SMALL-SCALE FISHERIES
PROMOTION IN SOUTH ASIA

A regional FAO/UNDP Project

ECONOMICS OF ARTISANAL AND MECHANIZED FISHERIES IN KERALA

A Study on Costs and Earnings of Fishing Units

Bay of Bengal Programme
Development of Small-Scale Fisheries
Madras, India

Programme for Community
Organisation
Trivandrum, India

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RAS/77/044

A Regional FAO/UNDP Project **Working Paper No. 34**

ECONOMICS OF ARTISANAL AND MECHANIZED FISHERIES IN KERALA

A Study on Costs and Earnings of Fishing Units

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PREFACE

This document is a comparative study of the costs and earnings of artisanal and mechanised fisheries in Kerala. It describes the rationale, conduct and findings of the study, along with recommendations for future action.

Preparation for the study began late 1979. Field work was carried out between April 1980 and March 1981. The processing of information was completed in August 1981.

The study was executed by the Programme for Community Organisation (PCO) — a voluntary agency based in Trivandrum that undertakes village-level development work, training, educational programmes and research — in cooperation with the FAQ projects for small-scale fisheries development.

The PCO team was led by John Kurien, a research associate of the Centre for Development Studies in Trivandrum. In charge of data collection and data processing was K. Balakumaran Nair. FAO members of the team were Roif Willmann, Associate Expert (Economics) and a consultant, Gunnar Nybo, who is responsible for costs and earnings studies in Norway's Directorate of Fisheries.

Selected for the survey were 242 fishing units **operating** out of 15 different villages along five districts of the Kerala coast. More than two **dozen youths belonging** to fishing communities were employed as enumerators. Over the year of the study they collected statistics of over 20,000 fishing trips which between them produced fish worth over Rs. 5 million and yielded more than ***1.5*** million "bits" of information. Only a preliminary analysis of the raw data has been possible so tar.

This has been the first large systematic study in Kerala, and perhaps one of the first such studies in South Asia, on costs and earnings in the artisanal fisheries sector. The study has indicated that the productivity profitability and objective contributions to the national economy of fishing units of the artisanal type are on anaverage as good as,or better than, those of mechanised vessels—though the same cannot be said-of the earnings of individual fishermen. These findings may justify the allocation of more resources and effort **to' the** technical **development of the** artisanal sector.

One of the major difficulties in formulating and implementing sound development programmes in fisheries is a lack of basic techno-economic and socio-econoniic data. It is hoped that this study will prove useful to fisheries planners and administrators in this context—as a basis for policy formulation, for the design and extension of credit schemes and subsidies, for fisheries management. It may reveal those areas which are in urgent need of management.

The authors of this report would like to acknowledge their thanks to:

- the task force of enumerators, field coordinators and research associates who worked as a close-knit team to undertake this major study.
- Elizabeth Mathew, S. R. Jayakumar, A. O. Kuruvilla and Virgin Mary who shared the major burden of consolidation and analysis of data, and to K. Balakumaran Nair, who was the overall coordinator for data collection and analysis.
- the owners of the sample fishing units selected for the study who extended active cooperation, and to representatives of several associations of tishermens who were equally helpful,
- officials of the Kerala State Department of Fisheries, particularly T. R. Thankappan Asari, chief of the project cell, who always extended timely assistance and sound advice on matters relating to the content and conduct of the study.

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— economists of the Centre for Development Studies, Trivandrum and staff of the Programme for Community Organisation, who were ever ready to provide help and share expertise.

— Gordon Eddie, FAO consultant, who served as technical editor for this report, and whose experience and critical insights were invaluable for the finalization of the report.

The authors hope that this study proves useful for those who are committed to Kerala's fisheries development arid the welfare of its fisherfolk.

The FAO/UNDP project "Small-Scale Fisheries Promotion in South Asia", which funded this costs and earnings study, was in operation from 1978—1981, and was a smah sister project of the SIDA-funded Bay of Bengal Programme for Small-Scale Fisheries Drevelopment. The UNDP project helped carry out several factual studies and assessments, pre-investment surveys and feasibility studies relating to small-scale fisheries in Bangladesh. India, Sri Lanka, Pakistan and Thailand.

This document is a working paper and has not been officially cleared by the FAQ, the UNDP, the Government of Kerala or the Government of India.

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1. INTRODUCTION

1.1 The fisheries sector of the economy of Kerala

The state of Kerala is a narrow strip of lush green land bounded on the east by high hills interspersed with rivers, and on the west by the Arabian Sea. It is situated in the south-west corner of the Indian Peninsula between 8°18' and 12°48' north and 74°52' and 77°22' east.

Kerala has 590 kilometres of surf-beaten coastline. The area of the continental shelf off this coast is about 40,000 km^2 and the overlying waters are considered to be among the most productive in the Indian Ocean. The potential annual sustainable yield of the south-west coast region, of which Kerala is only a part, is estimated to be in the range of 0.8 million to 1.2 million tonnes. Of this roughly half is taken at present.

Fish and fisheries play a crucial role in the well-being of Kerala's economy. Although the coastline is only about one-tenth of the whole coastline of India, the landings in Kerala constitute more than one-fourth of the country's total marine fish production. During 1976—SO they averaged 330,000 tonnes and contributed, at current prices, approximately 5.6 per cent of the state's net domestic product in 1978—79. The sector provides the main source of income for about 114,000 active fishermen and for almost an equal number engaged in the allied activities of processing and marketing. Approximately three quarters of the animal protein intake of the state's 25 million population is derived from fish. Earnings from the export of marine products from Kerala have during the past two decades been of considerable importance: they account for 18 per cent of the state's export earnings (1979—80) and 39 per cent of the country's total earnings from export of marine products of Rs. 2,489 million (1979-80).*

The marine fisheries sector is therefore one of the major concerns of the economic planners in the state of Kerala and the object of various development programmes.

The concern for the fisheries sector became acute following the severe decline in the total fish landings from 420,000 tonnes in 1975 to only 280,000 tonnes in 1980. This recession in fish production was accompanied by decreasing profitabilities, particularly of fishing units in the mechanised sector, which were also hit by fast-rising fuel prices.

Among the problems that have to be solved are (i) how to rehabilitate the mechanised sector and resume its development (ii) how to up-grade and expand the catch capability and production of the artisanal sector.

One of the major difficulties in the formulation and implementation of sound development programmes is the lack of basic techno-economic and soclo-ecoriomic data. Acknowledging this point, the most recent document spelling out the strategy and action programme for fisheries development in Kerala states:

> "The lacunae of valid statistical and economic data have not only made planning unrealistic in these areas but also rendered appraisal of the performance of fishery development projects quite difficult." (Krishnakumar, 1980)
>
> It could be added that they make it equally difficult to estimate the potential benefits of new projects.

1.2 Need for costs and earnings studies

Those responsible for planning and development require, among other things, information on costs and earnings, in order to assess the techno-economic and socio-economic performance

* For a more comprehensive description of Kerala's fisheries sector see: General description of marine small-scale fisheries in Kerala, Working Paper No. 30, FAO/UNDP Project RAS/044, Small-Scale Fisheries Promotion in South Asia.

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of different fishing systems, whether in the artisanal or in the mechanised fleets. Such information provides a rational basis for the planning and execution of development programmes including technical development, and in assessing their economic and social impact. They can also help to provide a sound basis for policy formulation and the design and execution of measures such as credit schemes and subsidies. The information gained through costs and earnings studies are relevant to fisheries management: they may reveal those fisheries where the need for introducing fishery management is most urgent; they may also provide useful indications of the likely future need for management measures arising from the introduction of improved technology.

In the case of small-scale or artisanal fisheries, their real importance and potential often cannot be appreciated because of the lack of detailed information on the operations and economics of individual fishing units and fishermen, and of the fleet as a whole. Their contribution to the economy as well as the efficiency of their fishing techniques cannot be assessed without hard facts and economic analyses. The urgent need of economic analysis to strengthen and promote small-scale fisheries development has been expressed many times by governments and international funding organisations. Notwithstanding these requirements, detailed studies of costs and earnings in the artisanal or small-scale fisheries sector are still few and far between and there is not a great deal of practical field experience to draw upon when planning them and carrying them out.

1.3 The project

In view of the needs expressed in the foregoing, the FAO/UNDP Project for Small-Scale Fisheries Promotion in South Asia (RAS/044) approached the Government of Kerala with a proposal to carry out a costs and earnings study of the fishing fleets, with which the government readily concurred.

Accordingly the FAO/UNDP Project for Promotion of Small-Scale Fisheries in South Asia then entered into an agreement for the joint execution of the work with the Fisheries Research Cell of the Programme for Community Organisation (PCO), a non-government organisation which has been active in development work among the small-scale fishermen in the Trivandrum district of Kerala for over a decade.

The study relates to the operations of the fishing fleets for the year 1980—81. Preparation for the work began in late 1979 and the processing of the information presented in this report was completed by August 1981. The study produced much more information than it has so far been possible to process and analyse with the facilities at present available.

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2. FISHING BASES, CRAFT AND GEAR IN KERALA

2.1 The fisheries

2.1.1 There are about 30,000 fishing craft in Kerala of traditional types, very few of which have yet been motorized. There are also about 3,000 mechanized gilinetters and trawlers. More than two-thirds of the annual landings in Kerala are taken by the traditional craft.

The traditional craft usually operate from the beach; there are about 220 recognized landing places along the coast of Kerala. Twenty-three landing centres exist for mechanized boats, of which ten can be used in all weathers, but full fishing port facilities (jetty, sheltered auction hall and berths for vessels) exist only at Cochin. During the peak season for prawn fishing some 1,500 to 2,000 mechanized boats operate out of Neendakara, where facilities are rudimentary and inadequate. The development of fishing harbours and fish landing centres was begun during the III Five-Year Plan and is continuing.

2.1.2 Both demersal and pelagic fishery resources are to be found off the coast of Kerala. Their distribution and local abundance are strongly influenced by the seasonal variations in oceanographic conditions. The area is subject to the South-West Monsoon. Besides affecting the distribution and availability of the fish, the monsoon produces heavy surf on the beaches, particularly in the southern part of the state. There are therefore good and bad seasons for fishing, both in terms of weather and in terms of the availability of the fish to capture. During the season of fine weather, fish are not always available in paying quantities. During the bad weather season, fishing operations often have to be suspended, although fish are available, sometimes largely because of the difficulty and danger of putting off from the beach through the surf.

As in all tropical waters, the number of species of fish is large; the availability of each of the marketable species varies with season and location in ways peculiar to that species.

For example, the biggest harvest of prawns comes in late May when mud-banks *(chaka4ra)* form off the coast. During the rough monsoon season, in June and July, ribbon fish are plentiful. The anchovy move northwards and closer to the shore in September. Cuttle fish, if they appear, will do so early in October. Fishing for *Kalava* (rock cod) in deeper waters begins in November; at this time the sea is calm. Oil sardine and mackerel, migrating southwards, are available in quantity from mid-October.

Since all but a few of the traditional craft depend upon sail, oar or paddle for propulsion, the capabilities of the fleet based on any one landing centre for following the fish stocks on their seasonal migrations, or searching for paying quantities of fish, are very limited. The strategy that makes most economic sense in these circumstances is therefore to adapt the methods of capture to whatever types of fish happen to be within reach at a particular time of year, and to accept that, at some seasons, little or no fish will be available.

The variety of different fishing gears used is large; few fishermen stick to one method of capture all the year round. Many fishermen therefore have more sets of fishing gear than they have fishing craft. For example, although some fishermen use hook-and-line from kattumarams all the year round, the typical fishermen from the Trivandrum district would use this method only in the calm, post-monsoon season (September to February); during March, April and May fishing with the anchovy net is usually more lucrative, while in the peak monsoon months of June to August boat seines produce higher earnings.

2.1.3 Because the fishing opportunities vary at different parts of the coast, both as regards species and as regards the distance to the fishing grounds, also because of variations in weather, currents and other environmental factors along the coast, and no doubt also for other reasons including local availability of materials and skills, a variety of different types of traditional fishing craft has been developed over the centuries. Some types of craft are used only seasonally, in

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combination with particular types of gears. Other types of craft may be multi-purpose. Not all craft are in use at any given time, for various reasons.

2.1 .4 A very large variety of craft and gear combinations can therefore be observed, as one travels along the coast, and operating at varying distances off-shore, and at various seasons. The situation will vary from year to year, according to the abundance and availability of the various fish stocks.

The main types of craft and fishing gear are described below. Appendix 5 contains some gear illustrations.

2.2 Craft

(i) *Kattumaram*

The kattumaram of Kerala, commonly referred to as *maram,* is a raft of 3—5 logs of *chilla* wood (Albyzzia stipulata) tied together with coir ropes. The rope is tied around a cross-piece of wood in the shape of stumped bull horns which is placed at the ends of the logs. The logs are spaced to provide a self-draining feature and to reduce or relieve the effects of wave impact in heavy surf. In Kerala, there are approximately 10,000 of these craft, more than 9,000 in Trivandrum district.

The sizes, method of construction and shape of the Kerala kattumaram make a crew of more than three persons impracticable; space for fishing gear and fish storage is also severely restricted. Kattumarams are however made in different sizes according to the type of fishing gear to be used. Smaller kattuma rams (3—4 metres long) are used with the hook-and-line and small meshed gill-nets, such as the anchovy net and the sardine net. The longer large-mesh driftnets require a larger craft (5—7 metres long). Boat seines are usedfrom two such kattumarams. The present price of kattumarams varies between Rs. 1,000 and Rs. 3,500. They are individually owned. The expected life is about seven years.

(ii) *Plank canoe*

The plank canoe called a kettu vallam is a type of wooden boat 7 to 15 metres in length, 1 to 2 metres wide and 0.7 to 1.5 metres deep. It is made by seaming together several planks of jungle jack with coir ropes. The inside of the canoe is then coated with pitch to make it water tight. Although hull form and construction make it most suitable for calm weather operation, the plank canoe can also be used in moderate surf. The crew is 6 to 15, depending on the size of the craft.

The larger plank canoes are most common in Alleppey district. They are also used in Trivandrum district for fishing with hooks and lines at depths of over 150 metres.

The investment required for such vessels is now between Rs. 3,000 and Rs. 12,000 depending on its size. In Alleppey a vessel is frequently owned jointly by 6 to 12 people.

The expected lifetime of a plank canoe is about six years. The number of plank canoes in Kerala is estimated as 5,000.

(iii) *Dugout canoes*

The dugout canoe, called *ottathadi vallam,* is made as the name implies by scooping out wood from a single log of soft mango or jungle jack. The keel portion is left thicker than the sides which are hollowed out so as to form internal stiffening ribs.

Dugout canoes are of three kinds. The *odam* or vanchi which is over 10 to 15 metres in length; the middle sized *thoni* and the 4 to 5 metre-long *beeputhoni.* About 15,000 dugout canoes are operated in Kerala.

Large dugout canoes carry a crew of up to 15 and normally employ boat seines in pairs or encircling nets. The small and medium dugouts employ gillnets, cast-nets or hook-and-line.

The acute shortage of large soft-wood trees has resulted in exorbitant prices for newly constructed dugouts. A large *va/lam* will now cost between Rs. 20,000 and Rs. 22,000. For the same

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reason, resale value is also high. Users of dugout canoes now take great care of their craft but nevertheless are gradually being forced to change to plank canoes.

Dugout canoes have been known to last for 50 to 60 years but the average lifetime is around 12 to 15 years. The larger dugouts are generally owned collectively and the smaller ones individually. They operate all along the Kerala coastline but are predominant in the Kozhikode and Cannanore regions.

(iv) *Mechanized boats*

Mechanized boats, called *enthravalkritha* boats, were first introduced in Kerala as fishing craft in the early 1950's. Their use became widespread only in the 1960's. In Kerala there are at present three types of mechanised boats: (a) gillnetters (300), (b) trawlers (3,000) and (c) purse seiners (45). Only the first two types were monitored in the present study.

Mechanized boats have been constructed in timber, marine plywood, fibreglass and steel. Wooden boats have so far been the cheapest and most popular in Kerala.

Gillnetters are about 8—9 metres long and use engines of between 16 and 34 hp. They operate from protected harbours or bays and carry a crew of four and 100—150 kg of large mesh gillnets. A gillnetter now costs about Rs. 60,000—90,000. It has a lifespan of about 10 years.

The trawlers in Kerala are medium-sized mechanized boats 10 to 12 metres in length with engines between 45 and 75 hp. They fish primarily for prawns, but retainthe bycatches. A trawler costs around Rs. 160,000 and has an economic lifetime of about 10 years. Trawlers operate along the whole length of Kerala's coastline. The largesf concentration is in the Quilon region.

2.3 Gear

(i) *Encircling net*

Encircling nets, called as *koruvala* and *thanguvala,* are close-meshed nets of nylon yarn used in fishing fast-moving, delagic, shoaling typefishes like sardine and mackerel. They are operated in water depths of 6 to 10 metres.

This gear is used from a plank canoe or dugout canoe and isnormallyoperated by crews of 15 persons. When a moving shoal is spotted the crew row ahead of it, drop one end of the net and swiftly pay out the rest so as to encircle the shoal. The bottom of the net is lifted and the whole net closes-in simultaneously. The fish is then scooped into the canoe. This method is used all the year round in the Alleppey region.

An encircling net costs about Rs. 12,000—15,000, has a lifespan of 7 to 8 years, and is generally collectively owned.

(ii) *Boat seines*

Boat seines are nets of cotton or nylon with a bag-like shape and long wings of rope or netting attached to the sides. They are generally operated from two craft, each craft handling the hauling ropes attached to one or other of the wings. The seine is towed behind the craft at a position equidistant from both of them, and when a shoal is spotted the crews row towards it in such a manner that the fish shoal enters between the craft; sometimes scaring devices are used to drive the fish into the nets; the wings shepherd the shoal into the bag end of the seine.

Boat seines called *thattumadi* are used from kattumarams in the Trivandrum region. Theyoperate during the monsoon and post-monsoon months in an area where the water depth ranges from 15 to 25 metres, primarily to catch ribbon fish, anchovies, carangids and occasionally prawns. They are bell-shaped cotton nets with coir rope wings and cost now about Rs. 3,000—4,000; they have an expected life of seven years. These boat seines are as a rule individually owned.

Boat seines called *kollivala* are operated from dugout canoes in the Kozhikode - Cannanore region. They operate in the post-monsoon months in an area where the water depth ranges from 10 to 15 metres. The species caught are primarily sardines and mackerels. The *kollivala* is a nylon parabolic-shaped bag with a footrope and belly moving ahead of the headrope, and

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wings of large mesh monofilament plastic netting. This seine costs Rs. 10,000—12,000 and has an expected lifespan of seven years. Such boat seines are generally collectively owned.

(iii) *Shore seines*

Shore seines or beach seirtes are commonly called *Kambava/a* or *noonavala.* These are bag-like nets, either rectangular or hemispherical in shape, made of cotton or nylon, with long coir ropes and webbing attached on two opposite sides. The length of the ropes and webbing vary according to the general depth at which the seine is to be released before it is hauled onto the beach.

