the net economic yield and the question of costs (Scott 1955), and later biologists became concerned with broad interests of conservation (Holt and Tabbot, 1978).

First beginning with Gordon (1954) and Scott (1955) economists have identified the over exploitation of marine fisheries as an unregulated common property problem. Then the thrust has been on "optimal" management models for the ocean fisheries in which socially optimal or efficient policies for resource exploitation are derived (Carlander 1969). Achieving rational management in the ocean fishery had become more diffcult with the mounting competition among fishermen for this valuable yet limited marine resources.

Exclusive Economic Zone (EEZ) and management

It is common knowledge by now that most coastal states assert and exercise jurisdiction over fisheries within a 200-mile exclusive zone.

For centuries the basic claim by nations to exercise authority over marine fisheries insisted that access to them must be open to all beyond a narrow belt of national territory in the Ocean. Further many coastal states over the years insisted through unilateral legislation that the coastal state could lawfully extend some degree of control over living resources beyond national territory. However the first (1958) and second (1960) United Nations conference on the Law of the Sea (UNCLOS) were unable to agree on an extension of the territorial sea or an exclusive fishery zone in the water column (Anderson 1977). But

these conferences left no doubt that a 3 mile territorial sea had little international support while a wider area of exclusive coastal control and preferential rights over fisheries met with widespread approval.

During the period following the 1958 conference until the beginning of the third UNCLOS conference in 1974, many countries extended their jurisdiction beyond the traditional 3 miles. The third UNCLOS held at Caracas estabilished broad and exclusive coastal state authority over fisheries within a zone of 200 nautical miles measured from the base line for the territorial Sea. The quality of "exclusiveness" in relation to authority over resources of the economic zone including fisheries is emphasised. The coastal states right in the zone are declared to be "sovereign" for certain specific purposes, namely exploring and exploiting, conserving and managing the natural resources, whether living or non living, of the sea bed and subsoil and the superjacent waters (William 1983).

George *et.al.* (1977) observed that all the 200-mile Exclusive Economic Zone would constitute about 40 percent of the world oceans and that of 90 percent of the traditional fishing grounds and 70-80 percent of the global catch.

With the declaration of Indian Economic Zone, India had assumed not only exclusive jurisdiction but also a great responsibility for the optimum exploitation of living and non-living resources in about 2 million Sq. Km area. The 41st amendment to the constitution enacting "The Territorial Waters", Continental shelf, Exclusive Economic Zone and other Maritime Zones Act. 1976" came into force on the 25th August, 1976. The

Act defines the various Zones and the rights and jurisdiction in respect of these zones. The limit of the "Territorial Water" extends to a distance of 12 nautical miles from the appropriate base line. The sovereignity of India extends to these waters with the right of innocent passage for all foreign ships but only with the Government's permission for foreign warships.

As per the classification the area beyond and adjacent to the territorial waters and extending to a distance of 24 nautical miles from the appropriate base line shall form the "contiguous Zone". The Government of India had full jurisdiction in this area to take measures with regard to the security of the country in immigration, sanitation, customs and other fiscal matters.

The "continental shelf" extends to the outer edge of the continental margin or to a distance of 200 nautical miles from the appropriate base line. In this area, India had sovereign rights for exploration, exploitation, conservation and management of all resources. The Exclusive Economic Zone is an area beyond and adjacent to the territorial waters with a limit of 200 nautical miles from the base line. In addition to the rights mentioned for continental shelf, India will have sovereign rights for producing energy from tides, winds and currents and such other rights as recognized by international law.

The maritime boundaries between India and other countries adjacent to it shall be determined by mutual agreement. Pending such an agreement, the maritime boundary between India and such countries shall not exceed beyond the line which is equi-distant from either coast line. The area under exclusive economic zone works out at 2.02 million Sq.kms. comprising of 0.86 million

Sq.km. of the west coast, 0.56 million Sq.km. off the east coast and 0.60 million Sq.km. around the Andaman and Nicobar Islands (George *et.al.*1977). The Indian EEZ would thus represent about 2.8 per cent of the surface area of the Indian ocean (excluding Antartic).

Multiple stock effort distribution

In a free access fishery consisting of a number of separable grounds, stocks or stock complexes, those yielding higher rents tend to draw effort, disproportionately, at the expense of those yielding lower rents (Anderson 1977 and Andrew 1990). This results in a non optimal distribution of effort from the stand point of rent maximization. Of course, in free access fisheries effort tends to expand until eventually resource rent is dissipated in respect of all stocks. However, it is also noteworthy that during the process of expansion in a new fishery- before all rent is dissipated - there is misallocation of effort towards the stocks yielding the higher rents per unit of effort. The prawn fishery of some of the centres in Indian coast illustrate this phenomenon well. The rich prawn stocks are heavily fished during the high season when the prawns are spawning. But relatively little interest has been shown in the less rich mixed stock of the top end (George 1969, Kuthalingam *et.al.* 1978, James 1981 and Muthu 1988). They have been inadequately explored and only lightly fished. The reason given by the fishermen is simple; as long as there are dense stocks in these centres they have little interest in the sparser stocks of the top end. The result now is that the prawn fishery has expanded to the point of open entry equilibrium, dissipating the

rent that the rich prawn stock could yield. Meanwhile the stocks of the top end have remained largely unexploited.

It may also be speculated that the best returns will be earned only if the fishery is conducted at a high enough level of effort to utilize available scale economies (e.g. in prawn searching, vessel servicing and processing). Fishing units are attracted to the higher rent stocks (prawns) as long as average returns (catch per unit of effort - cpue) from those stocks are greater than from less rich stocks (Gordon 1954). Yet, to the fishery as a whole, marginal returns per unit of effort on the richer stocks may have fallen to zero or have turned negative, while marginal returns from less rich stocks remain positive.

In analytical terms, each boat operator chooses to join the trawl fishery because average returns (cpue) are higher than in the other techniques of fishing. But considering the fishery as a whole, marginal returns in prawn fishery are lower than what they would be in other fisheries, so that aggregate returns for the units do not achieve their potential maximum.

Policy prescription in open access fishery

Reviewing in chronological order to quote Crutchfield and Zellner (1962) "if we may assume that market prices for goods reflect with reasonable accuracy the preferences of consumers, the basic economic objective from the standpoint of society is to see the fisheries maximize net economic yield - the difference between the aggregate money value of output and the aggregate money cost of input needed to produce it.

The overall goal is elaborated upon by noting five important

areas where the fishing industry should, according to Bromley and Bishop (1977) be judged like any private enterprise; (i) output and factor allocation (2) efficiency (in the narrower sense of cost minimization) (3) progressiveness in technology (4) Income distribution and (5) stability. The criterion concerning income distribution (Crutchfield and Zellner 1962) is particularly relevent. "Returns from fishing should be distributed among participants on a basis that approximates their contribution to production. This requirement implies that income to labour and capital should be equal to those they could earn in other occupations. A level of fishing effort based on exploitation of the inability of fishermen or vessel owners to move freely to other activities would not necessarily be optimal even if other requirements are met."

They propose a system of progressive reductions in the number of licenses through competitive bidding. A tax on fish is also suggested. This system, they suggest, would achieve several desirable results including economic efficiency, improved technology , keeping the most skilled fishermen in the fleet, and placing the burden of risk for price and cost changes in the governments involved.

The study by Christy and Scott (1965), though it focuses on the world ocean fisheries rather than a specific fishery, is much more practical and policy oriented than theoretical". The goal of economic efficiency can be approached by preventing excessive entry into the industry, so that those who fish would be producing the maxmimum economic revenue (to be shared among them, or appropriated by the public) and so that those who are

prevented from participating will be able to produce other goods and services valued by the community".

Bell (1972) has studied the U.S. northern lobster fishery. In discussing the objectives of fishery regulation, he notes "The optimum management strategy for any fishery is to permit effort to expand to the point where the marginal cost of the resources (capital and labour) needed to produce a pound of fish is equal to the price consumers are willing to pay for that last pound of fish ".

Gates and Norton (1974) also pointed out the limitations of entry to the level of effort which produces maximum economic efficiency. The maximum economic efficiency is defined as that position where price equals marginal cost. They also estimate that the difference in fish products available to consumers would not be very much less under limited entry than under open access.

To the extent that economists can agree that a more equal distribution is to be preferred, this would raise serious questions about much of the literature in Applied Fisheries Economics. Consider, for example, the emphasis one often finds on limiting entry to minimum number of the most efficient units. If the Crutchfield - Zellner definition of efficiency is used, it is quite possible that those units which are permitted to fish will also be those with the greatest capacity to earn income outside of fishing while those excluded would have fewer income earning possibilities outside fishing. Even where the opportunity cost concept is used as the basis of analysis, potential future fishermen excluded under entry limitation may be highly immobile compared with those who achieve entry.

Hence limitation of entry on the basis of efficiency might well encourage greater inequality. Production function and cost functions are directly influenced by other decision making units. For the design of practical fisheries management policies, the language of the Marine Fisheries Conservation Act of 1975 (the extended jurisdiction legislation) is relevant (Anderson, 1977). To quote section 304, "Any fishery management plan prepared by any council may

1. Designate zones where and designate periods when, fishing shall be limited, or shall not be permitted or shall be permitted only by specified vessels or with specified gear.

2. Establish a system under which access to the fishery shall be limited in order to achieve optimum sustainable yield on a basis which may recognize, among other considerations, present participation in the fishery or fisheries, historical fishing practices and dependence on the fishery, value of existing investments in vessels and gear, capability of existing vessels to engage in other fisheries, history of compliance with fisheries regulations imposed pursuant to this act and the cultural and social frame work in which the fishery is conducted".

After providing a brief discussion of the concept of maximum sustainable yield (MSY) as a management objective, the House Report turns to a discussion of the optimum sustainable yield (OSY). Again to quote. "Once the MSY of the fisheries or stock has been determined..... the developer of a management plan can begin to think in terms of the OSY. Thus while biologists in the past have tended to regard any unused surplus of a fishery as

waste, the resource manager may well determine that a surplus harvest below MSY will ultimately enhance not only the specific stock under management, but also the entire biomass.....The concept of OSY is, however, broader than the consideration of the fish stocks and takes into account the economic well-being of the commercial fishermen, the interests of the recreational fishermen, and the welfare of the nation and its consumers. The optimum sustainable yield of any given fishery or region will be carefully defined in order to respond to the unique problems of that fishery or region. "

An overview of small-scale fisheries in India

Swaminathan (1981) pointed out four major points of distinction between small-scale and large-scale fisheries. First is that the human being play a much more important role in small scale fisheries than in large scale fisheries. Second is capital input, where small-scale fisheries are labour-intensive and large-scale fisheries are capital-intensive. The third distinction is an ecological one associated with environmental pollution and related repurcussions in large scale industries. The fourth is in the kind of energy used. The small-scale industries use the recycling or renewable type of energy. In large scale industries more and more energy of non-renewable type is used. According to the Expert consultation committee on small-scale Fisheries Development of F.A.O. (1980), "small-scale fisheries refer to that sector of fisheries which is labour intensive and is conducted by artisans whose level of income, mechanical sophistication, quantity of production, fishing range political influence, market outlets, employment and social

security and financial dependence keep the fishermen sub-servient to the economic decisions and operating constraints placed upon them by those who buy their production".

Saxena (1983) indicates that the two terms of small-scale and large-scale fisheries are highly relative and are determined by technological, economic and social parameters. For simplicity and statistical purposes small/traditional/artisanal fishermen in India may be defined as those fishermen who are owning and or operating non-mechanised boats while those who own and or operate mechanised boats may be categorised as medium fishermen.

Under marine fisheries, inshore fishing, off-shore fishing and deep-sea fishing could be specified and various authors have discussed the same (Silas *et.al.* 1976, Sudersan and Joseph 1978, and Mathai 1983). Inshore Fisheries refers fishing in inshore waters up to 10 fathoms (1 fathom = 6 ft.) depth from the coast. Fishing operations in these areas are mainly conducted by employing small fishing boats which are not mechanised. Off-shore fishing denotes fishing in the area between 10 and 40 fathoms depth, which is done mainly by mechanised fishing boats, which are made of wood and vary from 25 to 50 ft. in overall length. The boats are equiped with oil engines.

Deep-sea fishing indicates the exploitation of fishing resources beyond 40 fathoms. For this purpose the boats have to be larger in size, because they are required to undertake fishing voyages of 7 to 10 days duration. The vessels are made of steel and normally exceed 50 feet in overall length, and are equiped with engines of 200 HP and above.

Studies on resource exploitation and production economics

The primary task of management is to determine the effort needed to exploit the allowable level of resource (Lackey 1978 and Kesteven 1981). It must in fact be viewed as part of the overall policy measures needed for the most rational exploitation of the total natural resources of a country. Different estimates are available with regard to the potential resources of the Indian Ocean (Silas *et.al.* 1976, George *et.al.* 1977, James 1988, Sudarsan and Somvanshi 1988). A break-up of this estimate with respect to the south west coast, north west coast, upper east coast and lower east coast is also available. In spite of these macro level figures, no accurate estimates regarding the resources falling within the different depth zones off the different maritime states are available (Choudhury 1986). This is a major limiting factor in deciding appropriate management measures.

Several studies carried out along Indian coast indicate that at present the marine fish landings are confined mostly to inshore belt up to 50 meters in depth (Gokhale 1971, Qasim 1973, Dharmaraja *et.al.* 1987). The prawn resources are intensively fished due to its high export price in this belt (George *et.al.* 1981, Chhaya 1983, Saxena 1984, Devaraj and Smitha 1988 and Muthu 1988). The deep sea zone beyond 50 meters depth contains about 50 percent of the annual potential yield. The studies further indicate that where as increase in catches from the traditionally exploited resources like oil sardine, mackeral, bombay duck and prawns is expected to be marginal the increase possible from additional efforts to exploit varieties like small tunas, white

baits, horse mackeral, cat fish, ribbon fish and threadfin bream is likely to be considerable. Like wise, the considerable edible fish bio-mass and crustaceans from the outer shelf and slope offer good scope for exploitation. Another major potential of oceanic resources to be exploited are the larger tunas and squids. (Silas and Pillai 1982).

Discussing the growth and productivity of Indian fisheries Rao and Rao (1989) conclude that the marine fish production growth rate could not go up much partly due to lack of capital investment in deep sea fishing areas. All operations are done from the inshore area which means there is over-capitalization. New capital and technologies are required to increase the marine fish production from the EEZ. Joseph and Radhamma (1970) studied deep sea prawn resources of the South west coast of India. They concluded that the potentiality or abundance of a particular species is only one of the factors determining the economic viability. They further found that there is no significant seasonal fluctuation in the abundance of deep sea prawn.

A few studies were conducted to analyse the programme of mechanisation of small boats and efforts of Government of India in relation to deep sea fishing (Chidambaram 1983, Mathai 1983 and Kalawar 1985). They suggested alternative strategies through which India can exploit the fishery resources of EEZ. Chidambaram (1985) in his study on "Man power planning - an assessment for the next decade" pointed out that considerable work remains to be carried out on determining the untapped fisheries resources in the deeper waters, assessing the maximum

sustainable yield from the exploited fisheries and planning control and regulatory measures, methods for rational exploitation of various fisheries resources, analytical methods in respect of production economics and management, social and economic set up of the fisheries in different areas and extension.

Reviewing the fisheries development policies and the fishermen's struggle in Kerala, Kurien and Achari (1988) indicated that lack of clearly formulated policies has resulted in the enunciation of numerous and often mutually conflicting development objectives. Unfortunately deep sea fishing has always been associated with exports. It has also been assumed that only very capital intensive technologies can be utilized for this. It is important to focus more on the internal market and to use a combination of capital and labour/intensive technologies to harvest this resource.

Costs and earning studies of different craft gear combinations are very useful to know the comparative economic efficiency of different investment options. A few micro level studies were carried out about the economics of different craft-gear combinations at selected centres along Indian coast. Krishna Iyer *et.al.* (1970) studied the comparative fishing ability and economic performance of 9.15 m (30') 9.76 m (32') and 10.97 m (32') vessels operating along Kerala coast on the basis of data for four consecutive years from 1964 to 1968. They concluded that the bigger size boats are comparatively more efficient.

Joseph (1973) analysed the economics of operation of the

17.5 m on indigenous steel trawlers along the Kerala coast. He concluded that these boats are operating on profit and they can operate about 250 days per annum.

Noble and Narayanan Kutty (1978) studied the economics of indigenous fishing units (thanguvalai and ayala valai) operating at Manassery near Kochi. They indicatd that the gross income in relation to investment is very good in the indigenous fishing units and giving out proportionately higher rate of production than the mechanised units. The country crafts require comparatively less investment and it can be economically put into action even when the fish in the sea is scanty.

James (1981) studied the exploited and potential capture fishery resources in the inshore waters of India. He found that the return per unit of investment of non-powered boats has been found to be twice that of the powered boats and generate almost seven times more direct employment than the mechanised boats. He concludes that attempts for diversification of fishing in coastal waters to exploit the under-exploited and non-conventional resource should be intensified for achieving a rational exploitation of the resources of the inshore areas and for maintaining a balance between the mechanised and non-mechanised fishing.

The impact of motorization of catamarans along Thirunelveli and Kanyakumari coast has been studied by Sathiadhas (1982). The gross and net earnings of motorized units increased due to higher catches of cuttle fish. However, he has pointed out that there is not much difference in catch and revenue between motorized and non-motorized units along Thirunelveli coast where the wind blows

favourably most part of the year enabling the non-motorized units to operate equally effective.

Kurien and Rolf Wilmann (1982) made a detailed study on the costs and earnings of artisanal and mechanised fishing units in Kerala. Wide coverage has been given in the study by giving due representation for a number of indigeneous craft-gear combinations operating along Kerala coast. The study illustrates the technical variety of the Kerala fisheries especially of the artisanal sector. The results of the study suggest that the performance and potential of the artisanal fisheries may justify greater attention and support than has been accorded in the past. But the study appears to be biased towards the artisanal sector. Although the study has thrown light on the profitability of different investment options, it lacks detailed information on fish marketing systems to suggest broad management strategies for the overall development of marine fisheries in the region.

Krishna Iyer *et.al.* (1983) studied the economic efficiency of 9.82 m and 11 m fishing trawlers along Kerala coast. They concluded that the number of fishing trips per year determines the profit and loss of the trawler. With the increase in the number of fishing trips, the profit also increases for both types of trawlers.

Unnithan *et.al.*(1985) attempted an economic analysis of 22 m and 23 m deep sea trawlers under operation from the Visakhapatnam base of Andhrapradesh in the east coast. The study indicated that the deep sea fishing in Indian waters is a profitable

venture. However, the economic parameters like catch per trawling operation, cost of production, productivity per man year, energy etc. establish the superiority of 23 m vessel.

Costs and earnings of traditional fishing units along Trivandrum coast, Kerala has been studied by Sathiadhas and Panikkar (1988). The study covers catamarans with hooks and lines, catamarans with gillnets and P.B. canoe fitted with OBM. Considering the catch and revenue in different seasons for these units, monsoon period (June-August) is found to be more productive and profitable. The study indicates that the catamaran units show better input-output and capital efficiencies as compared to OBM units since the initial investment of them is comparatively less. Catamarans with hooks and lines are highly suitable as a family enterprise for the small investors who are capable to go for fishing on their own units. However in terms of higher productivity, gross and net income and employment potential the canoe fitted with OBM is more efficient.

Panikkar *et.al.* 1990, studied the comparative economic efficiency of mechanised boats operating at Cochin Fisheries harbour in Kerala. They have given a set of Key economic indicators to assess the comparative efficiency of purse seiners, gillnetters and trawlers and concluded purse seiners are more efficient than the other two types of mechanised units.

Saxena (1984) studied the management aspects of shrimp fishery with particular reference to India. According to him the Indian shrimp fishery after 1975 is experiencing negative growth rates, forcing the fishery to its declining stage which

has been substantiated by reduction in catch per unit effort. In the light of the decline of Indian shrimp fishery, three types of tools to manage the same has been suggested - first an exhaustive techno-economic survey should be undertaken to study the production, processing and marketing costs, margins, practices, channels etc. alongwith the socio-economic conditions of the local fishermen in order to provide alternative employment opportunities and financial compensation. The second type of management tools includes regulatory measures and third relate to the encouragement of shrimp culture. Swaminathan (1978) also observed in this context that one peculiar feature of the prawn fishery is that most of the penaeid prawns are subjected to exploitation in the juvenile phase.

Balan *et.al.*(1989) conducted a detailed study on the impact of motorization of country craft in Kerala. The costs, earnings and key economic indicators for motorized and non-motorized plank built boats, canoes and catamarans operating hook and lines, boatseines and gillnets were worked out. Returns to capital and labour were comparatively more for motorized units. Further extending the area of operation and adopting diversified fishing methods became feasible due to motorization. It has been observed that motorization has brought an element of dignity to the fishing profession. The study indicated that the landings of motorized craft has substantially increased during the last decade and non-motorized showed a declining trend. They further assessed the impact of motorization and other related aspects and also made suggestions for suitable management measures.

Sehara *et.al.*(1986) observed that OBM boats are more popular

in Gujarat. There is similarity in trawlnet and gillnet operation in Gujarat and Maharastra but method of dolnet operation differs in both the states. The non-peneaid prawns in Maharashtra and Bombay-duck in Gujarat are the main stay of dolnet catches. Sehara and Karbhari (1989) studied the gillnet fisheries by OBM units along North West coast of India with special reference to costs and returns. Fishermen prefer OBM units since the capital investment is lesser and the profit investment rates is higher. Based on various economic parameters the gillnet fishing by dugout canoes fitted with outboard engine was found to be profitable in north west coast. The same authors (1991) also studied the economics of trawl fishing at Porbandar in Gujarat. All the economic efficiency measures show that trawl operation at Porbandar was profitable, but it requires a minimum of about 6 years to recover the capital investment with the existing rate of net income.

Datta and Dan (1989) studied the economic efficiency of different craft-gear combinations prevailing along the Orissa coast. The estimated gross returns from trawler was considerably higher than the income from other types of fishing units. But in terms of factor productivity the non-mechanised units are more efficient.

Studying the economics of catamaran fishing along the Madras coast, Sathiadhas and Panikkar (1991) concluded that the catamaran owners can enhance their earnings by increasing the size of craft as well as number of gears. The poor economic condition coupled with scant availability of finance from the Institutional agencies force the fishermen to sustain with the

less equiped fishing equipments, which in turn results in lesser returns entangling them in a vicious circle of poverty.

Reviewing the performance of catamarans operating along Andhra coast, Sivasubramanian (1991) pointed out that most of the fishermen usually put out to sea without suitable gear or have only one kind of gear when atleast three kinds are needed. The limitations catamarans face in terms of area covered and the amount of time they can stay out at sea make it necessary for them to use atleast three types of gear to capture different species, during the various seasons of availability- within their fishing range. He went to the extent of concluding that the days of catamarans are numbered. However this observation requires further detailed investigation.

Marketing scenario of marine fish

Resource development alone cannot be sufficient for the growth of fishing unless it is coupled with infrastructure and marketing development. Discussing the marine food industry in Kanyakumari and Thirunelveli districts of Tamilnadu, Leela Nayar (1973) indicated the tremendous employment potential and it was estimated that nearly 100 man days will be required to process and distribute one tonne of the finished product. Supply and demand projections of marine fish up to 1980-81 has been made by Shambu Dayal (1973) and it was helpful for formulating policies of production and marketing during the last one and a half decades.

Studies conducted on marine fish marketing pointed out that the transportation of fish is very inefficient in India (Singh and Gupta 1983, Srivastava and Kulkarni 1985, Sathiadhas and

Panikkar 1988). Due to inadequate transportation, no fresh fish is available in potential markets located away from the landing centres, whereas surplus fish at harbours is being sent to fish meal plants. Further it has been observed that the catches of certain varieties like sardines and mackerels are landed in large quantity in fishing season which results in the glut at producing centres.

Singh and Gupta (1983) examined the prevailing marketing system for different forms of fish in domestic markets. The paper in addition analysed costs, returns and risks of various market intermediaries. Mammen (1983) analysed the existing fish marketing system with a view to suggest some alternative channels to provide better quality fish to consumers and higher returns to producers.

Panikkar and Sathiadhas (1985) studied the marketing system and price spread of some of the commercially important marine fish in Kerala state. The analysis indicated that fishermen's share of consumers rupee varied from 31 to 68 percent. The fishermen get a better share for quality fishes having high consumer preference than for cheaper varieties. They suggested a fast and efficient transportation system for the improvement of marketing of fish. The same authors made another detailed study on marine fish marketing trend in Kerala (1989) and observed marked improvements in the system. The average annual prices for almost all varieties of fish showed a continuous increase during the decade starting from 1980. Fish marketing in Kerala has been transformed into a modern stage despite the infrastructure constraints and inherent complications in the

marketing system. The fishermen's share in consumers rupee showed an increase over the years inspite of increasing marketing costs.

Sathiadhas & Panikkar (1988) made a study on market structure and price behaviour of marine fish in Tamilnadu. They concluded that fish marketing in Tamilnadu is still under the clutches of middlemen. Of the 25 varieties of fish covered under the study, the percentage of marketing margin in consumers price for 20 varieties which constitute 90 percent of landings worked out at more than 40 percent.

Abdul Hakim (1979) indicated that the Indian sea food export growth was stimulated by heavy demand from abroad. As a result, Indian products were never "marketed" but only passively "supplied". Because heavy demand and vast markets existed for Indian shrimps abroad, the importing country or agency offered higher prices than those existed within the country. The Indian exporters attracted by this price differences have been contributing their share to the various world markets. They fail to exploit the demand structure to their advantage.

Saxena (1970) analysing the price behaviour of Indian frozen shrimps in U.S. markets narrated that the price we realized for our shrimps was only one third to one half of the value on a pound basis when compared to what other countries realized for their exports. He suggested a detailed study by a team of marketing and processing experts to improve the image of Indian shrimps and other marine product exports.

Studying on the scope for diversification of marine products for exports, Ganapathy (1978) indicated that apart from prawns

there were number of other rich fishery resources available in our waters which were yet to be tapped for export purposes. The excessive dependance on shrimp and few other items alone may result in closure of factories, once the export market crashes. So there is urgent need for diversification of marine products. Analysing the exports of marine products in different forms, Rao (1983) also suggested alternative forms of fish exports which should be explored to sustain the past rate of growth in view of decline in shrimp landings. He also suggested various promotional activities to develop markets for new products.

The review of literature reveals that studies relating to economic aspects of the marine fisheries of our country were not many and most of them were conducted at selected centres and at micro level. They could not help much in deriving policy perspectives either at state or national level. The noteworthy micro level studies carried out in our country was the economics of artisanal and mechanised fisheries in Kerala by Kurian and Willman (1982) in the production sector and a fish marketing study covering all maritime of states of India by IIM, Ahmedabad. Both studies were not conducted with adequate data base. Fisheries economics has emerged as an important subject only recently in the Indian context. Hence the present study on production and marketing management of marine fisheries in Tamilnadu can be considered as a pioneering attempt, in this newly developing industry.

CHAPTER III

MATERIALS AND METHODS

MATERIALS AND METHODS

Marine fisheries industry in India has a three-tier system with the artisanal sector operating country craft with or without outboard engines, small mechanised sector consisting of small trawlers (32 to 42 footer with 60 to 110 HP engines) gill netters (28' to 36' with 45 to 65 HP inboard engines) and purse seiners (40 to 48 footers with 120 HP engines) and that of large vessels engaged in EEZ and the contiguous high seas. Large number of fishermen, who are in the lowest rungs of the socio-economic ladder of the society, are engaged in marine fishing adopting various types of fishing methods suiting to different seasons and regions. Initially the choice of fishing techniques was governed only with the motive of simply collecting some food or earning a livelihood. The open entry possibility and the increase in demand for sea food has converted the subsistance marine fishing activities into a highly competitive commercial venture.

The monetary returns received by the investors and labourers has become the guiding factor in the option of any fishing technique. The growth and development of marine fisheries is further linked with internal and external marketing of fish and infrastructure facilities connected with the main and subsidiary sectors . Hence the extensive data on production and marketing aspects with wide coverage is very essential to evolve proper policies for planning and management of this sector.

Both primary and secondary data are collected and used in

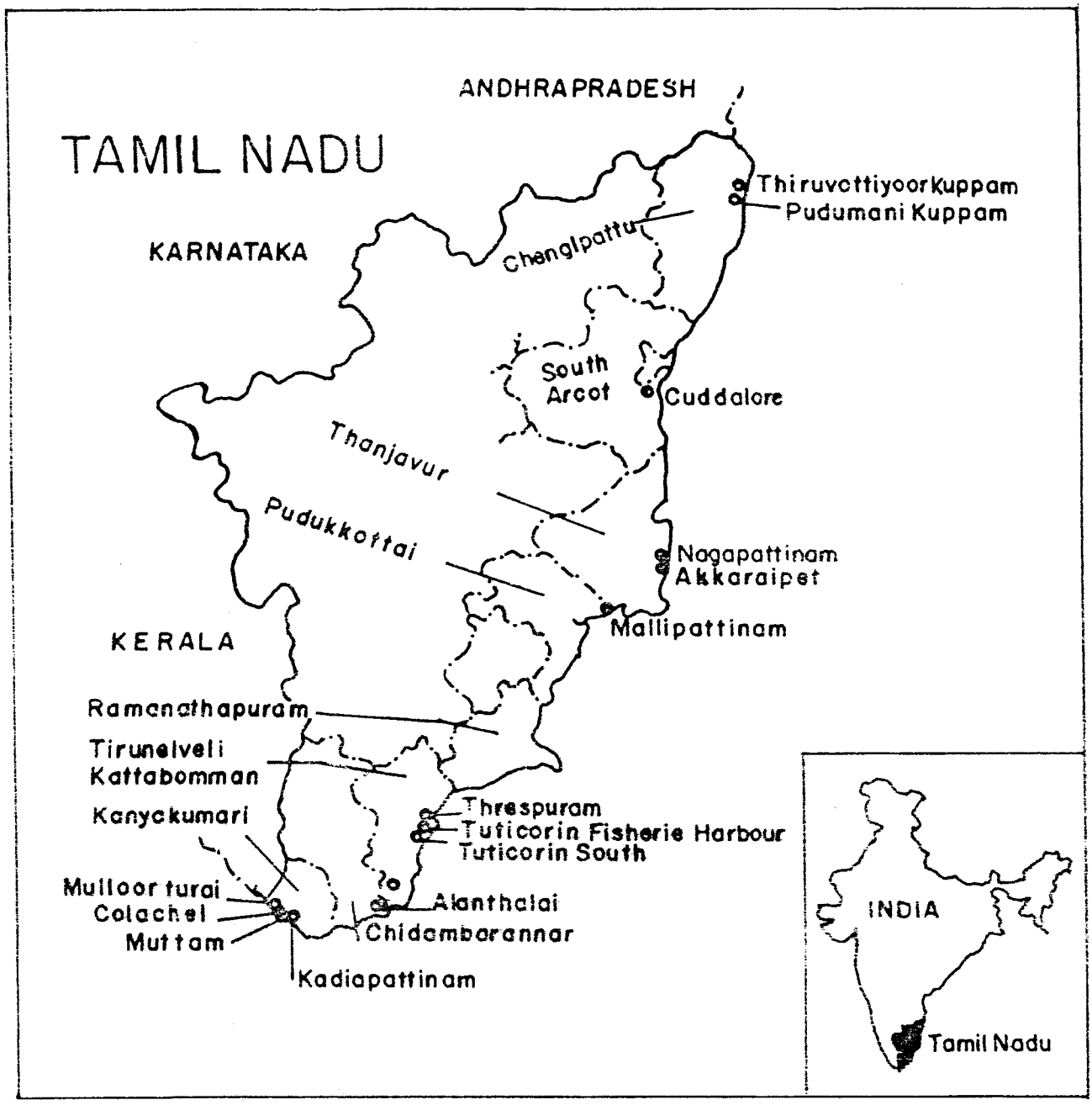
the present study. The capital inputs towards initial investment and operational costs widely vary between different types of fishing methods and also between different places. Further, even for the same type of fishing unit, operational costs vary not only between different units but also for the same unit for different trips. Hence continuous monitoring of the costs and earnings of a particular type of fishing units atleast for an year covering all fishing seasons is very essential to work out various parameters of fish production. Fish marketing also involves lot of intermediaries from the producer at fish landing centres to the consumers in retail markets. The perishable nature of fish and consequent urge for quick supply to long distances within minimium time, preservation, storage, processing, transportation and the nature of passing through many hands before reaching the ultimate consumer make any fish marketing study meaningful only by collecting data at all stages of the marketing channel. Since the data on economics of production and marketing of marine fisheries are very much limited, primary data have been collected from selected sample centres of Tamilnadu coast (Fig. 1) to supplement the secondary data.

Sources of secondary data

Acquisition and dissemination of data connected to marine fisheries development is being done continuously by various agencies. The Central Marine Fisheries Research Institute (CMFRI) Kochi, National Institute of Oceanography, (NIO) Goa, Central Institute of Fisheries Technology (CIFT) Kochi, Fisheries Survey

Fig. 1

MAP SHOWING THE SAMPLE CENTRES (o) COVERED UNDER THE STUDY



of India (FSI) Bombay and Marine Products Export Development Authority (MPEDA) Kochi, are some of the leading organizations engaged in the promotion of R&D, exploratory fishing and International trade in marine fisheries. Besides, the Directorate of Fisheries, Tamilnadu also provide good published data on various aspects of marine fisheries in the State.