Shore seines are bulky and heavy and require the use of plank or dugout canoes to shoot them. Leaving one end of the rope on the shore, the canoe, manned by 3—4 crew, is launched; as it moves out, the boat crew payout the rope and the wings until the bag is reached. The bag has its mouth fitted with weights at the bottom and floats at the top to keep it open. Once the bag is dropped, the craft moves shoreward paying out the wings and ropes of the other side of the net, and delivers the end of that rope to the shore crew. The shore crew, numbering 15—20, pull in the two ends of the ropes in synchrony. The crew on the craft meanwhile return to a position behind the seine and move shorewards with it; their function is two-fold (a) to control the hauling according to the water movement and (b) to prevent fish from getting out of the bag, scaring them by beating oars on the water. Just before the bag reaches the shore, some of the crew of the canoe jump into the water to close the mouth. The most commonly caught species include anchovies, tunrties, carangids, pomfrets, sardines and mackerels.

Shore seines require an investment of about Rs. 3,000—8,000 depending on the length of the ropes, wings and the material of which the bag is made. The expected lifetime of a shore seine is about seven years. The use of shore seines is widespread in the Trivandrum and Alleppey regions particularly in the non-monsoon months from September to April. They are generally individually owned in the former district and collectively in the latter.

(iv) *Gillnets*

Gillnets are a broad generic name for nets which are wall-like in nature and in which fish get caught when their gills get entangled in the meshes. The mesh size is chosen to suit the size and species of fish which it is intended to catch. Gillnets are made of cotton and nylon.

(a) *Driftnets*

Driftnets, called *ozhukuvala* or *neetuvala* are now made of nylon yarn ranging between 6 and 24 ply. They vary in length and width. Driftnets are operated from kattumarams, plank canoes and dugout canoes. After the net is shot, one end is attached to the side of the craft, which drifts along with the net. Fishing is normally undertaken at night at depths ranging from 20 to 50 metres. The species of fish caught by the driftnets depend on the size of the mesh and the depth at which the net is set. The common species include tunnies, seer, pomfret, shark, ray and catfish for large-mesh driftnets and sardines and mackerels for small-mesh driftnets.

Driftnets require an investment varying with length (hence weight of nylon) from Rs. 5,000 to Rs. 10,000 in the artisanal sector and Rs. 15,000—20,000 in the mechanized sector. They may be individually or collectively owned.

(b) *Set gillnets*

Set gillnets are fixed between floats and weights and are attached to a craft that generally remains stationary. Different types of set gillnets are used for catching different species of fish.

The *netholivala* is used exclusively for anchovies; the half-centimetre mesh size makes it too small and delicate to use for other species. Anchovy nets are generally made of cotton and cost only about Rs. 700—1,000. Recently, however, such nets have been made in nylon (2 ply) in some villages. The nylon anchovy nets cost about Rs. 2,000—2,500 and have an expected life span of about 10 years compared to 6 years for cotton nets. Anchovy nets are operated exclusively in the Trivandrum region, from kattumarams, for 5 months of the year in areas where the water depth is 15—17 metres. They are individually owned.

Prawn nets, called *konjuvala,* are used primarily to catch prawns and fish like sardines, mackerel and jew fish. They are fabricated from 3 ply nylon yarn.

The average sized prawn net using 7—9 kg of nylon yarn now costs between Rs. 1,200 and Rs. 1,500. It is individually owned and operated from kattumarams or small dugout canoes in the Trivandrum and Quilon regions in areas where the water depth is between 18—25 metres. They have an expected life of six years.

Cha/avala are used primarily to catch sardines. The mesh size varies depending on the size of sardine available in the region of operation. In general the mesh size is about 1.5 cm and these nets are fabricated out of 2 ply and 3 ply nylon yarn. Sardine nets are used with kattumarams in Trivandrum in areas where the water depth is about 25 metres and with small dugouts in Quilon and Kozhikode where the water depth is 10—13 metres. Depending on the weight of nylon used to fabricate it, a sardine net will cost Rs. 2,000—5,000. They have an expected life of 6—8 years. These nets are generally individually owned.

(c) *Cast nets*

The cast net (commonly called Veeslnivala) is, as the name implies, simply cast from a craft over the water surface when fish are spotted. The cast net is a small-meshed, nylon, conical net with a long line attached to the vertex. The circular open end is weighted with lead or iron. It requires considerable strength, balance and skill to cast the net in such a way that it forms a flat circular shape just on reaching the water surface. As soon as the net touches the surface it sinks down fast because of the weights. Fish directly under it get enclosed in the net. On hauling in the net with the rope at the vertex, it closes onto the fish and their gills get entangled. The cast net is used to catch inshore shoaling species of fish such as sardines and mackerels. This technique can be used only over even, smooth bottomed sea floors in areas where water depths are between 6 and 10 metres.

A cast net now costs between Rs. 1,000—1,200 and has an expected lifetime of two years. It can be operated even with a fairly old dugout canoe which would not otherwise be still suitable for fishing. Cast nets operated from a craft (as distinct from cast nets thrown from the shore) are found in the Kozhikode and Cannanore regions.

(d) *Bottom set lobster nets*

The lobster net, called a *kaluralvala,* is a coloured, bottom gillnet that is anchored by stones on the rocky parts of the sea bed where lobsters are normally to be found, at a depth of 3—5 metres. The upper end is supported by floats, but does not extend to the surface.

Fishermen set the net in this fashion, take several bearings, and return to shore. They return after 6—8 hours to retrieve the net using a hook-and-line.

(v) *Hook-and-Line*

Hook-and-line, commonly called *choondayam-kangoose* or *beepu-choonda,* consist generally of iron or aluminium hooks attached to droppers or snoods of nylon/cotton cord, which are fastened at intervals to one long nylon/cotton line which has attached to it, at one end, iron or stone weights. The size of the hooks and the thickness of the line used varies according to the species of fish to be caught. The length of the line and the weight of the iron or stone will depend on the depth at which the operation is to be conducted.

Hooks and line sets are used from kattumarams, plank canoes and dugout canoes in areas where the water depth varies from 10 to 150 metres. Natural baits or artificial lures (made of twinkling nylex yarn) are attached to the hooks to attract the fish. Special types of large iron hooks with small fish as bait and strong cotton lines are used to catch larger fishes like shark. The most commonly caught species include tunnies, catfish, rock cod, shark and ray fish.

Hook-and-line is the fishing gear requiring the lowest investment: the large cotton lines are locally twisted and treated with tamarind dye. The cost is between Rs. 150 and Rs. 700. The nylon snoods, aluminium/iron hooks and iron/stone weight cost between Rs. 20 and Rs. 80 depending on the number of hooks and length of line. Due to the very high frequency of losses, the cost of the

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snoods and hooks is generally considered as an operating expenditure rather than as an investment. Hooks and lines are used on all parts of the Kerala coast.

(vi) *Trawinet*

The bottom trawl is a conical shaped net towed over the sea bed. On the wings of the trawl net, rectangular boaros called otter boards are attached to weigh the whole net down to the bottom and maintain the lateral opening. The vertical opening is maintained by floats. Bottom otter trawling is restricted to the mechanized sector.

Trawl nets are made of polyethylene yarn and cost now between Rs. 2,000 and Rs. 3,000. A net generally lasts for about 12 months. The steel towing warps and the otter boards which need replacing less often cost about Rs. 3,000-4,000.

The bottom trawl is used to catch prawns and demersal fish. Trawling takes place off all parts of the Kerala coast.

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3. METHODOLOGY AND ORGANISATION OF STUDY

Few, if any, detailed studies of the costs and earnings of an artisanal fishery as large and complex as that of Kerala have been done before. It is therefore desirable to describe the methods used in the study and the way in which it was organised.

In short, the methods devised for the study proved entirely praoticable, but are doubtless capable of improvement and development. Meanwhile the account whith appears later below of the organisation and methods of the study may prove useful in the planning and execution of similar studies in the future elsewhere.

Also, it may well prove possible to use the large amounts of data for purposes other than those envisaged in the planning of the present work, or to use them in other ways, in order to produce different kinds of results and to gain further insights. If this were to be attempted, it would be necessary to know how the raw data were collected and to understand the limitations and possible errors of the methods employed.

In what follows, the first section describes the problems of sample selection, the second the method adopted, and the third the manner of organisation of the collection and processing of the data. The final section indicates some of the characteristics of the methods and the data that should be borne in mind when using them or when interpreting or implying the results.

3.1 Selection of a representative **sample**

It would be impracticable to collect and record accurate information on the fishing operations and costs and earnings of each and every craft in so large and complex an activity as the artisanal fisheries of Kerala. Fortunately, this is not necessary provided that appropriate sampling procedures are adopted, and that the sample data are representative of the whole.

3.1 .1 *Statistical base*

One of the main problems encountered in the application of sampling techniques was the lack of reliable frame data in terms of both the size and the characteristics of the population. As many as three governmental agencies had at different points of time during the previous decade undertaken censuses of fishing craft, gear and tackle in Kerala state. They were (a) The Department of Fisheries of the State **of** Kerala, (b) The Central Marine Fisheries Research Institute, and (c) The Kerala State Livestock Census Division. However, as elaborately pointed out elsewhere (Kurien, 1978) the data recorded by these various sources are not comparable and in some cases there may not be a complete correspondence between data and reality. It was therefore not possible to rely upon the existing statistical information to provide a correct estimate of the numbers and nature of fishing craft and gear and of their distribution along the coast. The only feasible way of arriving at a 'representative sample' therefore seemed to be to draw upon the field knowledge of the Fisheries Research Cell of the PCO. Such an approach will obviously have its limitations. The method is based on a *priori* knowledge, but its validity, in the sense of whether the sample is representative of the population, can only be assessed *ex post facto.*

3.1 .2 *Seasonal redeployment of effort*

A special problem arises because of the seasonal variations in the craft and gear in use; because only a few fishermen own all the main types of craft and gear; and because individual fishermen change from one type of fishing to another at different times.

3.1.3 Yet another problem, common to much research work involving the co-operation of fishermen, is that it is easiest to work with the most successful ones, and these are the ones most likely to co-operate and give accurate information.

3.1.4 *Caveat*

In such circumstances, and bearing in mind the bias of purposive sampling, it is essential for the reasons outlined in the preamble to this chapter that the details of the sampling technique be clearly understood. See also 3.4 below.

3.2 Method of selecting sample

3.2.1 *Selecting the districts*

The entire 590 km coastline of Kerala was divided into three regions - viz, south, central and north - making each region as homogenous as possible from the point of predominant fishing practices and fish resources. The southern region comprised the districts of Trivandrum and Quilon; and the central region the districts Of Alleppey, Ernakulam and Trichur; and the northern region the districts of Malappuram, Kozhikode and Cannanore. During the initial phase, the study was confined to Trivandrum and Quilon districts in the southern region and Alleppey in the central region. However, four months later it was extended to Kozhikode and Cannanore districts in the northern region.

Thus five districts were selected as representing the three regions of the state. These were also the districts where the Programme for Community Organisation has grassroots contacts.

Taken together these five districts account for 71 per cent of the Kerala coastline length (420 km out of 590 km); 76 per cent of the number of fishing villages (189 out of 249) and 79 per cent of the fish catch (217000 tonnes out of 279000 tonnes in 1980).

The survey period in Kozhikode and Cannanore districts comprised six months only, from 1st August to 31st January 1981. In previous years between two-thirds and three-quarters of the total yearly landings occurred during this time period. Accordingly, the aggregated data for the survey year somewhat under-estimate the performance of thefishing units monitored in Kozhikode and Cannanore districts.

The craft-gear combinations found in the five districts include almost all the types operated anywhere along the coast of Kerala. This is also true about the species of fish caught using these craft and gear. ft seems reasonable to assume that in relation to geographic area, volume of catch, craft-gear combinations and species of fish, the five districts chosen for the study are adequately representative of the state's marine fisheries activity.

After this purposive selection of the districts, a two-stage sampling technique was adopted to select the final sample centres and sample craft-gear combinations.

3.2.2 *Selecting the sample centres*

In the *first stage,* the sample centres, that is to say, the individual villages where enumerators were to be stationed, within the sample districts, were selected. The choice was governed by such considerations as (a) the reliability of the data to be collected during the course of the year (b) the 'representativeness' of the final sample units to be monitored in the centre and (c) the geographic spread of the centres.

Based on this, the major criteria influencing the choice of a centre are listed below:

(1) A village where a fair mix of craft-gear combinations, representative of the district, is to be found.

(2) A village where the Programme for Community Organisation has good contacts with the fishermen.

(3) A village noted for especially effective operation of a particular craft-gear combination.

Based on these criteria the locations of the fishing villages chosen as sample centres are shown in Appendix 1.

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3.2.3 *Selecting the craft-gear combinations*

It will be seen from the previous chapter that not all fishing craft are in use the year round; fishermen may transfer from one type of craft to another according to season; while some fishermen and some craft may employ the same method of capture throughout the year, in other cases a variety of different gears will be in use according to season and fishing opportunities. After careful consideration of this situation, and the various options open, it was decided that the basic fishing units for study would be representative of particular craft-and-gear combinations. A "fishing unit" is therefore herein defined as an individual example of one particular combination of type of craft and kind of fishing gear: a combination which in many cases is seasonal and temporary. The second stage of sampling therefore comprised the selection of the craft-gear combinations which would be monitored in each centre during the course of the study. This stage was undertaken after the appointment of the enumerators in the respective centres. The process of data collection in order to select the final sample combinations and units in a centre became a preliminary training in, and familiarisation of the village enumerators with the basic procedures of sampling surveys.

The first task before them was to list all the types of craft-gear combinations used in their centre and then make a census of the existing number of fishing units in each of these combinations. The contribution of each combination to the total village fish production and the seasons during which the combination was in active use were ascertained by questioning elderly fishermen, auctioneers and the church or temple accountants, and by group discussions. The details were recorded on charts to facilitate the final selection of sample units.

3.2.4 *Selecting the units for study*

(a) Considerations of cost and manageability indicated that not more than 250 units could be studied altogether. The choice of the sample size in each centre was governed by two factors:

(i) the diversity of the predominant craft-gear combination in the centre; a minimum of two individual sample units was thought necessary for representing one particular type of craft-gear combination in the centre and (ii) the number of enumerators recruited in the centre; it was thought that 7—10 units could be monitored by each enumerator.

(b) Once the ceiling on the sample size of a centre was fixed, the choice of the sample units depended upon two criteria of representativeness:

(1) Intra-village consistency:
Rules of thumb for identifying the primary or dominant types of craft-gear combinations were used, as follows:

(i) The units for study would be selected only from those craft-gear combinations whose contribution to the total annual fish production of the centre constituted more than 5 per cent and which numbered at least 50 units.

(ii) From each of the above dominant craft-gear combinations, a number of units was selected bearing in mind the ceiling fixed on the total fixed sample size for that particular centre and giving weight not only to the total number of fishing units in each combination but also, and more especially, to their contribution to the total landings in the village.

(iii) Bearing in mind that some combinations or units would not be in use for the whole year, the selection of units for study was to be such that the enumerators would be able to monitor a more or less constant number of units throughout the year.

(2) inter-village differences:
The combinations selected in each village and the priorities assigned were to reflect differences *between* villages.

(3) District-wise representativeness:
The sum totals of the sample units by type of combinations for all the villages together were to give what was considered by those best-informed on the subject to be a representative picture for the whole district.

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(c) An illustration — sample selection in village TAQ.

The method of selecting the units for study can be illustrated by the case of a hypothetical fishing village TAQ, with a population of 500 active fishermen (composed of non-working owners; working owners; workers) using two main types of craft — (a) and (b) and gears — U, V, W, X, Y. Craft (a) is available in four subtypes a_1 to a_4. The craft-gear combinations used are as follows: Ua_1, Ub, Ua_2, Wa_2, Xa_3, Ya_4, and it is ascertained as outlined in 3.2.3 above that these are normally in active use as indicated in Table 1.

A total number of 23 sample units is purposively selected on the basis of the relative number of units of each combination and their share of the total production. These will be subject to monitoring at the relevant times.

Two village youths are recruited as enumerators so that the number of sample units that it is practicable to have under observation ranges between 14 and 20, because each enumerator can track on the average between 7 and 10 units per day. The selection to be under active study during any particular month can be derived from Table 1.

3.2.5 *Basis of study*

There are two possible approaches to study the cost and earnings of the sample units.

One method would be to monitor units owned by a few individual fishermen (in case of the village TAQ, say 6 or 7 fishermen could be found who own between them the chosen selection of 23 units). This approach would give the costs and earnings of the various combinations as well as the incomes for the year of those particular individuals.

A second approach would be to ask as many different individual fishermen to co-operate as there are units **to be studied (23** in the case of village TAQ).

This approach would give the costs and earnings of the various dominant combinations in the village but only a part of the incomes of those particular individual fishermen, for the year, because the combinations are not in use all the year round.

The first method would mean that the data were collected only from the village elite; those who have the possibility of owning all, or most of the craft-gear combinations.

The second approach was chosen. It involved more fishermen; it further ensured the possibility of getting a greater representativeness of craft-gear combinations and ownership. The sample units will be owned by a wider spectrum of fishermen of varied affluence, and likely to capture a wider range of performances.

3.2.6 *Other possible approaches*

Another and completely different and in some ways more convenient approach, would have been to monitor the affairs of a selection of owners. This would not necessarily have produced representative figures for the performance, or costs and earnings, of the various craft-gear combinations, and it would have been liable to bias because it is often the case that co-operation can be secured for research most easily from the more successful. The same applies to "random" selection of craft.

3.3 Organisation of the data collection and processing

3.3.1 *Project staffing*

During the course of the study, the field staff consisted of 23 village level enumerators and five field co-ordinators. At the co-ordinating office there were six research associates (four of whom worked only during the last 3 months of the study), a technical co-ordinator and an honorary study co-ordinator. (An organisation chart is given in Appendix 3.)

3.3.2 *Securing co-operation at village level*

The staff in the co-ordinating office visited all the selected centres and met the owners of the sample units and the local leaders — priests, village headmen, and leaders of fishermen's unions

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Table 1

Distribution of craft-gear combinations in village TAQ and selection of sample units for study

C—G combination	No. of Units in the village	Percentage of total village fish production	Months in operation												Sample units selected purposively (for costs and earnings study)
			A	M	J	J	A	S	O	N	D	J	F	M	
Ua_1	65	40	7	7	7	7	7	7	7	7	7	7	7	7	7
Ub	45	10	3	3								3	3	3	3
Va_2	275	5			3	3	3	3							3
Wa_2	75	5						2	2	2	2	2	2	2	2
Xa_3	125	25		4	4	4	4	4	4						4
Ya_4	250	15	4	4			4	4	4	4	4	4	4	4	4
	835	100	14	18	14	14	18	20	17	13	13	16	16	16	23

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(trade associations) to explain the objectives and purpose of the study. In all the centres the response was encouraging.

The participant owners were given a brief note on the *modus operandi* of the study with a specific assurance about the confidentiality of the information they would provide. The enumerators were young people from the respective villages and no undue hesitation was perceived on the part of most of the owners in reporting the actual facts and figures, except for a few owners of mechanised boats. They were reluctant to disclose costs and earnings at a time when they were making a case to the government for concessional fuel prices. Moreover, some had had previous experience of collaborating in research, which had not yet produced any apparent results or benefits to them.

The study co-ordinator sent letters explaining the aims and methods of the study to all educational institutions, associations and agencies — governmental and non-governmental — who were concerned with the issues of fishermen and fisheries development, in order to enlist their co-operation in the study on specific issues of mutual interest.

The study was also publicized in the local press and radio.

Throughout the twelve months of daily enquiry, a general tempo of enthusiasm was maintained in the centres, reflecting the involvement of the people in the study and the effectiveness of the dialogue and the publicity.

3.3.3 *Training of the field staff and pie-testing of schedules*

The village enumerators were youths from the respective villages, from fishing families, who therefore were thoroughly familiar with fishing but had no earlier experience in systematic data collection. In view of the technical nature of the field enquiry it was thought appropriate to give the field staff a few basic theoretical and practical exercises in data collection.

In an attempt to impart training and also pre-test the questionnaire and schedule, a pilot field enquiry was conducted. The enumerators and field co-ordinators spent two weeks in the field canvassing data. This exercise formed a good opportunity for practical training and also for assessing (a) the appropriateness of the schedules and questionnaire to be used during the study (b) the rigour of the concepts and (c) whether the time and number of people allotted were sufficient to undertake the task.

In the light of the experience gained in this pilot enquiry, corrections and modifications that seemed necessary or desirable were made to the schedules and the questionnaires. They were then printed and made ready for the start of data collection which was scheduled for April 1, 1980.

Meanwhile, to facilitate sharing of experiences and to discuss the problems the enumerators had encountered in the pilot study, a one-day training and refresher session was held involving the entire staff. This was useful both in clarifying technical doubts and in engendering team-spirit among the staff.

3.3.4 *System of guidance, correction and review*

A system of guidance, correction and review was built into the study's structure of functioning, as illustrated in Figure 1.

The system encouraged contact and exchange of experiences and ideas among the members of the study team. This in turn fostered the team-spirit which is difficult to sustain in people engaged in repetitive tasks and working in small isolated groups. An important benefit was the feedback of practical experience and problems to the designers and supervisors of the study.

3.3.5 *Data collection, consolidation and tabulation*

The basic data collection was done on a daily basis. Every day the enumerators were expected to make actual observations of the fish sale transactions on the sea shore. This enabled them to get a general idea of the prices, the quantities being landed

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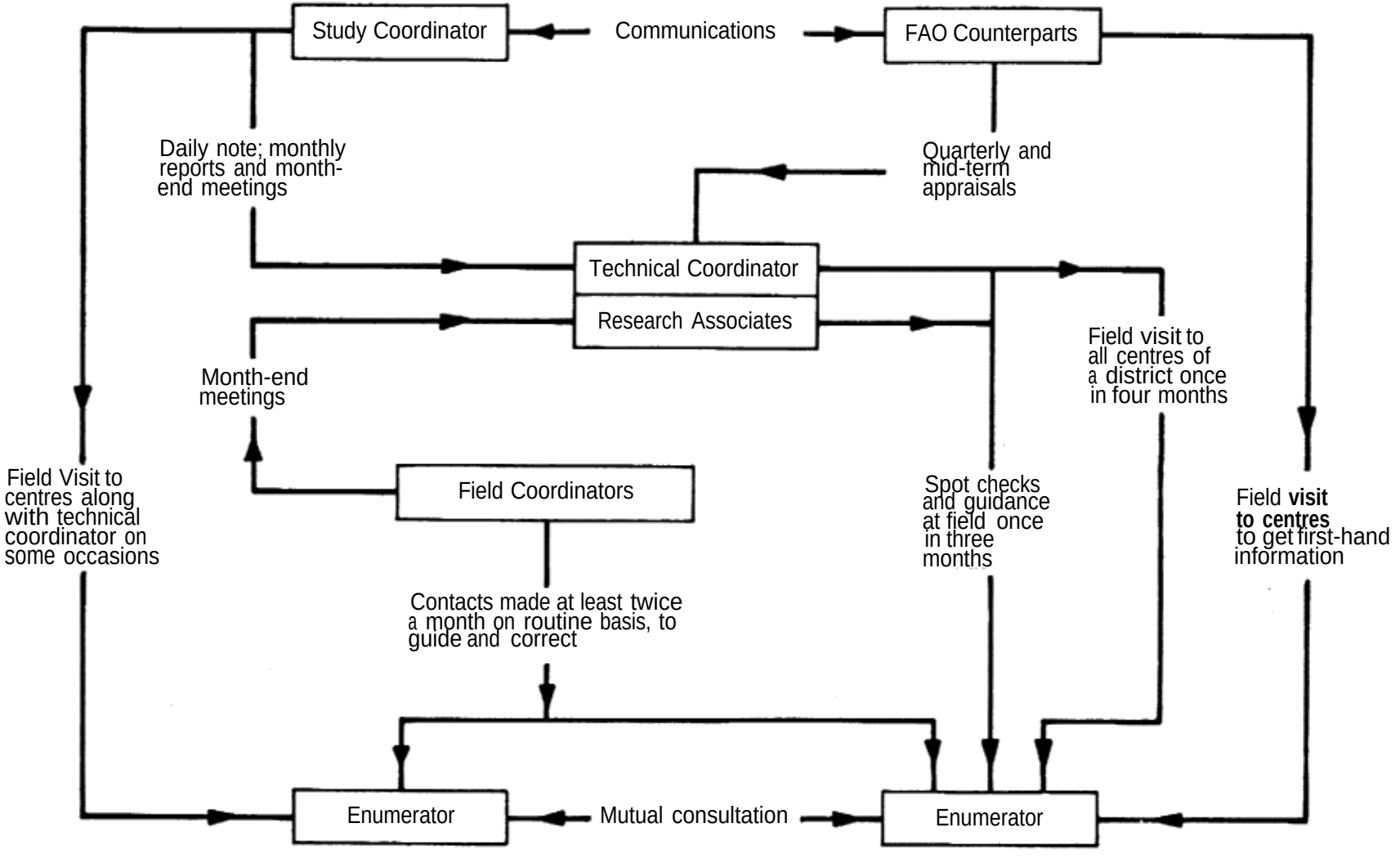
Figure 1

GUIDANCE CORRECTION AND REVIEW PROCEDURES



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and the general marketing situation at the centre. They could also hear from fishermen about the fishing conditions – wind, current, the water depth at which fishing was carried out and so forth. Thereafter, at a time most appropriate and convenient to the sample unit owner(s), the enumerators visited the household and canvassed the details relating to the costs and earnings of the fishing trip(s) undertaken during the day. The data collected was entered directly into the schedule. After the data for one week was recorded in the schedule the enumerators added these up and entered the weekly totals. (Details about the schedules and questionnaires are given in Appendix 2.)

Figure 2 illustrates the further stages of analysis.

3.4 Sources of error and other limitations

3.4.1 There are always special risks of inaccuracy in systems of collecting statistical information through enumerators dispersed in the field, although in many cases the errors may cancel each other.

3.4.2 One possible source of error peculiar to the present system is the method of estimating the weight of the fish landed by the individual fishing units under study. This was done by eye. However, in many instances the enumerator will have been able to consult the fishermen, who usually have a fairly good idea of how much they have caught. Errors could be reduced by training and by spot check in future studies, at some extra cost.

Any errors in estimates of weight landed do not affect records of earnings: earnings were recorded independently of weights.

3.4.3 Because the data have had to be processed manually, and because of the limited time and effort available for revision of the work, it is possible that computational errors may have gone unnoticed so far.

3.4.4 The units under study had been pro-selected by the methods described earlier above on the basis of advice taken from various groups of people who could be expected to be thoroughly familiar with seasonal variations in the combinations and their patterns of use. With the resources available to the project, it was not possible to carry out any deliberate checks on whether the selection of units being monitored was in fact the closest possible model of the active village fleet at any given time. However, no obvious discrepancies wore remarked. Nevertheless, caution should be exercised if any attempt is made to estimate the total earnings of a particular village fleet from the information collected.

If it were felt necessary and desirable, the methodology could readily be further developed to meet this point, at the cost of extra effort.

3.4.5 In many fisheries, the range of performance of individual fishermen or individual units is very wide, typically three-to-one (see BOB P/WP/6: Bottom Long lining in Sri Lanka: Further Trials).

It was found that the range of variation of fishing units using the same typo of craft-gear combination but operating from different fishing villages was indeed considerable (see chapter 10). Thus, in any attempt to treat the relatively small sample of 242 fishing units (less than 0.7 per cent) as a model of Kerala's fishing fleets, it has to be accepted that the confidence limits are wider than would have seen desirable. Study of the range and distribution of the performances of all the individual fishing units in each craft-gear combination would further illustrate this point.

3.4.6 The question of whether the selection was biased towards the more skilled fishermen remains. As pointed out in 3.2.5 above, the decision was made to study as large a number of individual fishermen/owners as possible, in preference to studying as few as possible, partly in order to minimise this risk. Given the resources, it would be possible in future studies of this kind to make a check on how representative the selection was, as regards performance, by studies over short periods of time in several villages, or over a longer period in one village.

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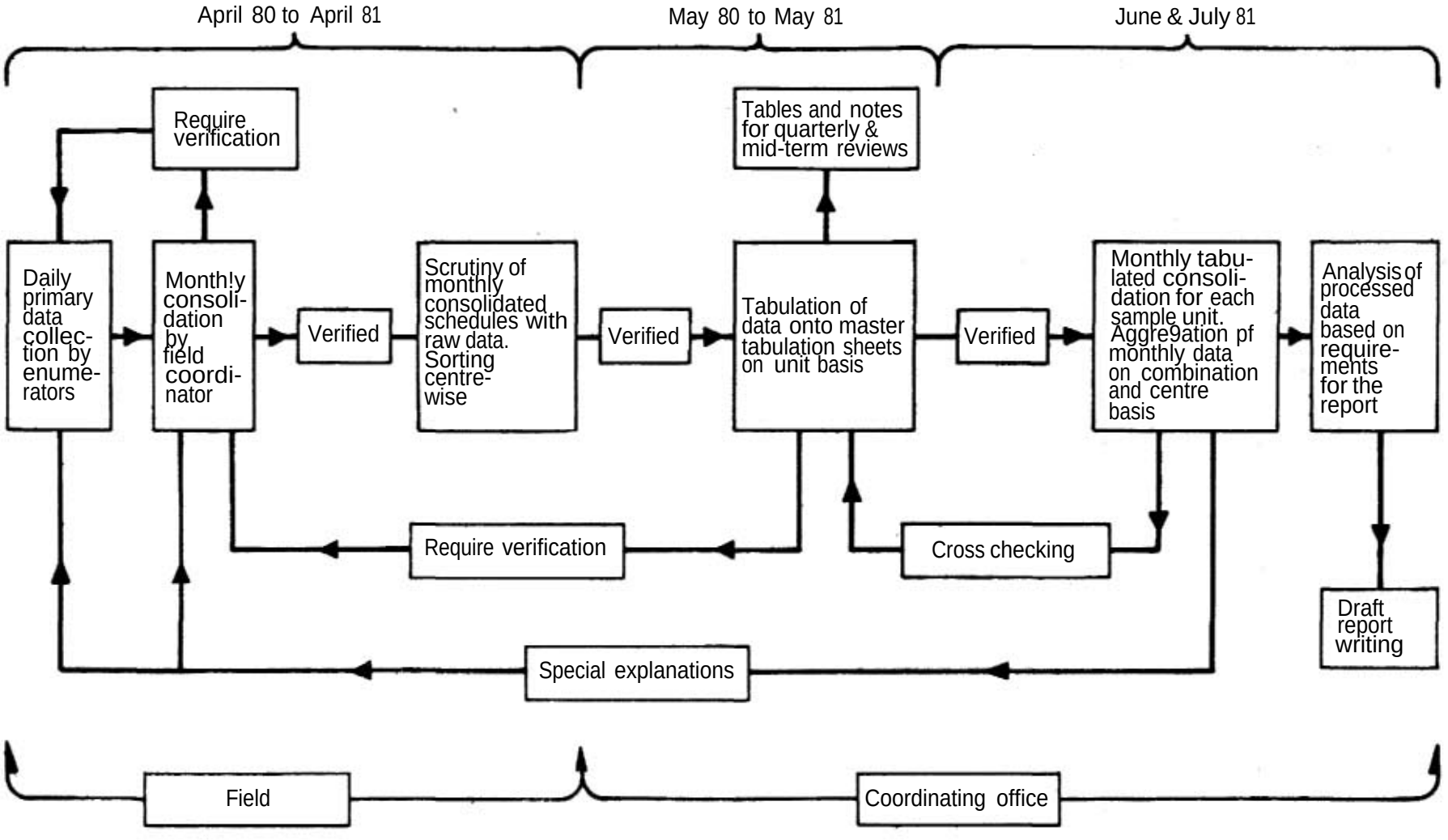
Figure 2

DATA COLLECTIONS VERIFICATION AND CONSOLIDATION PROCEDURE ADOPTED DURING THE COSTS AND EARNINGS STUDY OF FISHING UNITS IN KERALA STATE



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Moreover, a study of the range and distribution of individual performances, using the data of the present study, should give some guidance on the size of sample required in relation to the confidence limits desired for future studies.

3.4.7 The purposes of the study were different from the purposes for which the official statistics are collected and published, arid the methods used in the field differed in detail. Bearing also in mind the points made earlier, it would be surprising if some discrepancy could not be found between the official data and that collected during the study.

More important, it would be possible, by making certain assumptions, to derive from the project data figures for total landings of fish in Kerala, total earnings and the like, but such calculations would not be justified at present and the results would not be valid. One reason for this is that an up-to-date and accurate census of fishing units and fishermen would first be needed, and in the conditions of the Kerala fisheries, this is a big undertaking. Nor must it be forgotten that, although the methods used in the project are subject to the risks of inaccuracy and lack of representativeness discussed above, the methods used **to** collect the official statistics must be open to broadly similar criticisms.

The data and results of the present study must therefore be regarded as complementary to, and not substitutes or replacements for, the official statistics.

4. THE DERIVATION OF INFORMATION FROM THE DATA

4.1 Processing of data

4.1.1 By the methods described in Chapter 3 above, data were gathered relating to 21,128 fishing trips made by 242 individual fishing units operating out of 15 bases. 22 different craft-gear combinations were represented. Over one million man hours were spent at sea in the course of these activities and produced fish to the value of Rs. 5.13 million at first sale.

4.1.2 These raw data are in the possession of PCO in the form of written records.

4.1.3 65 separate bits of data relating to performance, productivity and costs and earnings were to be collected for each fishing trip. Some 1.4 million separate bits of information have thus been collected and have to be processed. Up to the time of writing this report it has not been possible to process the data except by hand.

4.1.4 On the basis of craft-gear combinations, monthly and annual totals have been calculated of landings, man hours, costs and earnings, etc.

4.2 Analysis of data

4.2.1 Most of the findings presented later below are the results of analysis of the data in its highest state of consolidation, namely, at the annual level. The exception is the analysis of seasonal variations in Chapter 11 which uses the monthly data.

4.2.2 The data have not yet been subject to analysis at more disaggregated levels, partly because of lack of time and manpower, but mainly because of the practical limitations of data processing by hand.

4.3 Nature and scope of results

4.3.1 The results presented later below should therefore be regarded as being of a preliminary nature. They do not necessarily illustrate the full variety and usefulness of the information that could be derived through more analysis.

4.3.2 It has not been possible to carry out an analysis, even at the consolidated level, of the scope and depth that may be desirable and useful, because of the lack of time and the limitations of manual data processing. Further analysis would however require electronic processing of the data.

4.3.3 Analysis at the more disaggregated levels would produce additional useful information on the performance and costs and earnings of the fishing fleets. It should also provide useful guidance on whether the methodology could be improved in future studies, as suggested in Section 3.4 above, and if so, how this could be achieved. Once again such studies would require electronic processing of the data.

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5. FISHING ACTIVITY DURING 1980-81

The results of the analysis, so far as it has been taken, are presented in the following chapters. Their significance will be the better appreciated if, first, a general impression is given of the fishing during 1980—81, followed by a description of the activities and performance of the sample under study.

5.1 The fishing in 1980

The year 1980, during which time the major part of this study was conducted, was an exceptionally bad fishing year.

5.1.1 The monsoon began earlier than usual and the seas were more than usually rough; there was a great deal of coastal erosion. Rough seas and high surf were witnessed in Trivandrum district even in August.

5.1.2 Further, fish was scarce: the oil sardine flush never appeared; the anchovies did not move inshore; the ribbon-fish fishery was a failure; cuttlefish prices soared but catches were not as high as in former years.

5.2 Utilization of vessels

5.2.1 Figure 3 indicates the normal seasonal pattern of fishing. Table 2 indicates for each of the combinations monitored in the study, the maximum period of the year when fishing with such a combination is possible, the percentage of days when fishing actually took place during 1980 and the reasons given by the fishermen for not being able to go fishing. The total possible fishing days are the expectations of the fishermen, based on experience; the reality varies from year to year. The expected fishing season for particular craft-gear combinations ranges between 360 and 150 days. The *anchovy net/kattumaram* has the lowest expected number of fishing months — five — because it cannot be used in the monsoon seas; because of the non-availability of anchovies al other times; and because of the presence of ribbon fish at other times that would destroy the fragile anchovy net. The mechanised boat combinations, the encircling nets and the *driftnet/kattumaram* are sure of being able to operate all the year round.

In 1980-81, the percentage of days actually fished during the expected periods of operation are generally low. They vary from 10 per cent in the case of the *hook-and-line/plank canoe* combination to 59 per cent for the *cast net/dugout canoe* combination.

In 10 out of the 22 combinations monitored during the study, over half the expected days of fishing became idle days either because of unfavourable weather, because of the lack of fish or both.

5.2.2 In Table 2 unfavourable weather" means conditions such as rough surf, which make setting out to fish impossible or dangerous; lack of favourable wind; or presence of an unfavourable current which may affect the possibility of timely return to shore. Three of the expected seven months of operation of the *boat seine/kattumaram* are during the roughest monsoon season (May—July). Table 2 shows that unfavourable weather accounted for 60 per cent of the days not fished. The six months of operation of the *prawn/dugout canoe* combination are during the calmer months of the year (November—March) and in this particular case from a protected beach; only one per cent of the days not fished is attributed to unfavourable weather. In the case of the *hook-and-line/plank canoe* combinations which go fishing at a depth of 150 metres and take 3—4 days for a trip, most of the 72 per cent of non-fishing days reported as unfavourable weather were due to unfavourable wind or current.