The biological and oceanographic data whereever necessary for the present analysis have been collected from the publications of the above organisations. The data with regard to the present exploitation of marine fishery resources along Tamilnadu coast (Time series, gear wise, centrewise etc.) have been collected from the National Marine Living Resources Data Centre (NMLRDC) of CMFRI. The information relating to the updated census of marine fisheries published by the Directorate of Fisheries, Tamilnadu and the export marketing data by MPEDA over the last few years has been obtained and extensively used for the present study.

Primary data

Although a good deal of secondary data on marine fisheries in Tamilnadu is available it appears to be not sufficient for any meaningful economic analysis. Hence it has been supplemented by primary data, collected under a suitable sampling design. Data on costs and earnings of different craft-gear combination and price of different varieties of fish including handling and transportation charges at various points of the marketing channel covering all seasons for a period of one year have been collected by direct observation at selected centres.

Different craft-gear combinations prevalant along Tamilnadu

coast have been identified. Traditional sector comprising both the motorized and non-motorized catamarans and plank built boats has innumerable technological options as various types of gears can be operated depending upon its suitability according to seasonal us well as spatial variations in relation to catch abundance of certain species. Sample units representing different craft-gear combinations in artisanal, motorized and mechanised sector at different landing centres have been randomly selected for continuous observation. Similarly for studying the marketing efficiency, the data on price at landing centre, wholesale market and three retail markets have been regularly collected twice in a week continuously for a year. The study year for data collection was April 1989 to March 1990. Three types of schedules were designed, tested and used for this study.

Schedule I is for collecting general information of landing centres and fixed cost details of craft-gear combinations (Appendex I)

Schedule II is for collecting data on the day to day operating expenses, species-wise catch and revenue from sample units (Appendix II)

Schedule III is for collecting the marketing data at different points in the marketing channel (Appendix III)

Since the Kanyakumari coast with 7 percent of states coastline inhabited by 25 percent of fishermen households and producing one fourth of the annual marine fishery resources of the state using a variety of craft-gear combinations, more centres have been purposely selected from here for continuous observation.

Artisanal sector

There are about 30 thousand catamarans and 10000 other types of country craft engaged in marine fishing along Tamilnadu coast. This is 31 percent of the total non-mechanised units operating in all maritime states of India. Different types of specialized gillnets and hooks and lines are the major gears operated by this sector. The extensive utilization of wind energy for the propulsion of craft is the significant feature of artisanal fishing in this region. Sample units of catamarans operating sardine gillnets (chalavalai) and hooks & lines are observed throughout the year at Kadiapattinam in Kanyakumari coast. The catamarans operating a combination of gillnets suitable for different seasons like sardine gillnet, rays net (thirukkai valai) and lobster net (sinkiral valai) at Alanthalai in Chidambaranar coast, combinations like shark net (thadichi valai) sardine gillnet and a drift gillnet (vala valai) at Akkaraipet near Nagapattinam in Thanjavour coast and sardine gillnet, prawn net (raal valai) and rays net (thirukkai valai) at Thiruvottiyoor kuppam in Chengalpet district have been observed in the non-mechanized catamarans category. Data have been collected from plank built boats with sardine gillnet units at Tuticorin south, trawlnet (thallumadi) in Therespuram near Tuticorin in VOC District and another type of gillnet (Koivalai) units at Mallipattinam in Thanjavoor District. At each centre a sample of 20 units was randomly selected and data on initial investment, season-wise operational costs, species-wise catch and earnings have been collected for a period of one year. Further,

the data on seasonal gears like boatseine, *thathuvalai*, disco net, and *Kalral valai* also has been collected as and when operated at the selected landing centres of Kanyakumari coast during the course of this investigation.

Motorized sector

Motorization of country craft is gradually increasing along Tamilnadu coast. At present there are about 2000 Motorised country craft which is hardly about 5 percent of the total traditional units. Motorization is comparatively more in Kanyakumari, Thirunelveli Kattabomman and V.O. Chidambaranar districts of the state. Costs and earnings data for 60 motorized units - 20 cataramaran units each operating sardine gillnet and *valivalai* at Kadiapattinam in Kanyakumari coast and 20 P.B. Boats operating sardine gillinet at Threspuram near Tuticorin have been collected for ten sample days in each month during the study year.

Mechanised sector

There are about 2500 mechanised units operating along Tamilnadu coast. More than 90 percent of them are trawlers. Pudumanikuppam, Cuddalore, Nagapattinam, Mandapam, Rameswaram and Tuticorin are the major centres of mechanised units. Data on costs and earnings of 60 sample units at Nagapattinam, Tuticorin and Pudumanikkuppam are collected for ten days in each month during the study year. Data on seasonal operation of mechanised boats at Colachel in Kanyakumari coast also have been collected during June - November 1989.

Analysis and interpretation of data

Suitable statistical and econometric tools were used in the analysis and interpretation of data. The average cost and earnings of different type of fishing units have been worked out on annual basis. To evaluate the economic efficiency of different craft-gear combinations a number of key economic indicators such as rate of return, capital turn-over ratio, net operating income, profit etc., have been worked out. The marketing margins and fishermen's share in consumer's rupee for about 22 varieties of fish were also calculated.

The Cobb-Douglas production function was used to find out the functional relationship of input and output for selected types of craft-gear combinations (Panikkar and Srinath, 1991). The model used is given as:-

$$Y = a.\ x1^{b1}.x2^{b2}.x3^{b3}....xn^{bn}$$

Where **Y** is the output

and **x1, x2.....xn** are various inputs.

b1, b2.....bn are elasticities of production of their corresponding inputs,

and **a** is a constant.

The marginal physical product (MPP) was calculated as

$$MPPx = b.\ \bar{y} / \bar{x}$$

where **MPPx** is the marginal physical product of x and b is the elasticity of production of input x ;

$\bar{y}$ is the mean level of output and $\bar{x}$ is the mean level of input x used.

Economic efficiency dictates that the use of each unit of input(x) is at the level where the value of its marginal product(**MVPx**) equals its unit cost(**Px**).

i.e. **MVPy = Px**

where, **MVPy** is the value of the marginal product of y and **Px** is the unit price of x.

If **MVPy** is greater than **Px** the amount of input used is to be increased and if **MVPy** is less than **Px** then the amount of input should be reduced to maximize profit.

To compute price spread (by concurrent method) the gross marketing margin(**GMM**), percentage of marketing margin(**PMMCR**) and percentage share of fishermen (**PSFCR**) are calculated as follows:

$$GMM = RP - LP$$

$$PMMCR = (RP-LP)x100/RP$$

$$PSFCR = LPx100/RP$$

where **RP** denotes average retail price and **LP** that of the landing centre price.

Since correlation coefficient is the commonly used measure of pricing efficiency and market integration in developing countries (Blyn 1973, Harris 1979, Lundal and Peterson 1983, Naik and Arora 1986) in this study also the same has been used.

CHAPTER IV

GENERAL PROFILE, RESOURCES AND PRODUCTION TREND

GENERAL PROFILE, RESOURCES AND PRODUCTION TREND

Tamilnadu is one of the important maritime states on the south east coast of India. The State covers a geographical area of 1,30,057 Sq. Km with the population of about 5 crore (Anon 1981). The south west monsoon and the north east monsoon are the rainy seasons in the State, the normal rainfall being 945.7 mm per year. Agriculture plays a dominant role in the economy of the State contributing to about 31 percent of the State's income. Tamilnadu, descending to the tip of the peninsular India, has the unique advantage of facing three major seas the Arabian sea, Indian ocean and the Bay of Bengal and having the advantage of rich marine fishery resource potential capable of further development. Historically, the State has a long and glorious tradition of maritime activity including the export of pearls and chanks since time immemorial to many Mediterranean countries such as Rome, Greece and Egypt.

The coastline of Tamilnadu

The coastline of Tamilnadu runs to about 1000 Kms sharing 940 kms by the east coast of India and 60 kms by the west coast which is located in Kanyakumari District. Almost the entire coast line of Tamilnadu is heavily surf beaten and the sea shore is mostly sandy. However, the shore of Kovalam, Mamallapuram, Cape Comorin and Colachel is partly rocky and sandy. The shore area between Vedaranyam to Karaiyur in Thanjavour District is swampy. The coastline of Tamilnadu can be broadly classified into three regions namely (i) The coromandal coast (2) The Palk Bay and (3) The Gulf of Mannar coast.

The coastal belt covering the districts of Madras, Chengal pet, South Arcot and part of Thanjavour form part of coromandal coast. The Palk bay region covers the coasts of the districts of Thanjavour, Pudukottai and part of Ramanathapuram. Comprising Kanyakumari, Thirunelveli Kattabomman and a portion of Ramanathapuram coast upto Pamban, the Gulf of Mannar coast is characterised submerged chains of coral reefs with high surf conditions in the southern end.

Fish Landing Centres

There are 352 landing centres along the ten coastal districts of Tamilnadu. The coastal districts are: 1. Chengalpattu 2. Madras 3. South Arcot 4. Thanjavour 5. Pudukottai 6. Ramanathapuram 7. Chidambaranar 8. Thirunelveli Kattabomman and 9. Kanyakumari.

Mechanised fishing boats require convenient places for landing which could protect them from adverse weather conditions. There are about 10 landing centres along the coast where harbours are available with different levels of berthing capacities. They are 1. Pudumanikuppam 2. Cuddalore 3. Nagapattinam 4. Mallipattinam 5. Kodikarai 6. Mandapam - South 7. Mandapam - North 8. Ramaeswaram 9. Tuticorin and 10. Chinnamuttom.
Fishing boats berthed at Rameswaram is depicted in Plate II.

Apart from these harbours the following centres have jetty facilities for the operation of mechanised boats. 1. Ennore 2. Portonovo 3.Pazhayar 4. Arcotuthurai 5. Sethubavachattram 6. Kottaipattinam 7. Jegadapattinam 8. Valinokkam 9. Keelakarai 10. Chinna Ervadi 11. Pamban 12. Veerapandian pattinam 13. Thiruchendur and 14. Colachel

Sectoral human resource use

There are about 1 lakh fishermen households inhabited along the 422 coastal villages of Tamilnadu. (Anon 1981) The total marine fishermen population of the State is about 5 lakhs, the average size of family being 5 (Jacob *et.al.* 1985) . The maximum number of fishermen are in Kanyakumari District, the number being 1.2 lakhs forming about 25 percent of the total fishermen population in the State. The average number of fishermen population per village is also highest in this district. The literacy level of fishermen for the state as a whole is about 20 percent which ranges from 8 percent in Thanjavour District to 31 percent in Chengalpet District.

The standard of living of a family to a very large extent will depend upon its occupational structure, level of employment and income of the working members of the family. There are about 1.3 lakhs adult males in which 88 percent are engaged in fishing and other activities (Anon 1986). For 90 percent of the adult work force, the major occupation is fishing, 2 percent in fish trade and in the remaining 8 percent, some of them are in fishery allied activities.

The human resource-base of India is a source of strength as well as of weakness. The huge and rapidly growing mass of population along the coastal belt is a potential labour force which, if properly harnessed, can be a massive productive asset. Given the backlog and a long period of neglect in the field of human-resource development, the task of harnessing such a huge mass in marine fisheries sector is formidable; continuous additions to the numbers at the natural rate of growth render the

task far more difficult.

Means of production

Fishing gear is the actual tool/implement to catch fish and craft is the floating platform for operating the gear. The fishing units under operation along Tamilnadu coast can be widely classified into three categories as (i) mechanised (2) motorised and (3) traditional non-motorised fishing units. Boats fitted with inboard engines having hp. of 45 and above operating trawlnets and gillnets are considered as mechanised boats. Country crafts fitted with outboard/inboard motors with less than 30 hp. are considered as motorised crafts . The number of traditional crafts operating in Tamilnadu coast continues to be the highest in the country. (Table IV-1)

TABLE IV-1

Details of fishing craft in Tamilnadu

CATEGORY	TYPE OF CRAFT	NUMBER
1.Mechanised	1)Wooden boats	2432
	2)FRP boats	82
2.Motorised	1)Plank built boats	967
	2)Catamarans	1804
3.Trditional	1)Masula boats	212
	2)Plank built boats	6896
	3)Dug out canoes	1331
	4)Catamarans	28132
Total		41856

Majority of fishermen adopt primitive techniques of fishing for their subsistance. Some of the fishermen are using the same technique which their ancestors had used for a very long time. Catamaran and canoe are the two basic forms of country craft that have been in existence through centuries in the coast. They still remain dominant as the best suited traditional craft

propelled by wind and man power. The catamaran is the beach landing type of craft which is operated on the open coromandal coast facing the Bay of Bengal and on the Kanyakumari coast facing the Indian Ocean. The canoes and plank built boats are in operation on the relatively protected areas of the Palk Bay and the Gulf of Mannar. The mechanised boats introduced in the fifties substantially increased in number due to the export demand and high unit value realization of prawns (Sathiadhas and Venkataraman, 1981) use largely trawl nets. Trawl nets, diversified resource specific gillnets, long lines and shore seines are the major types of gears operated by the fishermen of Tamilnadu coast. As per the latest census (Anon 1986), there are about 362678 gears in operation in Tamilnadu and 61 percent of them are gill nets.

Capital Investment

The capital investment towards fishing along Tamilnadu coast by the fishermen at current prices (excluding large trawlers) works out at Rs. 825 million comprising Rs.386 million in the mechanised sector and Rs.439 million in the motorized and non-mechanised sector. The percapita investment per working fisherman comes to about Rs. 8100.

Area of Exploitation

The continental shelf of Tamilnadu coast (upto 100 fathoms or 200 metres depth) is narrow having width varying from 40 to 60 kms. It covers an area of 41,412 Sq.kms, which is the actual fishing area. The classsification of inshore, off shore and deep sea area of the continental self is given in Table IV-2.

Table IV-2

Inshore, Off shore and deep sea area of Tamilnadu

CONTINENTAL SHELF	AREA IN SQ.KMS
1. Inshore (0 to 10 fathoms depth)	16,058
2. Off shore (10 to25 fathoms depth)	7,197
3. Deep sea (25 to 100 fathoms depth)	18,157
Total	41,412

In addition to the above area of continental shelf, the EEZ provides immense scope for extending our area of exploitation farther into deep waters.

The inshore waters can be fished by small-craft which cannot stay for longer period in the sea. In the off shore zone and deep sea waters, mechanised boats and bigger vessels with refrigeration facilities are required to carry out fishing operations.

Fishing season

Seasonal, climatic and oceanographic variations are determined by the two monsoon periods which largely have a direct bearing on fisheries. The fishing season all along Tamilnadu coast is from January to September except in west coast (Kanyakumari district) where the season for fishing is from April to December. The period from October to December is generally off season due to North East monsoon, except in Kanyakumari District where the off-season is from January to March. During monsoon period the sea is rough and occasional cyclone and stormy weather, prevail particularly in the districts of Thanjavour, Pudukkottai and Ramanathapuram.

Fishing grounds

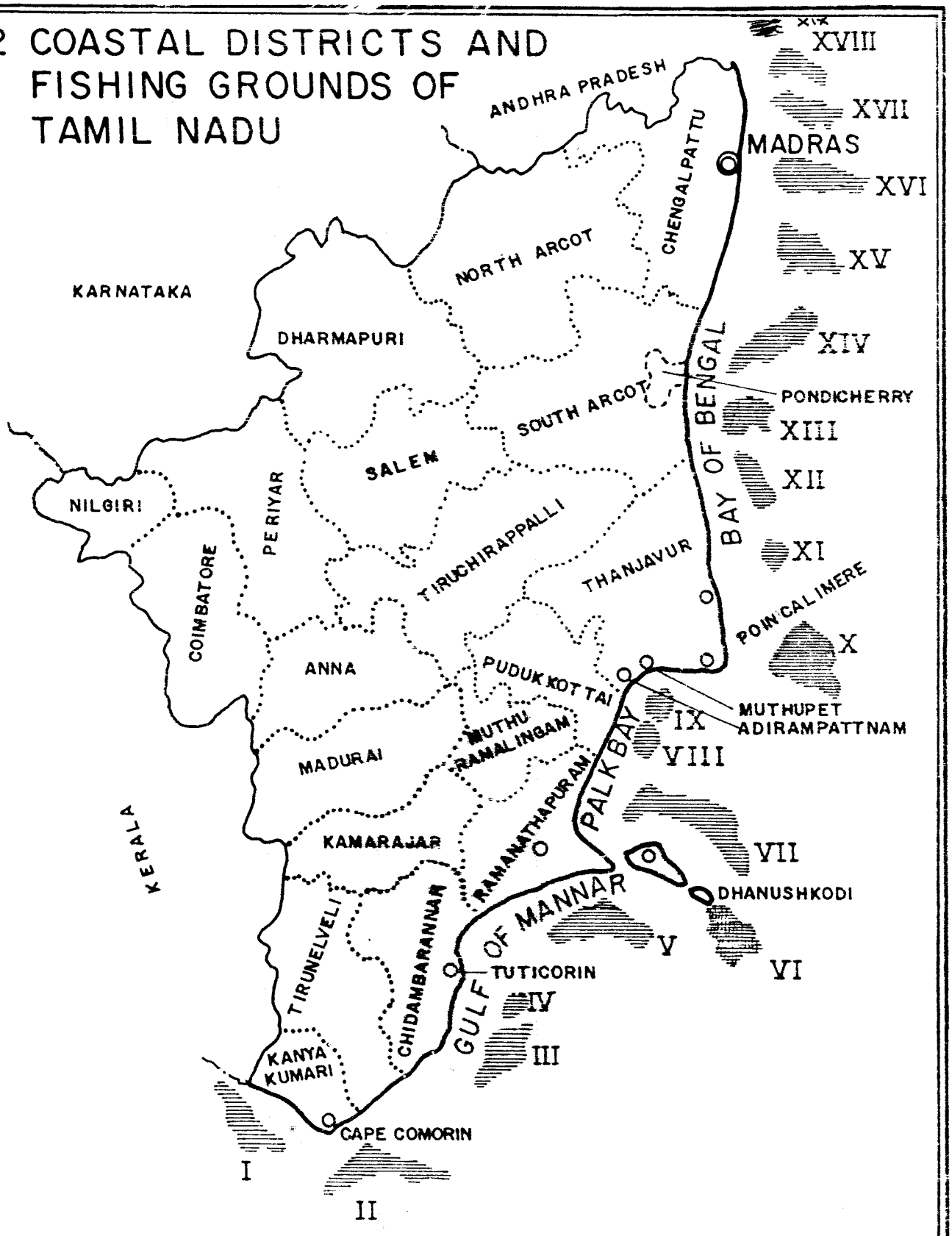
There is a clear lack of information on new grounds except for the Palk Bay, Gulf of Mannar and Wadge Bank regions(Anon 1984). The results of the survey of Pelagic Fishery Project (PFP) have indicated that there is a total stock of about 5,50,000 tonnes around the peninsular curve including the Wadge Bank, Gulf of Mannar and Palk Bay, besides the seasonal piling up of the white-baits resources in the Gulf of Mannar. (George et al 1977) The fishing grounds off Tamilnadu coast has been largely exploited by vessels of other countries particularly of Srilanka, Thailand, Taiwan and USSR.

The map of coastal districts with fishing grounds of Tamilnadu is given in Fig. 2

Availability of major fishes in the different fishing grounds
(as shown in Fig.2)

FISHING GROUNDS	NAME OF COMMERCIALLY IMPORTANT FISHES AVAILABLE
1.Colachel	Seer fish, Perches, White fish, Horse mackerel, Shark, Rays, Mackerel, White bait, Sardines, Lethrinus, Serranus, Redsnaper, Leather Jacket and Cuttle fish.
2.Wadge Bank	Perches, Horse Mackeral, Pomfrets, Sharks, Rays, Prawns, Lethrinus, Serranus, Red-snapper, Flat fish and Cuttle fish.
3.Punnakayal and 4.Cape comorin	Seer fish, Perches, White fish, Horse mackerel, Shark, Rays, Prawns, White bait, Sardines, Lethrinus, Serranus and Red snapper.
5.Tuticorin	Seer fish, Perches, Shark, Rays, Prawns, White bait, Sardines, Lethrinus, Serranus, Red snapper and Leather Jacket.
6.Dhanushkodi 7.Pamban and 8.Rameswaram	Seer fish, Perches, Silver bellies, Pomfret, Cat fish, Rays, Prawns, Crabs, Sardines, Thread fin breams,

Fig. 2 COASTAL DISTRICTS AND FISHING GROUNDS OF TAMIL NADU



	Lethrinus, Serranus, Red snapper, Leather Jacket and Cuttle fish.
9. Adirampattinam	Seer fish, Perches, Mullet, Horse Mackerel, Jew fish, Pomfrets, Cat fish, Shark, Rays, Prawns, Pristipoma, Crabs, Hilsa toli, Polynemus, Flat fish and Cuttle fish.
10. Muthupet	Mullet, Horse Mackerel, Jew fish, Shark, Rays, Prawns and Pristipoma.
11. Point Calimere	Mullet, Jew fish, Pomfrets, Crabs, Mackerel and Polynemus.
12. Nagapattinam	Mullet, Jew fish, Cat fish, Shark, Rays, Prawns, Crabs, Mackerel, Lizard fish and Flying fish.
13. Tranquabar	Mullet, Horse Mackerel, Jew fish, Silver bellies, Sharks, Rays, Prawns, Crabs, Mackerel, Lizard fish and Flying fish.
14. Portonovo	Mullet, White fish, Horse Mackerel, Silver bellis, Ribbon fish, Sharks, Rays, Pristipoma, Crabs, Mackerel, Lizard fish and Flying fish.
15. Cuddalore	Mullet, Whitefish, Pomfrets, Shark, Silver bellies, Ribbon fish, Prawns, Crabs, White bait, Lizard fish and Thread fin breams.
16. Sadras	Seer fish, Horse Mackerel, Barracudas, Silver bellies, Shark, Rays, Mackerel, White baits, Sardines, Clupeids and Thread fin breams.
17. Madras	White fish, Horse Mackerel, Barracudas, Silver bellies, Ribbon fish, Cat fish, Shark, Rays, Prawns, Mackerel, Sardines, Clupeids, Lizard fish, Thread fin breams and Cuttle fish.
18. Ennore	Seer fish, Horse Mackerel, Barracudas, Ribbon fish, Pomfrets, Cat fish, Sharks, Prawns, Crabs, Mackerel, Sardines, Clupeids, Flying fish and Leather Jacket.
19. Pulicat	Seer fish, Mullet, White fish, Horse Mackerel, Jew fish, Cat fish, Prawns, Pristipoma, Crabs, Mackerel, Sillago and Polynemus.

Wadge Bank is the richest fishing ground along the Tamilnadu coast. It lies south of Cape Comorin about 88 Kms. off the coast, extending about 56 kms on either side of Cape Comorin. This is a submarine plateau varying in depths from 35 to 200 metres.

Production trend and potential yield

Marine fish landings in Tamilnadu during 1951 - 52 was only 45,700 tonnes (Alagaraja et.al. 1982). From this low level, the landings improved substantially and reached a level of 93280 tonnes during 1961-62, 212937 tonnes during 1971-72, 235820 tonnes during 1981-82 and 303275 tonnes during 1990. More than 250 varieties of fish are caught in the sea off Tamilnadu coast. Sardines, Anchovies and Mackerals among the pelagic fishes and Silver bellies, Ribbon fish, Sharks, Scianids and Perches among the demersal varieties constitute the major share in the landing of fish in the state in terms of quantity.

The mechanised landings with about 28 percent of the total landings during 1976 increased to 62 percent during 1990. The introduction of synthetic nets coupled with high export demand for shrimps intensified mechanised fishing. The landings by trawlers alone accounted for about 90 percent of the mechanised catch. The introduction of more mechanised trawlers during the seventies and increased tempo of the same during the early eighties was solely responsible for the rise in production by the mechanised sector. However, the catch rates of the traditional fishing units declined drastically during the last 15 years. Many traditional fishermen felt that their returns were affected by the intensive fishing operations of mechanised units in the

inshore waters. The damaging of the nets of traditional fishermen in the sea by mechanised fishing fleets was also a general complaint (Balakrishnan and Alagaraja 1984). In some of the fishing centres conflict between mechanised and non-mechanised fishermen was also noticed demanding some sort of regulation over the area of fishing operation (Silas *et.al* 1980).

Table IV-3

Trend of marine fish landings by mechanised and non-mechanised sectors in Tamilnadu (1976-1990)

YEAR	MECHANISED LANDINGS (tonnes)	MECHANISED GROWTH (%)	NON-MECHANISED LANDINGS (tonnes)	NON-MECHANISED GROWTH (%)	TOTAL LANDINGS (tonnes)	TOTAL GROWTH (%)
1976	63621 (28)		162457 (72)		226078	
1977	50359 (24)	-21	155687 (76)	-4	206046	-9
1978	81495 (38)	62	131404 (62)	-16	212899	3
1979	101758 (43)	25	133250 (57)	1	235008	10
1980	94131 (43)	-7	123263 (57)	-7	217394	-7
1981	106664 (48)	13	114632 (52)	-7	221296	2
1982	127542 (52)	20	118419 (48)	3	245961	11
1983	146225 (52)	15	134514 (48)	14	280739	14
1984	116190 (46)	-21	135930 (54)	1	252120	-10
1985	95549 (48)	-18	105002 (52)	-23	200551	-20
1986	117898 (49)	23	124143 (51)	18	242041	21
1987	173747 (57)	47	129886 (43)	5	303633	25
1988	168564 (57)	-3	127100 (43)	-2	295664	-3
1989	164481 (58)	-2	116819 (42)	-8	281300	-5
1990	187765 (62)	14	115510 (38)	-1	303275	8

The production trend of some of the commercially important varieties of marine fish during the period 1976 to 1990 is given in Fig.3,4&5. Elasmobranchs recorded maximum catch during 1975 (23025 tonnes) and then showing steep decline and reaching the lowest 7865 tonnes of landings in 1990. Similarly catches of other sardines also improved over the years and reached the peak landings of 46366 tonnes in 1987. Afterwards a drastic decline in the landings of this resources was seen as the landings fell to the level of 19611 tonnes in 1990.

The production trend of other commercially important varieties in domestic market like perches, croakers, silverbellies, seerfish, tunnies and pomfrets, in general, shown a rising trend over the years. The increase in landings of perches has been four fold in 1990 over that of 1971. However the peak landings of these species were 22029 tonnes for croakers in 1982, 69109 tonnes for silverbellies in 1983, 7179 tonnes for seerfish, 4233 tonnes for tunnies in 1980 and 1705 tonnes for pomfrets in 1973.

Exportable varieties like penaeid prawns and cuttle fish recorded substantial increase in landings and growth rates during 1965 to 1990 (Table IV-4). The penaeid prawn landings was only about 2198 tonnes during 1965 which increased to about 19110 tonnes during 1990. Similarly, the estimated cuttle fish landings was only about 78 tonnes during 1965 which increased to the level of about 7434 tonnes in 1990.

Fig. 3 Production trend of seer fish, tuna and pomfrets (1971 - 90)

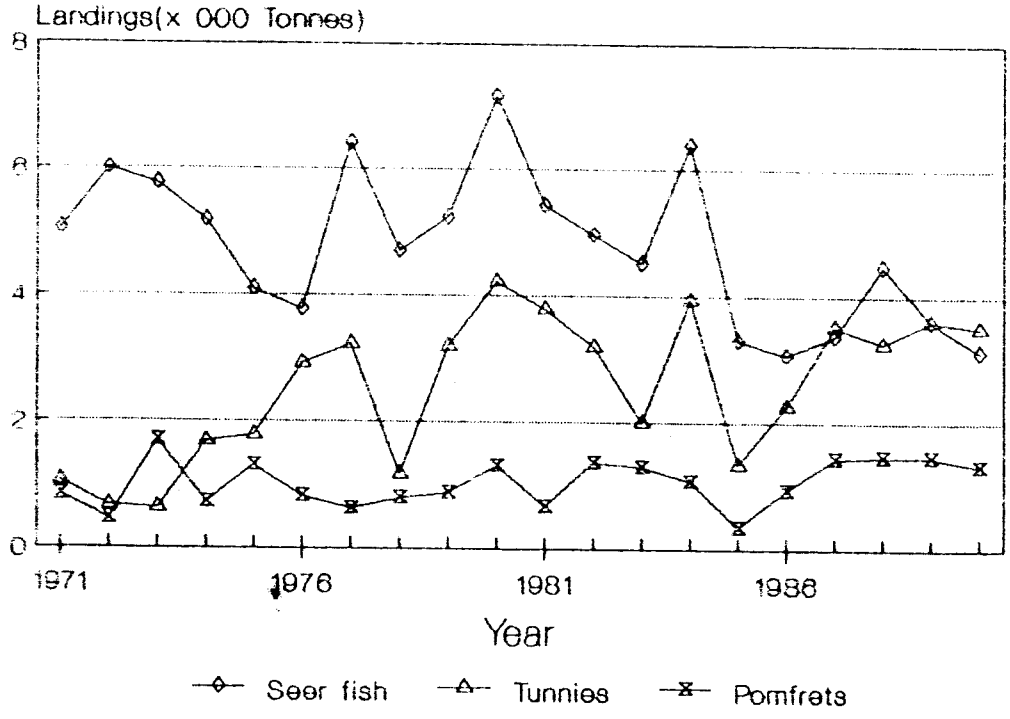


Fig. 4 Production trend of elasmobranchs croakers and perches (1971-90)

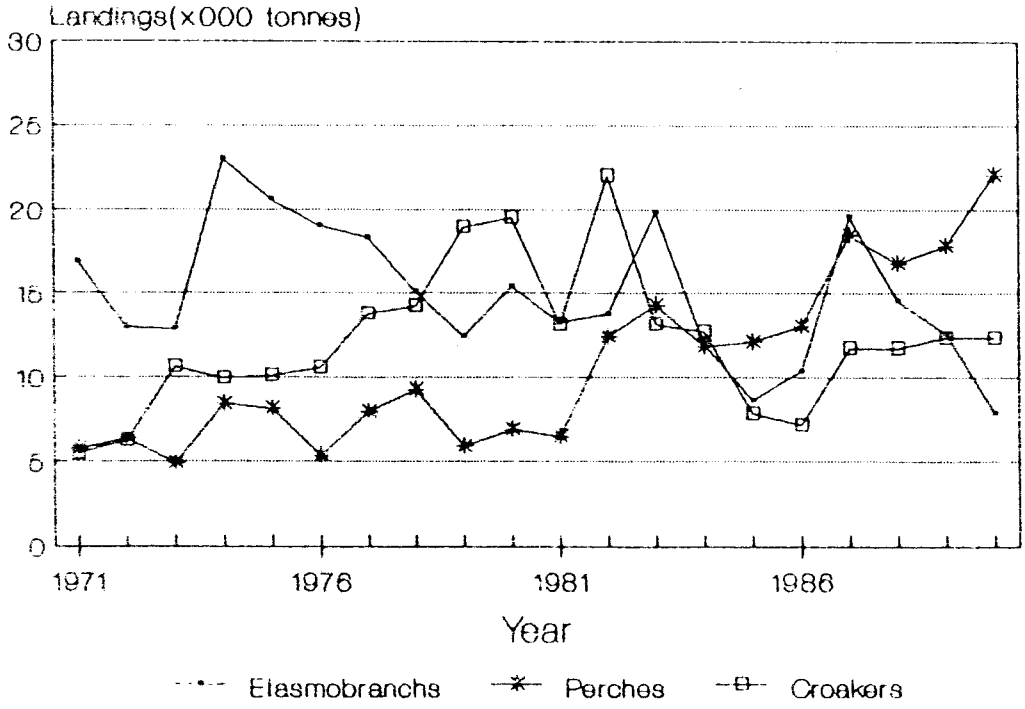


Fig. 5 Production trend of other sardines and silver bellies (1971-90)

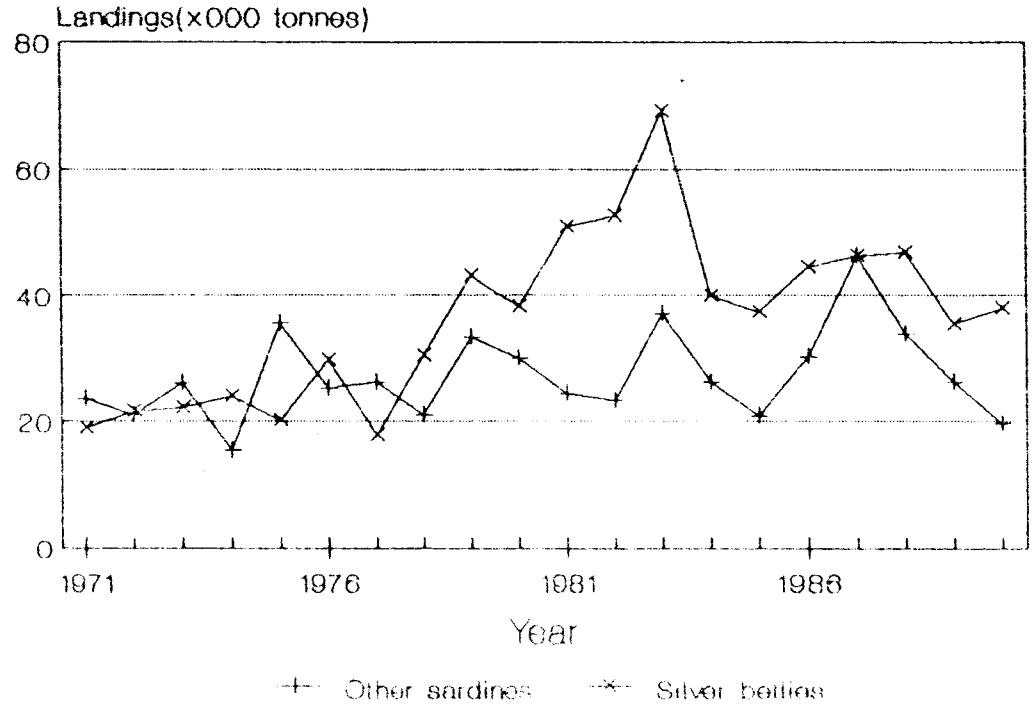


Table IV-4

Growth rates in the landings (in tonnes) of major exportable varities of marine products in Tamilnadu (1965-1990)

YEAR	Penaeid prawns		Cuttle Fish	
	Catch	Growth(%)	Catch	Growth(%)
1965	2198		78	
1966	5136	+133.7	183	+134.6
1967	7137	+39.0	227	+24.0
1968	6159	-13.7	268	+18.0
1969	5526	-10.3	293	+9.3
1970	4724	-14.5	77	-73.7
1971	3637	-23.0	389	+405.2
1972	4885	+34.3	248	-36.2
1973	4504	-7.8	426	+71.8
1974	8060	+79.0	955	+124.2
1975	11460	+42.2	2953	+209.2
1976	8864	-22.7	1451	-50.9
1977	8197	-7.5	1375	-5.2
1978	13327	+62.6	1042	-24.2
1979	10222	-23.3	1903	+82.6
1980	9082	-11.2	1472	-22.6
1981	13548	+49.2	1687	+14.6
1982	14086	+4.0	3238	+91.9
1983	13458	-4.5	3877	+19.7
1984	15154	+12.6	3694	-4.7
1985	11304	-25.4	4441	+20.2
1986	15640	+38.4	3905	-12.0
1987	17409	+11.3	4050	+3.7
1988	16461	-5.4	4208	+3.9
1989	16886	+2.6	5535	+31.5
1990	19110	+13.2	7434	+34.3

Marine fisheries calendar

The marine fisheries calendar will be highly useful for the fishermen, fishery enterpreneurs and others connected with the fisheries and allied industries. It would be possible to find out the peak season for different varieties of fish and appropriate gears to trap it from this calendar (Mahadevan *et. al.* 1988 and Ramamurthy *et.al.* 1988). The marine fisheries calendar prepared for 20 commercially important varieties of fish on the basis of the annual landings from 1981 - 90 has been given in Table IV - 5.