5.2.3 In Table 2 "non-availability of fish" means that no signs indicating the presence of fish have been found, making a fishing trip (even if the weather were favourable) not worth

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Figure 3

EXPECTATIONS ABOUT SEASONS OF OPERATION AND MAIN SPECIES OF FISH CAUGHT BY TYPE OF CRAFT—GEAR COMBINATION

	Craft – Gear Combination	Apr May Jun Jul Aug Sep Oct Nov Dec Jan Feb Mar	Main species **caught**
1.	Encircling net—canoe		Sardines, Mackerels. Prawns
2.	Boat seine—dugout canoe		Sardines, Mackerels
3.	Boat saine—kattumaram		Ribbon fish, Anchovies, Caranx
4.	Cotton shore seines—canoe		Anchovies, Ribbon fish. Scads. Tunnies
5.	Nylon shore seines—plank canoe		Sardines. Anchovies; Scads
6.	Small mesh driftnet—plank canoe		Sardines, Mackerels
7.	Large mesh driftnet—dugout canoe		Tunnies, Seer fish
8.	Large mesh driftnet—kattumaram		Tunnies, Seer fish, Caranx
9.	Anchovies net—kattumaram		Anchovies
10.	Prawn net—kattumaram		Prawns, Sciaenids, **Lactarius**
11.	Sardine net—kattumaram		Sardines
12.	Prawn net—dugout canoe		Prawns. Sciaenids, Lactarius
13..	Sardine net—dugout canoe		Sardines
14.	Cast net—dugout canoe		Sardines, Mackerels
15.	Lobster net—dugout canoe		Lobsters
16.	Hook & Line—plank canoe		Sharks, Rays, Perches, Cat fish
17.	Hook & Line—dugout canoe		Sharks. Rays, Perches, Cat fish, Rock Cod
18.	Hook & Line—kattumaram		Tunnies, Shark, Seer fish, Cuttle Fish
19.	Trawl net—mechanized boat		Prawns. Perches, Sciaenids, Cat fish
20.	Large mesh driftnet—mechanized boat		Tunnies, Seer fish, Pomfret, Shark. Caranx

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Table 2

Fishing activity in 1980—81

Sl. No.	Craft-gear combination	Total expected months of operation	Percentage of days fished during expected period	Percentage of days during expected period not fished due to		
				Un-favour-able weather	Non-availa-bility of fish	Other reasons
1.	Encircling net—plank canoe	**12**	**32**	**21**	**34**	13
2.	Encircling net—dugout canoe	**12**	25	28	45	**2**
3.	Boat seine — dugout canoe	**6**	57	4	16	23
4.	Boat seine — kattumaram	7	14	60	15	11
5.	Cotton shore seine — plank canoe	9	38	23	20	19
6.	Cotton shore seine — dugout canoe	9	36	19	22	23
7.	Nylon shore seine — plank canoe	6	27	16	42	15
8.	Small mesh driftnet— plank canoe	**8**	42	15	32	11
9.	Large mesh driftnet — dugout canoe	8	34	8	13	45
10.	Large mesh driftnet— kattumaram	12	20	36	31	13
11.	Anchovies net — kattumaram	5	25	30	27	18
12.	Prawn net—kattumaram	12	14	41	30	15
13.	Sardine net—kattumaram	9	41	29	10	20
14.	Prawn net—dugout canoe	6	35	1	31	33
15.	Sardine net—dugout canoe	12	26	8	19	47
16.	Cast net—dugout canoe	6	59	17	7	17
17.	Lobster net—dugout canoe	**9**	53	11	22	14
18.	Hook & line — plank canoe	10	10	72	14	**4**
19.	Hook & line — dugout canoe	**9**	19	25	16	40
20.	Hook & line — kattumaram	11	35	30	20	15
21.	Trawl net— mechanized boat	12	44	10	17	29
22.	Large mesh gillnet— mechanized boat	**12**	**27**	**15**	**10**	**48**

undertaking. This accounts for from 7 per cent to 45 per cent of days not fished. The sharp fall in fish catch in 1980 as compared to the average of the earlier five years 1975—79 as shown in Table 3 substantiates this fact. It is of interest to note that in the combinations which are predominantly fishing for sardines and mackerels in Alleppey district, non-availability of fish meant the loss of between 32 and 45 per cent of the total expected days of operation. This is consistent

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with the drop in the catches of these species as reported by the Central Marine Fisheries Research Institute (CMFRI) and shown in Table 3.

Table 3

Variations in catch of certain important fish species in Kerala

Species	1975—79 yearly average (1000 tonnes)	1980* (1000 tonnes)	Percentage increase or decrease
Oil sardine †	115.0	69.7	—39.0
Mackerels †	55.5	18.5	—66.6
Anchovy	11.9	7.8	—34.5
Ribbon fish	16.0	12.9	—19.4
Seer fish	**4.6**	**3.8**	**—17.4**
Pomfrets	**1.8**	**0.9**	**—50.0**
Caranx	**10.6**	**4.4**	**—58.5**
Tunnies	**9.5**	**10.6**	**+11.6**
Prawns	**45.3**	**52.6**	**+16.1**
Total	360.2	279,0	**—22.5**

* Provisional

† In Alleppey district between 1979 and 1980 the drop in the catches of oil sardine and mackerel are of the order of 57 and 49 per cent respectively.

Source: Central Marine Fisheries Research Institute, Cochin.

5.2.4 In Table 2 "other reasons" for not being able to fish account for between 2 and 55 per cent of the total expected period. This includes reasons such as damage and repair of the craft or gear; maintenance of mechanised boats or lack of spares; non-availability of workers; and sickness of the owner or his child.

5.3 Fishing activities

5.3.1 Table 4 summarizes some of the prime items of the sample under study.

5.3.2 In terms of fishing trips undertaken, the trawl net, hook-line set and gillnet groupings, in order of ranking, together accounted for 68 per cent of the total number of fishing voyages undertaken. The trawl net, shore seine, gilinet and encircling net groupings in that order, accounted for 67 per cent of the total manpower expended during the fishing trips.

5.3.3 Just three groupings together — trawl nets, encircling nets and gillnets — caught 73 per cent of the fish landed and the trawl net and encircling net together produced 69 per cent of the value of the fish caught. (The trawlers fish primarily for high-valUed prawns.)

5.3.4 Table 4 gives only a very rough picture of the relative importance in various ways of the craft-gear combinations chosen for study. The figures are not indications of performance. The forthcoming chapters will present assessments of the performance of different craft-gear combinations, judged by various techno-economic and economic criteria, and based on the data presented in the Summary Table (Appendix 4) given at the end of the report.

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Table 4

Some prime items of the costs and earnings study of fishing units in Kerala

Groupings	No. of craft-gear combinations	No. of fishing units selected	No. of fishing trips (*)	Total effort (1000 man hours) (*)	Catch landed (1000 kg) (*)	Value of catch landed (Rs. 1000) (*)
Artisanal						
I. **ENCIRCLING NET**	2	17	1732 (8)	142 (14)	404 (24)	756 (14)
II. BOAT SEINE						
(a) with dugout canoe	1	5	523 (2)	71(7)	91(5)	120 (3)
(b) with kattumaram	1	28	789 (4)	31(3)	49 (3)	108 (2)
III. SHORE SEINE						
(a) cotton seine	2	15	2198 (10)	137 (13)	109 (6)	284 (6)
(b) nylon seine	1	4	194 (1)	17 (2)	16 (1)	18 (neg)
IV. GILLNET						
(a) driftriet						
(i) small mesh	1	13	1292 (6)	58 (6)	118 (7)	203 (4)
(ii) large mesh	2	24	1374(7)	56 (5)	47 (3)	134(3)
(b) specialised gilinets	5	49	3641 (17)	59 (6)	65 (4)	160 (3)
(c) cast net	1	3	338 (2)	7 (neg)	8 (neg)	18 (neg)
(d) bottom set lobster net	1	2	233 (1)	5 (nag)	nag (nag)	7 (nag)
V. HOOKS AND LINE						
(a) with plank canoe	1	8	101 (1)	28 (3)	19 (1)	56 *(1)*
(b) with dugout canoe	1	8	403 (2)	27 (3)	54 (3)	92 (1)
(c) with kattumaram	1	21	2130 (10)	41(4)	35 (2)	103 (2)
Mechanised						
VI. TRAWL NET	1	30	4705 (22)	263 (26)	582 (35)	2770 (55)
VII. LARGE MESH GILLNET	1	15	1475 (7)	82 (8)	99 (6)	300 (6)
Total	22	242	21128 (100)	1024(100)	1696 (100)	5129 (100)

(*) Figures in bracketsgive the percentage on the total.

neg. negligible

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6. PRODUCTION, EFFICIENCY AND PRODUCTIVITY OF VARIOUS CRAFT-GEAR COMBINATIONS

The performance of fishing vessels and fishermen is influenced by a number of factors: the skill of the fishermen; natural conditions like the productivity of the sea, weather conditions and the accessibility of the resources in respect of distance from the shore, fishing depth and degree of aggregation or dispersion of fish; the capital intensity and sophistication of the technology. In monetary terms, efficiency and productivity are, in addition, determined by fish prices. High prices can compensate for low physical productivity, as for example, in lobster fishing.

In capture fisheries the reproductive capacity of the fish stocks will set a limit to the long term sustainable yield and will affect the relationship between fishing effort and catch. That is to say efficiency and productivity will be affected if in the course **of** the development of a particular fishery more and more fishing units are added to the fleet, and catches decline as more fishing units exploit the same limited resource base. This may in some cases be partly compensated by higher prices, if there are no ready alternative supplies, but there is nevertheless a size of fleet which represents the optimum investment **and this** is often exceeded. Over-investment in fishing vessels may increase employment opportunities for fishermen at the cost of reduced earnings. More often there may be a need to limit or even reduce the number of operational fishing units, or to divert some of the fishing units to fish on other, less heavily exploited resources.

In fisheries science, the most commonly used measure of the efficiency of the fishing operation is the catch per unit of fishing effort. "Fishing effort", in the terminology of the dynamics of exploited fish population, is what causes fishing mortality: the fraction of the fish stock removed by fishing in each year. In this sense, it is only indirectly related to inputs. Moreover there are no simple and agreed methods of measuring the fishing effort of the types of craft-gear combinations with which this study is concerned, except the trawlers, nor of comparing the fishing **effort of different** combinations **fishing the same stock. The present study** is concerned rather with the output obtained for a given input.

In what follows, variations in production, earnings, efficiency and productivity of the different craft-gear combinations are examined. The first part deals with catches and earnings, the second with risk, the third with the efficiency **of use of** manpower during actual fishing trips, and the fourth analyses the labour and capital productivities **of** different craft-gear combinations over the entire fishing season, whatever that may be.

6.1 Catches and earnings

6.1.1 It need hardly be said that the average catch per trip varies between different types and sizes of craft and gear. The variations in average catches between similar types of gear used by

Table 5

Variations in catch between kattumarams and canoes using similar types of gear (Catch landed per trip in kg)

Grouping	Boat-seine	Specialised Gillnets		Driftnet	Hooks and lines
		Sardine net	Prawn net		
Kattumaram	62	9	8	20	16
Canoe	173	28	17	34	189

different craft, varying in numbers of crew and size of gear, are apparent in Table 5. The table does not only show the differences in average catch over different types of craft using the same typo of gear, but also exhibits a wide variation within the same type of craft, using different types of gear. This indicates that care has to be exercised when choosing and defining categories for statistical tabulation or economic analysis and caution exercised when aggregating data.

6.1.2 In Table 6 the weighted averages of catch landed and gross earnings per trip are given for different gear groupings. The catch landed per trip ranged from 233 kg for encircling net fishing with a crew of 15 to only 1 kg in the case of lobster fishing with a crew of two fishermen. Large-mesh driftnetting with mechanised boats of exotic design yielded an average catch per trip only twice as much as that attained by non-motorized artisanal units using the same type of gear.

Table 6

Catch and gross earnings per trip for different gear groupings

		Average crew size	Catch landed per trip (weighted average) kg	Gross earnings per trip (weighted average) kg
	Artisanal			
I.	ENCIRCLING NET	15	233	436
II.	BOAT SEINE			
	(a) with dugout canoe	16	173	228
	(b) with kattumaram	5	62	138
III.	SHORE SEINE			
	(a) cotton seine	20	50	131
	(b) nylon seine	15	80	93
IV.	GILLNET			
	(a) driftnet			
	(i) small mesh	7	91	**157**
	(ii) large mesh	3	34	121
	(b) specialised gillnet	3	18	42
	(c) cast net	4	24	53
	(d) bottom set lobster net	2	1	28
V.	**HOOK AND LINE**			
	(a) with plankcanoe	8	189	538
	(b) with dugout canoe	4	129	229
	(c) with kattumaram	2	16	49
	Mechanised			
VI.	TRAWL NET	5	124	588
VII.	LARGE MESH GILLNET	4	67	210

Source: Appendix 4.

6.1.3 The average gross earnings per trip varied between Rs. 588 for the trawlers and Rs. 28 for lobster fishing. Both the mechanised combinations attained gross earnings per trip which were low considering the high costs connected with mechanised fishing.

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6.1 .4 On the basis of gross earnings per crew member and trip, the *hook-and-line/plank canoe* units attained the best result among the artisanal craft. These units, however, make trips lasting on an average six times longer than that of an encircling net fishing unit.

6.1.5 Earnings are discussed more fully in Chapter 9.

6.2 Risk

6.2.1 An important characteristic of fishing is the uncertainty and unpredictability of catches, which has both quantity and price dimensions. At the time of embarking on a fishing trip the fishermen have no way of predicting the size of the catch. There is also uncertainty about the price that will be obtained on selling the fish.

6.2.2 The unpredictability of the size of the catch can be expressed numerically as a risk. The measure used in the study was the number of occasions when a fishing trip made by a fishing unit yielded no catch, expressed as a percentage of the total number of trips made. (A more sDphisticated measure would be a probability distribution of size of catches: this is an example of what might be done with more powerful data processing). The risk indicator as thus defined varied from zero for the mechanised sector combinations to 40 per cent in the cases of *boat seine! dugout canoe* combinations. (See Summary Table — Appendix 4.) The probability of catching fish is affected by fish behaviour and fish abundance, the technique of fish catching, the time spent fishing, the distance from the shore at which fishing was undertaken, the skill of the fishermen, and other factors. Comparisons between the risk indicators for different craft-gear combinations must be made bearing this in mind. Nevertheless the figures suggest that there is an element of correlation between the distance of the fishing ground from the shore, and risk. Most of the inshore fishing combinations seem subject to a higher risk of no catch than those, such as hooks-and-line and large mesh-driftnets, fishing further offshore. This may possibly be because the fisherman is prepared to accept a higher risk of failure in inshore waters, since the effort and costs that may possibly be wasted are kept within reasonable limits, but it may be no more than an expression of the behaviour patterns of shoaling, pelagic species like sardines, mackerels or anchovies: they either appear inshore in large shoals yielding high catches or fail to appear.

6.3 Catch per man-hour

6.3.1 An important input is the manpower expended for catching a given quantity of fish. As the process of catching fish — or waiting for fish to get entangled in the net or hook — forms only a fraction of the total expenditure of manpower during the trip, one can in practice calculate two different parameters: *the catch per man-hour of fishing* and *the catch per man-hour at sea.* The former takes into account only the actual fishing time, while the latter includes in addition, the time or effort taken to reach the fishing ground and return from it.

The man-hours of fishing is the product of the number of fishing hours and the number of crew on the fishing unit. *The man-hours at sea* is the product of the total trip time and the number of crew. These two definitions have been used for both the artisanaf and the mechanised sector. This approach allows comparison between the sectors as regards efficiency of use of man-power, but ignores the expenditure of mechanical work by mechanised vessels, which was not estimated during the present study except in terms of fuel costs.

The numerical comparisons also obscure the significant differences in the work of the crews in the various craft-gear combinations. For example, night fishing is considered generally more ardous than fishing by day. Encircling nets require a spurt of vigorous activity, once the shoal is spotted, Gillnet fishing on the other hand requires patience and watchful waiting. Other differences are related to the quality of the fishing equipment and the skill of the crew. Catches are also influenced by the relative abundance and the degree of dispersion of the resources. The *catch per man-hour at sea* is in addition affected by the distance of the fishing ground from the shore.

6.3.2 As can be seen in Table 7, the encircling net operations in inshore waters for catching shoaling pelagic fish species attained a catch per man-hour of fishing three times higher than the *hook-and-line/plank canoe* combinations that were operating at an average depth of over

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Table 7

Catch and gross earnings per unit of effort

	Groupings	Average trip time (hrs.)	Average water depth in area of operation (metres)	Catch per man hour of fishing effort (kg)	Catch per man hour of total effort (kg)	Gross earnings per man hour of total effort (Rs.)	Risk indicator (No. of trips with no catch as per centof total trips)
	Artisanal						
I.	ENCIRCLING NET	6	8	5.4	2.9	5.40	25
II.	BOAT SEINE						
	(a) with dugout canoes	9	14	2.5	1.3	1.70	40
	(b) with kattumaram	7	19	2.4	1.6	3.50	13
III.	**SHORE SEINE**						
	(a) with cotton seine	**3**	**16**	**1.4**	**0.8**	**2.10**	**11**
	(b) with nylon seine	**6**	**6**	**1.3**	**0.9**	**1.10**	**4**
IV.	**GILLNET**						
	(a) driftnet						
	(I) small mesh	7	14	5.0	2.5	3.50	26
	(ii) large mesh	16	34	1.3	0.8	2.40	5
	(b) specialisod gifinet	**7**	**20**	**1.9**	**1.1**	**2.70**	**8**
	(c) cast net	5	5	2.0	1.3	2.70	13
	(d) bottom set lobster net	**11**	**6**	**0.3**	**0.0**	**1.40**	**21**
V.	HOOK AND LINE						
	(a) with plank canoe	36	74	1.6	0.7	2.00	9
	(b) with dugout canoe	14	41	4.2	2.0	3.50	2
	(c) with kattumaram	**9**	**38**	**1.3**	**0.8**	**2.50**	**7**
	Mechanised						
VI.	TRAWL NET	11	34	3.5	2.2	10.50	0
VII.	LARGE MESH GILLNET	15	32	1.9	1.2	3.80	0

Source: Appendix **4.**

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seventy metres. Exceptionally high catches per man-hour of fishing were also attained by *book-end-l/ne/dugout canoes* combinations in Alleppey and Kozhikode districts, which operated at an average depth of approximately 40 metres, and by *small-mesh-driftnet/plank canoe* combinations fishing inshore in Alleppey district. This may be attributed to a relatively rich resources abundance, and in the case of hook-and-line fishing, to high skill and experience, including knowledge of the best times and places. The two boat-seine combinations and, among the specialised gillnet combinations, the *anchovy-net/kattumeram* units Were also efficient in use of manpower.

6.3.3 In the mechanised trawlers and gillnetters, where human labour is augmented and partly replaced by engine power, the catches per man-hour of fishing and per man-hour at sea were nevertheless low. However, in monetary terms, the trawlers realized the highest gross earnings per man-hour: more than double the next best craft-gear combination, namely encircling net fishing with canoes.

6.4 Capital intensity: productivity **of labour and capital**

6.4.1 Data on catch or gross earnings per man-hour of effort or per trip show the efficiency or productivity of the fishing unit when it is in actual operation. These data, however, do not tell us how productive the craft-gear combinations were over the entire year. This is affected both by seasonal patterns of utilisation and by the intensity of utilisatiori during the operating season.

6.4.2 Two commonly used criteria of productivity are the labour and capital utilized to achieve a given amount of production. Here *labour productivity* is expressed as the yearly catch, or gross earnings per fisherman and *capital productivity* as the yearly catch, or gross earnings per unit of capital invested.

In an economy where labour is plentiful and cheap and capital goods are relatively scarce, the technology applied should make use of relatively more labour and relatively less capital equipment. In other words, the *capita/intensity,* or the investment per crew member in fishing assets, should be low. This usually implies that labour productivity also remains low, as labour power is not augmented or replaced by machines, and technologies requiring high capital investment and offering economies of scale are not applicable. Though a low labour productivity may be desirable from an employment point of view, it will set an upper limit to the personal income levels. The personal income levels, on the other hand, are not exclusively influenced by the labour productivity, but are also determined to some extent by the distribution of ownership of the productivity assets.

6.4.3 Figure 4 brings out the relationship between the capital intensity and the labour productivity of the fishing techniques monitored during the study. Though the diagram reveals a clear trend of increasing gross earnings per crew with increase in capital invested per crew, this correlation is not very strong in some cases. On the positive side hooks and line with kattumarams, lobster fishing and cast net fishing, realized high labour productivities at very low levels of investment per crew member. The reason for these good results can be attributed to very intensive utilization cf the fishing assets over the year. Table 8 gives the capital invested per man hour of total effort expended by various combinations during the survey year.

6.4.4 Several craft-gear combinations failed to attain average yearly gross earnings equal to their respective capital costs. Four of them were kattumaram-based combinations: prawn nets, anchovy nets, driftnots and boat seines. The *driftnet/dugout canoes* and both the mechanised combinations also performed badly in this respect. All these craft-gear combinations were also among these which expended very low levels of human effort relative **to the corresponding** investment levels in fishing assets.

6.4.5 With the exception of hook-and-line fishing and sardine net fishing, all other kattumaram-based fishing operations performed rather poorly as regards both labour productivity and capital productivity.

This is partly due to a bad fishing season in 1980/81 with relatively low abundance of anchovies and ribbon fish, and to unusual rough surf conditions in the 1980 monsoon season. These apart, some of the technical limitations of the kattumaram also account fortheir overall poor performance.

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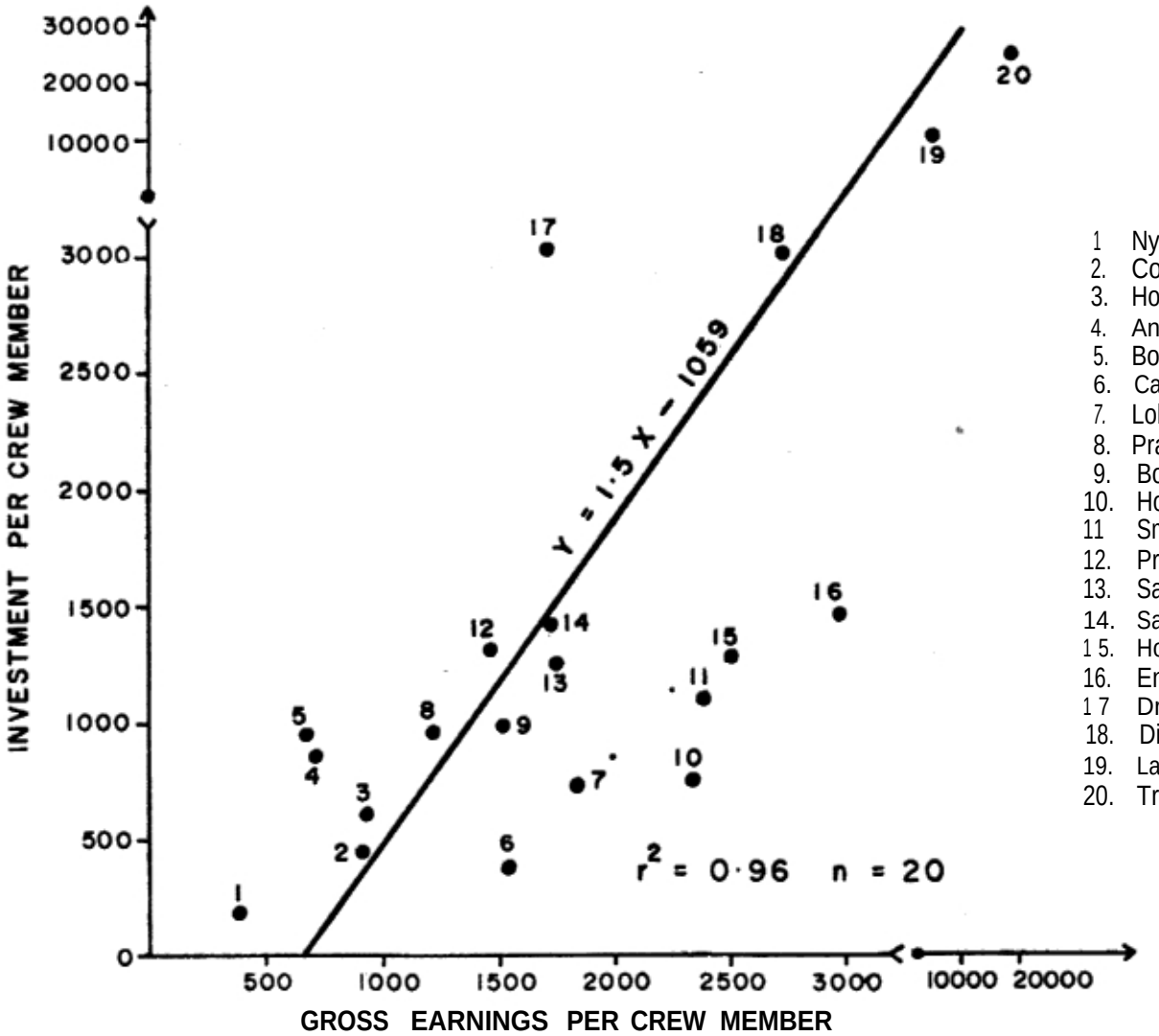
Figure 4

RELATIONSHIP BETWEEN CAPITAL INTENSITY AND LABOUR PRODUCTIVITY



1 Nylon shore seines—plank canoe
2. Cotton shore seines—canoe
3. Hook and line—plank canoe
4. Anchovies net—kattumaram
5. Boat seine—kattumaram
6. Cast net—dugout canoe
7. Lobster net—dugout canoe
8. Prawn net—dugout canoe
9. Boat seine—dugout canoe
10. Hook and line—kattumaram
11 Small mesh driftnet—dugout canoe
12. Prawn net—katturnaram
13. Sardine net—dugout canoe
14. Sardine net—kattumaram
1 5. Hook and line—dugout canoe
16. Encircling net—canoe
1 7 Drift net—kattumaram
18. Dicftnet—dugout canoe
19. Large mesh gillnet—mechanised boat
20. Trawl net—mechanised boat

Table 8

Capital-effort ratios for some selected craft-gear combinations

Craft-gear combination	Capital invested per man-hour of total effort expended (in Rs.)
Very low	
1. Lobster net — dugout canoe	0.61
2. Shore-seine (nylon)	0.72
3. Hook line — kattumaram	0.81
4. Cast net — dugout canoe	**0.85**
5. Shore-seine (cotton)	**0.89**
Very high	
6. Encircling net—canoe	**2.60**
7. Driftnet — dugout canoe	2.68
8. Prawn net — kattumaram	3.38
9. Boatseine—kattumaram	**4.35**
10. Driftnet—kattumaram	**4.40**
11. Anchovies net—kattumaram	4.58
12. Mechanised gillnetter	**7.19**
13. Mechanised trawler	15.11

source: Appendix 4.

6.4.6 As can be seen from Table 9, among the highly efficient utilizers of capital were the encircling net units. This high capital productivity was attained in spite of a comparatively high ratio of capital to effort (implying a low intensity of capital utilization). This underlines the extreme effectiveness of the technique, when a good fishing opportunity does occur.

6.4.7 The small-mesh driftnet fishing units monitored in Alleppey district operate to some extent in competition with the encircling net units, and attained the same high capital productivity although at slightly lower gross earnings per crew member.

6.4.8 Among the craft-gear combinations with high capital productivities were also the shore-seine units. As implied in Table 8, the shore-seine units were very intensively used over the year and this accounts largely for this good result. However, the labour productivity was very low in spite of the intense utilization of the fishing assets over the year.

6.4.9 The capital productivity of the large-mesh driftnet units was remarkably low, particularly in comparison to the hook-and-line units, which to some extent caught the same fish species. This can primarily be attributed to the very expensive nylon nets, compared to the cheaper hooks-and-lines.

6.4.10 For both the mechanised fleets, the capital productivities were poor. In the case of trawling it is believed that, at present, too many boats share a limited resources base. This had already in previous years led to declining catch rates and thus decreasing labour and capital productivities. On the other hand, the very poor capital productivity of the mechanised gill-netters is neither a matter of relatively low fish abundance in 1980/81 nor a case of too many operational boats. It is believed by well-informed people to be due to the poor design of the vessels: they are too high powered in relation to their catching potential.

6.4.11 In summary, the artisanal fishing units on an average made a better use of invested capital than the mechanised units. Among the artisanal fisheries, the productivities in Trivandrum district wore in general rather poor. This reflected the prevailing adverse natural conditions, a bad fishing season and the limitations of the technology in use. An excellent performance on

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both accounts, labour and capital productivity, was attained by encircling net operations, small-mesh driftnet fishing, hook-and-tine fishing, lobster and cast net fishing.

Table 9

Capital intensity, labour and capital productivity by gear grouping

	Groupings	Capital intensity (Investment per crew member) **(Rs.)**	Labour productivity (Gross earnings per crew member per annum) **(Rs.)**	Capital productivity (Yearly gross earnings per unit of investment) **(Rs.)**
	Artisanal			
I.	ENCIRCLING NET	1442	**2998**	**2.00**
II.	BOAT SEINE			
	(a) with dugout canoe	952	1507	1.67
	(b) with kattumaram	886	646	0.83
III.	SHORE SEINE			
	(a) with cotton seine	430	934	2.50
	(b) with nylon seine	210	310	1.43
IV.	GILLNET			
	(a) driftnet			
	(i) small mesh	1146	2356	2.00
	(ii) large mesh	3144	2053	0.65
	(b) specialised gilinets	1163	1312	1.11
	(c) cast net	464	1546	3.33
	(d) bottom set lobster net	775	1772	2.50
V.	HOOK AND LINE			
	(a) with plank canoe	546	905	1.67
	(b) with dugout canoe	**1271**	2543	**2.00**
	(c) with kattumaram	759	2357	3.33
	Mechanised			
VI.	TRAWL NET	26650	18578	0.71
VII.	LARGE MESH GILLNET	10371	5466	0.52

Source: Appendix 4.

7. COSTS AND COST-EFFECTIVENESS

Costs can be divided into two categories: fixed and variable. Fixed costs include expenditure or allocations which pertain to capital — such as interest, depreciation and other expenditures arising whether the productive assets are actively utilized or not. Variable costs are expenditures incurred in the course of generating revenues and are generally presumed to be linked to the levels of gross earnings or output.

In most industries costs are exclusively borne by the entrepreneur and the worker gets a wage which is also a cost item. In most fisheries, however, the normal system of crew remuneration includes sharing the earnings, and in some of the systems the earnings are shared after they are netted of certain costs, which results in a part-sharing or complete sharing of costs as well.

In the artisanal fisheries sector a clear polarity of interests between owner and crew does not generally exist. With owners participating to a great extent as crew, both the apportioning of costs and earnings strictly between the factors of production — labour and capital — take a wide variety of forms and are not necessarily 'rigid' in their patterns.

In this chapter the nature of the costs incurred and their relation to earnings are examined; also the pattern and the logic of cost-sharing. An analysis is presented of the cost-effectiveness **of** the different craft-gear combinations.

7.1 Costs

The average aggregated costs over the year for all the 22 combinations are set forth in Table 10.

7.1.1 *Fixed costs*

The two items included under the heading of fixed costs were insurance and depreciation.*

While insurance is a real expenditure, depreciation is a cost allocation which does not lead to a cash outflow. Only the fishing units of the mechanised sector are insured, and recently this has been made compulsory. The normal insurance coverage is only for the months of September to May; coverage during the 3 monsoon months requires the payment of a higher premium. Default in payment of the premium is very common. In the sample, insurance accounts for 4 per cent and 1 per cent of the gross earnings for the trawlers and gillnetters respectively.

Depreciation was calculated on a straight line basis, using the reported initial investment and the reported average lifetime of the respective gear and craft.

The 'correct' assessment of depreciation allocations was difficult. Different bases considered were: (a) present value of the fishing assets in actual possession (b) present price of new fishing assets of the same type (c) initial investment or actual cost of the fishing assets at the time of purchase. In time of high inflation either (a) or (b) seem best. However, in both cases there were considerable variations in the statements (both under and over estimates) by the fishermen. In respect of comparability the most accurate were likely to be the costs they incurred in buying the craft and the gear. This method, while it ensured the comparability between different craft-gear combinations, led to a systematic under-estimation of the capital in use. The useful service life of the various items was also ascertained by questioning fishermen.

The ratio of depreciation to gross earnings is a measure of how much of the output is set apart for replacement of capital. The ratio varied from 6 per cent for the *encircling net/plank canoe* to 23 per cent for the *prawn net/kattumaram.* These two combinations had respectively the second highest and second lowest gross earnings during the survey year. Depreciation in the mechanised sector was 18 per cent of gross earnings for the trawlers and 25 per cent for the gillnetters.

* The survey failed to assess interest payment. The two main problems were (a) separating interest payments from the payments of principal and (b) the impossibility of assessing interest payments in the form of preferential fish prices to the creditor in cases where he was the buyer of the fish.

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7.1.2 *Variable costs*

Variable costs can be regarded as comprising (a) owner's operating costs and (b) common operating costs. From the owner's point of view the remuneration to the crew and to other workers on shore are cost items.

(a) *Owner's operating costs*

The general practice in Kerala fisheries is for the owner to bear only a part of the total operating costs. These may include costs of fuel and lubricating oil, repairs and maintenance of craft and gear, food for the crew and other expenses such as certain shore charges. There are instances when owners bear all the expenses of a particular trip; when the fish catch is very small and the total operating costs exceed the gross earnings. This practice is quite common when the size of the crew on a fishing unit, and the number of non-owner workers, are both large.

In the mechanised sector, the operating cOsts borne by the owners amount to between one fifth and one-third of the gross earnings. In the artisanal sector, the share of operating costs borne by the owner was highest for the *lobster net/dugout canoe* (86 per cent of the gross earnings) and lowest in the case of the *encircling net/plank canoe* where it is less than one per cent of the gross earnings. In the mechanised sector, the main sub-items of owners' expenses were repair and maintenance of craft and gear, and fuel costs. The former is very high because it involves purchase and fitting of manufactured mechanical parts and requires specialised skills and services, all of which are costly. Fuel costs were borne by the owners of some of the gillnetters while they are generally included in the common operating costs of the trawler fleet.

(b) *Common operating costs*

Common operating costs refer to those items of the operating costs which are deducted before the earnings (most of which are from the sale of fish) are apportioned between crew and owners. There are variations in what are treated as common operating costs incurred along the time continuum of the fishing trip—food and drinks immediately before, during and after the trip: fuel during the trip; commissions for marketing the fish; traditional taxes and occasionally contributions to common funds created and utilised by a collective consensus of workers and owners after the trip.

In the artisanal sector, the common operating costs varied between 5 and 30 per cent of the gross earnings. They are high when the gross earnings and the number of crew members are high. The cost of food is the most important item and the length of the trip and the time of the day when the fishing trip is undertaken, as well as the extent of physical strain of the operation, all affect this cost item. Food expenses are over 6 per cent of the gross earnings in the case of encircling net fishing, driftnet fishing and the *hook-and-line/plank canoe* units.

The next most important items of common operating costs in the artisanal sector are the traditional taxes and offerings collected for the church/temple/village funds and utilised for religious and social purposes. With the exception of lobster fishing, all combinations incurred this cost. While it is a cost to the crew and owners it is a contribUtion to common good and hence part of the value added. The sales commission given to agents or auctioneers who facilitate the sale of fish is an expenditure incurred by all except three of the combinations. Inclusion of repairs and maintenance of craft and gear in the common operating costs is restricted almost exclusively to Trivandrum district, where it is general practice that minor repairs to gear are borne collectively. The expenses of fcod and drink to crew (which more often than not include the owner himself) during or after repair work on the net, are owners' operation costs. The absolute and relative amounts are however very small.

The practice of hiring a craft or gear from another person occurs only in Trivandrum and Alleppey districts. In Trivandrum the leasing of kattumarams is common. A fisherman may have an anchovy net but not the appropriate size of kattumaram, or sometimes an accident may put a kattumaram out of action and one may have to be leased to continue fishing operations. The hire-charge is not a fixed amount but generally equal to one half of the share received by a crew member.

Repayment of loans as a common operating cost is incurred generally in cases where a large number of the crew are also owners. By common agreement they set aside a fixed percentage

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	ENCIRCLING NETS		BOAT SEINES		SHORE SEINES			DRIFTNETS			
	with plank canoe	with dugout canoe	with dugout canoe	with kattu-maram	cotton seine-plank canoe	cotton seine-dugout canoe	nylon seines	small mesh with plank canoe	large mesh with dugout canoe	large mesh with kattu-maram	anchovies net with kattu-maram
1. Gross earnings	100	100	100	100	100	100	100	100	100	100	100
2. Fixed costs:											
(i) Insurance	—	—	—	—	—	—	—				
(ii) Depreciation	6	11	7	18	6	16	12	9	11	21	16
3. Totaloperating costs	16	26	11	16	24	17	14	16	32	19	12
A. Owneroperating costs	0.9	3.1	2.9	2.0	6.0	5.2	3.9	3.4	4.8	2.8	1.2
(i) Repair and maintenance of craft	0.4	3.1	0.1	0.1	1.2	0.0	0.5	1.0	0.1	0.1	0.0
(ii) Repair and maintenance of gear	0.5	0.0	0.2	0.3	2.7	1.8	3.1	2.3	1.4	0.9	0.5
(iii) Food	0.0	0.0	0.8	0.5	03	0.1	0.0	0.0	0.9	1.3	0.8
(iv) Materials	0.0	0.0	1.7	0.3	0.8	2.0	0.0	0.0	0.4	neg.	neg.
(v) Others	neg.	0.0	0.1	0.8	1.0	1.4	0.4	0.1	2.0	0.5	0.1
8. Common operating costs	15.1	22.7	8.2	14.0	18.4	12.0	10.5	12.3	27.4	16.2	10.9
(I) Food	8.0	7.4	2.6	3.4	3.2	0.5	4.5	7.1	10.6	8.1	3.7
(ii) Traditional taxes and offerings	1.1	4.1	0.8	1.9	3.1	0.9	0.2	1.5	0.6	1.7	1.9
(iii) Materials	1.2	0.7	0.5	neg.	0.2	neg.	0.3	0.9	0.0	0.1	0.0
(iv) Commission	1.0	4.7	3.2	1.9	0.9	0.0	0.0	0.0	4.4	0.3	0.4
(v) Repair of craft and gear	0.0	0.0	0.0	0.2	0.4	0.0	0.0	0.0	neg.	0.3	0.4
(vi) Remuneration to other owners	0.1	0.3	0.0	2.3	3.0	0.0	0.0	0.0	0.0	0.9	0.1
(vii) Repayment of loans	1.4	5.4	0.2	neg.	0.0	0.0	0.0	0.6	0.0	0.0	0.0
(viii) Others	2.4	0.1	0.9	4.3	7.7	10.6	5.5	2.8	11.8	4.8	4.4
4. Remuneration to crew in cash	40	43	61	51	50	44	76	38	41	41	50
5. Remuneration to others in kind	6	4	8	9	4	4	2	7	5	10	4
in cash	8	12	neg.	8	2	7	0	16	neg.	4	flog.
Net profit	24	4	13	—2	14	12	—4	14	11	5	18

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rnings study **of fishing units** in Kerala State during 1980—1981 (as percentages)

SPECIALISED GILLNETS				CAST NETS	BOTTOM SET	HOOKAND LINES				TRAWL NET	LARGE MESH GILLNETS
sardine net with		prawn net with		with dugout canoe	lobster net with dugout canoe	with plank canoe	with dugout canoe	with kattu-maram		with media-nised boats	with mecha-nised boats
attu-Laram	dugout canoe	kattu-maram	dugout canoe								
100	100	100	100	100	100	100	100	100	Grossearnings	100	100
									Fixed costs:		
—		-	—	—	—	—	—	—	(i) Insurance	4	1
12	**9**	**23**	**9**	7	20	16	8	6	(ii) Depreciation	18	25
17	12	20	8	**14**	14	**34**	**24**	17	Total operating costs	78	60
2.4	3.7	4.5	1.8	2.6	8.6	4.9	3.5	4.1	Owner operating costs	20.4	29.4
neg.	0.7	0.4	0.0	0.6	0.0	0.8	0.5	0.5	(i) Repair and maintenance of boat	16.1	14.1
1.8	0.8	2.5	neg.	1.5	0.0	1.3	0.9	0.3	(ii) Repair and maintenance of net	3.4	6.2
0.5	0.6	0.6	0.2	0.4	0.0	0.9	0.3	0.4	(iii) Jetty/Harbour charges	0.1	0.2
neg.	1.4	0.2	0.3	0.0	8.5	0.0	0.1	0.2	(iv) Fuel	0.3	6.5
neg.	0.2	0.8	1.3	neg.	0.1	1.9	1.7	2.7	(v) Batta	neg.	1.8
14.3	8.2	15.9	6.0	11.7	5.5	29.5	21.0	12.6	(vi) Others	0.6	0.6
5.2	3.1	4.8	0.1	5.9	neg.	**12.9**	5.3	4.2	Common operating costs	**58.1**	**31.0**
3.5	**1.3**	**4.3**	**2.6**	**2.7**	**0.0**	**0.6**	**1.3**	**1.6**	**(I)** Diesel and fuel	49.3	**19.3**
0.3	**0.0**	**0.0**	**0.0**	**0.0**	**neg.**	**0.7**	**0.4**	**1.0**	(ii) Batta/Ration/Food	4.8	6.9
neg.	**2.3**	**0.6**	**0.3**	**1.9**	**0.0**	**0.2**	**2.6**	**1.6**	(iii) Ice	0.2	0.0
1.1	0.0	0.5	0.0	0.0	0.1	0.0	0.0	0.1	(iv) Basket	0.3	neg.
3.1	**0.0**	**3.6**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.7**	(v) Auction fee	2.1	3.4
0.0	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**1.0**	**0.3**	**0.0**	**(vi) Fuel**	**0.3**	**neg.**
1.1	**1.4**	**2.1**	**3.0**	**1.2**	**5.4**	**14.1**	**11.0**	**3.3**	**(vii) Materials**	**0.1**	**flog.**
									(viii) Others	1.1	1.5
34	62	33	66	**69**	**57**	**37**	**50**	**56**	**Remuneration to crew in cash**	**13**	**26**
14	**5**	**14**	**4**	**5**	**0**	**4**	**7**	**10**	**Remuneration to others in kind**	**1**	**5**
1	**neg.**	1	**0**	**0**	**0**	**10**	**3**	**1**	**in cash**	**0**	**0**
22	12	9	13	5	9	–1	8	**10**	**Net profit**	**—14**	**—17**

of the gross earnings for making the repayments of the principal or the interest. With the exception of the *driftnet/kattumaram,* all other combinations where such a cost is a common operating cost are collectively owned; they are to be found in Alleppey and Kozhikode districts.