Table IV - 5
Marine fisheries calendar of Tamilnadu for commerically important varieties

NAME OF FISH	AV. CATCH (Tonnes)	PER-CENT	PEAK SEASON	MAJOR GEARS
1 Penaeid prawns	15306	6	JULY-SEP	TN, BS, SS
2 Cephalopods	4207	2	APR-JUN	HL, TN, BS
3 Silverbellies	45394	17	OCT-DEC	TN, BS, SS
4 Other sardines	28827	11	JANU-MAR	BS, DN, GN, SS
5 Stolephorus	12466	5	OCT-DEC	SS, GN, DN, TN, BS
6 Rays	9866	4	JULY-SEP	DN, TN
7 Ribbonfishes	7787	3	JULY-SEP	GN, TN, BS
8 Mackerel	7575	3	APR-JUN	GN, DN, BS
9 Oil sardine	6015	2	APR-JUN	DN, BS, GN, SS
10 Threadfin breams	4946	2	JANU-MAR	TN, H&L
11 Goat fishes	4494	2	APR-JUN	TN, DN
12 Seer fishes	4231	2	JULY-SEP	H&L, LL, GN, DN, TN
13 Sharks	3085	1	APR-JUN	H&L, GN, SS
14 Tunnies	2913	1	APR-JUNE	LL, DN, TN
15 Catfishes	3024	1	JULY-SEP	H&L, SS, TN
16 Wolf herring	2823	1	OCT-DEC	TN, H&L
17 Lizard fishes	2742	1	JULY-SEP	TN, H&L
18 Scads	2177	1	OCT-DEC	H&L, GN, SS
19 Barracudas	2510	1	JANU-MAR	H&L, GN, SS
20 Pig-face breams	2096	1	JANU-MAR	H&L, LL

TN = Trawl net , BS= Boat seine H&L = Hooks and lines
GN= Gill net, LL= Long lines DN= Drift net
SS= Shore seine

In terms of catch abundance, silver bellies and other sardines form the major species in Tamilnadu with peak seasons of April - June and January - March respectively. Penaeid prawns forms about 6 percent of the total landings of the state with the peak season of July - Sept. White baits (Stolephorus), rays, ribbon fish and mackeral are other varieties in the order of catch abundance.

Distribution and Marketing

The consumer preference for the marine fish is always for fresh fish in internal markets. The distribution pattern of fish to the end users in the domestic market indicates that about 75 percent supplies are made in fresh form, 12 percent in iced

and 13 percent as dried form. (Sathiadhas and Panikkar 1988). Exportable varieties like prawns, lobsters, Crabs, Cuttle fishes etc. are mostly supplied to processing plants for freezing, canning etc.

All the fishing villages along Tamilnadu coast constitute the primary marketing centres of marine fish. The producers offer their marketable catch for sale, not by weight but by measures of heaps, lots or baskets; such unit measures vary not only from locality to locality but also with in the same locality and for the same types of fish depending upon the size of the catch. The fish is generally auctioned by traditional auctioners or middlemen on commission basis, who also take the responsibilities for realizing the sale proceeds from the traders. In Tamilnadu, mostly these auctioners are fisherwomen. About 25 percent of the marine fish are marketed close to the landing centres by retailers who carry the fish either by head loads or bicycles. The major part however is taken to the fish markets in the centres and towns run by the Corporation or Municipalities or to the private fish markets. The rest of the stock is transported by vans, trucks and trains to distant market

Export trade

Traditionally, Tamilnadu is an exporter of marine products. Dried fish and dried prawns were the main items shipped in earlier times. In the last ten years frozen items have been increasingly exported. Madras, Nagapattinam and Tuticorin are the ports in Tamilnadu handling the export cargo. Shrimps, lobster tails, shark fins, fish mews, beche-de-mer sea shells, edibile oyster, mussels, sea weeds and cuttle fish are the

potential items of export. The quantity of marine products exported from the State increased from almost 4566 tonnes fetching a value of Rs.53.11 lakhs in 1962 to 1.34 lakh tonnes fetching 839.37 crores in 1990.

Fish processing Industries

Many processing plants in the private as well as government sector have come up along with the increase of sea food exports in Tamilnadu over the years. There are at present 25 ice plants with a production capacity per day of about 80 tonnes ice and cold storage capacity of 180 tonnes in the State. The first freezing plant was erected and commissioned at Ennore near Madras only during 1968-69. Now as many as 40 plants with a combined freezing capacity of 190 tonnes per day and frozen capacity of 3107 tonnes have come up. There are only two canning plants in the State with installed capacity of 1.5 tonnes per day. There are 5 fish meal plants in the State with a total installed capacity of 7 tonnes of fish meal per day. The high demand for nylon and synthetic nets paved the way to set up a number of net making plants both in private and public sector.

Transportation

Almost all the fish landing centres of Tamilnadu coast are well connected with motorable road facilities. Mode of transportation of fish to different markets are by head loads, cycles, auto vans, tempos, trucks insulated vans and trains. The processers and exporters were in general using only the road transportation system for moving marine products either for processing or for shipping.

Spoilage of marine fish

About 9 percent of exportable and 30 per cent of non-exportable fish catch were spoiled at the time of landing itself (Anon 1984). With regard to the landings of country crafts 13 percent of the exportable variety and 29 percent of the non-exportable variety were getting spoiled. Bulk of the spoiled fish was getting converted either as dried fish or as fish meal. Quantum of fish spoiled in between the landing point and ultimate consumers are also substantial. With the increase in distance the quantity of ice used has to be increased to minimize the spoilage.

Indebtedness and credit

Many fishermen could not earn sufficiently even to meet the day to day consumption expenditure of their families (Panikkar 1980, Panikkar and Alagaraja 1981, Sathiadhas and Venkataraman 1983 and Senthilathiban *et.al.* 1990). Extensive sample survey conducted by the Institute for Techno Economic Studies, Madras (Anon., 1986) indicate that 63 per cent of marine fishermen households in Tamilnadu are in debt. The average outstanding debt per indebted household works out at Rs.3110. The fishermen living below poverty line are mostly in the vicious circle of perpetual indebtedness. Private money lenders are the major source of credit (75 percent) followed by banks (12%), relatives (7%) and co-operative societies (6%). There are about 339 registered co-operative societies in the marine sector. Their performance is not at all impressive and most of them are now defunct.

Social status The fishing communities living along Tamilnadu coast are Chettiar, Pattanavar, Paravar, Mukkuvar, Muslims (Rowthar), Sembadavar, Valayar and Pattamgattiar. Almost all of them are recognized under backward community by the State Government. About 60 percent of the marine fishermen families live in huts. Basic sanitary requirements are very much limited in fishing villages and the marine fishermen mostly use the open seashore for their toilet purposes. About 40 per cent of fishermen household have protected water supply and the remaining depend on well water. The average size of marine fishermen household is 5. Literacy rate is higher among the males with 58 per cent as against 25 percent for females. Only about 27 per cent of fishermen households availed the facility of electricity for lighting purpose in their house.

Marine fisheries contribution to GDP

The share of fisheries in GDP of our country is not phenomenal as compared to some of the fishing nations of the world (Rao and Rao 1989). During 1990 the contribution of marine fisheries in the GDP of Tamilnadu works out at Rs.1516 million which is about 3 percent of the state's domestic product. The average capital turn over ratio of States marine fisheries works out at 184 percent at the current level of exploitation and price.

To sum up, the general profile of the marine fisheries economy of Tamilnadu reveals that there is enormous scope to enhance the production and marketing aspects of this vital sector for improving the economic status of fishermen by adopting timely appropriate management measures.

CHAPTER V

TECHNOLOGICAL OPTIONS AND CAPITAL INVESTMENT

TECHNOLOGICAL OPTIONS AND CAPITAL INVESTMENT

Fishing operations may be distinguished according to location of fishing ground and according to technology or type of fishing gear. For historical as well as economic reasons, fishermen are locked into particular types of technology and locations of operation from which it is not easy for them to escape, even if other types of gear and locations are more profitable. There were wide differences among fishermen operating the same type of gear in different locations as well as among fishermen operating different types of gear in the same location. Even the fishermen operating the same type of gear in the same location had diverging cost and incomes (Panayotlu 1985). However cost-minimization and profit maximization are the twin inter-related objectives which influence the decision making of the investor on choices of techniques to be adopted for any production process. Capital being a scarce resource to many of the fishermen, the choice of their fishing techniques at times drifts towards labour-intensive devices. Various technological options at different levels of investment are available to the marine fishermen of Tamilnadu.

Suitable craft and gear combination is the basic requirement for the capture of fish. Fishing gear forms the actual tool/implement to catch fish, and craft is the floating platform for operating the gear to catch fish. A wide variety and type of fishing craft and gear have been used along our coast from time immemorial, each type having been evolved through generations of trial and error methods (Govindan 1983). However,

the technology of motorization of the existing traditional craft and introduction of mechanised boats is of recent origin.

CRAFTS

Even though, the type of fishing craft used along the coast of Tamilnadu are very wide with different regional names , all these can be grouped into a few basic types. However, only those which are widely used like catamarans, canoes and plank built boats and mechanised boats have been included in this study.

Catamarans

The word "Catamaran" seems to have been originated from the Tamil Word "Kattumaram" which literally means "logs tied together". Possibly, it would have been the first floating platform used by the coastal fishermen (Menon 1985). Further, it is the simplest form of a fishing craft that has been used in the Bay of Bengal by the fishermen of India and Sri Lanka.

The catamaran used in the southern Tamilnadu coast is of the boat shape, made by lashing together 3 to 5 logs, with the centre log/logs placed Keel-wise at a lower level than the side logs, so as to form a boat shape. They are hence classified as "boat catamarans". The "raft catamarans" are operating along the northern Tamilnadu coast and Andhra Pradesh. It is formed by lashing together 3 to 9 logs in a raft form slightly curved and not absolutely flat. The size of both type of catamarans range from 4 m to 9 m OAL, with width ranging from 60 cm to 1.8 m. Depending upon its size, the requirement of capital investment ranges from Rs.2000 to 8000. About 30000 catamarans are under operation along Tamilnadu coast. Earlier catamarans used sails alone for propulsion and now OBM also is used.

Plank built boats

Variations in design and construction of plank built boats exist between different regions. The "Kettuvallam" of southern Tamilnadu, "Tuticorin type boat" in the gulf of Mannar region and the "masula boat" in northern Tamilnadu come under this category. These craft range in size from 8 m to 9.5 m OAL and width of 1.75 to 2 m. The initial investment for these boats ranges from Rs.10,000 to 30,000. At present (1991), there are about 7000 non-mechanised and 1000 motorized plank boats operating along Tamilnadu coast. The life expectancy of a plank built boat is about 7 years.

Mechanised boats

The wooden boats of 8 to 12 meters in length are widely used for trawl and gill net operations in the mechanised sector. There are about 2300 trawlers and 200 gill netters operating along Tamilnadu coast. Mechanised boats are constructed with timber, marine plywood, fibreglass and steel. Wooden boats have been so far the cheapest and most popular in Tamilnadu.

Dugout canoe

As the name implies this craft is made from a single log of wood. There is no keel for the craft, but the bottom is made thicker than the sides which are made thinner. The art of making a dug-out canoe can be compared to carving or sculpture, as these craft are beautifully shaped and fashioned and possess excellent lines. The size of the dug out canoe depends on the size of the timbers available, which will restrict the length, beam and depth of the craft. They range in size from a tiny "one boy" canoe of 2 m OAL to large odam of about 12 m OAL.

These craft are declining in number in recent years along Tamilnadu coast and at present there are about 1300 dug-out canoes in the state. In the districts of south Arcot and Ramanathapuram relatively more dug-out canoes are under operation.

Gears

There are a number of gears indigeneously developed by the fishermen for exploiting different fisheries in the coastal areas to suit local conditions (Mohan Rajan *et.al.* 1985 and Miller 1990). The major type of gears employed in small scale fisheries of Tamilnadu can be grouped under (i) Seine nets (ii) Hook and line (iii) Traps (iv) Gillnets v) Trawlnets and vi) Miscellaneous

Seine nets

Boat seines and shore seines are the prominent seine nets prevalent in Tamilnadu. The operation is by encircling a located shoal of fish with the help of a long wall of netting, equipped with floats on its upper margin on edge called the head rope and [illegible] weights or sinkers on its lower margin edge called the foot rope. After the encircling the trapped fish can be removed from the enclosure. Such nets operated from the shore (known as shore seines), are locally called as *Karavalai* in Tamilnadu. If the fish shoals are away from the shore it may not be possible to catch with the help of shore seines. In such cases, one or two craft will carry the net and encircle the shoal of fish in the sea, and the net will be hauled on the craft itself. Such nets which are set/shot from a boat and hauled on to the boat are known as boat seines and locally as ***thattumadi*** or ***thurivalai.***

Hook and line

The principle involved in hook and line fishing is to lure the fish to take a bait. Hooks are concealed in the bait and the fish gets hooked when it tries to vomit or spit out the bait. There are several types of line fishing, from a simple hand line to a much complicated long line which can either be set or drift and made to fish in any desired depth.

Traps

In modern fishing, fish traps appear to be losing importance. Traps can be made in various shapes and sizes using rigid materials like wiremesh, welded mesh, or bamboo or netting materials. The opening or entrance to the trap is one - way - valve either conical in shape or the inside of the opening is provided with flaps or flappers which will open inwards only, allowing the fish to enter the trap and prevent their escape. Traps used in Tamilnadu are mainly basket traps and those made with roots of palmera trees. Lobster traps used in Kanyakumari Chidambaranar coast of Tamilnadu are the most popular and important fish traps.

Gill nets

Gill nets are the most important fishing gear widely used all along the Indian coast. Various types of gill nets are in use, each type having its own regional importance and known by different regional designations. The gear is a long wall of netting, laid across in sea, either on the surface, mid water or bottom. The mesh size and spread depends on the species to be caught. When the fish tries to pass through the mesh opening, it gets caught at the gills. By adjusting the floats and

weights, the net can be made to fish in any desired depth. The net can be allowed to drift with the water current or can be set to remain in a fishing ground. Gill nets are usually single walled and in some cases double walled or triple walled. Triple walled is more popular and known as "trammel net".

Trawl nets

Trawl nets are essentially conical shaped bag nets, with long or short wings, depending on the design of the gear, which can be dragged in water, with the help of a boat either in the bottom, midwater or surface, the mouth of the net being kept open by various devices, when it is being dragged. The principle involved is to drag the gear through water either on the bottom, surface or mid water and sweep the area, collecting all the fish which come in the way of the opening of the net. The prominent gear characteristics like mesh size, life expectancy and capital requirement of the important type of fishing gears along with names operating along Tamilnadu coast are given in Table

ging pattern of fishing technology

The marine fishing techniques used along Tamilnadu has undergone frequent changes. Some of the gears prominent a few years ago were either modified or displaced by new type of gears. Fishermen are very much conscious about the technical efficiency of these gears. The cotton thread used for the nets in earlier years were completely replaced by synthetic twines. Further, a recent technological improvement is the use of out board motors (OBM) for propelling catamarans and in board engines for plank built boats.

Table V - 1
Prominent features of important fishing gears (Tamilnadu)

Gear Category	Local Name	Mesh size	Av. No or pieces per unit	Life Expec-tancy	Capital Invest-ment (Rs.)
I. Seiene nets	Kara valai Kamba valai	8-10 mm	1	5 yrs	30,000
2. Boat seine	Thattumadi	10-15 mm	2	5 yrs	5,000
II.Hooks & Line	(i) Mattu (Ayiramkal thoondi)	No.6-16	900-1000	2-3 mo	2,000
	(ii) Shark Thoondil	No 0-1	30-36 Nos	2-3 mo	2,000
	(iii) Thoondil	No.16	400-500 Nos	1-3 mo	500
	(iv) Others	-	-	2-3 mo	1,000
III Gillnets					
(i) Drift net	Valivalai	60-130 mm	10	3-5 yr	50,000
(ii) Sardine net	Chala valai	20-30 mm	3	2-3 yr	3,500
(iii) Rol net	Kangooz valai	45-50 mm	2	3-4 yr	3,500
(iv) Anchovies net	Netholi valai (Kutcha valai)	15-18 mm	2	3-4 yr	3,000
(v) Mackerel net	Etcha valai (Ayala valai)	30-35 mm(or) 45-50 mm	4	3-5 yr	4,000
(vi) Prawn net	Disco valai	40-50 mm	4	3-4 yr	3,500
(vi)Shark net	Thadichi valai	180-200 mm	7	3-4 yr	25,000
(viii) Hilsa net	Koivalai	60-75 mm	10	4-5 yr	45,000
(ix) Lobster net	Kalral valai	60-65 mm 40-50 mm	1	3-4 yr	2,000
([illegible]net	Thirukkai valai	400-450 mm	1	3-4 yr	2,500
[illegible]omset net	Thathu valai	140-150 mm	1	3-4 yr	2,500
[illegible]ers				2-4 yr	3,000
[illegible] nets					
[illegible]mp trawl	(i) Ralmadi	15 mm	1	6 mon	3,500
[illegible]h trawl	Thallumadi (or) Thallu valai	20-30 mm	1	2 yr	2,000
3. Pair trawl	High opening trawl	45 mm	1	1 yr	20,000

The operations of shore seines along the coast line has been drastically reduced in recent years. Similarly, the *ral valai* (prawn net) operation also has been mostly replaced by disco net. The operations of boat seines is witnessing a declining trend over the years. For some of the bottomset gill nets like *kalral valai*, the mesh size of the net was substantially reduced in recent years. Earlier, the mesh size was in the range of 90-

110 mm and later it has become 40-50 mm. Several modifications were noticed in the operations of hook and line also over the years. The operation of *thalluvalai* (trawl net) by the sail boats both at Palk Bay and Gulf of Mannar is also introduced only in the last decade. The recent price escalation of certain varieties of fish also led changes in the fishing technology. For instance, the export demand of cuttle fish has induced the motorization of traditional crafts in the country especially along the south west coast of Tamilnadu.

Craft-Gear Combinations

The fishing craft either operate with a specific type of net through out the year or different types of net depending upon seasonal availability of different varieties of fish. In the mechanised sector, trawlers and gillnetters operate the same gears throughout the year. However, in the artisanal and motorized sector the catamarans and plank built boats have different types of gear combinations.

About 90 per cent of the traditional fishing craft operating along Tamilnadu coast use wind energy for their mobility and more than 80 percent of the gears used by them are different types of gill nets. Many fishermen not having any craft also possess some pieces of gill nets with which they join the craft owners according to the seasonal requirement. Different types of specialized gillnets are used for different species of fish. Gill nets mainly used for catching sardine is widely being operated along the entire coast with different local names such as *chalavalai, kolavalai* and *kavalai valai* in different regions. The local names of a few other prominent types of gillnets are

paru valai, netholi valai, podivalai, ral valai, vala valai, valivalai, disco valai, koivalai, thadichi valai, thirukkai valai, thathu valai and *kalaral valai* or *sinkiral valai*. The sardine gillnet is operated through out the year. The prawn nets (ral valai) and disco net operation is mostly restricted to the period from June to september. Bottom set gill nets like *thirukkai valai, thathuvalai* and *sinkiral valai* operation varies from region to region but mostly confined to July to February.

Details regarding the average trip time, actual fishing hours and distance of fishing ground for the prominent craft gear combinations are given in Table V-2 and employment pattern and average annual fishing trips for each combinations given in Table V-3.

Table V - 2
Fishing details of selected craft-gear combinations at selected centres (Tamilnadu)

[illegible]TEGORY	Trip Time Hours	Actual Fishing Hours	Depth of Operation	Distance of Fishing ground (Kms)
[illegible]isanal sector [illegible]amarans with-				
[illegible]ooks & Lines	7	4.3	25-40	5-10
Disco-net	5	4	10-20	1-4
Boat seine	5	3	10-12	1-3
Anchovies net	3	2	10-20	1-4
Drift net	14	10	20-40	8-12
Sardine net	5	3	20-30	4-8
Prawn net	8	5	10-30	3-6
Thadichivalai	72	32	30-40	10-15
Rays net	4	24	35-40	8-10
Lobster net	4	24	6-10	1-3
Thathu valai	4	24	35-40	7-10
2 Plank built boats with				
Shore seines	3	2	8-12	0-1
Sardine net	8	4	10-20	7-12
Koivalai	14	6	10-20	7-12
Drift net	12	8	40-45	12-15
Thallu valai	6	5	3-5	1-2

Table V-2 (continued)

Fishing details of craft-gear combinations at selected centres (Tamilnadu)

Category	Trip time hours	Actual fishing hours	Depth of operation	Distance of fishing (kms)
B Motorised sector				
1 Catamarans with-				
Hooks and lines	8	4	50-55	14-18
Sardine net	6	4	10-20	7-12
Drift net	14	10	25-40	7-15
2 Plank built boats with sardine net	8	4	15-20	7-12
C Mechanised sector				
Trawlers	10	6	30-50	15-20
Gillnetters	14	8	30-50	15-20
Pair trawlers	12	6	40-50	15-25
Fish trawlers	12	8	35-50	15-25

It may be seen that in the artisanal sector catamarans with hook and line or with anchovies net operate maximum number of days. For the better utilization of craft and available man power, some other type of gear also are required for effective fishing throughout the year. With regard to plank built boats [redacted] number of fishing days per annum was observed for [redacted]*alai* operations. The annual employment, generated in- [redacted] of man days per unit is comparatively more in plank built [redacted]oat combinations rather than catamaran combinations both in motorized and non-motorized sectors. In the mechanised sector maximum fishing operations per annum was undertaken by trawlers.

Initial Investment

The capital investment of a fishing unit varies with the size of craft, type of engine and the number and pieces of gear owned. Most of the fishing units operating are old. There is considerable cost difference in the initial investment of old and new units. The resale value of the fishing units at the time of

observation has been considered as initial investment. The age of the fishing equipment, catagory wise life span, wear and tear suffered during the course of operation and the general appreciation of some fishing units due to cost escalation in recent years are considered in assessing the capital investment on fishing equipments.

Table V - 3
Employment pattern and labour share in different craft-gear combinations (Tamilnadu)

CATEGORY	No of crew	Crew Share (per cent)	Trips (annual)	Annual Employ-ment (Man Days)
A. Artisanal sector				
(i)Catamarans with :				
1. Hooks and lines	1-4	75	240	600
2. Disco net	2-3	75	83	208
3. Boat seine	6	66	80	480
4. Anchories net	2-3	66	240	600
5. Drift net	3-4	66	150	525
6. Sardine net	2-3	66	120	300
7 [illegible]wn net	2-3	66	80	200
[illegible]ichi valai	5-6	70	100	1650
[illegible] net	3-4	66	40	140
[illegible]ter net	2-3	66	120	300
[illegible]hu valai	3-4	66	125	312
[illegible]ank built boats with:				
[illegible]ore seines	20-35	70	180	4860
[illegible] Sardine net	5-6	66	240	1320
3. Koivalai	6-7	66	240	1560
4. Driftnet	5-6	66	170	935
5.Thalluvalai	3-5	60	280	1120
B.Motorized sector				
(i) Catamaran with:				
1. Hooks and lines	3-4	66	240	840
2. Sardine net	2-3	66	240	600
3. Drift net	3-4	66	175	412
(ii) Plank built boat with with sardine net	5-6	50	260	1430
C.Mechanised sector:-				
1. Trawlers	6	40	220	1320
2. Gillnetters	5	50	200	1000
3. Pair trawlers	12	40	100	2400
4. Fish trawlers	6	40	80	480

Some of the important craft-gear combinations in the traditional sector have been identified and the information on average capital investment on them at selected centres in Tamilnadu coast is given in Table V-4.

Table V - 4
Average investment of different craft-gear combinations in artisanal sector at selected centres 1989-90 (Tamilnadu)

Name of Centre	Craft-gear combination	Average Invest-ment(Rs.)	Total (Rs.)
Kurumpanai	Catamaran	3500	6500
	Sardine net	3000	
Colachel	Catamaran	3500	6000
	Hooks and lines	2500	
Kadiapattinam	Catamaran	7000	47000
	Drift net	40000	
Alanthalai	Catamaran	6500	
	Sardine net	3000	
	Rays net	2500	13500
	Lobster net	1500	
Akkaraipet	Catamaran	10000	
	Shark net	25000	
	Valavalai	5000	45000
	Sardine net	5000	
Thi[illegible]ottiyoorkuppam	Catamaran	7500	
	Sardine net	3500	
	Rays net	3000	15500
	Prawn net	1500	
[illegible]rthurai	Plank built boat	10000	
	Shore seine	30000	40000
[illegible]orin	Plank built boat	20000	
	Sardine net	10000	30000
Threspuram	Plank built boat	18000	
	Thalluvalai	2000	20000
Mallipattinam	Plank built boat	15000	
	Koivalai	48000	63000

The technological options and investment range are very wide. The average capital investment for a catamaran units with a single type of gear varies from Rs. 6000 for a hook and line unit at Colachel to Rs.47000 for a drift net unit at Kadia - pattinam. Similarly the investment for a catamaran unit with three types of gears varies from Rs. 13500 at Alanthalai to Rs.

The investment option for a motorized catamaran unit ranges from Rs. 25500/- to Rs.74500/-. The average capital investment of a motorized plank built boat comes about Rs.47000/- at Tuticorin.

Trawlers and gillnetters are the major mechanised units operating along Tamilnadu coast. Seasonal operation of pair trawlers and fish trawlers are also popular now a days. The average capital investment of a trawler works out at Rs.303500, pair trawler Rs.62000, fish trawler Rs.3.06000 and gillnetter Rs. 320000 at selected centres.

The analysis indicated that several technological options with varying investment ranges are available to the marine fishermen of Tamilnadu. Each type of craft-gear combination has its own merits and demerits. The co-existence of most of these innumerable techniques are imperative due to the seasonal nature of marine fisheries. However the availability of detailed information on the costs and earnings and comparative economic efficiency of different methods of fishing are very essential for the investors to decide the appropriate technology.

CHAPTER VI

COSTS AND EARNIGS OF FISHING UNITS

COSTS AND EARNINGS OF FISHING UNITS

The techno-economic performance and comparative efficiency of different types of fishing methods are determinent and decisive factors in the allocation of scarce resources. The production sector of marine fisheries consists of the artisanal, motorized and mechanised sub-sectors. The balanced growth of all these sectors should be taken care of in the development process. The options of different technologies are mostly based on profitability (Campleman 1976 and Sathiadhas 1989). Lack of detailed information on the economics of operations of different fishing methods is the present major lacunae in the selection of appropriate technology within each sector.

Seasonal operation of resource specific gears depending upon abundance of certain species is a common feature. Normally a catamaran unit has more than one gear. A clear picture about the profitability of a catamaran unit will emerge only by studying the annual costs and earnings of either a single gear or a combination of gears operated by them atleast for an year. However the operational costs and earnings of some of the seasonal gears widely operated by catamarans such as disco net, boat seine, *thathu valai* and lobster net are worked out to assess the comparative economic efficiency among these least capital intensive indigenous units.

I A. Seasonal artisanal fishing units

(1) Disco net operations by catamarans

The disco net operation along Kanyakumari coast of Tamilnadu is mostly confined to June-September coinciding with the availability of P. indicus. The average operational costs and earnings of disco-net operation by catamaran at Poothurai and Ezhudesam Chinnathurai centres of Kanyakumari coast have been given in Table VI - 1.

Table VI - 1

Operational costs and earnings of seasonal Disco net by catamarans (JUNE - SEP)

ITEM		SEASON	PER_TRIP
Actual No. of fishing days		83	--
Oper. Expenditure (Rs.)			
Labour		7719	93.00
Repair & maintenance		664	8.00
Auction charges		415	5.00
Other expenditure		249	3.00
Total		9047	109.00
Ca[illegible] Revenue (Q:Kg V: Rs.)			
P[illegible]icus	Q	83	1.00
	V	5395	65.00
[illegible]thus Sp.	Q	83	1.00
	V	747	9.00
[illegible]nius Sp.	Q	83	1.00
	V	1245	15.00
Silverbellies	Q	83	1.00
	V	249	3.00
Miscellaneous	Q	581	7.00
	V	5229	63.00
Total	Q	913	11.00
	V	12865	155.00

The average initial investment of a catamaran with disco net works out at Rs. 5000/-. The average number of fishing trips during the season comes about 83. The distance of the fishing ground is less than 4 kms and the average fishing hours per trip ranges from 2 to 5 hours. The average operational expenses of

these units works out at Rs. 9047 as against a gross revenue of Rs.12865. More than 90 percent of the operational expenses are the share of the wages of 2-3 crew members. *P.indicus, Otolithus sp. Johnius sp.* and silver bellies are the major species caught in these units. The net operating income for catamaran with disco-net works out at Rs. 3718 per season.

(2) Boat seine operation by catamaran

Boat seine operation by catamaran is comparatively labour-intensive as it requires about 6 crew. The operation of this net is mainly confined to May-September period. The operational cost and earnings of seasonal boat seine operation by catamaran at Enayam centre in Kanyakumari coast of Tamilnadu is given in Table VI - 2.

Table VI - 2
Operational costs and earnings of seasonal Boat seine(Thattumadi) by catamarans (MAY - SEPT)

IT[illegible]		SEASON	PER_TRIP
[illegible] fishing days		80	
[illegible]tional expenses (Rs)			
[illegible]bour		54960	687.00
[illegible]Repair & maintenance		2400	30.00
3.Auction charges		4000	50.00
4.Other expenses		1600	20.00
Total		62960	787.00
Catch and revenue	(Q-Kg V-Rs)		
1.White baits	Q	7200	90.00
	V	28800	360.00
2.Ribbon fish	Q	8000	100.00
	V	50000	500.00
3.Rainbow sardine	Q	1600	20.00
	V	4800	60.00
4.Others	Q	2800	35.00
	V	16800	210.00
Total	Q	19600	245.00
	V	100400	1130.00

The actual number of fishing days ranges from 70 to 90 days during the season. The operational cost works out at Rs. 62960/- per season and Rs. 787/- per trip. The major varieties of fish caught in these units are white baits, ribbon fish and rainbow sardines. The average catch per unit per season works out at 19600 kg realizing a gross revenue of Rs.100400. The catch per trip of a catamaran operating boat seine is 245 kg realising a gross revenue of Rs. 1130. The net operating income of these units works out at Rs.27440 per season and Rs.343 per trip.

(3) Catamaran operating seasonal bottom-set gill nets

Thathuvalai and *Kalral valai* (lobster net) are the two prominent bottom-set gillnets widely operated along Tamilnadu coast in different seasons. With regard to the operation of these bottom set gillnets, fishermen leave the shore in the evening and set the net in the fishing ground and return by night itself. Next day morning about 8 A.M. they go to the ground, collect the catch and return to the shore. The net will be removed only on saturdays and if any repairing is required it will be done on sundays and again it will be set in the night. During week days when the net is in the ground, if any damage is noticed, that particular piece will be removed, repaired and replaced next day.

The average operational expenses and earnings of *thathuvalai* operation at Kadiapattinam and lobster net at Muttam in Kanyakumari coast have been worked out and given in Table VI - 3 and VI - 4.