Part of the common operating costs is classified as other expenditures; expressed as a proportion of gross earnings they are high in the case of hook-and-line and for driftnet fishing with canoes and also for shore-seine fishing in Trivandrum district. In the case of the hook-and-line combinations the cost of bait has been included under this heading. The *driftnet/dugout canoes* operating in Kozhikode incurred costs for the transport of their craft to a point from where they could launch safely to sea in stormy weather. The shore seines in Trivandrum paid expenses of workers for common activities undertaken by them like mending and drying nets, recoiling the wings and ropes and beaching the canoe ; these expenses are largelyin the form of food and alcoholic drinks.

In the mechanised sector, major items of expenditure under common operating costs include fuel, food, ice, auction fees and materials like baskets etc. Fuel costs are by far the largest component of common operating costs. In the case of the trawlers they account for nearly half the gross earnings; one-fifth in the case of the gilinetters. By including fuel as a part of the common operating costs the owners ensure that the crew economise in its use.

Expenditure on food for the crew accounts for around 5—6 per cent of the gross earnings. Commonly the owners advance Rs. 5 per crew member per trip for this purpose which is later subtracted from the gross earnings. A part of this amount is collectively used for buying rice, condiments and kerosene. Cooking is done on board; the diet is rice and fish; any amount remaining is saved or used to buy cigarettes and betel leaves.

The composition of the operating costs — i.e. their breakdown into owner's and common operating costs — also varies between the groupings. In general the operating costs borne by the owner form the smaller proportion of the whole, with the exception of the bottom-set lobster net, where the owner bears as much as 61 per cent. (The range in the other groupings of the artisanal sector is between 7 and 27 per cent.) In the mechanised sector, while the owners of gillnetters bear 49 per cent of the total operating costs, for the trawlers their share is only 12 per cent. The reason for this large difference is that most of the owners of the former pay for the fuel, while it is a common operating expense in the case of the trawlers. The high common operating costs of 93 per cent for encircling nets are attributable to the crew's participation in a fund to repay loans for the purchase of equipment: in general the crew is composed primarily of those with ownership stakes in the fishing units.

(c) *Remuneration to crew end others*

Remuneration to crew is dealt with here as a cost from the point of view of owners. It must however be mentioned that in the artisanal sector, where owners by and large also participate in the fishing operations as crew, this remuneration partly accrues to them; to that extent the whole of this item cannot be regarded as a cost to owners. Between 32 per cent and 75 per cent of the gross earnings go to remuneration of the crew.

In the mechariised sector, the remuneration of the crew is a very low percentage of the grcss earnings: 13 in the case of trawlers and 26 in the case of gillnetters. The average income of the individual crew member is however comparatively high.

Remuneration in kind (expressed in money value) and cash to others are costs incurred for services and for contributions to the observance of socially sanctioned customs, paid for in the form of fish. They are made before the catch is displayed for sale. Some of the fish goes to the owner's household and is therefore not a cost for him. Further, some payments may be related to services that have nothing to do with fishing—such as payment to the barber—and therefore in a strict sense should not be considered a 'cost of fishing'.

7.2 The residue: **net profit or loss**

7.2.1 The ratio of average operating costs to the average gross earnings varies between 12 and 36 per cent in the artisanal sector and is as high as 65 and 66 per cent in the mechanised sector (see also Table 11).

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7.2.2 Profits or losses are the residues after paying all costs and setting aside all allocations. Five combinations made no profits on average, the average losses varying between 1 per cent and 17 per cent of the gross earnings. Where on average a profit was made, it ranged between 4 and 24 per cent of the gross earnings. It must be borne in mind that the figures quoted may conceal a wide range of performance of individual units in any particular combination. Earnings and profitability are discussed more fully in Chapter 9.

An analysis of the total operational cost and its components on a trip basisfor the seven different gear groupings chosen for study is presented in Table 11.

Table 11

Break-up of Operating costs per trip

	Groupings	Total operating costs		Owner's operating costs		Common operating costs	
		in Rs.	as percentage of gross earnings	in Rs.	as percentage of total operatirtg costs	in Rs.	as percentage of total operating costs
	Artisanal						
I.	ENCIRCLING NETS	76.00	18	5.00	7	71.00	93
II.	BOAT SEINES						
	(a) with dugout canoes	25.60	12	6.70	27	18.90	73
	(b) with kattumararn	21.60	17	2.60	14	19.00	86
III.	SHORE SEINE						
	(a) with cotton seines	31.60	26	7.80	25	22.80	75
	(b) with nylon seines	13.50	14	3.70	23	9.80	77
IV.	GILLNETS						
	(a) driftnets						
	(i) small mesh	24.60	17	5.30	20	19.30	80
	(ii) large mesh	**25.80**	**29**	**3.80**	**15**	22.00	85
	(b) specialised gillnets	**5.80**	14	1.40	24	4.40	76
	(c) cast nets	**7.60**	**16**	**1.40**	**12**	**6.20**	**88**
	(d) bottom set lobster net	4.10	14	2.50	61	1.60	39
V.	HOOK AND LINE						
	(a) with plank canoe	190.80	36	27.30	14	163.50	86
	(b) with dugout canoe	55.70	26	7.90	14	47.80	86
	(c) with kattumaram	8.00	18	1.90	25	6.10	75
	Mechanised						
VI.	TRAWL NETS	387.00	66	45.00	**12**	**342.00**	**88**
VII.	LARGE MESH GILLNETS	126.50	65	61.50	49	65.00	51

Source: Appendix 4.

The operating costs per trip vary considerably between the groupings, the mechanised sector's being the highest and the bottom-set lobster net of the artisanal sector being the lowest. Within the artisanal sector the operating costs per trip of the encircling nets is about 19 times that of the bottom-set lobster net.

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7.3 Cost-effectiveness

To assess how effectively a rupee of operating cost is used by the different craft-gear combinations, the average weight and average value of fish that can be caught by each combination for a total operating cost of Rs. 100 has been calculated. The results are presented in Table 12.

These parameters are important in the light of the use of scarce inputs — particularly hydrocarbon fuels— in the economy. The returns in weight of fish can be taken, for example, to be an index of cost-effectiveness in the production of animal protein. The return in value terms reflects how this is modified if the varying prices received for the fish caught by the different groupings are taken into account.

Table 12

Cost efficiency by gear groupings

	Groupings	Fish landed per Rs. 100 operating costs in weight (kg.)	Value of fish sold per Rs. 100 operating costs (Rs.)
	Artisanal		
i.	**ENCIRCLING NET**	305	**582**
II.	**BOAT SEINE**		
	(a) with dugout canoe	674	856
	(b) with kattumaram	283	614
III.	**SHORE SEINE**		
	(a) with cotton seine	155	399
	(b) with nylon seine	594	689
IV.	GILLNET		
	(a) driftnet		
	(i) small mesh	371	646
	(ii) large mesh	132	375
	(b) specialised gill nets	**316**	**761**
	(c) cast net	**320**	**698**
	(d) bottom set lobster **net**	**21**	**707**
V.	HOOK AND LINE		
	(a) with plank canoe	**99**	**293**
	(b) with dugout canoe	240	400
	(c) with kattumaram	201	595
	Mechanised		
VI.	WITH TRAWL NET	32	154
VII.	LARGE MESH GILLNET	53	162

Source: Appendix 4.

8. CATCH DISPOSAL AND FISH PRICE

Even at what would be regarded as low levels of productivity in the fisheries only a small portion of the catch can be consumed immediately by the producers themselves; since fish is very perishable, fishing communities even in an artisanal fisheries come to engage in trading at an early stage in their development.

There are two broad categories of catch disposal: (a) fish taken for consumption and (b) fish marketed.

8.1 Fish taken for consumption

Not all the fish caught is sold. When an artisanal fishing unit lands, the first allocation of fish is for the consumption needs of the households of the crew, the non-crew owners of the fishing unit; the people whose services are generally paid in kind such as the barber; and the old and physically handicapped of the village.

For want of a more accurate estimate it has been assumed that 50 per cent of the fish taken for consumption goes to the households of the crew and owners of a fishing unit. The remaining goes to pay for services and contributes to a traditional, informal village social security system.

While the economic importance of fish taken for consumption and given away gratis to others (who may in turn sell it rather than eat it all) must be borne in mind, it should nevertheless not be forgotten that the practice also has socio-cultural aspects. The price of cuttle fish is so high (Rs. 33 to Rs. 40/kg) that no fisherman will give it away gratis; even fish for consumption for his own house is bought from the market. Thus when fishermen in Trivandrum fish exclusively for cuttle fish, the normal pattern of fish supply in the village is upset and social strains can result. One consequence of mechanisation, the concentration of the fleet in fewer ports, may also make it difficult to continue the practice of giving fish away in the villages.

The study shows that quantitatively, fish taken for consumption varies from region to region and even combination to combination. It is a function of the crew size and the quantity as well as of the species landed. On an average, however, about 5 per cent of the catch is disposed of in this way. As much as 16—18 kg is distributed when the encircling net combinations reach the shore with over 200 kg of fish. This is evidently because of the large number of crew and the relatively large catch landed per trip. The *hook-and-line/plank canoe* and the *boat-seine! kattumararn* also have large numbers of crew and relatively large catches per crew member providing large quantities of fish for consumption. In contrast, shore seines, which employ between 15 and 21 crew, provide no more than 2 kg of fish to be distributed for consumption. This is explained by the very low catch per man. No fish is given away for consumption in the case of lobster fishing for the simple reason that the average catch of lobster is too low and the export price too high to permit this.

The mechanised boats operating trawl nets, which have the same crew size as the *boat-seine/ kattumaram* land double its catch but only provide half the amount of fish for consumption —2 kg compared to 4 kg. See Table 13.

8.2 Marketing structures and prices of fish

To a large extent the marketing structure determines the shore price which in turn affects the gross earnings.

The marketing structure at any given landing place and its subsequent forward linkage are determined by several factors. These include the main groups of species landed, the accessibility of the seashore, the number and the type of buyers, the mode of selling, the socio-religious custom, the proximity of consumption centres or the ultimate market. These factors are mutually interacting. Observation of the situation in Kerala confirms that the pattern of marketing structures

Table 13

Variations in fish taken for consumption of selected craft-gear combinations

	Combination		Average catch/trip (kg)	Crew size	Fish for village consumption per trip (kg)
1.	Lobster net — dugout canoe	..	**0.85**	**2**	**0**
2.	Encircling nets—canoes	..	233	15	16–18
3.	Hook line—plank canoe	..	**190**	**8**	**10**
4.	Boat seine — kattumaram	..	**62**	**5**	**4**
5.	Shore-seine canoes ..	..	52	15–21	0.8–2.0
6.	Trawl net—mechanised boat	..	**124**	**5**	**2**

and linkages is first of all related to the structure of the fishing fleets and their patterns of operation, despite the degree of independence that the two systems also exhibit.

The inter-relationship is best seen in the scales of operation of production and marketing in the different regions of the state. In Trivandrum for example, where the predominant craft isthe kattumaram, the size of landing is small —varying on the average from 5 kg to 50 kg. This is reflected by the small-scale distribution system, composed of thousands of men carrying 25—50 kg of fish on cycles and of women carrying 5—15 kg on their heads. In Alleppey both the production and marketing operations are on a larger scale: canoes land 100—300 kg and lorries carry away ½-1tonne of fish each.

Another important factor that influences the web of relationships that make up the marketing structure is the mode of selling or more precisely the organisation of transactions between producers and buyers. Negotiations between producers and buyers are generally conducted through the aegis of an intermediary who is either a commission agent or an auctioneer. The function of this intermediary is to facilitate the process of exchange of fish and money at first sales. This is done by mediating in a bargain or by conducting an auction which disposes of the produce at a value mutually acceptable to the fishermen and the buyers. In general the responsibility of the intermediary ceases once the value of the fish placed before him is settled. His services are paid for by the fishermen and form part of their common operating costs.

Buyers of fish on the sea shore are generally the women or men who distribute fish by headload, the men who use cycles, the wholesale merchants who use lorries, a limited number of other hawkers, and purchasing agents of exporters.

The type and the number of these buyers and the mode of disposal of fish both have a bearing on price and hence on the earnings of a fishing unit.

Bargaining is generally practised where the buyers are fewer in number and exercise an element of monopsony power. Auctioning works when there are numerous buyers and supplies fluctuate, as they do in most fisheries.

The small-scale fish distributors are generally in business primarily in the interest of survival and livelihood. They buy small quantities of fish, transport it over short distances, serve a more or less regular clientele and make small profits. There is more movement of human weight than fish. Wholesale merchants handle large quantities, move them over long distances, indulge in a considarable amount of speculation, and attain high profits.

The nature of the end market influences the pattern of organisation of the marketing activity and in turn has its bearing on prices at first sale and earnings of fishing units. For example,

exportable species of fish and crustacea which are of high unit value require, and can support, a more capital-intensive and hierarchical marketing structure. In the neighbouring rural hinterlands of fishing villages, purchasing power is low and fish that is to be sold to them necessarily must go through less costly distribution networks and be bought at a lower price at first sale.

The analysis of fish flows undertaken in the study attempts to present a disaggregated picture of the movement of fish from the production to the consumption end. The region-wise analysis shows the variations in the marketing structure, both between and within the regions. The interrelationships between the mode of selling, the type of purchases and the nature of the end market are illustrated in the schematic diagrams presented below (Figure 5).

Variations of fish prices over different craft-gear combinations and between different districts are shown in Table 14.

By and large the differences in fish prices reflect variations in the species composition of the catch. The average fish price is highest in Quilon district, where lobster fishing, trawling for shrimps and large-mesh gillnetting for high quality fish were prominent among the monitored operations.

The higher average fish prices in Trivandrum district compared to the Alleppey and Kozhikode-Cannanore districts probably result from several causes. (1) The closeness **of the state's capital** city with many high and middle income earners may result in a higher effective demand. (2) The relatively higher landings of high quality fish species, such as seer, tunas, cuttle fish etc. (3) The existence of several efficient and genuine fishermen's co-operatives, which have improved the fishermen's economic power vis-a-vis intermediaries like money lenders and middlemen. (4) The less monopolistic and more atomistic marketing structure may result in higher competition and higher fish prices.

FIGURE-S

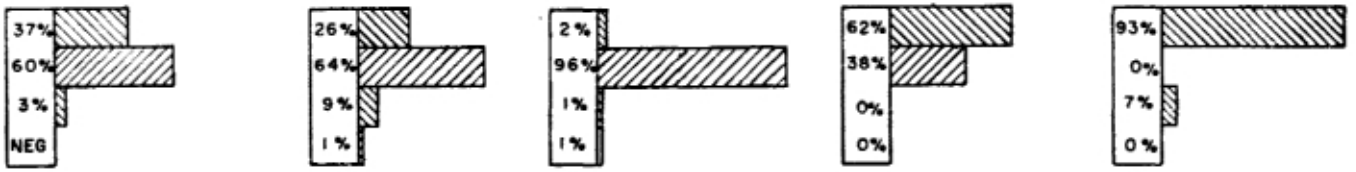
BAR CHARTS SHOWING INTRA — DISTRICT FISH FLOWS

TOTAL QUANTITY OF FISH SOLO

100 %	5%	40 %	32 %	13%
KERALA (1619 TONNES)	TRIVANDRUM **(241 TONNES)**	**QUILON (648 TONNES)**	**ALLEPPEY (523 TONNES)**	**KOZHIKODE – CANNANORE (207 TONNES)**

MOPE OF SELLING,

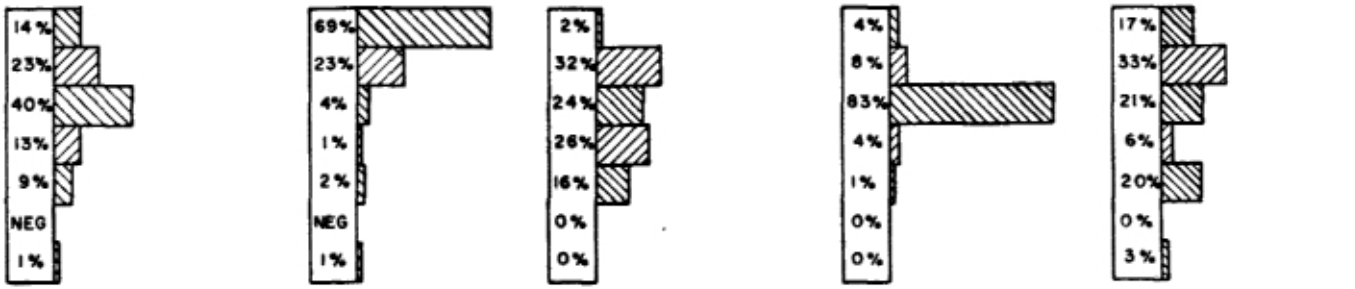
BARGAINING
AUCTION
FIXED PRICE
OTHERS



KERALA **TRIVANDRUM** **QUILON** **ALLEPPEY** **KO2HIKODE – CANNANORE**

PURCHASER

HEAD LOADERS
CYCLE LOADERS
LORRY MERCHANTS
EXPORTERS AGENT
MIDDLE MEN
CO - OPERATIVE SOCIETY
OTHERS



KERAL.A **TRIVANDRUM** QUILON **ALL EPPEY** **KOZHIKODE - CANNANORE**

FINAL MARKET

INTERNAL NEIGHBOURING **MARKET**
INTERNAL DISTANT MARKET
EXPORT

KERALA TRIVANDRUM **QUILON** **ALLEPPEY** **KOZHIKODE- CANNANORE**

<<

Table 14

Average fish prices **over different craft-gear combinations**

Craft-gear combinations in the district	Average price (Rs. per kg)	Average weighted price in the district (As. per kg)
Trivandrum District		
Boat seine / kattumaram	2.38	
Cotton shore seine / canoe	2.49	
Large mesh driftnet / kattumaram	2.33	
Large mesh driftnet / dugout canoe	4.57	2.56
Anchovy net / kattumaram	1.45	
Sardine net / kattumaram	2.60	
Prawn net / kattumaram	3.40	
Hooks line / kattumaram	2.97	
Hooks line / dugout canoe	3.29	
Hooks line / plank canoe	3.96	
Quilon District		
Sardine net / dugout canoe	2.96	
Prawn net / dugout canoe	3.00	
Lobster net / dugout canoe	33.38	4.63
Hooks line / dugout canoe	6.19	
Trawl net / mechanised boat	4.79	
Large mesh gillnet / mechanised boat	3.44	
Alleppey District		
Encircling nets / canoe	1.90	
Nylon shore seine / plank canoe	1.16	
Small mesh driftnet / plank canoe	1.74	1.83
Hooks line / dugout canoe	1.52	
Hooks line / plank canoe	2.61	
Kozhikode and Cannanore Districts		
Boat seine / dugout canoe	1.28	
Large mesh driftnet / dugout canoe	3.18	
Sardine net / dugout canoe	2.29.	1.82
Cast net / dugout canoe	2.18	
Hook & line / dugout canoe	1.55	
Large mesh gillnet / mechanised boat	2.36	

9. EARNINGS AND PROFITABILITY

In the previous chapter a cursory examination was made of the factors that influence price. It is now possible to discuss the revenues and profits from fishing: how much accrues and how it is distributed.

Revenues, or earnings, and profitability can be seen from three perspectives — from that of the worker-fishermen; that of the owner, who may also work; and that of society as a whole.

This chapter is divided into three parts. The first part consists of a discussion of the systems of sharing the divisible earnings and the logic and effect of such systems. How much of the revenues accrues to workers and owners from an average trip is considered in the second part. In the final part the profitabilities to the owners and to the economy as a whole are contrasted and compared.

9.1 Divisible earnings

91.1 Divisible earnings are normally that part of the value realised from the fish sold which are distributed as remuneration in cash to crew and owners; the gross earnings from fishing less the common operating costs.

There are situations when incomes from sources other than fishing, which accrue because of the use of the fishing unit, have to be added to arrive at the earnings—for example, payments received by the mechanised gillnetters for towing driftnet-dugout canoes in Kozhikode district.

There is a wide range of variations in the average divisible earnings of the various combinations. (See Summary Table — Appendix 4.) Earnings are affected by the combinations catching potential, the price of the fish and the amount of common costs deducted.

9.1.2 *The sharing system*

The system of sharing the divisible earnings is based on certain generally accepted notions accepted by workers and owners. Basically there are three shares — one for the crew, one for the craft and one for the gear. The crow shares are regarded as the return on labour. The share for craft and gear are the returns on capital; it is out of this that charges for interest are met and allocations for depreciation are made; and for some classes of repairs and routine maintenance.

While these guiding principles form the basis of the system, in actual practice there are considerable variations depending largely on (a) the nature of the fishing operation (b) the variations of skill and methods of task sharing among the crew and (c) the absolute size of the capital investment and the capital intensity.

In most of the simpler combinations, the general pattern of share division is more or less the same. It entails the divisible earnings to be split into a required number of shares, which is normally one more than the number of crew on the fishing unit. The rationale is that all the working crew get an equal share and the extra share is what accrues to the craft and gear and therefore appropriated by the owner. If the owner works as a crew member he is entitled to two shares — one as worker and the other as owner. However, as the capital intensity increases, the number of extra shares is increased and this increases the relative share at the disposal of the owner.

The divisible earnings of the anchovy net/kattumaram combinations are split into 3 shares: one for each of the two crow and the other for the owner, normally one of the crew. This is the case with all combinations which use the kattumaram as craft.

The divisible earnings of the *small-mesh driftnet/p!ank canoe* combination are apportioned into 10 shares —7 shares for the seven workers and 3 for the owners of the unit. On days when the operation of the unit requires the help of persons other than the fishing crew, the total number of shares is increased to say 13: 7 for the fishing crew, 3 for the helpers on land and 3 for the owners.

The pattern of sharing of divisible earnings by the more capital intensive combinations engaged in more complextypes of operation often entails a reward not only for labour and capital but also for management and specially skilled crew. Such considerations result in a differential share rate even among the crew. Provisions also exist for owners to appropriate one extra share which they in turn can distribute at discretion to members of the crew.

The divisible earnings of the *shore-seine/dugout canoe* combination are divided first into 2½ shares: one for the owner and 1½ for the workers. The 1½ shares are further divided into seven shares more than the number of crew. Each crew member first receives one share. Of the extra seven shares, three are given to the person who has contracted to underwrite all the major repairs to the unit, pay the dues for the church and advance money to crew members who are in need. The remaining four shares are redistributed to the best crew members **and to other minor** helpers. It is of importance also to note that owners **may, on occasions** when the value of fish sold is low, forego their shares and even bear all the operational expenses so that the crew are not discontent.

9.1.3 Table 15 shows the sharing patterns based on the annual aggregation cf the shares between the crew and the owners. Share to crew include3 what owners received as workers. What is called owner's share is strictly the returns to capital, including provision for maintaining the capital assets in being.

Table 15

Resultant sharing patterns of different craft-gear combinations

Crew share (%)	Owners' share (%)	Craft-gear combinations
30 —40	60 —70	Trawl net and large-mesh gillnets with mechanised boats.
40 —50	50 —60	Prawn net with kattumaram.
50 —60	40 – 50	Shore-seine with dugout canoe; sardine net with kattumaram.
60—70	30—40	Anchovies and large-mesh driftnets with kattumarams. Hook and line encircling net, shore-seine and small-mesh driftnet with plank canoes. Large-mesh driftnets and lobster net with dugout canoe.
70 – 80	20 —30	Boat seine and hook-line with kattumarams. Sardine nets; prawn nets; boat-seines; hook-line and encircling nets with **dugout** canoes.
80 —90	10 —20	Cast net with dugout canoe; shore-seine with plank canoe.

Source: Appendix **4.**

These resultant sharing patterns show that there is a range of variation in the crew's and owner's shares between the different craft-gear combinations. In most of the combinations the crew get more than 60 per cent of the divisible earnings. The capital intensive mechanised sector combinations provide a higher share to the vessel, ranging between 60 and 70 per cent of the divisible earnings.

9.1.4 The prevalence and continuance of the sharing system even in the more capital-intensive fisheries of the developed countries indicates that it is rooted very much in the nature of the occupation itself. Modifications have however taken place as the role of capital became more prominent.

In the case of Kerala fisheries, and from the point of view of the owners, the share system acts as the most effective 'supervisor' of costs — both the common operating costs and the remuneration to workers which is a cost for the owner. The variability of the latter mitigates to a large extent the owner's risks arising from the site of catch and variations in prices.

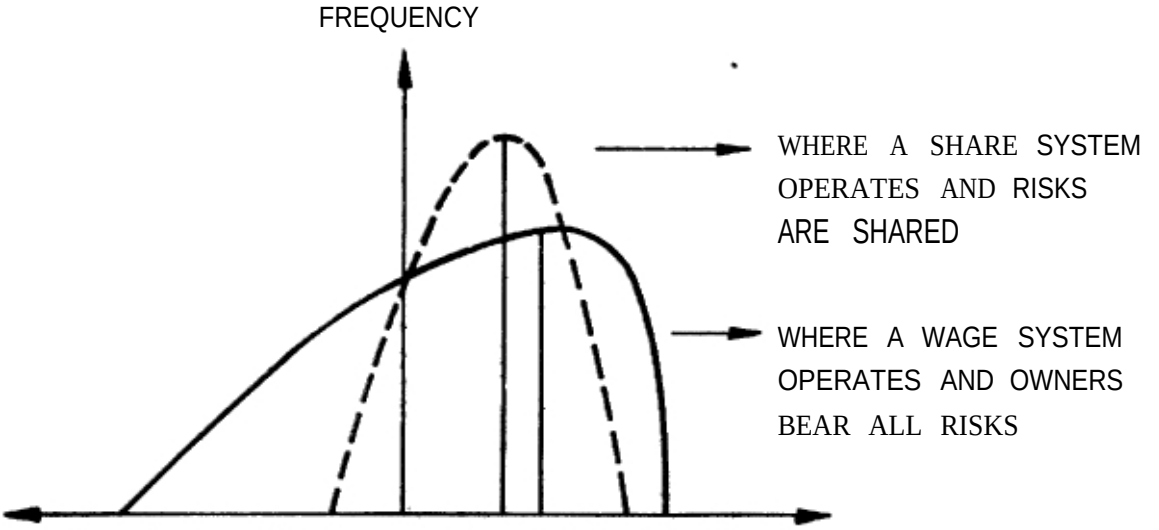
It has been pointed out elsewhere (Turvey and Wiseman 1956) that the share system has two effects:

(a) If the investment was successful the return to the entrepreneur would be less than marginal productivity of capital.

(b) If the investment was unsuccessful, the entrepreneur would bear less of the loss.
See Figure 6.

FIGURE -6

EFFECT OF SHARE AND WAGE SYSTEM ON EARNINGS



(WITH THE SHARE SYSTEM BOTH THE MODAL GAIN AND THE POSSIBILITY OF LARGE LOSS FALL)

SOURCES : TURVEY AND WISEMAN,
THE ECONOMICS OF FISHERIES
FAO, ROME 1956.

9.2 Remuneration to the crew

9.2.1 The distribution of the divisible earnings according to the conventions of the share system as described above indicates how the revenues generated by the different combinations are shared between workers and owners: what accrues to each on the "average fishing trip".

This is one way of measuring the relative efficiencies of different combinations; however,, from the standpoint of the fishermen workers and owners, the total remuneration received over a period of time is more significant.

The total remuneration as herein defined is the sum of all the cash payments plus the payments in kind. Payments in kind include the food (or cash expenditures for it) and fish which is given to the crew during or after a fishing trip. Where the money equivalents are not recorded money values have been imputed to them.

9.2.2 There are significant variations in the per capita remuneration to the crew across the different combinations. Table 16 shows the two components of the remuneration — cash and kind—along with the total.

Table 16

Per capita crew remuneration during period of operation

	Groupings	Per capita crew remuneration			Average expected period of operation (months)	Days actually operated in these months
		in cash	in kind (imputed value)	Total		
	Artisanal					
I.	ENCIRCLING NET	1208(80)	297(20)	1506	12	124
II.	BOAT SEINE					
	(a) with dugoutcanoe	915(89)	114(11)	1029	6	103
	(b) with kattumaram	369 (76)	58 (14)	427	7	30
III.	SHORE SEINE					
	(a) with cotton seine	462 (90)	51(10)	513	9	122
	(b) with nylon seine	233 (93)	18 (7)	251	6	48
IV.	GILLNET					
	(a) driftnet					
	(i) small mesh	912 (79)	249 (21)	1161	8	99
	(ii) large mesh	914 (76)	289 (24)	1203	9	77
	(b) specialised gillnets*	736 (78)	101 (12)	837*	8*	79
	(c) cast not	1069 (89)	133 (11)	1202	6	107
	(d) bottom set lobster net	1000 (100)	0 (0)	1000	9	143
V.	HOOK AND LINE					
	(a) with plank canoe	336 (70)	145 (30)	481	10	28
	(b) with dugout canoe	1273 (85)	229 (15)	1502	9	57
	(c) with Kattumaram	1325 (76)	222 (14)	1547	11	105
	Mechanised					
VI.	TRAWL NET	2415 (71)	991 (29)	3406	12	158
VII.	LARGE MESH GILLNET	1401 (70)	603 (30)	2004	12	98

Figures in brackets are percentages to the total.

* Periods of operation of the 5 individual combinations in this grouping range from 5 to 12 months and per capita crew remuneration from Rs. 384 to Rs. 1188.

Source: Appendix 4.

Payments in kind are non-existent for *lobster net/dugout canoes,* account for 7—10 per cent of the total remuneration in the case of shore-seines and are as much as 30 per cent in the case of the combinations in the mechanised sector. The importance of this in assessing the living standards of fishermen in relation to other workers in other sectors of the economy is apparent: money wage comparisons alone may be misleading.

9.2.3 The per capita remunerations recorded here are not to be equated with the total annual income of the fishermen, because in regions like Trivandrum, the fishermen generally operate more than three types of combinations in course of the year. Exceptions to this are fishermen workers in the mechanised sector and possibly those who work on the *encircling net/plank canoe* and the *hook-and-/ine/kattumaram* the year round.

9.2.4 Subject to the above caveat, the average per capita remuneration to crew is highest on the mechanised units — As. 3,406 on the trawlers and As. 2,000 on the gillnetters. The average worker on a trawler earns over twice of what his counterpart who works for the whole year round earns on the *hook-and-line/kattumaram.* Nevertheless the average fishermen using a hook-and-line and a kattumaram earns just 20 per cent less than the average worker on a mechanised gilinetter.

The crew remunerations per fishing day were—with the exception of the shore-seine units, sardine and prawn-net fishing on kattumaram and lobster-net fishing —all above As. 10, which is not quite as much as the prevailing daily wage rate of a landless agricultural labourer in Kerala. The remuneration per day was exceptionally high for the crew on dugout canoes going hook-and-line fishing (Rs. 26.40) and also forthe crew on mechanised craft (Rs. 21.60 and Rs. 20.40). (Please see the Summary Table, Appendix 4.)

Despite these latter figures the annual average income in fisheries especially of those who have only their labour to offer, is low. The average fishing family has seven members. If the livelihood of the entire family depends on the income of only one active fisherman, even taking the highest average per capita remuneration — Rs. 3,406 on the mechanised trawlers —the income per family member is less than Rs. 500 per annum. This is lessthan half the average per capita income of Rs. 1,056 (in current prices for 1979—80) for Kerala as a whole, The average family may have more than one active member, but the average artisanal fisherman's income is less than that of the average trawlerman.

9.3 Remuneration to the owners

9.3.1 Considerable debate centres on the question whether investments in the artisanal fisheries sector are made with the livelihood or the profit.motive. The self-employment characteristic of this sector blurs the distinction between capital, management and labour. The distinction between a 'wage worker' and a 'fishing partner' on most of the craft-gear combinations is very hazy. An owner with small resources is often in no better a position than the 'pure' worker fisherman.

The participation of owners in fishing operations suggests that it is 'livelihood and survival' rather than 'profits' that is the prime motive for fishermen investing in craft and gear. 'Profit' nevertheless seemed to be the driving force in a few of the craft-gear combinations.

The 'livelihood' motivation for investment in fishing is well illustrated by a comparison of the shares accruing to a non-owner worker and an owner on the fishing units using the kattumaram. These units are as a rule individually owned and the participation of owners as workers is fairly frequent. The 'profit motive' is only apparent in the case of the *shore-seine/plank canoe* combination, such units are also individually owned. The details are given in Table 17.

9.3.2 The preceding discussion focused on that part of the divisible earnings which accrued to owners as remuneration for both their work and their capital. In what follows only the latter will be discussed.

The owners' share of the divisible earnings less the owners' share of the operating costs is the gross profit available to the owners. From this gross profit the owners have to make allocations for capital replacement and interest charges.

Table 17

Inklings into livelihood and profit motives

Items	Craft-gear combination	Sardine net – kattu-maram	Prawn net – kattu-maram	Anchovy net – kattu-maram	Drift-net – kattu-maram	Shore seine – plank canoe
1.	Investment per fishing unit(Rs.)	1810	1650	1800	6760	7650
2.	Average crew size	2	2	2	2	21
3.	Owner's participation in fishing (percentage)	98	90	58	44	100
4.	Total divisible earnings per trip (As.)	16.54	18.36	23.15	5482	106.57
5.	What a non-owner worker earned per trip (share as worker) (As.)	5.13	6.40	11.78	31.57	3.37
6.	Individual owner's total earnings per trip (share as worker and owner) (Rs.)	11.41	11.95	11.36	23.24	37.00
7.	What the owner would have* earned if he did not go fishing (share as owner) (As.)	8.45	9.56	9.43	21.15	34.78

Source: Appendix 4.

* Row 6 minus Row 7 gives what the owners earned "as workers" in each case. This result added to Row 7 and Row 5, gives the "Total divisible earnings" as in Row 4. For other combinations see Appendix 4.

Average gross profit varied between Rs. 375 per season for the single owner of the *prawn net/ kattumaram* unit to Rs. 12,586 for the several owners of the collectively owned encircling nets. In general it would seem that fishing combinations using kattumarams resulted in lower gross profits during the year 1980. The highest average gross profits among kattumaram combinations accrued to the *driftnet/kattumaram* combination (Rs. 954) (See Summary Table—Appendix 4).

9.3.3 In 1980, for most of the combinations, a worker's remuneration was as much as the gross profit per owner. The marked exception was the cotton shore-seine combinations operated in Trivandrum district. That even the mechanised units fall into the general pattern is primarily attributable to the extremely high owner's operating costs. See Figure 7.