Table VI - 3

Operational costs and earnings of seasonal Thathu valai by catamarans (Apr-Oct)

ITEM		SEASON	PER_TRIP
No.of Fishing days		125	--
Operational expenses (Rs)			
1. Labour		24000	192.00
2. Repair maintenance		2500	20.00
3. Auction charges		1875	15.00
4. Others		1250	10.00
Total		29625	237.00
Catch & Revenue (Q-Kg V-Rs)			
Caranx	Q	625	5.00
	V	6875	55.00
Pig-face breams	Q	1875	15.00
	V	20625	165.00
Reef cod	Q	1875	15.00
	V	11250	90.00
Others	Q	625	5.00
	V	3125	25.00
Total	Q	5000	40.00
	V	41875	335.00

Table VI - 4

Operational costs and earnings of seasonal Kalal valai by catamarans (APR - NOV)

ITEM		SEASON	PER_TRIP
No. of fishing days:-		150	--
Operational expenses (Rs)			
Labour		18600	124.00
Repair & maintenance		1500	10.00
Auction charges		750	5.00
Other charges		750	5.00
Total		21600	144.00
Catch & Revenue (Q-Kg V-Rs)			
1.Lobster	Q	225	1.50
	V	22500	150.00
2.Pig-face breams	Q	300	2.00
	V	2250	15.00
3.Others	Q	750	5.00
	V	3000	20.00
Total	Q	1275	8.50
	V	27750	185.00

The season for *thathuvalai* operation extends from April to October and lobster net operations from March to November. The average fishing days comes about 125 for *thathuvalai* and 150 for lobster net operations by catamaran. Carangids, pig-face breams and reef cod are the major varieties caught in *thathuvalai* units and lobster and pig-face breames in lobster net units.

The gross earnings of a *thathuvalai* unit during the season works out at Rs.41875 as against the operational expenses of Rs.29625. Maximum operational expenses is constituted by labour charges which is nothing but sharing the net revenue among crew members keeping aside a share to craft and gear. The average catch per trip per unit comes about 40 kg for *thathuvalai* units and 8.5 kg for lobster net units as against the gross revenue of Rs.335 and Rs.185 respectively. About 50 percent of the revenue in *thathuvalai* units is realised from pig-face breams and about 75 per cent of the gross revenue in *kalralvalai* units from lobsters.

The net operating income for the seasonal operations of *thathuvalai* comes about Rs.12250/- and lobster net Rs.6150/- the same per trip being Rs.98 and Rs.41 respectively.

B. **Catamaran operating a single gear through out the year**

Some catamarans operate single type of gear throughout the year. The gears which can be utilized effectively to a reasonable extent through out the year along Tamilnadu coast are anchovies net (netholivalai), sardine net (chalavalai), drift gill net (vali valai) and hook and line. With less capital intensity, wider fishing range and higher employment opportunities are obtained with these type of gears.

The average operational cost and earnings of a catamaran operating anchovies net at selected centres in Kanyakumari coast is given in Table VI - 5.

Table VI - 5

Operational costs and earnings of seasonal Anchovies net by catamarans (9 months)

ITEM		SEASON	PER_TRIP
No. of fishing days		240	--
Operational expenses (Rs)			
1. Labour		25200	105.00
2. Repair & maintenance		1920	8.00
3. Auction charges		1680	7.00
4. Other expenses		1200	5.00
Total		30000	125.00
Catch & Revenue (Q-Kg V-Rs)			
1. White baits	Q	8400	35.00
	V	32400	133.00
2. Sardines	Q	960	1.00
	V	3600	3.00
3. Silver bellies	Q	480	2.00
	V	1200	5.00
4. Others	Q	480	3.00
	V	1200	3.00
Total	Q	10320	41.00
	V	38400	144.00

The number of average annual fishing days comes about 240 and the peak season is confined to July-september. The operation of this gear is restricted within a distance of 4 kms from the shore. White baits, sardines and silver bellies are the major varieties of fish caught in this gear. The average operating expenses per trip works out at Rs.125 as against a gross revenue of Rs.144. The gross revenue per annum works out at Rs.38400 as against the operational cost of Rs.30000. The net operating income works out at Rs.8400 per annum.

Hook and line is another gear operated through out the year by many catamarans. Quality fishes like tuna, caranx, cat fish, seer fish, reef cod and cuttle fishes are caught by this gear. The average annual fishing days of a catamaran unit with hook and lines at selected centres in Kanyakumari coast comes about 220. The average catch per trip works out at 18 kg with a gross revenue of Rs.186 (Table VI - 6).

Table VI - 6

Average catch and earnings of a catamaran with hooks & lines

VARIETY	Annual Catch (Kg)	Annual Revenue (Rs.)	Per Trip Catch (Kg)	Per Trip Revenue (Rs.)
1.Tuna	660	3960	3	18
2.Caranx	440	3300	2	15
3.Cat fish	220	1100	1	5
4.Seer fish	660	9900	3	45
5.Reef cod	660	3960	3	18
6.Pig-face breams	880	8800	4	40
7.Cuttle fishes	220	8800	1	40
8.Others	220	1100	1	5
Total	3960	40920	18	186

The average annual catch is 3960 kg. with gross revenue of Rs.40920. Cuttle fishes and seer fish are the major varieties earning maximum revenue for the non-motorized catamaran operating hook and line.

The average catch and earnings of a non-motorized catamaran operating sardine gillnet at Tuticorin south landing centre is given in Table VI - 7.

Table VI - 7

Average catch and earnings of a catamaran with sardine gill net (Chala valai)

VARIETY	Annual Catch (Kg)	Annual Revenue (Rs.)	Per Trip Catch (Kg)	Per Trip Revenue (Rs.)
1. Other sardines/ clupeids	3654	14616	17	66
2. Goat fish	524	2000	2	9
3. Others	1000	4096	5	19
Total	5178	20712	24	94

The major catch components in these units are other sardines and goat fish. On an average each unit operate about 220 days in a year with total catch of 5178 kg. valued at Rs. 20712/-.

Drift gill net (vali valai) operation is also carried out in all seasons by non-motorized catamarans. The average catch and earnings of these units operating at Kadiapattinam centre of Kanyakumari coast of Tamilnadu is given in Table VI - 8.

Table VI - 8

Average catch and earnings of a catamaran with vali valai

VARIETY	Annual Catch (Kg)	Annual Revenue (Rs.)	Per Trip Catch (Kg)	Per Trip Revenue (Rs.)
1. Tuna	2250	11250	15	75
2. Mackerel	750	3750	5	25
3. Caranx	600	4500	4	30
5. Barracudas	750	6000	5	40
5. Seerfish	450	4500	3	30
6. Pig-face breams	300	1500	2	10
7. Reef cod	450	1350	3	9
8. Sharks	300	1500	2	10
9. Pomfrets	300	3000	2	20
10. Others	1200	6000	8	40
Total	7350	43350	49	289

The annual fishing days ranges from 125 to 175. Quality fishes like, caranx, barracudas, seer fish, pig faced breams and pomfrets are caught in substantial quantity by these units. The annual catch per unit works out at 7380 kg with a gross revenue of Rs.43350, the catch per trip being 49 kg with Rs.289 as gross revenue. Tuna forms the maximum catch and revenue of these units.

The annual income and expenditure statement of non-motorized catamaran operating various single type of gears at selected centres of Kanyakumari coast is given in Table VI - 9.

Table VI - 9
Annual Income and expenditure statement of catamarans with single gear at selected centres (1989-90)

ITEM	Ancho-vies net	Sar-dine net	Drift gill net	Hooks & lines
I Initial Invetsment(Rs.)				
(1) Catamaran	2500	3000	5000	4000
(2) Gear	3000	3500	50000	3000
Sub Total	5500	6500	55000	7000
II Annual Fixed cost(Rs.)				
(1) Depreciation				
(i) Catamaran(20%)	500	600	1000	800
(ii) Gear (25% to 100%)	1000	1166	12500	3000
(2) Interest (15%)	825	975	8250	1050
Sub Total	2325	2736	21750	4850
III Operational Costs(Rs.)				
(1) Labour Share	25200	12075	25100	28572
(2) Repair & Maintenance	1920	700	2500	300
(3) Auction charges	1680	1060	2140	2105
(4) Other expenses	1200	840	1060	420
Sub Total	30000	14675	30800	31397
IV Annual total cost(Rs.)	32325	17411	52550	36247
V Annual catch(Kg.)	10320	5178	7350	3960
VI Gross revenue(Rs.)	38400	20712	43350	40920
VII Net operating income (Rs.)				
(VI - III)	8400	6037	12550	9523
VIII Net profit (Rs.)				
(VI - IV)	+6075	+3301	-9200	+4673

The initial investment varies from Rs.5500 to 55000 for operating anchovies net to drift gill net by catamarans. The annual fixed cost portion of a catamaran unit with anchovies net works out at Rs.2325, sardine gill net Rs.2736, drift gill net Rs.21750 and hook and line Rs.4850. The annual operational cost varies from Rs.14675 for sardine gill net to Rs.31397 for hook and line. The net operating income varies from Rs.6037 for sardine gill net to Rs.12550 for drift gill net unit. The annual net profit of catamaran operating anchovies net throughout the year works out at Rs.6075, sardine gill net Rs.3301 and hook and line Rs.4673. However the catamaran operating drift gill net incur a net loss of Rs.9200 per annum. The loss for these units is mainly due to the high initial investment of Rs.50000 towards the nets alone and comparatively less number of annual fishing days.

C. **Catamaran operating a combination of gill nets**

The combination of various resource-specific gill nets suitable for different seasons is very essential for sufficiently efficient operation of catamaran units through out the year (Sathiadas and Panikkar, 1991). More than 60 percent of the gears possessed by the marine fishermen of Tamilnadu coast were different types of gill nets. Many fishermen not having any craft, possess some pieces of gill nets with which they join the craft owners according to the seasonal requirement. Most of the catamaran units in Tamilnadu coast has 3 types of gill net.

The annual costs, species-wise catch and earnings of these units at representative landing centres such as Thiruvottiyoorkuppam in Chengelpet district, Akkaraipet in

Thanjavour district, Alanthalai in V.O.C. district and Kadiapattinam in Kanyakumari district of Tamilnadu are discussed below.

The prominent gear combinations of catamaran unit differ from region to region. In general, in all regions catamaran units operate a pelagic gill net and another bottom set gill net although it is called by different local names in different regions. The gear combination at selected centres with the initial investment and average annual fishing trips are given in Table VI - 10.

Table VI - 10

Combinations of gill nets in catamaran units - Average initial investment & annual trips at different centres (1989-90)

CENTRE	Craft-gear combination	Initial investment Average per items	Initial investment Total	Annual fishing trips
1.Thiruvottiyoorkuppam (Chengalpet District)	Catamaran	7500		
	Kavalai valai	3500		
	Irukai valai	3000		
	Raal valai	1500	15500	257
2.Akkraipet (Thanjavur District)	Catamaran	10000		
	Thadichi valai	25000		
	Vala valai	5000		
	Kavalai valai	5000	45000	220
3.Alanthalai (V.O.C.District)				
	Catamaran	6500		
	Chala valai	3000		
	Thirukkai valai	2500		
	Sinkiral valai	1500	13500	232
4.Kadiapattinam (Kanyakumari District)	Catamaran	7000		
	Chala valai	3500		
	Thathu valai	2500		
	Disco valai	3500	16500	268

The investment varies from Rs.13500 at Alanthalai to Rs.45000 at Akkaraipet. The annual fishing trips for these units are comparatively higher than the catamaran operating a single type of gear throughout the year which varies from 220 trips at Akkaraipet to 268 at Kadiapattinam. The number of fishing trips observed at Akkaraipet is less as the operation of a single trip of *thadichi valai* unit requires about 2 days.

The average annual catch of a catamaran unit at Thiruvottiyoorkuppam works out at 7710 kg with catch per trip of 30 kg (Table VI - 11).

Table VI - 11
Average catch and earnings of a catamaran with gill nets * at Thiruvottiyoorkuppam (1989-90)

VARIETY	Annual Catch (Kg)	Annual Revenue (Rs.)	Per Trip Catch (Kg)	Per Trip Revenue (Rs.)
1. Elasmobranchs	1542	7710	6	30
2. Other sardines/ clupeids	3855	19275	15	75
3. Carangids	514	3855	2	15
4. Goat fish	771	3084	3	12
5. Others	1028	5140	4	20
Total	7710	39064	30	152

(*Gill nets: 1.*Kavalai valai* 2.*Irukai valai* 3.*Ral valai*)

Elasmobranchs, other sardines/clupeids, carangids and goat fish are the major varieties caught by these units. But other sardines/clupeids alone contributes about 50 percent of the catch and gross revenue. The annual gross earnings of these units are Rs.39064 with 257 fishing days.

Catamaran units at Akkaraipet incur higher investment but realize higher catch and revenue. The major varieties of fish caught in these units are perches, elasmobranchs, other sardines,

mackerel, croakers, carangids, seer fish and cat fish. The annual average catch works out at 25520 kg with gross revenue of 1,22,320 and the catch per trip being 116 kg with gross revenue of Rs.556.Perches forms the maximum catch and revenue of these units (Table VI - 12).

Table VI - 12
Average catch and earnings of a catamaran with gill nets * at Akkaraipet (1989-90)

VARIETY	Annual Catch (Kg)	Annual Revenue (Rs.)	Per Trip Catch (Kg)	Per Trip Revenue (Rs.)
1. Elasmobranchs	3080	12320	14	56
2. Other sardines /clupeids	2640	11000	12	50
3. Perches	6600	26400	30	120
3. Mackerel	2640	13200	12	60
5. Croakers	1100	4400	5	20
6. Carangids	880	5280	4	24
7. Seerfish	1100	13200	5	60
8. Catfish	880	3520	4	16
9. Others	6600	33000	30	150
Total	25520	122320	116	556

(*Gill nets: 1.*Thadichi valai* 2. *Vala valai* 3.*Kavalai valai*)

The gross earnings of a catamaran unit with three types of gears at Alanthalai is found to be Rs.36192 per annum with a catch of 7424 kg (Table VI - 13).

Table VI - 13
Average catch and earnings of a catamaran with gill nets* at Alanthalai (1989-90)

VARIETY	Annual Catch (Kg)	Annual Revenue (Rs.)	Per Trip Catch (Kg)	Per Trip Revenue (Rs.)
1. Elasmobranchs	1160	4176	5	18
2. Other sardines/ clupeids	4640	20880	20	90
3. Seer fish	464	6496	2	28
4. Ribbon fish	464	1856	2	8
5. Others	696	2784	3	12
Total	7424	36192	32	156

(*Gill nets:1.*Chala valai* 2.*Thirukkai valai* 3.*Sinkiral valai*)

Other sardines form about 62 per cent of catch and 58 per cent of gross revenue. Elasmobranchs, seer fish and ribbon fish are the other major components of the catch. On an average these units could operate about 232 fishing trips during 1989-90.

Maximum fishing trips for catamaran observed for the gear combination of sardine gill net, *thathu valai* and disco net at Kadiapattinam. Disco-net operation is mainly concentrated during June-July, *thathuvalai* during July-November and the *chala valai* for the remaining period of the year. Other sardines, reef cod, pig-face breams and goat fish are the major components of the catch by these units (Table VI - 14).

Table VI - 14
Average catch and earnings of a catamaran with gill nets* at Kadiapattinam (1989-90)

VARIETY	Annual Catch (Kg)	Annual Revenue (Rs.)	Per Trip Catch (Kg)	Per Trip Revenue (Rs.)
1. Penaeid prawns	268	10720	1	40
2. Other sardines /clupeids	4020	16080	15	60
3. Goat fish	1340	4020	5	15
4. Caranx	536	5360	2	20
5. Pig-face breams	1340	13400	5	50
6. Reef cod	1608	9916	6	37
7. Elasmobranchs	536	2144	2	8
8. Silverbellies	536	1876	2	7
9. Johnius spp.	268	2144	1	8
10. Others	804	2680	3	10
Total	11256	68340	42	255

(*Gill nets: 1.*Chala valai* 2. *Thathu valai* 3.*Disco valai*)

The average annual catch works out at 11256 kg with gross revenue of Rs.68340. Other sardines, pig-face breams and penaeid prawns earn substantial revenue for these units.

The annual income and expenditure statement of catamaran

operating with a combination of 3 types of gill nets at different centres along Tamilnadu coast is given in Table VI - 15.

Table VI-15
Annual income and expenditure statement of catamarans with combinations of gill nets at different centres (1989-90)

ITEM	Thiru-vottiyoor kuppam	Akkrai pet	Alan-thalai	Kadia pattinam
I. Initial Investment (Rs)				
1. Craft	7500	10000	6500	7000
2. Gears	8000	35000	7000	9500
Sub total	15500	45000	13500	16500
II. Annual Fixed Cost(Rs)				
1. Depreciation				
(i)Craft (20%)	1500	2000	1300	1400
(ii)Gears (33.3%)	2666	11666	2333	3166
2. Interest (15%)	2325	6750	2025	2475
Sub total	6491	20416	5658	7041
III. Operational costs(Rs)				
1. Labour	22700	76060	22050	41570
2. Repair & Maintenance	1200	1720	800	1480
3. Auction charges	1950	3700	1500	2750
4. Other expenses	1860	2800	820	1750
Sub total	27710	84280	25170	47550
(iv)Annual total cost(Rs) (II + III)	34201	104696	30828	54591
(v)Annual catch (Kg)	7710	25520	7424	11256
(vi)Gross revenue (Rs)	39064	122320	36192	68340
(vii)Net operating income (Rs) (vi)-(iii)	11354	38040	11022	20790
(viii)Net profit (Rs) (vii) - (ii)	4863	17624	5364	13749

The annual operational expenses vary from Rs.25170 at Alanthalai to Rs.84280 at Akkaraipet. The labour share alone constitutes more than 85 per cent of the operational costs of these units at all the selected centres. The annual fixed cost ranges from Rs.5658 at Alanthalai to Rs. 20416 at Akkaraipet. The annual total cost for the operation of catamaran unit works out at Rs.34201 at Thiruvottiyoorkuppam, Rs.104696 at Akkaraipet,

Rs.30828 at Alanthalai and Rs.54591 at Kadiapattinam. Since the catamaran unit has to meet the annual fixed cost irrespective of their fishing operations, the net operating income was also worked out and it ranges from Rs.11022 at Alanthalai to Rs.38040 at Akkaraipet. The catamaran unit with 3 types of gill nets are operating on profit at all the selected centres and it ranges from Rs.4863 at Thiruvottiyoorkuppam to Rs.17624 at Akkaraipet.

D. Plank built boats operating different gears in the artisanal sector

Next to Catamarans the plank built boats locally called as "vallams" or "Kettuvallams" are widely operated for marine fishing along Tamilnadu coast. There are about 8000 plank built boats operating along this coast in which 85 per cent are still depending on wind energy for their mobility (Anon. 1986). The shore seine operations, here and there along the coast is exclusively carried out by these crafts. In addition to the usual operation of innumerable gill nets along the entire coast these boats operate mini trawl net (thallu madi) in the near shore areas of Palk Bay and Gulf of Mannar. The annual costs and earnings of plank built boats operating shore seines, gill nets and mini-trawl nets at representative centres like Colachel in KanyaKumari District, Tuticorin and Threspuram in VOC District and Mallipattinam in Thanjavour District are discussed below.

The combination of plank built boat with different types of nets and their average investment and annual fishing days are given in Table VI - 16.

Table VI - 16

Plankbuilt boats with different gears - Initial investment and annual fishing trips at different centres (1989-90)

CENTRE	Craft-gear combination	Initial investment (Rs) Per Item	Total	Annual fishing trips
1.Colachel	Plankbuilt boat	8000		
(Kanyakumari District)	Shoreseine	30000	38000	180
2.Tuticorin	Plank built	20000		
(V.O.C.District)	Koivalai	10000	30000	240
3. Mallipattinam	Plankbuilt	18000		
(Thanjavur District)	Koivalai	45000	63000	210
4.Therespuram	Plank built	18000		
(V.O.C.District)	Thallumadi (mini trawlnet)	2000	20000	265

The average capital requirement for acquiring a plank built boat ranges from Rs. 8000 for shore seine operations at Colachal to Rs. 20000 for operating sardine gill net at Tuticorin. The average cost of a net ranges from Rs.2000 for *thallumadi* at Threspuram to Rs.45000 for *Koi valai* at Mallipattinam. The initial investment of a plank built boat unit ranges from Rs.20000 to 63000 for different gear combinations. The number of annual fishing trips ranges from 180 for a shore seine unit at Colachel to 265 for a *thallumadi* unit at Threspuram.

The operation of shore seine unit along Tamilnadu coast is showing a steady decline over the years. 5 to 10 persons go in a plank built boat to operate the net and about 20 to 50 persons in shore pull the net back. The technique is labour-intensive but the uncertainity of catch associated with this gear is too high. Often the landings are meagre, but there

are occasions of bumper catches. The average catch and earnings of a shore seine unit at Colachel area is given in Table VI - 17.

Table VI - 17
Average catch and earnings of a shoreseine unit at Colachel (1989-90)

VARIETY	Annual Catch (Kg)	Annual Revenue (Rs.)	Per Trip Catch (Kg)	Per Trip Revenue (Rs.)
1.White baits	9900	29700	55	165
2.Caranx	2880	33300	16	185
3.Barracudas	1440	7200	8	40
4.Rainbow sardine	1080	6480	6	36
5.*Chirocentrus dorab*	900	7200	5	40
6.Miscellaneous	3600	25200	20	140
Total	19800	109080	110	606

White baits, caranx, barracudas, rainbow sardine and *chirocentrus dorab* are the major varieties caught in these units. The peak months of shore seine operation are October to March. The annual average catch per unit works out at 19800 kg with catch per trip of 110 kg. The average annual gross revenue realized by this unit works out at Rs.1.09 lakhs and Rs.606 per trip. About 50 percent of the catch is constituted by white baits and more than 50 percent of revenue by caranx and white baits in these units.

The average annual catch of a sardine gill net operated by plank built boat at Tuticorin works out at 18960 kg with gross revenue of Rs.62400 (Table VI - 18). The catch per trip is 79 kg with gross revenue of Rs.260. Although other sardines, *thryssa spp* and *ilisha* species constitute major portion of the catch the main stay of sardine gill net highly depends on the availability of *sardinella gibbosa.*

Table VI - 18

Average catch and earnings of a plankbuilt unit with sardine gillnet at Tuticorin (1989-90)

VARIETY	Annual Catch (Kg)	Annual Revenue (Rs.)	Per Trip Catch (Kg)	Per Trip Revenue (Rs.)
1.Sardinella gibbosa	10800	43200	45	180
2.Sardinella albella	240	720	1	3
3.Sardinella sirm	960	6720	4	28
4.Thryssa spp.	3360	5040	14	21
5.Ilisha sp.	1200	1920	5	8
6.Others	2400	4800	10	20
Total	18960	62400	79	260

For *koivala* operations at Mallipattinam, the ownership of the net costing around Rs.48000 is equally shared among the crew members. The quality fishes like seer fish and carangids are caught in substantial quantities in these units (Table VI - 19).

Table VI - 19

Average catch and earnings of a plankbuilt unit with *Koivalai* at Mallipattinam (1989-90)

VARIETY	Annual Catch (Kg)	Annual Revenue (Rs.)	Per Trip Catch (Kg)	Per Trip Revenue (Rs.)
1.Other sardines/ clupeids	1260	3780	6	18
2.Perches	420	3150	2	15
3.Mackerel	2100	12600	10	60
4.Carangids	1050	10500	5	50
5.Seer fish	1050	14700	5	70
6.Cat fish	210	840	1	4
7.Ribbon fish	630	2520	3	12
8.Hilsa kelee	6300	25200	30	120
9.Others	420	3360	2	16
Total	13440	76650	64	365

However about 50 per cent of the catch is contributed by *hilsa kelee*. The estimated annual catch per unit is 13440 kg realizing a gross revenue of Rs.76650. The catch per trip comes

to 64 kg valued at Rs.365 .

Thallumadi is operated by the plank built boat with sails in the near shore areas within 5 meters depth range. It is operated throughout the year in Tuticorin area either towards north or south depending on the direction and intensity of wind. The average annual catch of a *thallumadi* unit at Thresspuram near Tuticorin works out at 2650 kg with gross revenue of Rs.38425 (Table VI - 20).

Table VI - 20
Average catch and earnings of a non-motorized plankbuilt unit with mini trawl net(Thallumadi) at Tuticorin (1989-90)

VARIETY	Annual Catch (Kg)	Annual Revenue (Rs.)	Per Trip Catch (Kg)	Per Trip Revenue (Rs.)
1.Penaeid prawns	1060	31800	4	120
2.Crabs	265	1855	1	7
3.Silver bellies	795	2120	3	8
4.Others	530	2650	2	10
Total	2650	38425	10	145

About 83 per cent of the revenue is realized from penaeid prawns. It is observed that the penaeid prawns are constituted by *M.dobsoni* and mostly Juveniles of *P.indicus* and *P.semisulacatus*. The exploitation of small size prawns by these units has been consistently critisized by the fishery scientists on conservation point of view (Sampson Manickam *et.al.*,1987; Suseelan and Rajan, 1991). However the number of unit in Palk Bay and Gulf of Mannar region is showing an increasing trend over the years due to its profitability with least effort.

Table VI - 21

Annual income and expenditure statement of plank-buikt boats operating different gears at selected centres (1989-90)

ITEM	Shore-seine (Cola-chel)	Sardine Gill net (Tuti corin)	Koi-valai (Malli-Pattinam)	Thallu-madi (Thres-puram)
I. Initial Investment(Rs)	38000	30000	63000	20000
II. Annual Fixed cost (Rs)				
(i)Craft (20%)	1600	4000	3600	3600
(ii)Gear 20% to 30%	6000	3300	9000	1000
(2)Interest (15%)	5700	4500	9450	3000
Sub total	13300	11800	22050	7600
III. Operational costs(Rs)				
(1)Labour share	72786	36520	42715	22350
(2)Auction charges	2200	3120	3300	1800
(3)Repair & maintenance	2000	3700	3500	2500
(4)Other expenses	900	800	1100	600
Sub total	77886	44140	50615	27250
(iv)Average Annual cost(Rs)	91186	55940	72665	34850
(v)Annual catch (Kg)	19800	18960	13440	2650
(vi)Gross revenue (Rs)	109080	62400	76650	38425
vii. Net Operating Income	31194	18260	26035	11175
viii. Net profit (Rs)	17894	6460	3985	3575

As seen from Table VI - 21, the annual fixed cost (depreciation for craft and gear and interest on initial investment) varies from Rs.7600 for a *thallumadi* unit at Tuticorin to Rs.22050 for a *Koivalai* unit at Mallipattinam. The annual operational cost ranges from Rs.2750 for a *thallumadi* unit to Rs.77886 for a shore seine unit. Just like the non-motorized catamaran operating different gears, here also labour charge accounts for more than 80 per cent of the operational costs. The average annual expenditure works out at Rs.91186 for shore seine unit at Colachal, Rs.55940 for sardine gill net unit at Tuticorin, Rs.72665 for *koivalai* unit at Mallipattinam and

Rs.34850 for *thallumadi* units at Threspuram. The net operating income ranges from Rs.11175 to 26035 per annum for different gears. The annual net profit is found to be Rs.3575 for *thallumadi* unit, Rs.3985 for *Koivalai* unit, Rs.6460 for sadine gill net unit and Rs.17894 for shore seine unit.

Although shore seine unit earns maximum net operating income and profit compared to other gears, its number is gradually declining all along the coast of Tamilnadu. Shore seine operation requires 30 to 50 labourers and their earnings share works out hardly about Rs.10 per head per fishing day. The non-availability of regular labourers for this low returns is perhaps the major reason for the declining of these units.

II. Economics of motorized fishing units

The process of motorization of country craft started in Tamilnadu in early eighties eventhough experimental projects on motorization were tried much earlier (Jacob *et.al.* 1985). Experiments conducted on motorization of country craft under the Indo-Norwegien project in mid fifties found that the programme would not be feasible. In 1970, under Indo-Belgium Fisheries Project about 100 catamarans were fitted with outboard engines at Muttom in Kanyakumari District (Gillet 1981). In 1974, the Marianad Fisheries Co-operative society in Trivandrum District initiated a similar experiment. Unlike in Gujarat, where motorization of country craft started in the fifties, the experiments in Kanyakumari district in Tamilnadu and Trivandrum district in Kerala were not a success (Balan *et.al.*, 1989). However motorization of country craft picked up very well from

the early eighties along Kanyakumari coast due to the high catch rates of cuttle fish and its high unit value realization due to export demand (Sathiadhas, 1982). Now the number of motorized craft is continuously increasing. Studies show that about 2 percent of catamarans and 9 percent of the other country crafts of Tamilnadu were motorized so far and this is to a larger extent confined to the southern districts like Chidambaranar, Thirunelveli and Kanyakumari districts.

Motorized catamarans operating hook and line at Muttam and *valivalai* at Kadiapattinam and motorized plank built boats operating sardine gill net at Tuticorin and *valivalai* at Kadiapattinam were selected for indepth study. The average initial investment of a motorized catamaran operating hook and line comes about Rs.25500 and the same operating *valivalai* comes about Rs.74500 (Table VI - 22).

Table VI - 22
Motorized country crafts with different gears - Initial investment and annual fishing trips at different centres (1989-90)

CENTRE	Craft-gear combination	Initial investment (Rs) Per Item	Total	Annual fishing trips
1.Muttam	Catamaran	5000		
	Engine	17000	25500	243
	Hooks and lines	3500		
2.Kadiapattinam	Catamaran	7500		
	Engine	17000	74500	195
	Vali valai	50000		
3.Tuticorin	P.B.Boat	20000		
	Engine	17000	47000	260
	Sardine gill net	10000		
4.Kadia pattinam	P.B.Boat	23000		
	Engine	17000	90000	220
	Vali valai	50000		

The average annual fishing trips range from 195 to 243 for *valivalai* and hook and line of catamaran units respectively. Similarly the motorized plank built boat operating sardine gill net requires an average investment of Rs.47000 and for *valivalai* Rs.90000. The average annual fishing trips of motorized P.B.boats range from 220 for *valivalai* unit to 260 for sardine gill net unit.

The average species-wise catch and revenue of motorized catamaran with hook and line have been given in Table VI-23.

Table VI - 23
Average catch and earnings of a motorized catamaran with hooks and lines at Muttam (1989-90)

VARIETY	Annual Catch (Kg)	Annual Revenue (Rs.)	Per Trip Catch (Kg)	Per Trip Revenue (Rs.)
1.Tuna	1215	7290	5	30
2.Caranx	1215	9720	5	40
3.Cat fish	243	1215	1	5
4.Seer fish	1215	18225	5	75
5.Reef cod	1215	7290	5	30
6.Pig-face breams	972	9720	4	40
7.Cuttle fishes	486	19440	2	80
8.Others	729	3645	3	15
Total	7290	76545	30	315

Tuna, caranx, cat fish, seer fish, reef cod, pig-face breams and cuttle fishes are the major varieties caught in these units. About 50 percent of the gross revenue is realized from the catches of cuttle fish and seer fish. The annual catch per unit is 7290 kg. with gross revenue of Rs.76545.

Motorized catamaran operating *valivalai* at Kadiapattinam earns an annual gross income of Rs.101010 from the catch of 15210 kg.of different varieties of fish (Table VI - 24).

Table VI - 24
Average catch and earnings of a motorized catamaran with valivalai at Kadiapattinam (1989-90)

VARIETY	Annual Catch (Kg)	Annual Revenue (Rs.)	Per Trip Catch (Kg)	Per Trip Revenue (Rs.)
1.Tuna	3900	19500	20	100
2.Mackerel	975	5850	5	30
3.Caranx	1170	7800	6	40
4.Barracudas	1170	10725	6	55
5.Seer fish	1950	19500	10	100
6.Pig-faced breams	975	6825	5	35
7.Reef cod	1170	3510	6	18
8.Sharks	975	5850	5	30
9.Pomfrets	1365	13650	7	70
10.Others	1560	7800	8	40
Total	15210	101010	78	518

More than 50 percent of the gross income is realized from the catches of quality fishes like seer fish, tuna and pomfrets. The average catch and earnings of a motorized plank built boat with sardine gillnet at Tuticorin is given in Table VI-25.

Table VI - 25
Average catch and earnings of a motorized plank built boat with sardine gill net at Tuticorin (1989-90)

VARIETY	Annual Catch (Kg)	Annual Revenue (Rs.)	Per Trip Catch (Kg)	Per Trip Revenue (Rs.)
1.Sardinella gibbosa	12480	52520	48	202
2.Sardinella albella	1300	4160	5	16
3.Sardinella sirm	2080	15600	8	60
4.Thryssa spp.	7800	11960	30	46
5.Ilisha spp	1300	2080	5	8
6.Others	3900	7800	15	30
Total	28860	94120	111	362

The catch composition indicates that the species *sardinella gibbosa* forms maximum catch and revenue of these units. The average annual catch per unit works out at 28860 Kg. with gross

revenue of 94120. The catch per trip being 111 kg. with gross revenue of Rs.362.

Number of motorized plank built boats operating drift gill nets is in an increasing trend over the years along Tamilnadu coast. Mostly quality fishes are caught in these units. The motorized P.B.Boats operating *valivalai* at Kadiapattinam earns a gross income of Rs.151580 with 21120 kg. of catch per annum (Table VI - 26).

Table VI - 26
Average catch and earnings of a motorized plank built boat with valivalai at Kadiapattinam (1989-90)

VARIETY	Annual Catch (Kg)	Annual Revenue (Rs.)	Per Trip Catch (Kg)	Per Trip Revenue (Rs.)
1.Tuna	5940	30800	27	140
2.Mackerel	660	3300	3	15
3.Caranx	2640	22000	12	100
4.Barracudas	1540	13200	7	60
5.Seer fish	3300	33000	15	150
6.Pig-faced breams	440	2640	2	12
7.Reef cod	660	2640	3	12
8.Sharks	1540	8800	7	40
9.Pomfrets	2200	22000	10	100
10.Others	2200	13200	10	60
Total	21120	151580	96	689

About 70 percent of the gross revenue is earned from the catches of seer fish, tuna, caranx and pomfrets. The overall catch per trip works out at 96 kg realizing a gross revenue of Rs.689.

The annual income and expenditure statement of motorized catamaran and plank built boat operating different gears at selected centres is given in Table VI - 27.

Table VI - 27

Annual income and expenditure statement of motorized units at selected centres (1989-90)

ITEM	Catamarans		Plank built boat	
	Hooks& lines (Muttam)	Vali-valai (kadia-pattinam)	Sardine gill net (Tuti-corin)	Vali-valai (kadia-pattinam
I. Initial Investment(Rs)	25500	74500	47000	90000
II. Annual fixed cost (Rs)				
1. Depreciation				
(i)Craft @ 20%	1000	1500	4000	4600
(ii)Engine @33%	5667	5667	5667	5667
(iii)Gear @20-50%	1750	10000	3300	10000
2. Interest @15%	3825	11175	7050	13500
Sub total	12242	28342	20017	33767
III. Operational costs (Rs)				
1. Labour share	42880	54000	53500	85150
2. Fuel cost	8505	8750	9100	15400
3. Repairing and maintenance	500	1750	6350	3000
4. Auction charges	3000	4800	3250	6750
5. Other charges	720	1400	1500	1700
Sub total	55605	70700	73700	112000
IV. Annual total cost (Rs)	67847	99042	93717	145767
V. Annual catch (Rs)	7290	15210	28860	21120
VI. Gross revenue (Rs)	76545	101010	94120	151580
VII. Net operating Income	20940	30310	20420	39580
VIII. Net profit (Rs)	8698	1968	403	5813

The annual fixed cost of a catamaran unit ranges from Rs.12242 operating hooks and lines at Muttam to Rs.28342 operating *valivalai* at Kadiapattinam. The annual fixed cost of P.B.boats operating sardine gill net at Tuticorin works out at Rs.20017 as against Rs.33767 for operating *valivalai* at Kadiapattinam. The operational expenditure varies from Rs.55605 to 70700 per annum for catamaram unit and Rs.73700 to 112000 for P.B. boat unit. All types of motorized unit observed are running on profit. Net operating income ranges from Rs.20940 to 30310 for catamaran unit and Rs.20420 to 39580 for

P.B. boat unit. However the highest net profit of Rs.8698 per annum is seen for motorized catamaran operating hook and line. Among the motorized P.B. boats the *valivalai* units earns Rs.5813 per annum as net profit.

III. Economics of mechanised fishing units

A. Seasonal fish trawl units at Colachel:-

The south west coast of Tamilnadu extends about 58 kms from Cape Comorin to Neerodi in Kanyakumari District. The fishery of this region was dealt with by Chacko and George (1958), Padmanaban (1966), Lazarus and Joel (1979) and Sathiadhas and Benjamin (1991). One of India's richest fishing grounds, the Wadge Bank, about 10,000 sq.km. in area is situated here. Colachel, which is a natural harbour, is the most important landing centre in this region. Normally 10 to 20 mechanised boats regularly operate from Colachel. But during the south-west monsoon months (June-October) large number of mechanised boats migrate to this centre and operate fish trawl locally known as *mixture madi* or *rope madi*.

Mechanised boats at Colachel set out for fishing by about 4 A.M. and return to the shore between 2 to 5 P.M. The number of crew in each boat ranges from 6 to 8. The net (mixture madi) looks like the usual trawlnet with a bigger mesh size costing around Rs.5000/-. Since there is no jetty facility at this centre, the boats are stationed at a distance and catches are bundled and tied to a rope and pulled to the shore by fishermen.

The average operational costs and earnings of seasonal fish trawl units at Colachel during July-October 1989 have been given in Table VI - 28.

Table VI - 28
Operational costs and earnings of a seasonal fish trawl units at Colachel (Jul - Oct 1989)

ITEM		Per Trip	Season
I. Operational costs (Rs)			
a) Labour		540	44280
b) Fuel		400	32800
c) Auction charges		50	4100
d) Repair and maintenance		30	2460
e) Other expenses		45	3690
Total		1065	87330
II. Catch & revenue (Q-Kg V-Rs)			
1. Cuttle fish	Q	50	4100
	V	1000	82000
2. Thread fin breams	Q	125	10250
	V	375	30750
3. Lizard fish	Q	200	16400
	V	300	24600
4. Reef cod	Q	50	4100
	V	250	20500
5. Others	Q	40	3280
	V	185	15170
Total	Q	465	38130
	V	2110	173020
III. Net operating income (Rs)		1045	85690
IV. Average No. of fishing Trips		-	82

The average actual fishing days per unit works out at 82 for (July-October 1989) season. The average operating expenses per trip come to about Rs.1065. Wages and fuel expenditure are the most important constituents of operating costs. The average fuel expenditure per trip works out to Rs.400 with diesel requirement of about 80 litres per trip. Wages to the crew is proportional to the catch as sharing system is followed in these units. The income after deducting the running costs such as

fuel expenses, auction charges and other day to day expenses is divided into three shares. The owner of the unit gets two shares for the boat and net and the remaining portion is equally divided among the crew as wages.

Cuttle fish, thread fin breams, lizard fish and reef cod are the major varieties of fish caught by these units. The average catch per trip during the season works out to 465 kg. and gross revenue at Rs.2110. About 50 per cent of the gross earnings is from cuttle fish catches. The success of fish trawl operation in Colachel region highly depends on the availability of cuttle fishes. The net operating income per trip works out to Rs.1045.

B. **Shrimp trawlers at selected centres**:-

There are at present about 2500 trawlers operating along Tamilnadu coast and 50 per cent of the total marine catch is accounted by them. Data on the daily catch, revenue and cost structure have been collected systematically for a period of one year at Tuticorin, Nagapattinam and Pudumanikuppam during April 1989 to March 1990. Most of the boats under operation at the time of investigation were old and had undergone lot of repairs and replacements over the years. However, for the present analysis, the capital requirement for a new trawl unit (1989) has been considered as the initial investment.

(1) **Catch and revenue**:-

The specie-wise average catch and revenue of trawler at Tuticorin have been worked out and presented in Table VI - 29.

Table VI - 29
Average catch and earnings of a trawler at Tuticorin (1989-90)

VARIETY	Annual Catch (Kg)	Annual Revenue (Rs.)	Per Trip Catch (Kg)	Per Trip Revenue (Rs.)
1. Prawns	16	400	3888	97200
2. Cuttle fish	10	175	2430	42525
3. Rays	6	25	1458	6075
4. Clupeids	50	200	12150	48600
5. Goat fishes	18	80	4374	19440
6. Croakers	4	20	972	4860
7. Carangids	18	144	4374	34992
8. Silver bellies	94	200	22842	48600
9. Seer fishes	3	70	729	17000
10. Barracudas	7	70	1701	17000
11. Thread fin breams	8	40	1944	9720
12. Other perches	20	150	4860	36450
13. Others	3	10	729	2430
Total	257	1584	62451	384912

Silver bellies and clupeids dominate in the catch and prawns dominate in revenue earned by these units. Prawns form about 6 per cent of the total catch but the revenue earned constitutes about 25 per cent of the gross revenue. It is interesting to note that the bye catches of trawlers at Tuticorin earns about 75 per cent of the gross revenue (Fig.6). The bye catches (Threadfin breams) of a trawler is given in Plate III. The average catch per trip works out to 257 kg realizing a gross revenue of Rs.1584. The average number of fishing trips per annum for the trawlers at Tuticorin comes out at 243. The catch per unit per annum is estimated as 62.45 tonnes earning a gross revenue of Rs.384912.

For the trawlers at Nagapattinam silver bellies, prawns, croakers, rays and thread fin breams are the dominant species in the catch (Table VI - 30).

Fig. 6 REVENUE FROM MAJOR CONTRIBUTOR FOR TRAWLERS - TUTICORIN

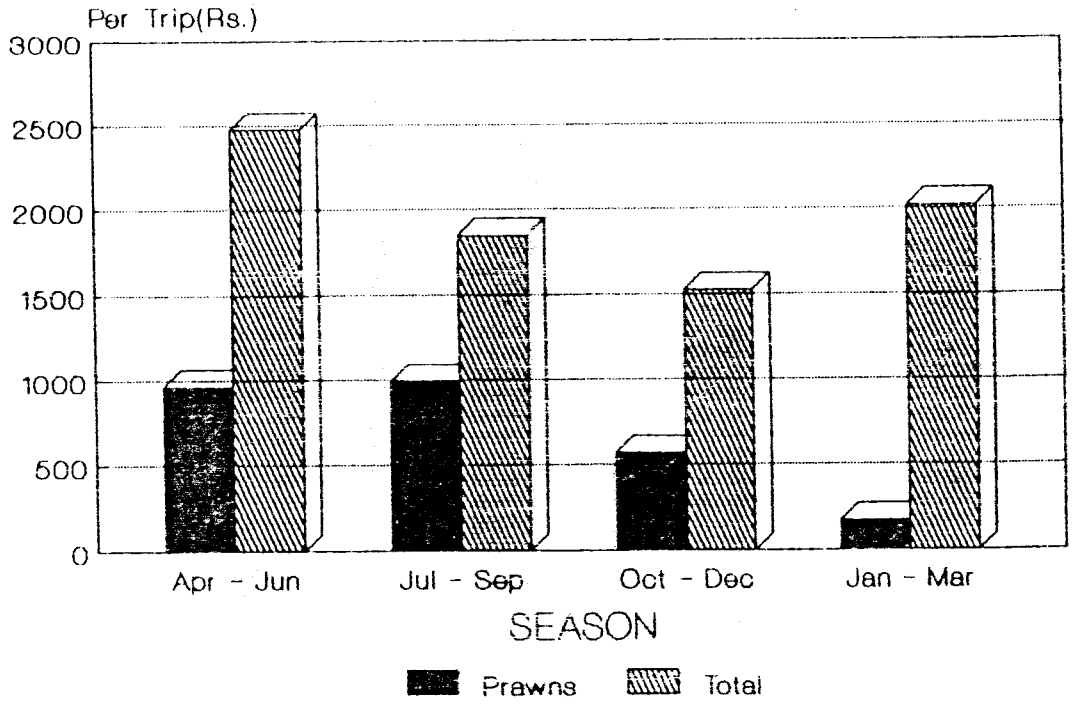


Fig. 7 REVENUE FROM MAJOR CONTRIBUTOR FOR TRAWLERS - NAGAPATTINAM

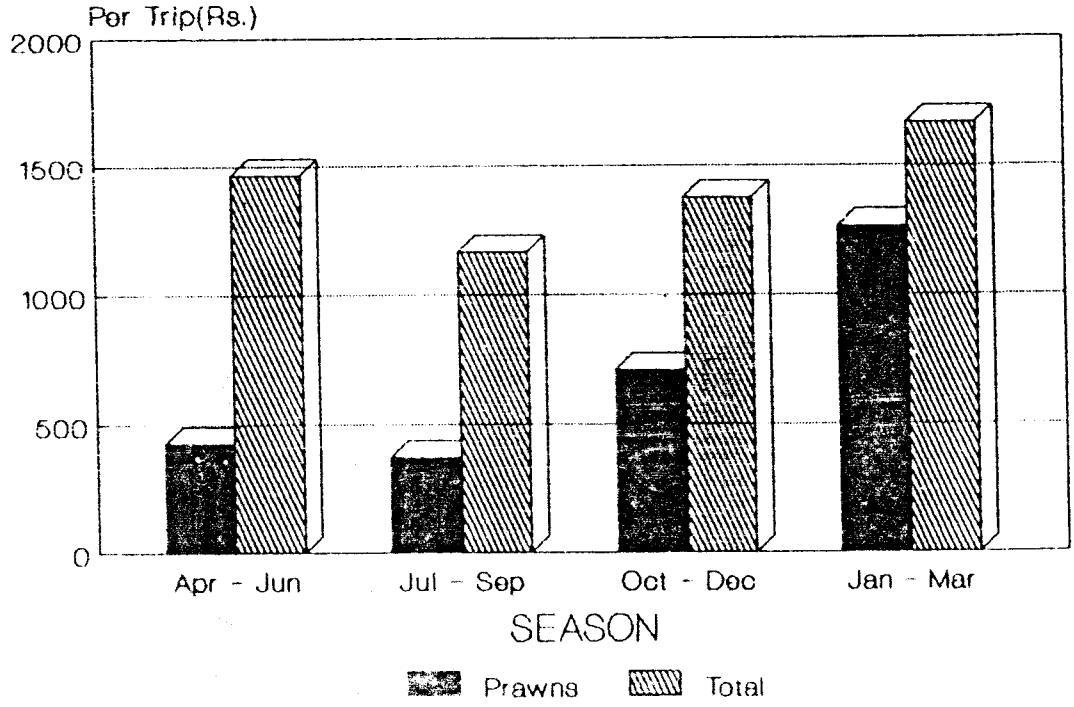


Table VI - 30
Average catch and earnings of a trawler at Nagapattinam (1989-90)

VARIETY	Annual Catch (Kg)	Annual Revenue (Rs.)	Per Trip Catch (Kg)	Per Trip Revenue (Rs.)
1. Prawns	55	1100	13200	264000
2. Cuttle fish	3	45	720	10800
3. Rays	37	85	8880	20400
4. Croakers	50	100	12000	24000
5. Ribbon fish	5	10	1200	2400
6. Carangids	25	75	6000	18000
7. Silver bellies	60	120	14400	28800
8. Pomfrets	4	75	960	18000
9. Thread fin breams	33	100	7920	24000
10. Other perches	15	90	3600	21600
11. Barracudas	4	20	960	4800
12. Flat fishes	10	50	2400	12000
13. Others	106	318	25440	76320
Total	407	2188	97680	525120

Although prawns contribute about 14 per cent of the catch, they realize about 50 per cent of the gross revenue (Fig. 7). The average catch per trip works out to 407 kg. realizing a gross revenue of Rs. 2188. The average annual catch of a trawler works out to 97.68 tonnes realizing a gross revenue of Rs. 5.25 lakhs for 240 fishing trips. With regard to trawlers at Pudumanikuppam, thread fin-breams and silver bellies are the dominant varieties in the catch (Table VI - 31).

Prawns constitute 6 per cent of the catch and 24 per cent of the gross revenue. Cuttle fishes constitute about 4 per cent of the catch and 13 per cent of the revenue. However, it is essential to note that about 76 per cent of the gross revenue of trawlers at Pudumanikuppam is from bye catches. The catch per trip works out at 472 kg realizing a gross revenue of Rs.2245.

Table VI - 31
Average catch and earnings of a trawler at Pudumanikuppam (1989-90)

VARIETY	Annual Catch (Kg)	Annual Revenue (Rs.)	Per Trip Catch (Kg)	Per Trip Revenue (Rs.)
1.Prawns	27	540	6372	127440
2.Cuttle fish	20	300	4720	70800
3.Rays	8	20	1888	4720
4.Croakers	26	60	6136	14160
5.Ribbon fishes	29	65	6844	15340
6.Carangids	40	160	9440	37760
7.Silver bellies	80	200	18880	47200
8.Pomfrets	2	40	472	9440
9.Thread fin breams	90	300	21240	70800
10.Other perches	30	150	7080	35400
11.Barracudas	10	80	2360	18880
12.Others	110	330	25960	77880
Total	472	2245	111392	529820

On an average, there are about 236 fishing days per annum for the trawlers operating at Pudumanikuppam. The average annual catch of a trawler is about 111.4 tonnes, with gross earning of about Rs. 5.29 lakh per annum.

There are reports that the prawn stock all along our coast are being fished intensively and there is practically no scope for increasing the fishing effort any more (Muthu, 1988). The present analysis also indicates that the catch rate of trawlers has considerably declined. The contribution of shrimps in total revenue is hardly 25 per cent both at Tuticorin and Pudumanikuppam. However, a healthy development is that the over-dependence of prawn catches for the sustenance of trawl unit has been drastically reduced as other varieties of fish caught also fetch better prices in the domestic market.

(2) Initial investment:-

The average initial investment of a new trawl unit during

1989 ranges from Rs.2.7 lakhs at Tuticorin to 3 lakhs at Nagapattinam (Table VI - 32).

Table VI - 32

Annual income and expenditure statement of trawlers at selected centres in Tamilnadu (1989-90)

ITEM	Tuti-corin	Naga-pattinam	Pudumani kuppam
I.Average initial investment (Rs)			
(a)Hull	140000	155000	150000
(b)Engine	125000	140000	130000
(c)Gear	5000	5000	5000
Total	270000	300000	285000
II.Annual fixed cost (Rs)			
(a)Depreciation			
(i)Hull & Engine (10%)	26500	29500	28000
(ii)Gear (50%)	2500	2500	2500
(b)Interest for investment (15%)	40500	45000	42750
Total	69500	77000	73250
III.Operating costs (Rs)			
(a)Labour	67200	122830	100775
(b)Fuel	164025	132000	200600
(c)Jetty rent and Auction charges	16300	21000	21500
(d)Repairing & maintenance	8000	12000	13200
(e)Other expenses	3000	3620	5400
Total	258525	291450	341475
IV.Annual total cost (Rs)	328025	368450	414725
V.Gross revenue (Rs)	384912	525120	529820
VI.Net operating income (Rs)	126387	233670	188345
VII.Net profit (Rs)	56887	156670	115095

The difference in investment between centres is mainly due to the variation in the type of wood used for hull and horse power of engines. The average capital requirement of hull alone ranges from Rs. 1.4 lakhs at Tuticorin to 1.55 lakhs at Nagapattinam and an engine ranges from Rs.1.25 lakhs to 1.4 lakhs between selected centres.

The fixed cost consists of the depreciation of fishing equipments which depends on its life expectancy, the interest for initial investment and any other costs which are incurred even if

there is no operation. The life expectancy of a new hull and engine is considered as 10 years. The interest for initial investment has been worked out at the rate of 15 per cent per annum. The annual fixed cost component of trawlers ranges from Rs.69500 at Tuticorin to Rs.77000 at Nagapattinam.

(3) **Operating costs**:-

The day-to-day expenses incurred for the working of the unit is termed as variable or operating costs. The expenses on fuel, wages to labour and repairing and maintenance are the major components of operating costs of a mechanised boat. Generally wages are proportional to returns as sharing system is followed in these units. The average annual average operating cost of trawlers worked out at Rs.2,58,525 at Tuticorin, Rs.292450 at Nagapattinam and Rs.341475 at Pudumanikuppam (Table VI - 32).

About 63 per cent of the operating costs of trawlers at Tuticorin, 45 per cent at Nagapattinam and 59 per cent at Pudumanikuppam are incurred towards fuel expenses. Similarly labour expenses accounted 26 to 42 percent of the operating expenses of trawlers at the selected centres.

(4)**Total cost and net income**:-

The total cost per annum (fixed & operating cost) for a trawler works out at Rs.328025 at Tuticorin, Rs.368450 at Nagapattinam and Rs.414725 at Pudumanikuppam during 1989-90. The operational cost alone constituted 79 to 82 per cent of the total annual cost of trawlers operating along the selected centres of Tamilnadu coast.

Net operating income per annum (income over operating expenses) for trawlers works out to Rs. 126387 at Tuticorin, Rs.233670 at Nagapattinam and Rs. 188345 at Pudumanikuppam. The annual net profit is obtained by deducting fixed and variable costs from the gross income of a unit in a year. Net profit realized by the trawlers ranges from Rs.56887 at Tuticorin and to Rs.1.57 lakhs at Nagapattinam during 1989-90.

Only a few studies on the economic viability of trawlers along Tamilnadu coast have been conducted so far (Sathiadhas & Panikkar, 1989 and Sathiadhas & Benjamin, 1990). These studies indicated that the trawl units along Tamilnadu coast are running on profit. Although the catch rates declined and cost of operation of the boats increased, better prices for the bye catches led to the success of these units. The present analysis also indicated that the prawn catches contributed substantial revenue only during a few months of the year. It has almost come to a stage that a trawler can survive even without prawn catch.

C. **Pair trawlers at Nagapattinam**:-

The operation of pair trawling by mechanised boats along Tamilnadu coast is a recent development. The continuous escalation of capital investment on fishing equipments, coupled with rising operational costs and decline in catch rates for trawlers created a dire need to diversify existing fishing methods and to re-deploy some of the inshore trawlers to catch under exploited fin fishes. This led to the introduction of single and two boat high opening trawl nets along Tamilnadu coast

for the operation of mechanised fishing boats.

The basic difference between traditional trawls and pair trawls are explained by various authors (Pandurangan and Ramamurthy, 1985; Pillai and Sathiadhas, 1982). The vertical mouth opening of high-opening trawl is about 3 metres and above, compared to the opening of less than a metre in traditional trawls. Because of the larger mesh size of these nets, the friction caused by the nets is much less than the conventional trawls enabling an increase in trawling speed and catch rate. The success of pair trawling is also due to the higher distance between the boats and gear and the fact that the boats do not pass directly over the path of the nets and thus do not disturb the fishes in shallow waters with engine and propulsion.

1. **Catch and revenue**:-

Pair trawlers leave either early morning or late evening and engage in day and night fishing before their arrival to the shore. Hence, the fishing trip of a pair trawler consists of two days. The average annual fishing trip of a pair trawler at Nagapattinam during 1989-90 comes about 100. The conversion of trawlers into pair trawlers and vice versa is very often noticed here depending upon the seasonal availability of prawns and quality fishes.

The catch per trip of a pair trawler works out at 1575 kg. realizing a gross revenue of Rs.7330. Rays, croakers, silver bellies, pomfrets and clupeids are the major varieties of fish caught in these units. The average species-wise catch and revenue of a pair trawler at Nagapattinam during 1989-90 are given in Table VI - 33.

Table VI - 33

Average catch and earnings of a pair-trawler at Nagapattinam (1989-90)

VARIETY	Annual		Per Trip	
	Catch (Kg)	Revenue (Rs.)	Catch (Kg)	Revenue (Rs.)
1. Prawns	35	800	3500	80000
2. Cuttle fish	5	75	500	7500
3. Rays	330	750	33000	75000
4. Croakers	300	450	30000	45000
5. Ribbon fish	25	40	2500	4000
6. Carangids	70	150	7000	15000
7. Clupeids	140	200	14000	20000
8. Silver bellies	300	450	30000	45000
9. Pomfrets	200	4000	20000	400000
10. Thread fin breams	70	210	7000	21000
11. Other perches	25	60	2500	6000
12. Others	75	150	7500	15000
Total	1575	7335	157500	733500

Although pomfrets constitute about 13 per cent of the total catch of the pair trawlers they earn about 55 per cent of the gross revenue (Fig. 8). The annual gross earnings of a pair trawler during 1989-90 at Nagapattinam works out to Rs.7.33 lakhs.

2. **Income and Expenditure:-**

The average initial investment of a pair trawling unit works out at 6.2 lakhs at Nagapattinam during 1989-90 (Table VI - 34). Since hull and engines of pair trawlers accounts about 6 lakhs, the annual fixed cost comprising of depreciation and interest for initial investment works out to 1.63 lakhs. Operational costs of a pair trawling unit works out to Rs.4.06 lakhs per annum. Labour is paid under sharing system which is proportional to revenue and constitutes about 43 per cent of the operating expenses. Fuel cost is the other important operating

Fig. 8 REVENUE FROM MAJOR CONTRIBUTOR FOR PAIR TRAWLERS - NAGAPATTINAM

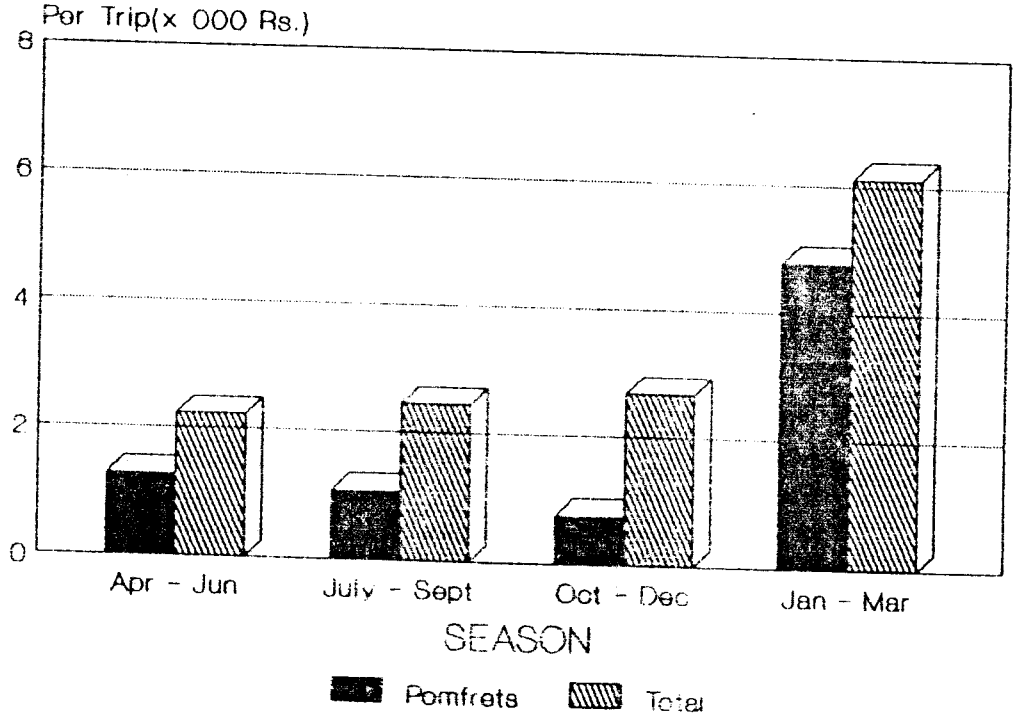


Table VI - 34

Annual income and expenditure statement of a pair trawler at Nagapattinam (1989-90)

ITEM	Amount (Rs.
I.Average Initial Investment (Rs)	
a)Hull	300000
b)Engine	300000
c)Gears	20000
Total	620000
II.Annual Fixed cost (Rs)	
a)Depreciation	
(i)Hull and Engine (10%)	60000
(ii)Gear (50%)	10000
b)Interest for investment (15%)	93000
Total	163000
VIII.Operational cost (Rs)	
a)Labour	173420
b)Fuel	168040
c)Jetty rent and Auction charges	30650
d)Repairing & maintenance	20200
e)Other expenses	14050
Total	406360
IV.Annual total cost (Rs)	569360
V.Gross revenue (Rs)	733000
VI.Net operating income (Rs)	326640
VII.Net profit (Rs)	163640

expenditure constituting about 41 per cent. The net operating income works out at Rs.3.26 lakhs per annum and the net profit Rs.1.63 lakhs.

Studies conducted earlier in this region (Pillai and Sathiadas, 1982; Pandurangan and Ramamurthy, 1985) indicates that pair trawling provided a new technique to fishermen of this region to harvest the hitherto underexploited valuable resources like pomfrets, rays, croakers, clupeids, carangids and perches in substantial quantity. The present study also confirms the same. Further, with the introduction of pair trawling the migration of boats to different centres in search of shrimps during the lean season has been drastically reduced. The convenience of

shifting from trawling to pair trawling or vice versa depending on the availability of various resources within the region has enhanced the overall catch rates of these units offering further scope to increase the landings along Tamilnadu coast.

D. **Gillnetters at Cuddalore and Pudumanikuppam**:-

Gillnet fishing by mechanised boats is slowly regaining its importance along Tamilnadu coast. Initially 7.6 and 9.1 metre boats were designed and introduced for gill netting. But the high profitability of shrimp trawling on those days led the fishermen to use these boats also for trawling with slight modifications. With declining catch rates of trawlers in recent years and increase in the prices of quality fishes in domestic market, the operation of gill nets by mechanised boats gathered momentum. Various studies conducted by different authors at different regions of our coastal belt (Silas et.al., 1984 and Panikkar et.al., 1990) indicate that there is enormous scope to increase the fishing effort of mechanised gill netters along our coastal waters. The present study on the economics of mechanised gill net fishing units has been carried out at Cuddalore and Pudumanikuppam, two important representative centres along Tamilnadu coast.

Catch and revenue:-

The gill netters usually bring quality varieties like seer fish, tunnies, carangids and sharks. The catch per trip of a gill netter at Cuddalore works out at 353 kg. as against 212 kg. at Pudumanikuppam (Table VI - 35 & 36).

Table VI - 35

Average catch and earnings of a gillnetter at Cuddalore (1989-90)

VARIETY	Annual Catch (Kg)	Annual Revenue (Rs.)	Per Trip Catch (Kg)	Per Trip Revenue (Rs.)
1. Sharks	41	205	6847	34235
2. Clupeids	4	12	668	2004
3. Carangids	3	21	501	3507
4. Seer fishes	140	2800	23380	467600
5. Tunnies	90	450	15030	75150
6. Others	75	300	12525	50100
Total	353	3788	58951	632596

Table VI - 36

Average catch and earnings of a gillnetter at Pudumanikuppam (1989-90)

VARIETY	Annual Catch (Kg)	Annual Revenue (Rs.)	Per Trip Catch (Kg)	Per Trip Revenue (Rs.)
1. Sharks	42	294	7560	52920
2. Rays	10	40	1800	7200
3. Cat fishes	5	25	900	4500
4. Perches	2	13	360	2340
5. Thread fins	2	15	360	2700
6. Carangids	36	360	6480	64800
7. Seer fishes	69	1725	12420	310500
8. Tunnies	36	216	6480	38880
9. Others	10	50	1800	9000
Total	212	2738	38160	492840

The average revenue earned per trip is Rs.3788 at Cuddalore and Rs.2738 at Pudumanikuppam. Seer fish is the dominant variety caught in gill netters in both the centres. About 40 per cent of the catch and 74 per cent of revenue at Cuddalore and 33 per cent of the catch and 63 per cent of revenue at Pudumanikuppam are accounted by seer fishes.

There are 167 average fishing trips at Cuddalore and 180

during 1989-90. The annual catch per boat works out at 60 tonnes at Cuddalore and 38 tonnes at Pudumanikuppam realizing a gross revenue of Rs.6 lakhs in the former and Rs.4.93 lakhs in the latter respectively.

2. **Capital requirement**:-

The initial investment of a gill netter varies from Rs.3.2 lakhs at Pudumanikuppam to Rs.3.5 lakhs at Cuddalore (Table VI - 37).

Table VI - 37

Annual inome and expenditure statement of gillnetters at Cuddalore and Pudumanikuppam in Tamilnadu (1989-90)

ITEM	Cudda-lore	Pudumani kuppam
I.Average initial investment (Rs)		
a)Hull	140000	135000
b)Engine	90000	85000
c)Gear	120000	100000
Total	350000	320000
II.Annual Fixed cost (Rs)		
a)Depreciation		
(i)Hull & Engine (10%)	23000	22000
(ii)Gear (25%)	30000	25000
b)Interest for investment (15%)	52500	48000
Total	105500	95000
III.Operating cost (Rs)		
a)Labour	159515	113500
b)Fuel	110220	99000
c)Jetty rent & Auction charges	31600	24642
d)Repairing & Maintenance	12550	10000
e)Other expenses	12230	8700
Total	326115	255842
IV.Annual Total cost (Rs)	431615	350842
V.Gross revenue (Rs)	632596	492840
VI.Net operating income (Rs)	306481	236998
VII.Net profit (Rs)	200981	141998

The boat (hull & engine) costs about Rs.2.2 lakhs at Pudumanikuppam and Rs.2.3 lakhs at Cuddalore. The value of a gill net always depends upon the number of pieces owned by each

unit. The average investment on gear varies from Rs.1 to 1.2 lakhs.

Annual fixed cost comprises the depreciation and interest for investment. The average annual fixed cost of a gill netter works out at Rs.95000 at Pudumanikuppama and Rs.105500 at Cuddalore.

3. **Variable costs**

Expenditure on labour and fuel are the major operating cost items of gill netters. Labourer is paid under sharing system which is proportional to revenue. Labour cost constitutes about 50 and 44 per cent of the total operating costs of gill netters at Cuddalore and Pudumanikuppam respectively. The average diesel requirement per trip works out at 120 litres at Cuddalore and 100 litres at Pudumanikuppam. The fuel expenses alone constituted about 34 and 39 percent of the operating costs of gill netters at Cuddalore and Pudumanikuppam respectively. The annual operating costs of gillnetters works out to 3.26 lakhs at Cuddalore and Rs.2.56 lakhs at Pudumanikuppam during 1989-90.

4. **Net operating Income and Profit**

The total cost of gill net operation comprises the annual fixed cost and operating costs of a unit. It works out to Rs.4.32 lakhs per annum for gill netters at Cuddalore and Rs.3.5 lakhs at Pudumanikuppam. Net operating income of a gill netter works out at Rs.3.06 lakhs in the former and Rs.2.37 lakhs in latter places respectively. The annual net profit is about Rs.2 lakhs at Cuddalore and Rs.1.4 lakhs at Pudumanikuppam.

The study indicates that the gill netters are found to be

highly efficient in terms of productivity and profitability even with less number and fishing trips. Gill net fishing by mechanised boats are mainly directed to catch seer fishes. Diversification to catch other quality fishes and introduction of bigger boats with longer operational range will further help to increase the profitability. In view of the enormous fishery resource potentialities in the Wadge Bank and EEZ of Tamilnadu, introduction of deep sea vessels especially for gill net fishing should be encouraged.

The costs and earnings of different craft-gear combinations in artisanal, motorized and mechanised sectors in marine fisheries of Tamilnadu has been discussed in this chapter. The average catch and earning per trip and annual income and expenditure statements not only brought out the profitability of various fishing technique of different investment ranges but also this will be helpful to assess the comparative economic efficiency.

CHAPTER VII

PRODUCTION FUNCTION, ECONOMIC EFFICIENCY AND MANAGEMENT

PRODUCTION FUNCTION, ECONOMIC EFFICIENCY AND MANAGEMENT

The catch and income in marine fishing may vary among fishermen due to differences in technology, input combination, fishery resource abundance, and technical efficiency in addition to pure luck (Panayotlu, 1985 and Fredericks 1985). The production of fish or any crop depends on the employment of various resources generally called inputs or factors of production. In marine fishing, the initial investment on equipments , labour, fuel and other operational expenditures are the factors of production. The production function describes the rate at which these factors are transformed into products. The production function estimation further yields information on returns to scale for various fishing techniques. To estimate the degree of efficiency of input use, an attempt was made to relate the value of the marginal products of inputs (MVP) to their price (P). The inputs considered for the computation of production function of some of the techniques are fuel, fishing days and repairing and maintenance charges (Panikkar & Srinath, 1991).

1. Trawlers at Nagapattinam

A Cobb Douglas type of production function is estimated for trawler operation at Nagapattinam and the equation is given below.

$$Y = 5.5674\ X1^{-0.0990}\ X2^{0.1226*}\ X3^{0.8558*}\ X4^{0.2596}$$

$$(0.3294)\quad (0.0566)\quad (0.3285)\quad (0.1757)$$

$R2 = 78\%$

*Significant at 5 percent level.

Where Y indicates gross revenue, X1 fuel cost, X2 repairing and maintenance cost and X3 actual fishing trips and X4 other operating costs.

The production elasticities of repairing and maintenance and fishing trips are significant at 5 per cent level, when number of fishing trips increased by 1 per cent from the average level, the output will increase by 0.85 per cent. Similarly if the repairing and maintenance cost is increased by 1 per cent the output will increase by 0.12 per cent. However the production elasticity of fuel cost is negative and not significant. It indicates that the fuel cost per trip should be reduced to maximize profit.

The MVP of fishing days for trawlers at Nagapattinam is worked out using.

$$MVPX3 = b3 \frac{\bar{Y}}{\bar{X3}}$$

Where X3 - fishing days
Y - average annual income and
b3 - the production elasticity.

To answer the question whether the inputs are used to the optimum level for maximizing profit, the marginal value products (MVP) of factors compared with their respective acquisition cost. The acquision b_i cost per day of operation works out at 1214 as against marginal value product of Rs.1872 for one fishing day. This indicates that the returns can be increased with enhanced number of fishing days.

Pair trawlers at Nagapattinam:-

The functional equation of pair trawlers is given below.

$$Y = 5.012357\ X1^{0.1681}\ X2^{0.1207*}\ X3^{0.6331*}\ X4^{0.2157}$$

(0.1153) (0.5122) (0.2021) (0.1955)

R2 = 78%

* significant at 5% level.

Here also Y and X1 to X4 are the same as in the previous function. For pair trawlers also the production elasticities of repairing and maintenance and fishing trips are significant at 5% level. When fishing trips (X3) are increased by 1 per cent from the average level, the output will increase by 0.63 per cent.

The marginal values of the two factors, repairing and maintenance and fishing trips have been worked out. The MVP of repairing and maintenance estimated at Rs.4.38 which indicates that an increase of one rupee in the maintenance cost from its average level brings out an additional income of Rs.4.38. This shows that the revenue can be further increased by timely repairing and proper maintenace of the fishing unit.

In the case of fishing trips an additional trip from the average level adds Rs.4640 to the total revenue. Since the average operating cost per trip works out at 4063, the present level of annual fishing trips (100) is almost near to optimum level of 114 trips.

3. **Motorized catamarans with hooks & lines:-**

The estimated production function is given below:

$$Y = 0.3292\ X1^{1.1780*}\ X2^{0.5456*}\ X3^{0.1932}$$

(0.2693) (0.0886) (0.1496)

R2 = 71%

*significant at 5 percent level.

Where Y = Average annual revenue per maintenance (Rs.)

X1 = Fishing days in a year

X2 = Annual fuel cost

X3 = Annual repair & maintenance charges

The value of marginal product of one trip works out at Rs.471 where as the average operating cost per trip is only Rs.229. This indicates that the number of trips per each unit as well as the number of units with hook and line can be increased to optimize the total income as well as profit from the fisheries.

Economic efficiency and management:-

To assess the comparative economic efficiency of different types of fishing units, the economic indicators such as rate of return, returns to labour, capital and fuel efficency, pay back period, break-even price etc. have been worked out on the basis of costs and earnings data. The capital turn-over ratio is used to measure the rate at which income is generated by capital investment. Rate of return and pay back period explains the economic feasibility of undertaking a particular investment. The returns to labour and their productivity per trip under various technological options give an idea about the allocative efficiency of labour.

The economic parameters of catamarans operating a single type of gear like anchovies net, sardine gill net, drift gill net and hook and line throughout the year have been worked out and given in Table VII - 1.

Table VII - 1

Key economic indicators - Cataramarans with single gear at selected centres of Tamilnadu (1989-90)

Economic parameters	Ancho-vies net	Sardine gill net	Drift gill net	Hooks& lines
1.Average annual fishing trips	240.00	220.00	150.00	220.00
2.Average catch per trip (Kg)	43.00	24.00	49.00	18.00
3.Gross revenue per trip (Rs)	160.00	94.00	289.00	186.00
4.Average operating cost per trip	125.00	67.00	205.00	143.00
5.Net operating income per trip	35.00	27.00	84.00	43.00
6.Quantity of fish produced per man day (Kg)	21.50	12.00	16.30	9.00
7.Value of production per man day	80.00	47.00	96.00	93.00
8.Wages received per manday	52.50	27.40	56.00	65.00
9.Operating cost per Kg. of fish	2.90	2.80	4.18	7.94
10.Average total cost per trip	135.00	79.00	350.00	165.00
11.Break even price per kg.of fish	3.13	3.30	7.14	9.16
12.Average price realized per Kg. of fish	3.70	3.92	5.90	10.33
13.Capital turn over ratio	6.98	3.18	0.78	5.84
14.Rate of return on capital (%)	125.00	67.00	--	82.00
15.Operating cost ratio	0.78	0.70	0.71	0.77
16.Total cost ratio	0.84	0.84	1.21	0.88
17.Pay back period (Years)	0.72	1.27	--	0.82

Single gear-craft combinations are less capital intensive and mostly oriented towards labour utilization. Catamarans with drift gill nets (valivalai) are operating less number of trips per annum among the four selected categories. However the earning per trip, quantity of fish caught and other parameters indicate the advantage of this combination provided if this unit operate more number of fishing trips. However the operation of hook and line by catamarans fulfil most of the economic tests to rank first among the least investment group of fishing techniques in the artisanal sector.

Combination of operating three types of gill nets, suiting different seasons of the year by catamarans is highly prevalent along Tamilnadu coast. The key economic indicators for

catamaran operating *Kavalaivalai, irukaivalai* and*rayalvalai* combination at Thiruvattiyoorkuppam,*thadichivalai, valavalai* and *kavalaivalai* at Akkaripet, *chalavalai, thirukkaivalai* and *sinkiralvalai* at Alanthalai and *chalavalai, thathuvalai* and disco net at Kadiapattinam have been worked out and given in Table VII-2.

Table VII - 2

Key economic indicators - Catamarans operating combination of gill nets at different centres

Economic parameters	(1) Thiru-vottiyoor kuppam	(2) Akkarai pet	(3) Alan-thalai	(4) Kadia-pattinam
1.Average annual fishing trips	257.00	220.00	232.00	268.00
2.Average catch per trip (Kg)	30.00	116.00	32.00	42.00
3.Gross revenue per trip (Rs)	152.00	556.00	156.00	255.00
4.Average operating income per trip	108.00	383.00	108.00	177.00
5.Net operating income per trip	44.00	173.00	48.00	78.00
6.Quantity of fish produced per man day	10.00	23.00	11.00	14.00
7.Value of production per man day	51.00	110.00	54.00	85.00
8.Wages received per man day	29.00	69.00	32.00	52.00
9.Operating cost per Kg. of fish	3.60	3.30	3.40	4.20
10.Average total cost per trip	133.00	476.00	133.00	204.00
11.Break-even price per Kg. of fish	4.43	4.10	4.15	4.85
12.Average price realized per kg.	5.06	4.79	4.88	6.07
13.Capital-turn over ratio	2.52	2.72	2.68	4.14
14.Rate of return on capital	46.40	54.20	54.70	98.30
15.Operating cost ratio	0.71	0.69	0.70	0.70
16.Total cost ratio	0.87	0.86	0.85	0.80
17.Pay back period (Years)	1.70	1.40	1.50	0.90

(1) *Kavalai valai+Irukai valai+Raal valai*
(2) *Thadichi valai+Vala valai+Kavalai valai*
(3) *Chala valai+Thirukkai valai+Sinkiral valai*
(4) *Clala valai+Thathu valai+*Disco net

All types of combinations of gill nets by catamaran are found to be economically efficient. However the catamaran operating *thadichivalai, valavalai* and *kavalaivalai* at Akkaraipet in the high investment group and *chalavalai, thathuvalai* and disco net at Kadiapattinam in the low investment group have been found

comparatively more efficient than the other units. The study further indicates that their earnings can be further increased if they take hook and line also along with other nets.

The economic indicators of non-motorized plank built boats operating shore seines at Colachel, sardine gill nets at Tuticorin, *Koivalai* at Mallipattinam and *thallumadi* at Threshpuram are given in Table VII - 3.

Table VII - 3
Key economic indicators - Plank built boats operating different gears at selected centres (1989-90)

Economic parameters	Shore seine (Cola-) chel)	Sardine gill net (Tuti-corin)	Koivalai (Malli-pattinam)	Thallu madi (Thres-puram)
1.Average annual fishing trips	180.00	240.00	210.00	265.00
2.Average catch per trip (Kg)	110.00	79.00	64.00	10.00
3.Gross revenue per trip (Rs)	606.00	260.00	365.00	145.00
4.Average operating cost per trip (Rs)	432.00	184.00	241.00	103.00
5.Net operating income per trip (Rs)	174.00	76.00	124.00	42.00
6.Quantity of fish produced per man day	3.67	16.00	11.00	2.50
7.Value of production per man day (Rs)	20.20	52.65	62.70	36.25
8.Wages received per man day (Rs)	13.50	30.43	33.90	21.08
9.Operating cost per Kg of fish (Rs)	3.92	2.33	3.77	10.30
10.Average total cost per trip (Rs)	507.00	233.00	346.00	132.00
11.Break-even price per Kg of fish (Rs)	4.60	2.95	5.40	13.15
12.Average price realized per kg of fish	5.50	3.29	5.70	14.50
13.Capital turn-over ratio	2.87	2.08	1.22	1.92
14.Rate of return on capital (Percent)	62.00	37.00	21.00	33.00
15.Operating cost ratio	0.71	0.70	0.66	0.70
16.Total cost ratio	0.83	0.90	0.94	0.91
17.Pay back period (Years)	1.50	2.20	3.80	2.40

The shore seine operation is slowly disappearing along Tamilnadu coast. The economic efficiency measures of these units operating at Colachel indicate that they are viable except satisfactory returns to labour. Although these units earn about Rs.174 as net operating income per trip the labourers receive hardly Rs.13.50. Hence, this can be encouraged as a part time avocation for the fishermen at suitable centres.

Plank-built boats operating *thallumadi* is showing an increasing trend along Tamilnadu coast. Although the average catch per trip is 10 per kg., they earn a gross revenue of Rs. 245 per trip as these units are directed to catch high priced prawns along the near shore areas. These units are economically viable and provides lot of employment to the fishermen of Gulf of Mannar and Palk Bay regions. But it is feared that more than 30 per cent of its catches comprise juvenile prawns which do not appear to be a good trend for the shrimp fishing of this region in the long run.

The capital turn over ratio (1.22), rate of return on capital (21%) and average annual fishing days (210) are comparatively less for the *koivalai* units at Mallipattinam. For better production and optimum profitability these units should be encouraged for motorization.

Motorized catamarans operating hook and line at Muttom and *valivalai* at Kadiapattinam and motorized P.B.boats operating sardine gill net at Tuticorin and *valivalai* at Kadiapattinam show better economic efficiency (Table VII - 4). The investment involved in these units are comparatively higher due to motorization. But the net operating income per day, average annual fishing trips and wages received by a labourer are far higher than the non-motorized units operating same type of gears. The results further indicate that the *valivalai* operation by motorized catamarans and P.B. boats earn more profit in the motorized sector. The earnings of these units can

Table VII-4
Key economic indicators - motorised units at selected centres (1989-90)

PARAMETERS	Catamarans		P.B. boats	
	Shore seine (Muttam)	Vali valai (Kadia-patti-nam)	Sardine gill net (Tuti-corin)	Vali valai (Kadia-patti-nam)
1.Average annual fishing trips	243.00	195.00	260.00	220.00
2.Average catch per trip (Kg)	30.00	78.00	111.00	96.00
3.Average revenue per trip (Rs)	315.00	518.00	362.00	689.00
4.Average value realized per Kg. of fish	10.50	6.64	3.26	7.17
5.Quantity of fish produced per man day	10.00	19.50	22.20	19.20
6.Value of production per man day (Rs)	105.00	130.00	72.00	138.00
7.Average remuneration received by a labourer per day (Rs)	59.00	69.00	41.00	77.00
8.Quantity of fish produced per litre of fuel (Kg)	4.30	8.70	15.80	6.90
9.Average fuel cost per trip (Rs)	35.00	45.00	35.00	70.00
10.Fuel cost per Kg of fish (Rs)	1.17	0.58	0.31	0.73
11.Average operating cost per trip (Rs)	229.00	363.00	283.00	509.00
12.Operating cost per Kg. of fish (Rs)	7.63	4.65	2.55	5.30
13.Average total cost per trip (Rs)	279.00	508.00	360.00	663.00
14.Break even price per Kg. of fish (Rs)	9.30	6.51	3.24	6.90
15.Capital turn over ratio	3.00	1.36	2.00	1.68
16.Rate of return on capital (Percent)	49.00	18.00	16.00	22.00
17.Pay back period (Years)	1.50	3.90	3.50	3.50
18.Operating cost ratio	0.72	0.70	0.78	0.73
19.Total cost ratio	0.88	0.98	0.99	0.96
20.Average net operating income per day	86.00	155.00	79.00	152.00

be further increased by enhancing the average annual fishing days if some other gears are supplemented to operate in the lean season. The key economic indicators for trawlers operating at Tuticorin, Nagapattinam and Pudumanikuppam are estimated and given in Table VII - 5.

The operation of trawlers during April 1989-March 1990 are highly profitable in all the selected centres. The annual fishing trips ranges from 236 at Pudumanikuppam to 243 at Tuticorin. The quantity of fish produced per manday ranges from

Table VII - 5
Key indicators of economic efficiency - Trawlers at different centres (1989-90)

ITEM	Tuti-corin	Naga-pattinam	Pudumani kuppam
1.Average annual fishing trips	243.00	240.00	236.00
2.Average catch per trip (Kg.)	257.00	407.00	472.00
3.Average revenue per trip (Rs.)	1584.00	2188.00	2245.00
4.Average value realized per Kg.of fish	6.16	5.38	4.76
5.Quantity of fish produced per manday	42.83	67.83	78.67
6.Value of production per manday (Kg.)	264.00	365.00	375.00
7.Average remuneration received by a labourer per day (Rs.)	46.00	85.00	71.00
8.Quantity of fish produced per litre of fuel (Kg.)	1.90	3.70	2.80
9.Average fuel cost per operation (Rs.)	675.00	550.00	850.00
10.Fuel cost per Kg. of fish (Rs.)	2.63	1.35	1.80
11.Average operating cost per day of operation (Rs.)	1064.00	1214.00	1447.00
12.Operating cost per Kg of fish (Rs.)	4.14	2.98	3.06
13.Average total cost per day of operat.	1276.00	1535.00	1757.00
14.Break even price per Kg.of fish (Rs)	4.96	3.77	3.72
15.Capital turn over ratio	1.43	1.75	1.86
16.Rate of return on capital (Percent)	36.00	67.00	55.00
17.Pay back period (Years)	3.14	1.60	2.00
18.Operating cost ratio	0.67	0.56	0.64
19.Total cost ratio	0.85	0.70	0.78
20.Average net operating income per day	520.00	974.00	798.00

43 kg. at Tuticorin to 79 kg. at Pudumanikuppam. Average remuneration received per day, ranges from Rs.46 at Turicorin to Rs.85 at Nagapattinam. Quantity of fish produced per litre of fuel varies from 1.9 kg. at Tuticorin to 3.7 kg. at Nagapattinam.

Average fuel cost per trip varies from Rs.550 to 850 between different centres. The fuel cost per kg. of fish production in trawlers works out at Rs.1.35 at Nagapattinam, Rs.1.80 at Pudumanikuppam and Rs.2.63 at Tuticorin. The break-even price per kg. of fish works out at Rs.4.96 at Turicorin, Rs.3.77 at Nagapattinam and Rs.3.72 at Pudumanikuppam as against the actual price of Rs.6.16, Rs.5.38 and Rs.4.76 respectively. The capital turn-over ratio, rate of return to capital and pay-

back period for the trawlers operating at different centres also show high economic returns. The present study confirms a diminishing trend in the catch and profitability. The present study confirms that the catch rates of prawns declined but the profitability has not shown any alarming scale of reduction.

Gill net operation by mechanised boats at Cuddalore and Pudumanikuppam centres have been studied and the estimated key economic indicators are given in Table VII - 6.

Table VII - 6

Key indicators of economic efficiency - gillnetters at Cuddalore and Pudumanikuppam (1989-90)

ITEM	Cudda-lore	Pudumani-kuppam
1.Average annual fishing trips	167.00	180.00
2.Average catch per trip (Kg.)	353.00	212.00
3.Average revenue per trip (Rs.)	3788.00	2738.00
4.Average value realized per Kg.of fish	10.73	12.92
5.Quantity of fish produced per man day	70.60	42.40
6.Value of production per man trip (Rs)	758.00	548.00
7.Average remuneration received by a labourer per trip (Rs.)	191.00	126.00
8.Quantity of fish produced per litre of fuel (Kg.)	2.70	1.93
9.Average fuel cost per trip of operation (Rs.)	660.00	550.00
10.Fuel cost per Kg.of fish (Rs.)	1.87	2.59
11.Average operating cost per operation	1953.00	1421.00
12.Operating cost per Kg. of fish (Rs.)	5.50	6.70
13.Average total cost per operation (Rs)	2585.00	1949.00
14.Break-even price per Kg. (Rs.)	7.32	9.20
15.Capital-turn over ratio	1.80	1.50
16.Rate of return on capital (Percent)	72.00	59.00
17.Pay back period (Years)	1.40	1.70
18.Operating cost ratio	0.52	0.52
19.Total cost ratio	0.68	0.71
20.Average net operating income per trip	1835.00	1317.00

The average annual fishing trips vary from 167 to 180. The cost of production per kg.of fish worked out at Rs.7.32 at Cuddalore and Rs.9.2 at Pudumanikuppam as against the market

price of Rs.10.73 and Rs.12.92 respectively. The average remuneration received per trip per crew ranges from Rs.126 at Pudumanikuppam to Rs.191 at Cuddalore. The average fuel cost per trip of operation is Rs.550 at Pudumanikuppam as against Rs.660 at Cuddalore. The quantity of fish produced per litre of fuel varies from 1.93 to 2.7 Kg. The fuel cost per kg. of fish production works out at Rs.1.87 at Cuddalore and Rs.2.59 at Pudumanikuppam. The other economic parameters like capital-turn-over ratio, rate of return on capital, pay back period and net operating income also indicate that the operation of gill nets by mechanised boats along Tamilnadu coast are highly profitable.

During the seventies and early eighties many fishermen shifted to trawl operations due to lucrative shrimp catches and less profitability of gillnetters (Panikkar *et.al.*, 1990). Now the quality fishes caught in gillnetters also receive good prices in the internal market and the profitability of these units increased substantially. The present study clearly indicates that the operation of gillnetters are more profitable than the trawlers along Tamilnadu coast.

The annual fishing trips of pair trawlers at Nagapattinam works out 100 (Table VII - 7). Since pair trawlers require 2 days per trip, the annual working days of crew comes to 200. The quantity of fish produced per man day in pair trawlers works out at 65.6 kg realizing a revenue of Rs. 305. The crew members in pair trawlers receive an average of Rs.72 per day. The average fuel cost per trip works out at Rs.1680. The quantity of fish produced per litre of fuel is Rs.4.7 kg.

Table VII - 7
Key indicators of economic efficiency - pair trawlers at Nagapattinam (1989-90)

ITEM	Naga-pattinam
1. Average annual fishing trips	100.00
2. Average catch per trip (Kg.)	1575.00
3. Average revenue per trip (Rs.)	7330.00
4. Average value realized per Kg. of fish	4.65
5. Quantity of fish produced per man day	65.60
6. Value of production per man day (Rs.)	305.00
7. Average remuneration received by a labourer per day (Rs.)	72.00
8. Quantity of fish produced per litre of fuel (Kg.)	4.70
9. Average fuel cost per trip (Rs.)	1680.00
10. Fuel cost per Kg. of fish (Rs.)	0.94
11. Average operating cost per trip (Rs)	4064.00
12. Operating cost per Kg. of fish (Rs.)	2.58
13. Average total cost per trip (Rs.)	5694.00
14. Break even price per Kg. of fish (Rs)	3.62
15. Capital turn over ratio	1.20
16. Rate of return on capital (Percent)	41.40
17. Pay back period (years)	2.70
18. Operating cost ratio	0.55
19. Total cost ratio	0.78
20. Average net operating income per trip	3266.00

Fuel cost per kg of fish production works out at Rs.0.94. The overall cost of production per kg. of fish works out at 3.62 per kg. as against receiving Rs.4.65 as average market price.

Other economic parameters also indicate that the operation of pair trawlers along Tamilnadu should be encouraged. The convenience of shifting from trawling to pair trawling or vice-versa depending on the availability of various resources with in the region has enhanced the overall catch rates of these units offering further scope to increase the landings along Tamilnadu coast by proper substitution of bottom and pair trawling appropriately.

The production function analysis indicates that the fishing effort can be increased in the motorized and mechanised sectors. For these units, enhancing the number of fishing trips with extended operation in deeper areas leaving the near shore zone to the artisanal sector is advisable. With regard to comparative economic efficiency - the hook and line units in artisanal sector, operation of drift gill nets as well as hook and line in motorized sector and gillnetters in the mechanised sector are found to be more efficient than other options.

CHAPTER VIII

MARINE FISH MARKETING, PRICE STRUCTURE AND PROFIT MARGINS

MARINE FISH MARKETING, PRICE STRUCTURE AND PROFIT MARGINS

Marine fishermen in India are said to have suffered from not getting the due price for their produce. The difference between the price of fish paid by the consumer and received by the fishermen is considered to be large. The general hypothesis is that conditions of monopsony and oligopsony characterize the fish marketing structure of India at the various stages and as a result fishermen do not get the advantage of high price prevalent at consumer markets. Basic economic theory indicates that in a perfectly competitive market no factor of production earns more than its opportunity cost and pure profit cannot exist in the long run because it is eliminated through competition. If a market is dominated by a single buyer it can be termed as monopsony, buyers monopoly with two buyers as duopsony, more than two but not too many as oligopsony and so on. Fish marketing in most of the developing countries are facing monopsony, oligopsony and monopsonistic competition (Fernado, 1985). Under conditions of imperfect competition, which include monopsony, oligopsony and monopsonistic competition, pure profit is expected to be positive in long-run equilibrium and it cannot be explained wholly in terms of the opportunity costs of the services provided by the middlemen.

Fish marketing system may be defined as all those functions and activities involved from the point of catching of fish to the point of final consumption. The pricing efficiency is concerned with improving the operation of buying, selling and other connected aspects of marketing process so that it will remain

responsive to consumer behaviour (Chhotan Singh and Vasisht, 1985 and Suryaprakash, 1979).

Domestic and export marketing

More than 90 percent of the marine fish landings of Tamilnadu is supplied in the internal markets. Prior to independence substantial quantity of dry fish was exported from the Tamilnadu especially from Tuticorin. With the advent of processing techniques like freezing and storage coupled with tremendous demand for prawns in several European countries, the export marketing of marine fish recorded phenomenal growth in recent years.

Frozen prawns earned substantial foreign exchange in marine fish exports and paved the way for the growth of an organized sea food export industry (Saxena, 1973). Product diversification in the export front has also been initiated to sustain the growth rate in the export front. Now, not only shrimps but also cuttle fish, shark- fins, crabs, seer fish etc. are also exported substantially. The economy of subsidiary industry of the marine fishery sector of the state, to a larger extent is highly depending on the demand of our marine products in the external markets. However, the development in the internal marketing system is rather slow. The parallel development of the domestic marketing system is also essential to sustain healthy development of marine fisheries sector in the long run. It must be remembered that apart from earning foreign exchange, exports were singularly responsible for increasing the earnings of the fishermen. At present the economics of operation of trawlers almost entirely depends on the price, the producer gets for

prawns which in turn depends on the international market. Though such complete dependence on the foreign market is not desirable, it is inevitable till the products obtain a sufficiently high demand in internal market.

Efficiency of fish marketing system

The marketing margin is an indicator of efficiency of the marketing system. In the absence of any value added process, higher the value of marketing margin the lower is the efficiency of the marketing system (Huger and Hirenath, 1984). On the one hand, the producers deserve a legitimate share in the consumer's rupee, and on the other, the consumers have to be safeguarded against excessive prices. These twin objectives can be achieved by ensuring various marketing services at reasonable costs i.e, restricting margins to a reasonable level. As fish like any other product moves closer and closer to the ultimate consumer, the selling price increases since the margins of the various intermediaries and functionaries are added to it. The perishable nature of the fish, seasonality of its production and the distance between the producer and the consumer are some of the important factors which require attention while assessing the marketing margin (Swarup *et.al.* 1985).

Marketing structure

All the marine fish landing centres of the State spreading the entire coastal belt serve as primary markets. However the major primary fish markets of Tamilnadu coast are Pudumanikuppam, Cuddalore, Nagapattinam, Mandapam, Rameswaram and Tuticorin, where the fish arrivals are comparatively higher due to mechanised landings. The mode of sales is by auctioning. The

mechanised gillnetters and indigenous fishing units mostly land their catches in the morning and most of the trawlers land their catch in the afternoon. The morning session of sales in primary markets was from 6 AM to 10 AM and evening market commences from 14.30 hours and continues till late evening.

There are several wholesale markets in the state located both near the coast and interior hinterlands. Some of the important wholesale markets of Madras city are Chintadripet, Jambazar and Saidapet. In Kanyakumari District, Vadasery and Kaliyakkavilai are the major whole sale centres of marine fish. Either the wholesalers are directly bringing the fish from the primary markets or getting supplies from the commission agents. The tempo van carries 600 to 800 kg of fish packed in baskets. The baskets of fish loaded for transportation are properly iced and packed to avoid spoilage.

The final phase in the supply line of marine fish is the innumerable retail markets located in the nook and corner of the State. The retailers collecting the fish either from the primary market or the wholesale market use mostly bicycles as their mode of transportation. There are many wholesalers supply fish directly to the retailing centres.

Market channels

Since the marine fish is consumed all over the country, it has to be carried to a long way from coastal to interior parts of the country. Marine fishes thus pass through the following prominent channels to reach the ultimate consumers.

1)Fishermen-Auctioneer-Agents of freezing plants-Exporter

-Retailer-consumer

2)Fishermen-Auctioneer-Processor (Dry fish)-wholesaler -Retailer - consumer

3)Fishermen-Auctioneer-Whole saler (Primary market) - wholesaler (retail markets) - Retailers - consumers

4)Fishermen-Auctioneer-Commission agents - Wholesaler -Retailer - Consumer

5)Fishermen - Auctioneer - Retailer - Consumer

6)Fishermen - Auctioneer - Consumer

The major portion of fish trading in internal marketing is practised through 3rd 4th and 5th channels. The auctioneers in the primary market and commission agents in secondary markets are also involved in the process without involving themselves in direct possession of the fish.

Auction sale

The prevalent practice of disposal of fish of large volumes is through auction where buyers participate in bidding. Normally auction is carried out after sorting of the catch (Plate IV). The open bidding is done simply by verbally declaring the bids of all the perspective buyers for a particular fish lot. As a rule, fish lots are awarded to the highest bidder.

In general, each fishing boat operator directs his catch to a particular auctioneer regularly. As producer's representative, the auctioneers perform the selling function for which they are paid a commission of about 5 per cent of the gross sales. Because fish is generally sold on credit, the auctioneer sometimes makes payments by himself to the suppliers promptly and fully to maintain their goodwill and confidence.

As producer's representative, the auctioneers are free to

negotiate with any buyer. Generally, the auctioneers sell their products on credit payable before the next purchase. In these cases the credit-worthiness of the buyer is the most important factor, considered by auctioners. There are also transactions that involve cash and instalment payments.

Marketing Expenses

The fish passes through a number of hands before reaching to the ultimate consumer. Due to its perishable nature proper preservation and handling is vital. Bamboo baskets are mostly used to pack the fish which is costing around Rs.20 and last for a period of about a month (Plate V). About 25 to 30 kg of fish can be packed in a single basket . The usual mode of transportation are trucks, tempos, motorized cycle rickshaws, bicycles and head loads. During 1989-90 the freight charge for a truck load was Rs.4 per Kilometer. In the Madras region, especially for the transportation of fish from Pudumanikuppam to Chinthadripet wholesale market and retail markets, the motorized cycle rickshaws are commonly used. At times even 2 to 3 retailers join together and transport their baskets in a single rickshaw. For packing one basket of fish, 10 to 15 kg of ice is used costing around Rs. 8/- to 12/-. The labour charges for packing and loading/ unloading works out to Rs. 3 per basket.

It was found that the marketing cost including handling and transporation of big size fishes like seer fish, giant sea perch, sharks and barracudas was comparatively higher than that of small size fishes such as sardines, lizard fish and thread fin breams.

Distribution pattern

The distribution pattern of marine fish in Tamilnadu towards

exports, fresh sales in domestic market and for dry edible as well as fish meal for selected years has been given in Tab.VIII-1.

Table VIII - 1
Distribution pattern of marine fish, Tamilnadu (1979-'90)

Distribution pattern	Years (percent) 1979	1985	1990
Fresh Domestic	50	52	60
Dry edible	37	34	22
Dry fish meal	7	8	10
Exports	6	6	8

The present analysis indicates that the supply of fresh domestic fish in internal marketing has increased to 60 per cent in 1990 from about 50 per cent in 1979 and 52 per cent in 1985. Similarly the supplies for exports and fish meal also shown improvement over the years. Utilization of ice for preservation has been widely accepted among the consumers and fish moves even interior and far off places from the sea shore with out much spoilage.

Price behaviour

The price behaviour of fish is mainly characterised by wide fluctuations at all stages of transactions in the marketing chain, which resulted from the highly perishable nature of fish and the high variation in its short run supply. Price is determined by the interaction of demand and supply at both producing centres (Primary markets) and consumer markets. At landing centres the market demand is the aggregate demand from wholesalers which is indicated by the number of trucks arriving at the centre and also from cycle vendors, retailers and individual

purchasers. There will not be much variation in the day to day volume of transactions by these purchasers or in other words, the short run demand is more or less stable. However, the level of supply on any day is completely unpredictable and short run supply is highly inelastic. Hence on any day, a bumper catch at a landing centre will slash down the fish prices and a small catch will boost the prices to very high levels. Though the short term fluctuation in fish price is very wide the average annual prices of all commercially important fishes in Tamilnadu during the last decade shows an increasing trend.

The increase in price of marine fish over the years has been substantial. This increase is much higher than all other food articles. The wholesale price of some selected varieties of fish in Tamilnadu for the years 1973-74, 1984-85 and 1989-90 is given in Table VIII - 2.

Table VIII -2
Wholesale price behaviour of selected varieties of marine fish in Tamilnadu

NAME	Average price (Rs/Kg) 1973-74 (*)	1984-85 (*)	1989-90 (**)
Seer fish	4.00	19.00	28.90
Rainbow runner	3.50	11.00	24.60
Pomfrets	5.00	17.50	23.15
Barracudas	2.00	11.25	15.20
Tuna	2.00	10.00	13.45
Sharks	1.50	11.25	13.85
Cat fish	1.00	7.75	13.00
Mackerel	2.00	6.25	9.00
Sardines	1.00	4.00	6.90
White baits	2.00	5.00	5.85
Ribbon fish	2.00	5.00	6.15
Rays	1.00	6.00	6.40
Silver bellies	2.50	3.00	4.20

(*)= Madras region /Source: Mohan Krishnan and Rajappan 1976
Sathiadhas and Panikkar 1988
(**)= Kanyakumari region(Present study)

It is interesting to note that the wholesale price of seer fish increased from Rs.4 per kg. during 1973-74 to Rs.28.90 during 1989-90, promfrets from Rs.5 to 23.15, sharks from Rs.1.50 to 13.85, cat fish from Rs.1 to 13, sardines from Rs. 1 to 6.9, rays from Rs.1 to 6.40 and so on.

The average retail price of selected varieties of marine fish during 1973-74, 1984-85 and 1989-90 is given in Table VIII-3.

Table VIII - 3

Retail price behaviour of selected varieties of marine fish in Tamilnadu

NAME	Average retail price (Rs/Kg) 1973-74 (*)	1984-85 (*)	1989-90 (**)
Seer fish	9.00	27.00	35.50
Rainbow runner	5.00	12.00	31.25
Pomfrets	9.00	22.80	29.50
Barracudas	2.50	15.35	21.00
Tuna	3.00	16.50	18.50
Sharks	2.50	17.00	17.00
Cat fish	2.50	11.00	16.50
Mackerel	3.00	9.85	12.50
Sardines	2.00	6.70	10.00
White baits	3.00	8.00	9.00
Ribbon fish	2.50	8.50	10.00
Rays	2.00	10.00	10.75
Silver bellies	3.50	6.00	6.25

(*)= Madras region/ Source: Mohan Krishnan and Rajappan 1976
Sathiadhas and Panikkar 1988

(**)= Kanyakumari region(Present study)

The retail price of seer fish increased from Rs. 9 per kg during 1973-74 to Rs.35.50 during 1989-90. Similarly all varieties recorded phenomenal increase in the retail prices over the years as shown in the Table.

There is considerable seasonal variation in the average primary, wholesale and retail prices of marine fish. The

average seasonal prices of different varieties of fish during 1989-90 has been worked out on the basis of data collected from selected landing centres, wholesale market at Vadasery and retail markets of Vadasery, Monday market and Swamiyarmadam of Kanyakumari District of Tamilnadu. All the varieties of fish covered under the study were divided into three groups based on the level of consumer preference. The consumer preference for a variety was determined by the annual average consumer price of that variety in the selected consumer markets. The fishes with annual average consumer price of above Rs.20 form Ist group, Rs.11.50 to 20 IInd group and less than Rs.11.50 IIIrd group in the present analysis.

The average prices for different varieties of fish at landing centres (Average price of 5 selected landing centres such as Kadiapattinam, Colachel, Muttom, Kurumpanai and Kanyakumari), Vadasery wholesale market and the selected retail markets during April - June 1989 are given in Table VIII - 4.

The fishermen received maximum price for seer fish (Rs.28 per kg) and minimum for silver bellies (Rs.3 per kg). Barring few varieties like seer fish, sharks etc. the price of many varieties are found to be more than double of the landing centre price. Among the consumer markets studied, the average retail prices of different varieties of fish were comparatively lower at Monday market of channel II and higher at Vadasery retail market of channel I.

Table VIII - 4

Average fish prices at primary,wholesale and retail markets in Kanyakumari region, Tamilnadu during April-June 1989 (Rs/kg)

VARIETY	LOCALNAME	Channel-I*		Channel-II*	
		LP	WP	RP1	RP2	RP3
Group.I						
1.Seer fish	Neymeen,Vanjiram sheela	28.00	34.00	45.00	40.00	41.0
2.Rainbow runner	Kozuvai	19.00	24.00	34.00	29.00	31.0
3.Pomfrets	Kadaikarumpu, Vaval					
4.Pig-face breams	Vilameen	13.00	18.00	31.00	26.00	27.0
5.Redsnapper	Mazhuvan	12.00	15.00	21.00	24.00	23.0
6.Barracudas	Oozhi, oozha	12.00	14.00	20.00	20.00	21.0
Group II						
1.Reef cod	Kalava	11.00	14.00	19.00	20.00	23.0
2.Tuna	Choorai	11.15	14.90	20.30	11.75	20.1
3.Sharks	Sorrah	12.30	15.10	22.65	19.50	17.4
4.Cat fish	Thedu, Keluthi	9.60	13.30	14.60	17.75	17.6
5.Wolf herring	Mulluvalai,Thoppi valai	8.35	11.15	16.15	13.60	14.9
6.Mackerel	Ayalai, Kanakeluthi	9.25	11.00	17.25	15.50	16.1
7.Scads	Kozhichalai	6.10	8.40	14.85	13.35	14.8
Group III						
1.Goat fish	Navarai, Sennagarai	5.30	7.65	13.00	14.50	15.1
2.Ribbon fish	Valai, savalai	5.00	7.00	14.00	11.35	12.0
3.Thread Fin breams	Sankara	6.00	7.35	10.00	11.30	12.0
4.Rays	Therachi,Thirukkai, Therandy	4.70	6.90	14.20	10.25	11.7
5.Lizard fish	Thumbili, Nakkandan	4.00	6.00	8.00	10.00	11.1
6.Indian pellona	Kuttha	5.20	7.40	11.60	10.60	11.6
7.Gold stripped sardine	Salai, Mathakondai	7.30	10.00	15.36	13.00	13.0
8.White baits	Netholi	5.75	8.80	14.65	11.80	12.6
9.Silver bellies	Karal	3.00	5.00	8.40	6.50	6.8

*Channel I - Fishermen-wholesaler-retailer chain
Channel II- Fishermen-retailer chain

The average, primary, wholesale and retail prices of fish during July-September 1989 are given in Table VIII - 5.

Fishermen received maximum price for seer fish in group I,sharks in group II and rays in group III. Comparatively higher retail prices were observed at Vadasery market. The prices of almost all varieties have shown a declining trend comparing to the previous season.

Table VIII - 5

Average prices at primary, wholesale and retail markets in Kanyakumari region during July - September 1989 (Rs/kg)

VARIETY	LP	Channel-I WP	Channel-I RP1	Channel-II RP2	Channel-II RP3
Group I					
1.Seer fish	23.70	28.40	36.85	34.40	35.50
2.Rainbow runner	19.00	24.00	33.00	28.00	29.00
3.Pomfrets	20.00	25.00	31.00	29.00	29.00
4.Pig-face breams	12.00	16.00	24.00	21.00	22.00
5.Red snapper	9.00	12.00	18.00	19.00	21.00
6.Barracudas	11.00	15.00	22.00	19.00	21.00
Group II					
1.Reef cod	8.00	12.00	17.00	18.00	20.00
2.Tuna	8.40	12.20	16.40	17.25	17.50
3.Sharks	10.40	12.95	18.05	15.05	14.95
4.Cat fish	9.10	13.35	17.65	16.50	15.80
5.Wolf herring	6.30	8.30	11.70	10.50	11.10
6.Mackerel	6.60	7.60	11.45	9.90	9.90
7.Scads	3.45	5.75	10.30	10.75	13.00
Group III					
1.Goat fish	3.20	4.75	8.15	6.75	8.85
2.Ribbon fish	4.00	6.00	10.00	8.50	9.85
3.Thread fin breams	3.75	5.45	8.45	7.30	9.25
4.Rays	4.30	6.35	10.65	8.15	9.00
5.Lizard fish	2.25	3.85	5.05	4.40	5.15
6.Indian pellona	3.00	5.05	9.15	7.70	9.40
7.Gold stripped sardine	3.55	5.60	10.25	8.25	7.60
8.White baits	2.70	4.45	9.00	7.05	7.55
9.Silver bellies	2.00	3.05	6.35	5.40	5.60

Fishermen received an average of Rs.21.60 per kg for seer fish and Rs.1.35 per kg for lizard fish during October-December. 1989 (Table VIII - 6).

Table VIII - 6

Average fish prices at primary, whole sale and retail markets in Kanyakumari region during October - December 1989 (Rs/kg)

VARIETY	LP	Channel-I WP	Channel-I RP1	Channel-II RP2	Channel-II RP3
Group I					
1. Seer fish	21.60	26.10	30.80	28.30	29.40
2.Rainbow runner	19.00	23.00	31.00	26.00	28.00
3.Pomfrets	18.00	21.00	30.00	27.00	27.00
4.Pig-face breams	9.00	13.00	20.00	17.00	19.00
5.Red snapper	7.00	11.00	15.00	16.00	17.00
6.Barracudas	9.00	12.00	20.00	16.00	17.00
Group II					
1.Reef cod	7.00	10.00	15.00	15.00	16.00
2.Tuna	8.65	11.35	15.90	14.40	15.50
3.Sharks	10.85	13.85	17.45	14.60	13.90
4.Cat fish	6.90	11.00	16.50	14.50	13.20
5.Wolf herring	4.70	6.65	9.90	8.25	8.85
6.Mackerel	5.80	7.20	12.00	10.15	10.50
7.Scads	--	--	--	--	--
Group III					
1.Goat fish	3.25	5.25	8.70	7.40	8.85
2.Ribbon fish	4.15	5.85	9.85	8.40	11.15
3.Thread fin breams	2.55	3.65	5.45	4.75	6.65
4.Rays	4.45	6.20	11.05	10.40	11.40
5.Lizard fish	1.35	2.35	4.50	3.85	5.25
6.Indian pellona	--	--	--	--	--
7.Gold stripped sardine	4.35	6.25	10.00	8.80	8.90
8.White baits	3.70	5.05	7.50	6.45	6.75
9.Silver bellies	3.00	4.60	6.25	5.50	5.90
9.Silver bellies	2.00	3.05	6.35	5.40	5.60

In general, the landing, wholesale and retail prices were lowest during the above quarter. The heavy fish landings in the peak season was responsible for the fall in prices. During January-March 1990 the fishermen received the maximum price of Rs.24.65 per kg for pomfrets and minimum of Rs.3.05 per kg for silver bellies (Table VIII - 7).

The lean season associated with lesser supply of marine fish boosted the primary and retail price during this quarter.

Table VIII - 7

Average prices at primary, wholesale and retail markets in Kanyakumari region during January - March 1990 (Rs/kg)

VARIETY	LP	Channel-I WP	Channel-I RP1	Channel-II RP2	Channel-II RP3
Group I					
1.Seer fish	24.40	29.55	45.00	35.00	39.00
2.Rain bow runner	24.00	28.00	38.00	34.00	35.00
3.Pomfrets	24.65	30.85	39.00	35.00	36.00
4.Pig-face breams	17.00	21.00	28.00	25.00	27.00
5.Red snapper	12.00	16.00	20.00	22.00	23.00
6.Barracudas	17.00	19.00	27.00	24.00	25.00
Group II					
1.Reef cod	12.00	16.00	19.00	21.00	23.00
2.Tuna	13.30	16.20	23.10	22.60	24.85
3.Sharks	11.00	13.80	18.85	16.35	17.60
4.Cat fish	10.55	14.60	20.55	18.40	17.30
5.Wolf herring	8.90	11.45	16.25	14.25	15.20
6.Mackerel	8.80	10.00	14.55	12.60	13.30
7.Scads	--	--	--	--	--
Group III					
1.Goat fish	5.00	8.40	13.70	11.30	14.15
2.Ribbon fish	--	--	--	--	--
3.Thread fin breams	5.25	8.00	13.50	11.50	15.00
4.Rays	4.50	6.25	12.20	9.55	10.85
5.Lizard fish	--	--	--	--	--
6.Indian pellona	3.85	5.00	6.55	6.15	7.85
7.Gold stripped sardine	4.75	6.50	10.00	8.75	9.30
8.White baits	3.85	5.70	9.50	8.00	9.45
9.Silver bellies	3.05	4.55	4.80	5.75	6.55

The quarterly minimum and maximum landing centre price and retail prices have been worked out and given in Table VIII - 8.

Table VIII - 8

Seasonal minimum and maximum prices at landing centre and retail markets for different varieties

VARIETY	MINIMUM			MAXIMUM		
	Landing centre (Rs/kg)	Retail (Rs/kg)	Season	Landing centre (Rs/kg)	Retail (Rs/kg)	Season
Group I						
Seer fish	21.60	28.30	Oct - Dec.	28.00	45.00	Apr-June
Rain bow runner	19.00	26.00	Oct - Dec.	24.00	38.00	Janu-Mar.
Pomfrets	18.00	27.00	Oct - Dec.	24.65	39.00	Janu-Mar.
Pig-face breams	9.00	17.00	Oct - Dec.	17.00	28.00	Janu-Mar.
Red snapper	7.00	15.00	Oct - Dec.	12.00	24.00	Apr-June
Barracudas	9.00	16.00	Oct - Dec.	17.00	27.00	Janu-Mar.
Group II						
Reef cod	7.00	15.00	Oct - Dec.	12.00	23.00	Janu-Mar.
Tuna	8.40	16.40	July-Sept.	13.30	24.85	Janu-Marc.
Sharks	10.40	14.95	July-Sept.	12.30	22.65	April-June
Cat fish	6.90	13.20	Oct - Dec.	10.55	20.55	Janu-June
Wolf herring	4.70	8.25	Oct - Dec.	8.90	16.25	Janu-Mar.
Mackerel	5.80	9.90	Oct - Dec.	9.25	17.25	Apr.-June
Scads	3.45	10.30	July-Sept.	6.10	14.85	April-June
Group III						
Goat fish	3.20	6.75	July-Sept.	5.30	15.15	Apri-June
Ribbon fish	4.00	8.50	July-Sept.	5.00	14.00	Aprl-June
Thread fin breams	2.55	4.75	Oct-Dec	6.00	15.00	Janu-March
Rays	4.30	8.15	July-Sept.	4.70	11.75	Aprl-June
Lizard fish	1.35	3.85	Oct-Dec	4.00	10.10	Aprl-June
Indian pellona	3.00	6.15	Jult-Sept.	5.20	11.60	Aprl-June
Gold stripped sardine	3.55	7.60	Jult-Sept.	7.30	15.30	Aprl-June
White baits	2.70	6.45	July-Sept	5.75	14.65	Aprl-June
Silver bellies	2.00	5.40	July-Sept.	3.05	6.80	Janu-March

The quarterly variation in landing centre price is very wide for pig-face breams, wolf herring, scads, thread-fin breams, lizard fish, sardines and white baits. The wide seasonal fluctuations of the prices of these varieties were in accordance with the volume of their landings. The minimum price was observed during October-December, for all varieties in group I, reef cod, cat fish, wolf herring and mackerel in group II, thread fin breams, and lizard fish in group III and during July-September for tuna, sharks and scads in group II and goat fish, ribbon fish, rays, pellona, sardines, white baits and silver bellies in group III. On the other hand, maximum prices in

landing and retail prices were observed during the lean months of January-June for all the varieties. The monthly average primary, wholesale and retail price movements for selected varieties of fish are given in Figure 9 to 14.

The average annual prices of different varieties of fish at primary, wholesale and retail markets in Kanyakumari region of Tamilnadu during April 1989-March 1990 have been given in Table VIII - 9.

Table VIII - 9
Average prices(Rs/kg) for different varieties of fish in Kanyakumari region during April 1989 - March 1990

VARIETY	Landing centre	Wholesale	Retail price Market I	Market II	Market III	Average
Group I						
1.Seer fish	24.00	28.90	38.00	33.70	35.65	35.50
2.Rainbow runner	20.20	24.60	33.75	29.35	30.75	31.25
3.Pomfrets	19.50	23.15	31.25	28.65	28.65	29.50
4.Pig-face breams	12.85	16.95	25.60	21.65	23.55	23.00
5.Red snapper	10.00	13.50	18.35	20.35	21.05	20.00
6.Barracudas	11.85	15.20	22.55	19.85	20.90	21.00
Group II						
1.Reef cod	9.45	12.85	17.20	18.30	20.45	18.50
2.Tuna	10.20	13.45	18.65	18.40	19.30	18.50
3.Sharks	11.00	13.85	19.10	16.25	15.95	17.00
4.Cat fish	9.00	13.00	18.35	16.65	15.75	16.50
5.Wolf herring	7.00	9.15	13.15	11.40	12.10	12.25
6.Mackerel	7.40	9.00	13.65	11.65	12.30	12.50
7.Scads	5.00	7.00	11.50	10.55	12.35	11.50
Group III						
1.Goat fish	4.10	6.55	11.10	9.90	11.75	11.00
2.Ribbon fish	4.20	6.15	10.30	9.00	10.80	10.00
3.Thread fin breams	3.85	5.50	8.40	7.50	9.50	8.50
4.Rays	4.55	6.40	11.75	9.60	10.70	10.75
5.Lizard fish	2.20	3.65	5.20	4.90	5.80	5.30
6.Indian pellona	4.00	5.80	9.05	8.10	9.75	9.00
7.Gold stripped sardine	4.80	6.90	11.10	9.35	9.45	10.00
8.White baits	4.00	5.85	9.80	8.15	8.90	9.00
9.Silver bellies	2.80	4.20	6.80	5.80	6.20	6.25

Seer fish, rainbow runner and pomfrets recorded comparatively higher prices and lizard fish, silver bellies and thread fin breams are available comparatively cheaper . The

Fig. 9 PRICE SPREAD OF SEER FISH
DURING 1989-90

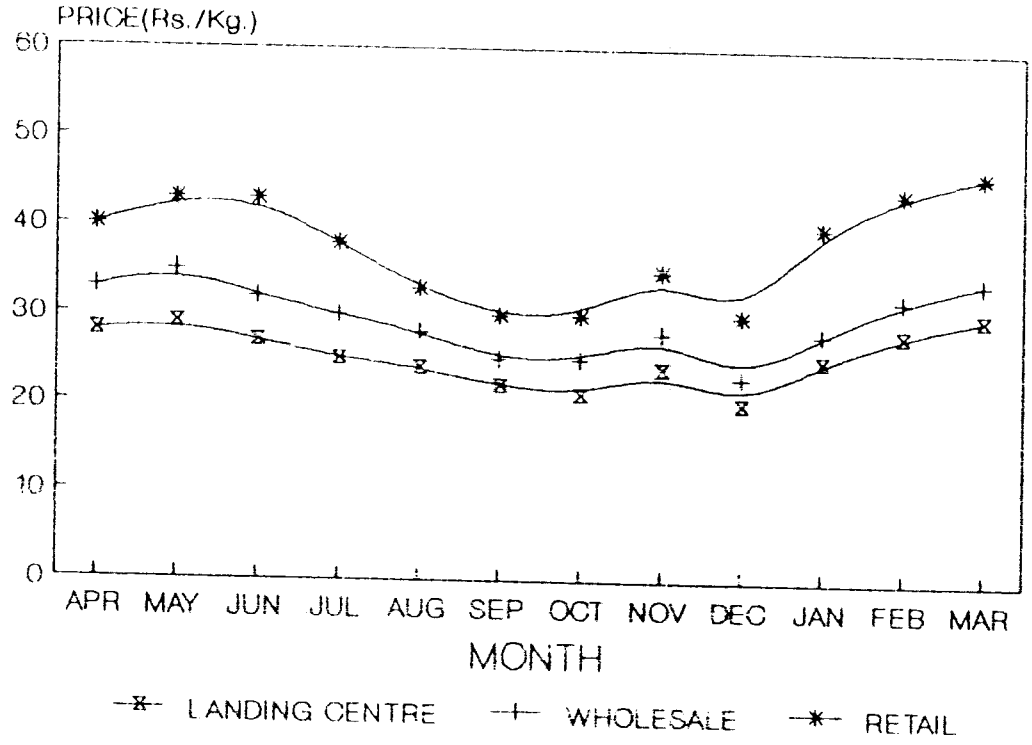


Fig. 10 PRICE SPREAD OF PIG-FACE BREAM
DURING 1989-90

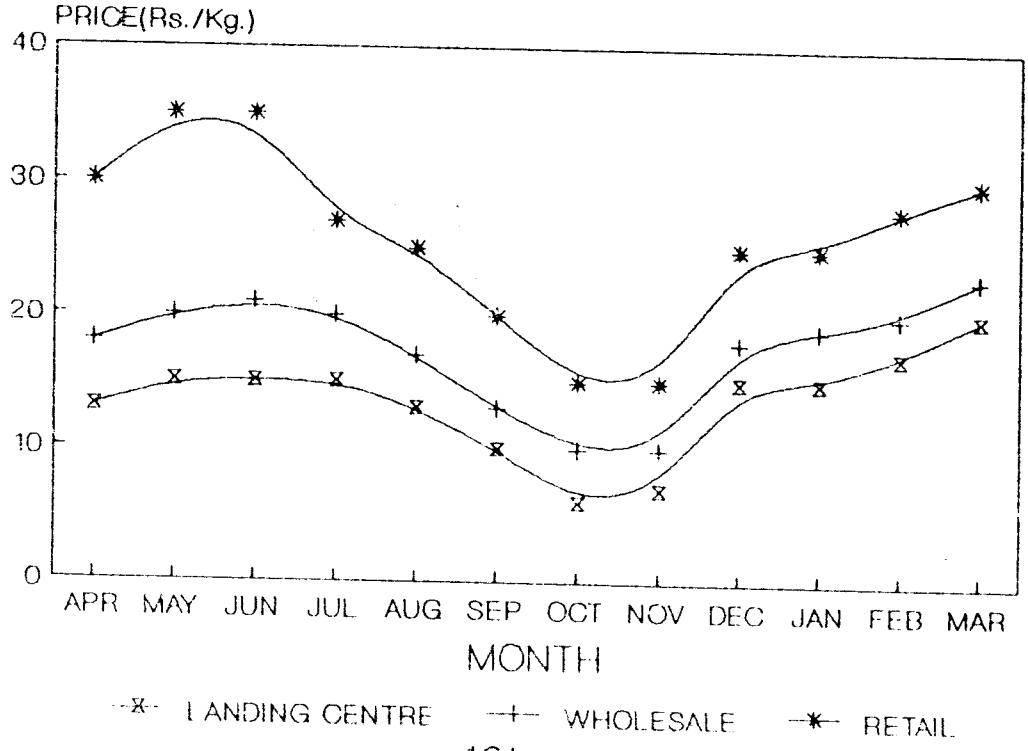


Fig. 11 PRICE SPREAD OF SHARKS DURING 1989-90

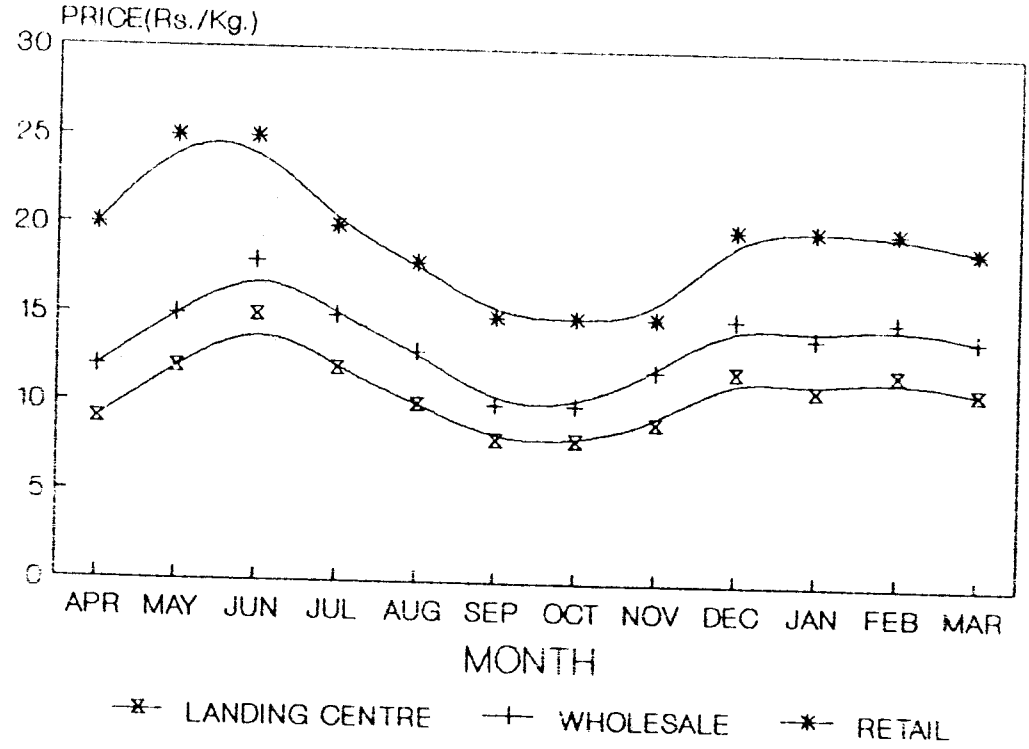


Fig. 12 PRICE SPREAD OF MACKEREL DURING 1989-90

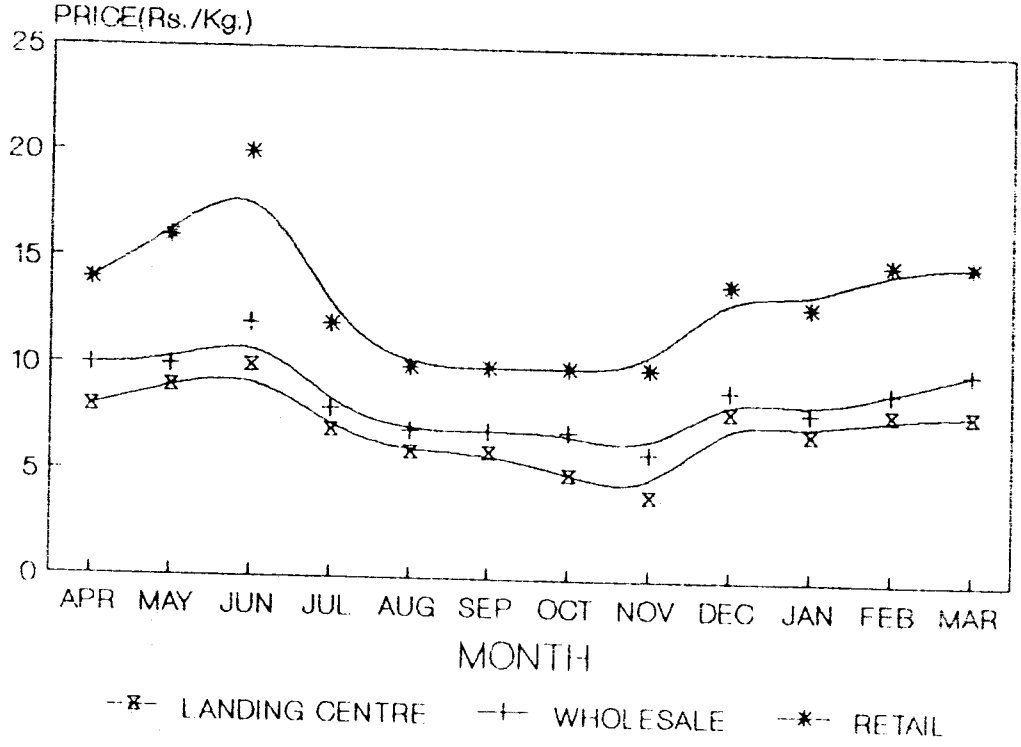


Fig. 13 PRICE SPREAD OF SILVERBELLIES DURING 1989-90

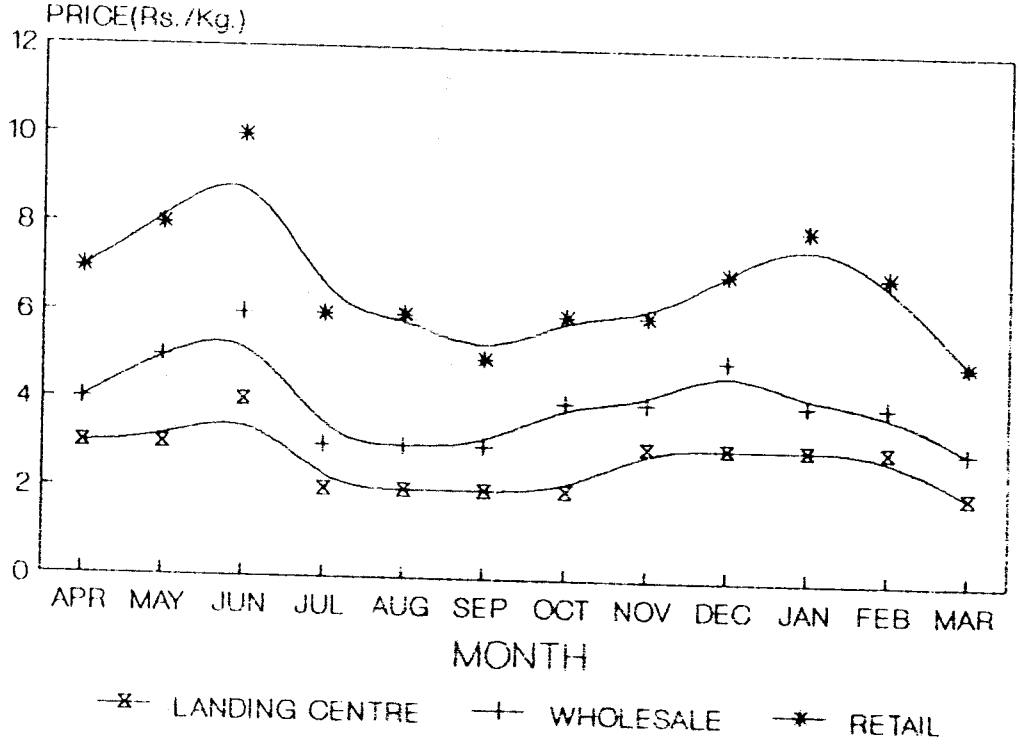
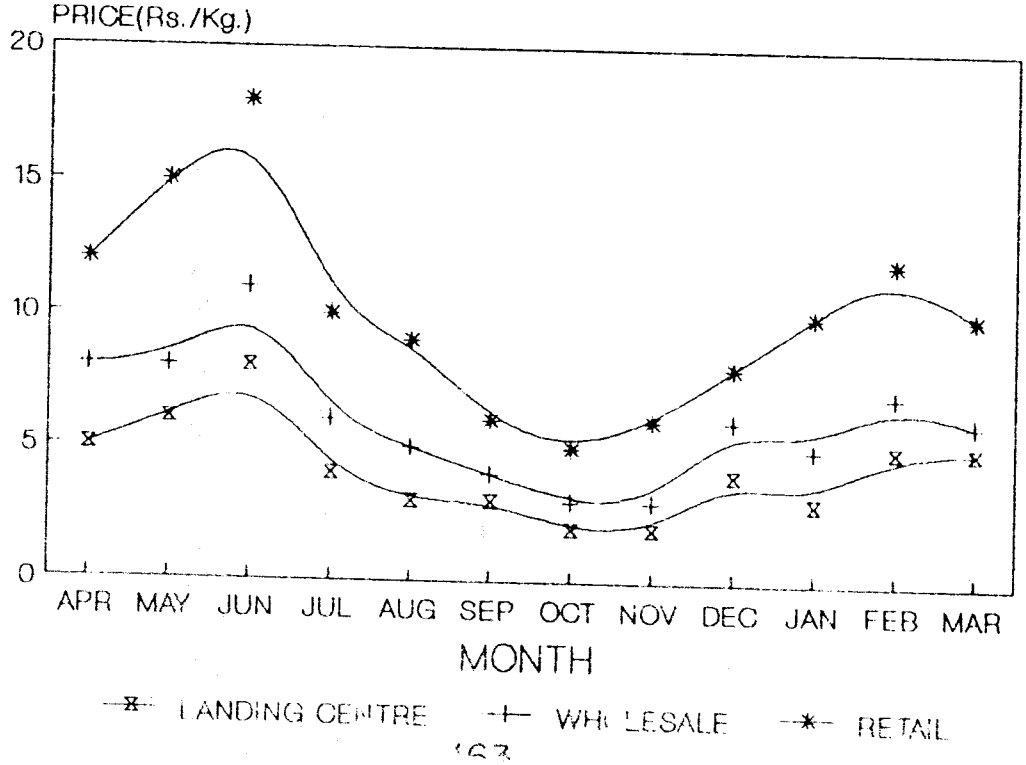


Fig. 14 PRICE SPREAD OF WHITE BAITS DURING 1989-90



retail prices at the urban retail market of Vadasery are higher than that of other retail markets. The percentage price difference between landing and retail points for the quality fishes in group I are comparatively lesser than the varieties in group II and group III categories. Almost all cheaper varieties given in group III category, the retail prices are more than double that of landing prices.

Marketing margins

The marketing margin accounted for a big chunk of the consumer price for most of the varieties of fish covered under the study. The margin is shared by auctioneers, commission agents, wholesalers and retailers and a portion goes towards marketing expenses including transportation. Marketing margins for different varieties of fish in Kanyakumari region during April 1989 to March 1990 for fishermen-wholesaler-retailer chain and fishermen-retailer chain presented in Table VIII - 10 and 11.

Table VIII - 10
Marketing margins for different varieties of fish in Channel I during April 1989 - March 1990

VARIETY	Marketing margin (1) (Rs/kg)	Percentage distribution		
		Marketing costs (2)	Wholesalers (3)	Retailers (4)
Group I				
Seer fish	14.00	7	28	65
Rainbow runner	13.55	7	26	67
Pomfrets	11.75	9	22	69
Pig-face breams	12.75	8	24	68
Red snapper	8.35	12	30	58
Barracudas	10.70	9	22	69
Group II				
Reef cod	7.75	10	34	56
Tuna	8.45	9	30	61
Sharks	8.10	9	26	65
Cat fish	9.35	8	35	57
Wolf herring	6.15	12	23	65

Table VIII -10 (continued)

	(1)	(2)	(3)	(4)
Mackerel	6.25	12	14	74
Scads	6.50	12	19	69
Group III				
Goat fish	7.00	7	28	65
Ribbon fish	6.10	8	24	68
Thread fin breams	4.55	11	25	64
Rays	7.20	7	19	74
Lizard fish	3.00	17	32	57
Indian pellona	5.05	10	26	64
Gold Stripped sardine	6.30	8	25	67
White baits	5.80	9	23	68
Silver bellies	4.00	13	23	64

Table VIII - 11
Marketing margins for different varieties of fish in Channel -II during April 1989 - March 1990
(Fishermen - retailer chain)

VARIETY	Marketing margin (Rs/Kg)	Percentage distribution	
		Marketing cost	Retailers margin
Group I			
Seer fish	11.55	7	93
Rainbow runner	10.80	7	93
Pomfrets	9.55	8	92
Pig-face breams	10.40	8	92
Red snapper	10.50	8	92
Barracudas	9.15	9	91
Group II			
Reef cod	10.00	6	94
Tuna	8.70	7	93
Sharks	5.45	11	89
Cat fish	7.10	9	91
Wolf herring	5.15	12	88
Mackerel	5.00	12	88
Scads	7.00	9	91
Group III			
Goat fish	7.25	6	94
Ribbon fish	6.20	6	94
Thread fin breams	5.15	8	92
Rays	6.20	6	94
Lizard fish	3.30	12	88
Indian pellona	5.35	7	93
Gold stripped sardine	4.90	8	92
White baits	4.95	8	92
Silver bellies	3.40	12	88

In the fishermen-wholesaler-retailer chain, the marketing margins ranged from Rs. 4 per kg. for silver bellies to Rs. 14 per kg. for seer fish. Marketing costs accounted 7 to 13 per cent of the marketing margins. The wholesalers share in the marketing margins for different varieties ranged from 14 per cent for mackeral to 35 per cent for cat fish and retailers margin ranged from 56 per cent for reef cod to 74 per cent for mackerel and rays.

The marketing margins are comparatively lower for most of the varieties in the fishermen-retailer chain . It ranges from Rs. 3.30 per kg. for lizard fish to Rs. 11.55 per kg. for seer fish. The marketing costs including transportation accounted for 6 to 12 per cent of the marketing margins of different varieties. However, the retailers receive a higher proportion of the margins ranging from 88 to 94 per cent as there were no wholesalers in the distribution channel.

Share of fishermen and middlemen in the consumer's rupee

An earlier study on fishermens' share in the consumer's rupee in Madras region of Tamilnadu indicated that fishermen received higher share in the consumer's rupee for quality fishes(Sathiadhas and Panikkar 1988). In the present study also, the higher share of producer in the consumer's rupee for quality fishes like seer fish and pomfrets in group I confirmed the earlier findings. The percentage distribution of consumer's rupee for different varieties of fish to fishermen and other intermediaries in fishermen-wholesaler-retailer chain (Channel I) and fishermen retailer chain (Channel II) are given in Table VIII - 12 and 13 respectively.

Table VIII - 12

Percentage distribution of consumer's rupee for different varieties of fish in Channel -I during April 1989 - March 1990

VARIETY	Percentage share to			
	Fisher-men	Handling &Trans-port	Whole-salers	Retail-ers
Group I				
Seer fish	63	3	10	24
Rainbow runner	60	3	10	27
Pomfrets	62	3	9	26
Pig-face breams	50	4	12	34
Red snapper	55	5	14	26
Barracudas	53	4	10	33
Group II				
Reef cod	55	5	15	25
Tuna	55	4	13	28
Sharks	58	4	11	27
Cat fish	49	4	18	29
Wolf herring	53	6	11	30
Mackerel	54	6	6	34
Scads	43	7	11	39
Group III				
Goat fish	37	5	17	41
Ribbon fish	41	5	14	40
Thread fin breams	46	6	14	34
Rays	39	4	11	46
Lizard fish	42	10	18	30
Indian pellona	44	6	14	36
Gold stripped sardine	43	5	14	38
White baits	41	5	14	40
Silver bellies	41	8	13	38

Fishermens'share in the consumer's rupee ranged from 37 percent (goat fish) to 67 percent (Seer fish) in channel I and 36 percent to 68 percent in channel II respectively. In almost all varieties fishermen received higher share in the consumer's rupee in channel II where there is no wholesalers in between the producers and consumers. It confirms that lesser the number of intermediaries in the marketing chain higher is the share to fishermen in the consumer's rupee.

Table VIII - 13

Percentage distribution of consumer's rupee for different varieties of fish in Channel -II during April 1989 - March 1990

VARIETY	Percentage share to		
	Fisher-men	Handling &Trans-port	Retail-ers
Group I			
Seer fish	68	2	30
Rainbow runner	65	3	32
Pomfrets	67	3	30
Pig-face breams	55	4	41
Red snapper	49	4	47
Barracudas	56	4	40
Group II			
Reef cod	49	3	48
Tuna	54	3	43
Sharks	67	4	29
Cat fish	56	4	40
Wolf herring	58	5	37
Mackerel	60	5	35
Scads	42	5	53
Group III			
Goat fish	36	4	60
Ribbon fish	40	4	56
Thread fin breams	43	4	53
Rays	43	4	53
Lizard fish	40	7	53
Indian pellona	43	4	53
Gold stripped sardine	50	4	46
White baits	44	5	51
Silver bellies	45	7	48

Fishermen received higher share for seer fish (63 to 68 percent) in group I, sharks (58 to 67 percent) in group II and sardines (43 to 50 percent) in group III categories of fish. Similarly, lower share was received by them for pig face breams (50 to 55 percent) and red snapper (49 to 55 percent) in group I, scads (42 to 43 percent) in group II and goat fish (36 to 37 percent) in group III categories.

The percentage share towards marketing expenses of handling and transportation ranges from 3 to 10 percent of the consumer's rupee. The wholesaler's share ranges from 6 to 18 paise of the consumer's rupees for different varieties. Retailer's share ranges from 24 to 46 paise in channel I and 30 to 60 paise in channel II of the consumer's rupee. In general, the wholesalers and retailers comparatively got more share in the consumer's rupee for cheaper varieties even with incurring higher handling and transportation charges.

Market integration and inter-relationship between prices

Much work has been done about the marketing efficiency of agricultural and marine products (Saxena, 1969 & 1970; Rao, 1971; Thakur, 1974; Rao and Prasad, 1978; Singh and Gupta, 1983; Jose Murikkan, 1983; Srivastava and Dharmareddy, 1983; Panikkar and Sathiadhas, 1985 & 1989; Srivastava and Kulkarni, 1985 and Sathiadhas and Panikkar, 1988).Correlation coefficient is the commonly used measure of pricing efficiency and market integration in developing countries (Blyn 1973, Harris 1979, Lundal and Peterson 1983, Naik and Arora 1986). The correlation in prices between different markets for all the commercially important varieties of fish has been worked out and the correlation matrices are given in Table VIII-14.

Table VIII-14

Correlation matrices for selected varieties of fish

	SEER FISH					RAINBOW RUNNER				
	LP	WP	RP1	RP2	RP3	LP	WP	RP1	RP2	RP3
LP	1					1				
WP	0.93	1				0.95	1			
RP1	0.73	0.79	1			0.81	0.86	1		
RP2	0.77	0.83	0.70	1		0.83	0.89	0.94	1	
RP3	0.77	0.82	0.78	0.84	1	0.80	0.87	0.94	0.95	1

Table VIII-14 (continued)

POMFRETS

LP	1				
WP	0.66	1			
RP1	0.87	0.56	1		
RP2	0.88	0.63	0.92	1	
RP3	0.84	0.61	0.88	0.91	1

PIG-FACE BREAMS

1				
0.98	1			
0.80	0.85	1		
0.78	0.79	0.87	1	
0.88	0.91	0.95	0.87	1

RED SNAPPER

LP	1				
WP	0.98	1			
RP1	0.90	0.93	1		
RP2	0.87	0.89	0.91	1	
RP3	0.87	0.89	0.89	0.89	1

BARRACUDAS

1				
0.98	1			
0.89	0.93	1		
0.93	0.92	0.88	1	
0.91	0.92	0.89	0.96	1

REEF COD

LP	1				
WP	0.97	1			
RP1	0.90	0.94	1		
RP2	0.89	0.91	0.91	1	
RP3	0.87	0.90	0.89	0.95	1

TUNA

1				
0.94	1			
0.87	0.90	1		
0.83	0.86	0.91	1	
0.89	0.90	0.92	0.94	1

SHARKS

LP	1				
WP	0.97	1			
RP1	0.78	0.76	1		
RP2	0.81	0.80	0.84	1	
RP3	0.81	0.79	0.76	0.88	1

CAT FISH

1				
0.91	1			
0.88	0.86	1		
0.91	0.80	0.91	1	
0.86	0.75	0.85	0.94	1

WOLF HERRING

LP	1				
WP	0.96	1			
RP1	0.87	0.91	1		
RP2	0.93	0.93	0.90	1	
RP3	0.91	0.93	0.91	0.95	1

MACKEREL

1				
0.96	1			
0.84	0.83	1		
0.64	0.62	0.78	1	
0.81	0.80	0.95	0.79	1

SCADS

LP	1				
WP	0.98	1			
RP1	0.85	0.86	1		
RP2	0.81	0.82	0.85	1	
RP3	0.81	0.82	0.83	0.97	1

GOAT FISH

1				
0.92	1			
0.82	0.88	1		
0.81	0.80	0.92	1	
0.81	0.86	0.96	0.94	1

RIBBON FISH

LP	1				
WP	0.87	1			
RP1	0.67	0.69	1		
RP2	0.73	0.67	0.82	1	
RP3	0.73	0.67	0.42	0.68	1

THREADFIN BREAMS

1				
0.96	1			
0.86	0.94	1		
0.94	0.98	0.94	1	
0.87	0.95	0.96	0.94	1

Table VIII-14 (continued)

RAYS

LP	1				
WP	0.85	1			
RP1	0.55	0.60	1		
RP2	0.53	0.54	0.59	1	
RP3	0.58	0.57	0.66	0.86	1

LIZARD FISH

1				
0.97	1			
0.94	0.94	1		
0.89	0.85	0.95	1	
0.82	0.78	0.93	0.94	1

INDIAN PELLONA

LP	1				
WP	0.93	1			
RP1	0.63	0.84	1		
RP2	0.77	0.91	0.92	1	
RP3	0.79	0.91	0.90	0.92	1

GOLD STRIPPED SARDINE

1				
0.96	1			
0.84	0.90	1		
0.87	0.91	0.96	1	
0.90	0.92	0.90	0.92	1

WHITE BAITS

LP	1				
WP	0.93	1			
RP1	0.77	0.90	1		
RP2	0.83	0.91	0.93	1	
RP3	0.76	0.84	0.88	0.94	1

SILVER BELLIES

1				
0.92	1			
0.65	0.77	1		
0.68	0.76	0.81	1	
0.75	0.74	0.74	0.78	1

The correlation coefficents of prices of different varieties of fish between markets are all positive and significant ($P < 0.01$). Hence the functional relationship between the landing price (LP), wholesale (WP) and retail prices(RP) have been estimated by linear regression analysis ($Y = a + bX$), taking landing centre price as independent variable and wholesale and retail prices as dependent variables and given in Table VIII- 15.

Table VIII-15
RELATIONSHIP WITH LANDING PRICE
(Y = a + b X)

	SEER FISH			RAINBOW RUNNER		
	a	b	r	a	b	r
WP	3.7106	1.0525	0.9352	5.5966	0.9414	0.9486
RP1	-6.1468	1.8437	0.7331	11.3073	1.1112	0.8127
RP2	7.9397	1.0749	0.7725	9.2887	0.9934	0.8324
RP3	6.3639	1.2216	0.774	12.0742	0.9246	0.7998
	POMFRETS			PIG FACE BREAMS		
WP	2.291	1.0685	0.6634	3.5032	1.0441	0.9769
RP1	7.8046	1.2018	0.8678	10.8907	1.1422	0.805
RP2	8.1279	1.0505	0.8766	8.0981	1.0538	0.7811
RP3	8.8602	1.0145	0.8375	10.3985	1.0209	0.8813

Table VIII-15 (continued)

	RED SNAPPER			BARRACUDAS		
WP	3.4372	1.0046	0.9788	4.9233	0.8684	0.9796
RP1	7.8806	1.0446	0.8975	11.7988	0.9065	0.8938
RP2	8.8124	1.1495	0.873	8.6832	0. 941	0.9289
RP3	10.5455	1.0505	0.8703	9.9681	0.9198	0.9108
	REEF COD			TUNA		
WP	3.1262	1.0287	0.9746	4.3633	0.8911	0.9413
RP1	8.1485	0.9623	0.8967	8.5874	0.9853	0.8698
RP2	7.6462	1.1271	0.886	8.0576	1.0127	0.8278
RP3	7.9853	1.3233	0.8718	7.218	1.182	0.8892
	SHARKS			CAT FISH		
WP	2.8871	0.9915	0.9695	3.9941	1.0079	0.9127
RP1	9.3225	0.8821	0.7828	9.5539	0.9831	0.8777
RP2	5.0151	1.0142	0.8137	8.8106	0.875	0.9096
RP3	5.6158	0.9319	0.8091	8.2069	0.8415	0.8632
	WOLF HERRING			MACKERAL		
WP	1.5662	1.0993	0.9607	1.5912	0.983	0.9598
RP1	2.8531	1.4933	0.8704	5.1505	1.1471	0.8398
RP2	2.3054	1.3176	0.9281	4.8678	0.9155	0.6365
RP3	2.3987	1.4118	0.912	3.7074	1.1581	0.8108
	SCADS			GOAT FISH		
WP	1.8193	1.0604	0.9806	1.5832	1.2041	0.9162
RP1	6.5433	1.0069	0.8547	3.6729	1.8038	0.8241
RP2	4.6133	1.2083	0.8073	1.8461	1.9626	0.8132
RP3	6.4203	1.2084	0.8095	4.0741	1.8698	0.8115
	RIBBON FISH			THREADFIN BREAMS		
WP	1.8444	1.0222	0.8662	0.7435	1.2382	0.9575
RP1	2.837	1.7852	0.6726	1.6419	1.7602	0.8566
RP2	3.0444	1.4222	0.7303	0.321	1.8801	0.9388
RP3	5.5704	1.2519	0.7356	2.679	1.7866	0.8688
	RAYS			LIZARD FISH		
WP	1.919	0.9818	0.8514	0.7101	1.3325	0.972
RP1	4.2891	1.6342	0.5521	2.6765	1.1574	0.9409
RP2	5.3467	0.9297	0.5351	0.8264	1.8698	0.8928
RP3	5.6563	1.1075	0.577	2.7318	1.3988	0.8248
	INDIAN PELLONA			GOLD STRIPPED SARDINE		
WP	1.4779	1.0815	0.9257	1.5527	1.1109	0.9591
RP1	4.329	1.1782	0.6303	4.6966	1.3283	0.8448
RP2	2.8442	1.313	0.7682	3.302	1.2501	0.87
RP3	5.2063	1.1364	0.7885	3.432	1.2523	0.9028
	WHITE BAITS			SILVER BELLIES		
WP	1.1926	1.1699	0.9294	0.7164	1.2536	0.9195
RP1	3.5769	1.5617	0.7689	3.2816	1.2673	0.6532
RP2	2.6659	1.371	0.8316	3.5445	0.8014	0.6853
RP3	3.2045	1.4304	0.764	3.528	0.9683	0.7491

In most of the varieties the rate of change in wholesale and retail prices are more than one percent. The rate of change in wholesale price of barracudas, tuna, sharks, rays and mackerel

are found to be less than one per cent. Similarly the rate of change in retail prices are also less than one per cent for these varieties in respect of some markets due to their seasonal abundance and excessive supply to these marketing centres during the season.

The relationship of wholesale price with retail price is estimated only for RP1 as the wholesale and retail transactions are carried out in the same market (Table VIII-16).

Table VIII-16

RELATIONSHIP OF WP WITH RETAIL PRICE

	a	b	r
SEER FISH	-12.8915	1.7602	0.7876
RAINBOW RUNNER	4.559	1.1861	0.8609
POMFRETS	20.1957	0.478	0.5559
PIG FACE BREAMS	6.4703	1.1287	0.8502
RED SNAPPER	4.1611	1.0506	0.9265
BARRACUDAS	6.4053	1.0606	0.927
REEF COD	5.0099	0.9522	0.9365
TUNA	4.1567	1.0765	0.8996
SHARKS	7.5011	0.8357	0.7585
CAT FISH	6.9771	0.874	0.8616
WOLF HERRING	0.6738	1.3641	0.9097
MACKEREL	3.798	1.1101	0.8325
SCADS	4.8653	0.9425	0.8651
GOAT FISH	1.5237	1.4641	0.8791
RIBBON FISH	0.734	1.5638	0.6953
THREADFIN BREAMS	0.164	1.4984	0.9429
RAYS	1.9459	1.5314	0.5967
LIZARD FISH	2.1495	0.8438	0.9404
INDIAN PELLONA	1.2317	1.3463	0.8415
GOLD STRIPPED SARDINE	2.6339	1.2255	0.9028
WHITE BAITS	1.2895	1.4535	0.9008
SILVER BELLIES	2.2167	1.0919	0.7672

Here also the rate of change in retail prices are more than one for most of the varieties except pomfrets, reef cod, sharks, cat fish and lizard fish. The arrival of substantial quantity of the above varieties directly from the landing centre for retail sales during the season is mainly responsible for this.

Policies for fish marketing : Need for change

Several lacunae exist in the present fish marketing system. There are many hazards in handling fish as it is a highly perishable commodity. Preserving fish from its perishability until it reaches the consumer is one of the essential requisites for increasing its marketability. Modern fish marketing policy should envisage not only meeting the existing demand for fish but also tapping the potential demand in the important markets. Changing the fish form according to the tastes and needs of the consumers would result in more sales. For the new fish products constant advertising has to be done so that the public are aware of these new products.

In China, government has a policy that all fish should be degutted before selling. This can be attempted in our country also. In most of the fish markets minimum facilities are not there to boost up the marketing methods. No proper grading or weighing is done for fresh fish, though in some centres dry fish is properly weighed and sold. No proper sheds for auctioning or inputs for preservation are existing in many marketing centres of marine fish. Several malpractices are also followed by the fish traders and sometimes even the spoiled fish is thrust on the consumers. Hence quality control in fish marketing is very essential.

Due to great uncertainities in fish production, the high perishability of fish, assembling of fish from too many scattered coastal landing places, with many species and many demand patterns and wide fluctuations in prices, and lack of suitable vehicles, the arrangement for supplying quality fish

continuously in the market without delay becomes relatively more difficult (Rao, 1983).

Inefficient collection and distribution of fish results in areas of fish surpluses and areas of deficit in the internal marketing system of Tamilnadu. Although middlemen are necessary, a long chain of them in fish trading tend to inflate marketing costs (Librero, 1985).

Government Policies - an evaluation

To develop the fishery industry and solve its marketing problems the Government has implemented a number of policies and programmes. The fish marketing through fishermen cooperatives has been encouraged. The state owned Tamilnadu Fisheries Development corporation (TNFDC) also has undertaken some selective buying and selling. However, these efforts could not produce the desired results. The present marketing policies and price structure do not provide any inducement to the fishermen to increase the fish production. Even the occasional bumper catch does not help the fishermen to increase his income from fishing. This can be rectified only through Government action in announcing a support price for those varieties which are caught in large quantity now and then (Panikkar and Sathiadhas 1989). The support price can be effectively implemented through a public agency having sufficient storage, processing and distribution facilities.

CHAPTER IX

SUMMARY, CONCLUSIONS AND POLICY IMPLICATIONS

SUMMARY AND CONCLUSIONS

The present study of production and marketing management of marine fisheries carried out along Tamilnadu coast indicates the importance of fish in economy and its vast potentialities for the overall development of the State. Different technological options with varying investment range are available to the fishermen. The production trend of marine fish for the last fifteen years (1976-90) indicates an upward trend. However, the increase is mainly due to the mechanised sector. In terms of catch abundance, silver bellies and other sardines are the major species in Tamilnadu and shrimps form about 6 per cent of the total landings.

In the artisanal sector, a number of catamarans are operating with single type of gear throughout the year and it is found to be uneconomic. The combination of atleast 3 types of gill nets operating by catamarans are found to be economically efficient. In this category also, catamarans operating *thadichivalai*, *valavalai* and *kavalavalai* in high investment group and sardine gill net, *thathuvalai* and disco net in low investment group are found to be comparatively more efficient than the other units. The earnings of these units also can be further increased if fishermen supplement hook and line along with other nets.

Shore seine operations by plank built boats along Tamilnadu coast is slowly disappearing due to uneconomic returns to labour. Further the economic efficiency measures indicate that the P.B.boats operating sardine gill net and *koivalai* is hardly sustainable and diversified fishing and motorization of these

units are essential to get optimum returns.

The study indicates that the motorized catamarans should concentrate more on hook and line and *valivalai* operations. Among various gear combinations by motorized P.B.boats, the operation of drift gill net is more profitable and highly advisable. The advantage of moving farther and deeper waters yield better returns for these units.

In the mechanized sector, the operation of all types of units like trawlers, pair trawlers, fish trawlers and gillnetters are found to be economically viable and profitable. However gillnetters are more profitable than other types of mechanised boats. There is good scope to increase the number of gillnetters along Tamilnadu coast which will enable to harvest more pelagic fishes which are having high demand in domestic market.

The increase in price of marine fish over the years has been comparatively higher than all other food commodities. There are wide seasonal fluctuations in the average prices of different varieties of fish. The study indicates that the marketing margins received by middlemen for most of the varieties are high. Fishermen received comparatively higher share in the consumer's rupee for quality fishes like seer fish and pomfrets, which is more than 50 per cent of the consumer's price. Fishermen's share in the consumer's rupee ranges from 36 to 68 per cent for different varieties. The wholesaler's share varies from 6 to 18 per cent and retailer's share from 24 to 60 per cent of the consumer's price. The prices at landing centre, wholesale and retail markets were found to be highly correlated for most of the fishes.

The first hypothesis that indigenous low cost fishing units cannot survive in the long run and mechanisation is the only remedy for optimizing the marine fish production is not found to be correct. The study indicates that several types of fishing units with varying investment range are available to fishermen. Each type of craft-gear combination has its own merits and demerits. The co-existance of most of these innumerable techniques is an imperative due to the seasonal nature of marine fisheries and other related factors.

Motorization of country craft helped the fishermen to improve their living conditions is the second hypothesis and it is found to be correct and well supported by results of this study. The third hypothesis is partly correct. As stated, for trawlers catch per unit effort is continuously declining in Tamilnadu coast. However due to the recent price escalation of all varieties of fish including trash fish, the trawlers are earning substantial revenue and their sustenance no longer depends entirely on prawn catches.

The production function analysis reveal that the third hypothesis of fishermen using factors of production in a rational way is proved correct to a certain extent. The cost of production of fish, labour productivity and other key economic indicators of different craft-gear combinations show that fishermen are cost conscious. But they are unable to select the most appropriate technology, mainly because of the financial constraints. The fifth hypothesis is that lesser the number of intermediaries in the fish marketing chain the higher is the share to fishermen in the consumer's rupee is proved to be correct.

Areas for further research

The mini-trawlnet (thallumadi) operation by non-motorized plank built boats in the near shore areas of Gulf of Mannar and Palk Bay region of Tamilnadu is in an increasing trend and it is economically viable and provide considerable employment. But the catch composition of these units are mostly comprised juvenile prawns. If the indiscriminate operation of these units are allowed to continue they will ultimately culminate into the proverbial killing of goose laying golden eggs. Further investigations are required to ascertain the advisability of operating these units along Tamilnadu coast.

So also some of the richest fishing and breeding grounds of prawns lying between the main land and chain of islands has been almost destroyed by various means. The preservation of the eco-system gains so much of importance when considering the present and future fishing industry. Further indepth studies should be conducted to formulate regulatory measures.

Since 1989, trawl fishing has been banned in Tamilnadu for 40 days every year from November 1 to December 10 which is considered as spawning period for prawns. The impact of ban on marine fishery resources and consequently its socio-economic implications have to be further probed by indepth bioeconomic studies.

Policy implications

The study brings out the higher level of profitability of mechanised gillnetters which is not fully reflected in the number of units under operation. It is mostly attributed to the comparatively higher level of investment of gill nets which costs

about Rs.1 lakh and the risk involved in the operation of this net which faces the threat of being damaged by trawlers. Because of this, even the motorized P.B.boats are reluctant to operate gill nets. The government has tried to regulate the trawl fishing in two ways in the past- one by restricting the fishing days and other by restricting the fishing time. But both the measures could not yield the desired results. As per the Marine Fisheries Regulation Act of 1985, the trawl fishing is allowed only beyond 5 km. from the shore. If it is strictly implemented it will overcome many problems. Introduction of an insurance policy for the gill nets and encouraging the operation of mechanised gillnetters in deeper waters are the other two options open to the Government for increasing the number of gill net units.

The catch rates of trawlers declined considerably in recent years. However, the increase in price of fish both in internal and external markets led its survival. No further addition in the present fleet of about 2,500 trawlers is necessary along Tamilnadu coast. Diversification of trawlers into pair trawling and fish trawl operations should be encouraged to increase the profitability of these units and also to reduce the high degree of dependence on shrimp catches.

There is enormous scope to increase the marine fish production of Tamilnadu. The resources in the Wadge Bank region offer Tamilnadu a challenging task to increase the fishing effort. Quality fishes like tuna, barracudas, pig faced breams, carangids, cuttle fishes and reef cod are caught in substantial quantities by the seasonal fish trawl operations at Colachel

indicating the high potential of these resources in the Wadge Bank region. Utilizing the new fisheries harbour at Chinnamuttam near Kanyakumari and sufficient development of infrastructure facilities at Colachel, the Wadge Bank region can be further exploited by regular mechanised gill net and fish trawl operations.

The vast potentialities of deep sea resources are yet to be fully exploited. The successful operation of pair trawlers fishing in 50 metre depth zone and beyond has brought rewarding catches. The poaching by foreign fishing vessels in the exclusive economic zone of Tamilnadu is an eye opener for encouraging the indigenous deep sea fishing.

Regarding the formulation of new marine fishery policies, the non-motorised units should be provided an exclusive fringe-zone for fishing so that the motorized units will extend their fishing to wider areas. As a fuel saving measure, the utilization of sails by the motorized units has to be encouraged. Motorization of sail crafts should be carried out only as a supplementary to the sails and not to supplant it.

In the marine fishery, maximum labour force is employed in the traditional sector. Most of the Tamilnadu fishermen are equipped with small-sized catamarans with one or two types of nets and many are only wage earners without having any fishing equipment. The pressing problem for them is the lack of finance to acquire proper fishing implements. Hence the Government and commercial banks can formulate some schemes to supply credit to this category of fishermen on easy terms and conditions for buying implements.

Marine fish marketing system in Tamilnadu is still at a primitive stage. The involvement of a number of middlemen in the marketing chain adversely affects the interests of both fishermen and consumers. In most of the fish markets minimum facilities are not there to carry out marketing activities properly. No proper grading or weighing is done for fresh fish and there is no proper sheds for auctioning or facilities for preservation at most of the marketing centres. Inefficient collection and distribution of fish results in the existence of areas of fish surpluses and deficits side by side in the internal marketing system.

Lack of marketing infrastructure is another factor responsible for lesser returns to fishermen. It may not be possible to start ice plants, freezing plants and other storage facilties in each fish-landing centre. The Government can provide these facilties at least for a cluster of villages through the fishermen cooperative societies. After successful demonstration, these units can be handed over to local fishermen societies on equity participation.

The Tamilnadu Fisheries Development Corporation (TNFDC) attempted the supply of fishing inputs and marketing of fish in some of the centres. The scheme is a failure due to various administrative and management lapses. Fish Marketing Societies with the full involvement of local fishermen may be able to deliver the goods. The present marketing system and price structure do not provide any inducement to the fishermen to increase the fish production. The role of middlemen in the fish marketing system is continuing unabated due to the absence of institutional involvement. Even the occasional bumper catch do

not help the producer to increase his fishing income. This can be rectified only through Government policy by announcing a support price for these varieties which are caught in large quantities now and then. The support price can be efficiently implemented only when there is a public agency to purchase fish. Such an agency should be provided with processing, storage and distribution facilities.

Vast stretches of coastal land is now lying fallow in Tamilnadu without proper utilization. This can be utilized for aquaculture and mixed planting of *casuarina*, cashew and coconut, so that the marine fishermen can be provided with alternate employment opportunities especially during lean seasons. In this connection it is better to form a Coastal Zone Development Authority (CZDA) exclusively for the development of the entire marine fishing sector.

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APPENDICES

APPENDIX I

MADURAI KAMARAJ UNIVERSITY
Dept. of Economics

Production and marketing management of marine fisheries in Tamilnadu

Schedule 1: General Information and fixed cost details of fishing units

1. Landing centre Village Dist. State

2. Code No./Name of the unit and its owner.

3. Craft/gear details:

	Length	H.P	Mesh size	Year of Purchase	Purchase value (Rs.)	Annual expenditure on repairing & maintenance(Rs.)
a) Craft:						
b) Gear:						
c) Engine:						
d) Other accessories: (specify)						

4. Loan taken for the investment on the unit

Source	Amount (Rs)	Interest (%)

5. Type of ownership : Fully owned/shared/leased.

6. a)	Number of crew	Family workers	Hired labourers
b) Number of persons employed/ engaged in loading/unloading, transporting and marketing the catch.			

7. How revenue is shared (Owner/Labourers)

8. Average expenditure per day per trip.

	Quantity	Value (Rs)
Kerosene		
Petrol		
Ice		
Wages(actual-rate or percentage)		
Auctioning		
Cleaning the craft		
Cleaning the net		
Other expenses(Specify)		

9. Average number of fishing trips in a year (season wise)

Apr.-June	July-Sept.	Oct.-Dec.	June-March

10. Time of departure from and arrival to the fishing ground

11. Duration of a fishing trip (hours)

12. Distance to fishing ground (Km)

13. Where and to whom the catch is sold

14. Mode of disposal of catch

15. Percentage of catch sold (specieswise)

	Name of fish	**Fresh**	**Dried**
1.			
2.			
3.			
4.			

16. Expenditure incurred on drying (Rs/ tonne)

17. Any other marketing expenditure incurred by the boat owners (Rs)

18. Licence, insurance, jetty rent etc. (Rs)

19. Any other expenditure (Rs)

20. Remarks, if any.

Date

Name of enumerator.

APPENDIX II

MADURAI KAMARAJ UNIVERSITY
Dept. of Economics

Production and marketing management of marine fisheries in Tamilnadu

Schedule 2. Operational costs and earnings of selected fishing units

Landing centre Dist.:

State: Name of the unit/code No:

Type of craft-gear combination. Month.....19

I. Species-wise catch and value per trip

	Date				
Name of fish	Qty. value (Kg)(Rs)	Qty. value (Kg)(Rs)	Qty. value (Kg)(Rs)	Qty. value (Kg)(Rs)	Qty. value (Kg)(Rs)

II. Details of operating costs per day/trip (Rs)

Item	Date				
Wages for fishing					
Loading, unloading &transportation charges					
Repair & maintenance (if any) Craft					
Gear					
Engine					
Kerosene Qty (lit)					
Value (Rs)					
M. oil					
Auctioning					
Rent for carrier boat, if any					
Bata					
Food					
Ice					
Salt					
Drying					
Market tax Others, if any					
Actual no. of fishing trips (monthly)					

Remarks.

Name of enumerator.

APPENDIX III

MADURAI KAMARAJ UNIVERSITY
Dept. of Economics

Production and marketing management of marine fisheries in Tamilnadu

Schedule 3. Price spread and marketing margins of marine fish.

A. Landing centre

1. Name of landing centre Village District

2. Date of observation

3. Name of the nearest fish markets and distance from the landing centre

4. Average number of traders at the time of disposal of fish

   a. Wholesalers :
   b. Retailers :
   c. Auctioneers :
   d. Consumers :

5. No. of trucks :..... Fare per Km....

6. No. of cycle vendors :

7. Head load vendors : Males..... Females.....

8. Quantity of ice used(Kg) : Value (Rs).....

9. Average wages/head load worker received per day:

10. Auction charges (Rs./Kg.):

11. No. of processing units :..... Capacity.....

12. No. of curing yards :..... Capacity.....

13. No. of peeling sheds :.....

14. Jetty facilities :Yes/No

15. Approach road to landing centre : Yes/No

16. Form of disposal of catch (%):

    a)Fresh..... b)Dried..... c)Processed.....

17. Packaging charges (Rs.) :.....

18. Auction rates at the landing centre.

Name of fish	Quantity (Kg.)	Price (Rs.)	Type of purchaser

B. Whole Sales Market

1. Name of wholesale market :
2. Date of observation :
3. Distance from the landing centre :
4. No. of Auctioneers in the market :
5. No. of wholesalers :
6. Transportation charges (Rs.) :
7. Other expenses of wholesalers (specify, Rs.) :
8. Auction rates for different variety of fish :

Name of fish	Quantity (Kg.)	Price (Rs.)	Type of purchaser

9. Availability of clean water Yes/No
10. Market time :

C. Retail market

1. Name of the retail market :
2. Date of observation :
3. Distance from landing centre (Km.).... Wholesale market...
4. No. of retailers :
5. Transportation charges from landing centre/wholesale market.
6. Packing charges if any :
7. Other expenses (specify) of retailers :
8. Price per Kg. at the retail market :

Name of fish	Price per Kg.

9. Average No. of consumers :
10. Average Quantity arrival of fish :
11. Market time :
12. Remarks if any :

Place :

Date :

Name of Enumerator