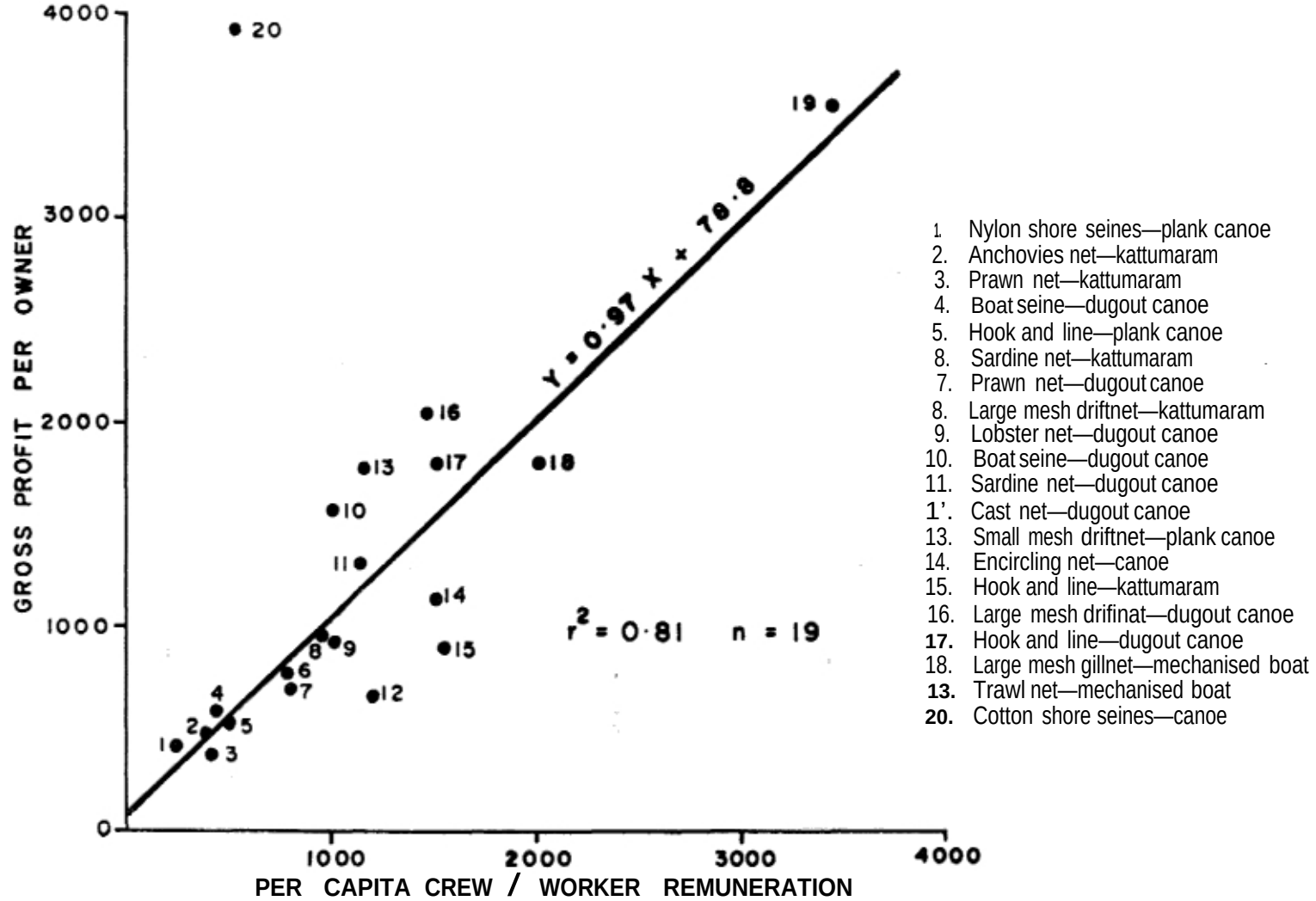
9.4 Profitability — private and social

In what follows, the contributions of the different craft-gear combinations to the national economy are examined and their social and private profitabilities are discussed.

9.4.1 The net income generated through an economic activity is commonly referred to as net value added. The *net value* addedshows the real addition to the national income after all physical

Figure 7

RELATIONSHIP BETWEEN EARNINGS OF CREW WORKERS AND PROFITS OF THE OWNER



In Figure 7 the linear regression line taking the first 19 pairs of values is shown in the diagram. The coefficient of determination (r^2) is 0.81. Taking all 20 pairs of values, the coefficient of determination is 0.32.

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inputs and/or costs incurred in the production process have been subtracted from the output. The *gross value added* includes in addition one cost, namely the sum allocated to depreciation. The net value added has three elements: (1) incomes accruing to labour: crew remuneration (2) profits and interest accruing to capital and (3) revenues accruing to the state, community and/or religious organisations in the form of taxes, "offerings" etc. In each case, incomes may occur not only in the form of money, but also in kind.

9.4.2 A measure of societal "efficiency" of the production process is the ratio of the value added to the total gross earnings. A high ratio indicates that the material cost in producing the respective output has been very small. Table 18 shows that for all artisanal craft-gear combinations at least four-fifths of the gross earnings were actual incomes. In the case of mechanised trawlers more than two-thirds of the gross earnings had to be set apart for paying costs like fuel, repairs, etc.

Table 18

Share of the gross value added on the gross earnings by gear groupings

	Groupings				Gross value added as ratio of gross earnings
	Artisanal				
I.	**ENCIRCLING NET**	..	..	..	0.92
II.	BOAT SEINE				
	(a) with dugout canoe	..	..	..	0.93
	(b) with kattumaram	..	..	..	0.90
III.	SHORE SEINE				
	(a) with cotton seine	..	..	..	**0.82**
	(b) with nylon seine	..	..	..	0.90
IV.	GILLNET				
	(a) driftnet				
	(i) small mesh	..	..	..	0.93
	(ii) large mesh	..	..	..	0.85
	(b) specialised gillnet	..	..	..	0.94
	(c) cast net	..	..	..	0.95
	(d) bottom set lobster net	..	..	..	0.86
V.	HOOK AND LINE				
	(a) with plank canoe	..	..	..	0.80
	(b) with dugout canoe	..	..	..	0.83
	(c) with kattumaram	..	..	..	0.90
	Mechanised				
VI.	TRAWL NET	..	..	..	**0.23**
VII.	LARGE MESH GILLNET	..	..	..	0.48

Source: Appendix 4.

9.4.3 In the sample studied, the combinations of the artisanal sector account for only 41 per cent of the gross earnings, but they account for 71 per cent of the value added created. The mechanised sector which accounts for 59 per cent of the gross earnings produces only 29 per cent of the value added.

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9.4.4 The *profitability* of an economic activity can be measured in different ways, according to the points of view of the different beneficiaries from the generated incomes. The amount of 'value added' per unit of investment is a measure of the profitability of the production process from the point of view of the entire economy. On the other hand a common measure of private profitability is the *'return on investment',* as measured by the net profit generated per unit of capital invested in the means of production. It is this private profitability which will usually decide if an owner of capital invests money in a certain economic activity or not. As the return on investment is influenced by the distribution of the value added, it is normally not in itself a completely satisfactory measure of the societal profitability of the production process.

9.4.5 Table 19 shows private and social profitabilities for different gear groupings.

Table 19

Private and social profitability of the different gear groupings

	Groupings	Return on investment* (net profit per unit of investment)	indication of social profitability (gross value added per unit of investment)
	Artisanal		
I.	EN CIRCLING NET	44.3	1.91
II.	BOAT SEINE		
	(a) with dugout canoe	20.8	1.48
	(b) with kattumaram	—2.0	0.72
III.	SHORE SEINE		
	(a) with cotton seine	33.4	1.95
	(b) with nylon seine	—5.4	1.33
IV.	GILLNET		
	(a) driftnet		
	(i) small mesh	28.4	1.91
	(ii) large mesh	5.7	0.60
	(b) specialised gillnet	16.5	1.14
	(c) cast net	15.8	3.06
	(d) bottom set lobster net	21.0	1.96
V.	HOOK AND LINE		
	(a) with plank canoe	—1.8	1.33
	(b) with dugout canoe	15.2	1.65
	(c) with kattumaram	32.2	2.78
	Mechanised		
VI.	TRAWL NET	—9.8	0.16
VII.	LARGE MESH GILLNET	—8.7	0.25

* *As discussed already, the depreciation allocations are systematically under-estimated; thus the returns on investment are in reality somewhat lower than shown in the above table. This however, does not affect the relative position of the different gear groupings.*

Source: Appendix 4.

From the societal perspective, cast-net fishing with dugout canoes and hook and line fishing with kattumarams were the most rewarding fishing techniques of the combinations studied. During the survey year these fishing units generated incomes averaging roughly three times their initial investments.

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Private profitabilities were high in the case of the encircling nets; the cotton shore-seines; the hook and line using a kattumaram and the small-mesh driftnets. There was only one artisanal fishing technique - the encircling nets— which attained a return on investment which was higher than the minimum interest rate of 36 per cent which prevails on the informal credit market in the artisanal fishing villages of southern Kerala. (Platteau et al. 1979).

9.4.6 In general, considering the high interest rates, the private returns to capital were not very lucrative in the artisanal sector during the survey year. While the returns to capital were in many cases insufficient to pay off the prevailing interest rates in the informal credit market the activities of the artisanal sector can nevertheless be regarded as highly beneficial to the national economy.

The mechanised units, on the other hand, performed very badly from the owners' point of view as well from that of the national economy. The average gross incomes generated were only one-fifth of the initial investments in the case of trawlers and one third in the case of gillnetters. In both cases the average unit was unprofitable for the owners. Several reasons for this poor performance of the mechanisod units have already been pointed out. From the point of view of the owners these include fast rising fuel costs and the higher earnings of the crew compared to artisanal units.

9.4.7 It is of interest to note that the two techniques resulting in the highest private profitability and with largely equal social profitabilities — encircling nets and cotton shore-seines — are similar in complexity of organisation but differ in ownership patterns.

The collectively owned and operated encircling nets (on an average in our sample 11 of the 15 crew were owner-workers) result in high private profitabilities for two reasons: (a) the techniques as such are very effective and have a high level of productivity when used at the right time and place (b) the collective ownership and work pattern permits the mode of allocation of returns to labour or capital to be flexible — by common agreement one or the other can be raised or lowered.

The cotton shore-seine units are all individuallyowned but require the collective efforts of 15—21 persons. Here high private profits and very low levels of crew remuneration can be found.

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10. ANALYSIS OF VARIATIONS BETWEEN DIFFERENT FISHING CENTRES

The performance of a single fishing unit is influenced by many factors. Some of these factors are related to the particular fishing village or geographical area: a fishing village located at the mouth of a river may be blessed with a richer resources abundance than a neighbouring village; the marketing power of the fishermen in village X may be higher than in the village Y and though the latter may catch more fish, the former may still earn more money* ; the number of fishing units of a certain craft-gear type operated in one village may have a bearing on a single unit's performance in various ways — one of which is that if more fishing units have to share the resources in a geographically limited area the catch per fishing unit may be smaller. Other factors which result in inter-centre and intra-centre variations are connected to differences in skills, size and type of equipment, operational patterns and so forth. Both groups of factors are important for explaining centre-wise variations and in many cases it is not possible to attribute the differences to only one or two factors.

Analysis of differences in performance between centres using similar craft-gear combinations will at least show whether differences exist arid may help to indicate whether a transfer of skills from one centre to another might lead to improved performance. It may also help to indicate the need for management of the fisheries: the number of fishermen in one area of the coast may be too high and thus the incomes are lower than in other areas where the number of fishermen is less; or, as noted earlier, further additions of craft and gear may just increase the competition for, or the pressure on, a stock already being fished at or above the optimum yield.

Analysis has been undertaken only for those craft-gear combinations which are operated in more than one of the sample villages. The analysis is split into six groupings, namely (1) encircling nets and small mesh driftnets, (2) boatseines, (3) shore-seines, (4) large mesh driftnets, (5) hooks and lines and (6) specialised gillnets.

10.1 Encircling nets and small-mesh driftnets

10.1.1 Encircling net operations have been monitored in three different fishing villages of Alleppey district, namely Punnapra, Kattoor and Azheekal. The encircling net units of Azheekal showed by far the best performance over the year. The gross earnings per fishing trip were 70% higher on average in this village than those of the units based on Punnapra. See Table 20.

The total number of encircling net units operated off Azheekal is only 22 as against 100 in Kattoor and 90 in Punnapra. In general, the number of fishermen is smaller and the diversification of fishing methods lower in Azheekal than in Punnapra and in Kattoor.

These facts may indicate that the pressure on inshore resources is lighter in Azheekal than in Punnapra and in Kattoor.

On a yearly basis, the encircling net units operated with dugout canoes off Punnapra attained gross earnings (Rs. 28,824) which were less than halfof those obtained in Azheekal (Rs. 59,463). Apart from lower efficiency on a trip basis, the number of trips per year was also considerably lower in the case of dugout canoes. This may be attributed to the greaten caution of the fishermen during the rough monsoon season, because the replacement and repair of dugout canoes is more difficult and expensive than of plank canoes.

However at times when dugouts did go fishing, the gross earnings per man-hour at sea were higher than those of plank built canoes operated off the same village. Dugouts are faster than plank canoes and this may be a distinct advantage when fishing with encircling nets.

*As already mentioned elsewhere, the assumed error margin of quantity and hence price estimates can be relatively high, particularly on the disaggregated level of the single fishing village or fishing centre. Therefore, the analysis of price variations has been excluded here.

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Table 20

Comparison of encircling net fishing in Alleppey District

	Punnapra		Kattoor	Azheekat	Average per fishing unit
	dugout canoe	plank canoe	plank canoe	plank canoe	
No. of fishing units **selected**	4	4	3	6	7
Investment per unit **(a) craft** **(b) gear**	**12750** 14500	**10250** **11375**	**6000** **8867**	**8710** **12000**	9544 **11853**
Average No. of crew	15.0	15.0	14.2	15.0	14.8
No. of fishing trips per year	81	118	96	108	**102**
Average trip time (hrs.)	6	6	5	5	5
Average water depth in area of operation (m)	6	7	8	11	8
Gross earnings per trip (Rs.)	357	321	463	549	437
Gross earnings per man-hour at **sea (Rs.)**	**4.20**	**3.60**	**6.50**	7.00	5.40
Gross **earnings during** period operated (Rs.)	28824	**37845**	**44299**	**59463**	**44491**
Per capita crew remuneration (Rs.)	910	1146	1274	2256	1506
Return on investment (%)	5	26	70	82	44

The pen capita crew remuneration varies considerably between different villages. A fisherman working from Azheekal in a plank canoe **earns on an average Rs. 2,256 almost** two and half times more than his fellow fishermen's average in a dugout from Punriapna (Rs. 910). The latter would be insufficient to sustain the fisherman and his family during the entire year; he will thus shift to small mesh driftnet and other fishing methods during pants of the year.

10.1.2 In the same three villages were also monitored small-mesh driftnets fishing with plank canoes. As can be seen from Table 21, the yearly gross earnings of these units were highest in Punnapra.

The higher gross earnings in Punnapra could, however, be achieved only through a disproportionately higher amount of effort and larger number of trips. The gross earnings per trip and man-hour at sea were lower in Punnapra than in Kattoor and Azheekal, in spite of noticeable higher investment levels in fishing gear in the former village. In Punnapra, the average weight of the gear was 45 kg compared to 26 kg in Kattoor and 30 kg in Atheekal. This may confirm the supposition that the pressure on inshore resources is greater in Punnapra than in Kattoor and Azheekal.

10.2 Boat-seines

Two types of boat-seine fisheries were monitored in two different regions of the Kerala coast Common to both types is the mariner of operation; two kattumarams pull a bell-shaped net or two dugout canoes pull a conical net fitted with large wings on either side of the mouth opening. In many other respects, however these two craft-gear combinations differ considerably — in crew size, investment, number of fishing days per year and the predominant fish species caught.

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Table 21

Comparison of small-mesh driftnet fishing in Alleppey District

	Small-mesh driftnet with plank canoe			Average per fishing unit
	Punnapra	Kattoor	Azheekal	
No. of fishing units selected	6	3	4	13
Investment per unit:				
(a) craft	2258	2383	3750	2746
(b) gear	7167	3017	2713	4838
Average No. of crew	6.7	6.0	7.0	6.6
No. of fishing trips per year	138	90	48	99
Average trip time (hrs.)	6	9	7	7
Average water depth in area of operation (m)	16	12	12	14
Grossearningspertrip(Rs.)	135	190	206	157
Gross earnings per man-houratsea (Rs.)	3.40	3.60	4.00	3.50
Gross earnings during period operated (Rs.)	18675	17163	9837	15598
Per capita crew remuneration (Rs.)	1492	1209	638	1161
Return on investment (%)	16	52	40	28

10.2.1 Table 22 shows that the gross earnings of boat seines operated in Kozhikode and Cannanore districts were approximately six times higher than of kattumaram boat seines fishing off Trivandrum district. This large difference is partly accounted for by the larger number of fishing trips and partly by higher gross earnings per fishing trip resulting from using a larger net. On a man-hour basis, the kattumaram boat seines were more efficient. Probably, during the relatively few operations of kattumaram boat-seiries, the abundance of fish, predominantly ribbon fish, might have been very favourable. However, on a yearly basis dugout canoes with boat-seines performed far better and attained a return on investment of 21 per cent compared to the net loss of the kattumaram boat-seines.

10.2.2 Among the boat-seine/kattumanram combinations, only the fishing units in Pulluvilla, Poonthura and Marianad made profits, though at a low rate of return. The units of Pulluvilla and Poonthura performed comparatively well owing to the larger number of fishing trips in course of the season. This is primarily due to their access to artificial harbours and surf-crossing piers located near these villages. Such physical infrastructure enables fishermen to operate their boat-seine even during peak monsoon months. Fishermen in villages of Trivandrum district that are far away from such facilities have to take much greater risks if they are to go fishing, as the smaller number of trips shows. The gross earnings per trip were highest in Marianad (Rs. 208), followed by Anjengo (Rs. 180) and Puthiyathura (Rs. 178). Apparently, the large number of trips made in Pulluvilla and Poonthura did not fully pay off through higher gross earnings, either due to a lower price at first sale or a lower catch per trip.

10.3 Shore-seines

10.3.1 Shore-seine fishing is one of the oldest and still one of the major fishing techniques along the Kerala coast. Recently, small-sized shore-seines, in which the bag is made out of

Table 22

Comparison of boat-seine fishing between different fishing villages

	Trivandrum District								Kozhikode/ Cannanore Districts		
	Boat-seine with Kattumaram							Average per fishing unit	Boat-seine with dugout canoe		Average per fishing unit
	Puthia-thura	Pullu-villa	Poon-thura	Vettu-caud	Thumba	Maria-nad	Anjen-go		Puthiya-kadavu	Chalil	
No. of fishing units selected	2	6	4	3	4	6	3	28	3	2	5
Investment per fishing unit:											
(a) craft	3700	4017	1975	2950	1278	2529	2942	**2763**	3600	13500	7560
(b) gear	2350	*2296*	2425	1850	1669	1823	2337	2084	3333	14000	7600
Average number of crew	5.6	5.8	5.3	5.8	5.1	5.0	5.5	5.5	15.6	16.3	15.9
No. of fishing trips per year	16	43	41	17	27	18	24	28	90	127	105
Averagetriptime(hrs.)	8	8	7	6	5	7	7	7	9	8	9
Averagewatordepth in area of operation (m)	22	19	23	18	24	14	14	19	16	11	14
Grossearningspertrip(Rs.)	778	110	127	138	103	*208*	180	137	265	192	230
Gross earnings per man hour at sea (Rs.)	3.80	2.30	3.50	3.70	3.70	5.70	4.60	3.50	2.00	1.40	1.70
Gross earnings during period operated (Rs.)	2848	4675	5239	2300	2755	3744	4320	3864	23850	24288	24012
Per capita crew remuneration (Rs.)	358	547	535	794	298	425	524	427	1072	978	1029
Return on investment *(%)*	—8	4	10	—9	—4	2	—5	—2	49	10	21

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nylon twine, have been introduced in some areas. In the study four shore-seines made out of nylon yarn were monitored in Punnapra, Alleppey district and 15 out of cotton yarn in five different fishing villages of Trivandrum district (Table 23).

103.2 On an average the cotton seines performed better than those made of nylon, but this difference cannot be attributed to the difference in material. Variations in the returns on investment are primarily related to the number of trips undertaken during the year. The nylon shore-seines on an average made only 49 trips as against 146 for the cotton shore-seines.

10.3.3 Among the cotton shore-seines, those operated in Pulluvilla and Poonthura achieved the highest returns on investment of 62 and 81 per cent respectively. Though in terms of gross earnings per trip the shore-seines in Thumba (As. 141) **and Anjengo (Rs.** 252) attained the best resufts, their overall performance was poorer than in Pulluvilla and Poonthura due to the smaller number of trips during the year.

10.3.4 Shore-seines used with dugout canoes are usually smaller in size, as the carrying capacity of the craft is lower than that of a plank canoe. This may be the reason for the very low gross earning3 per tfip achieved in Vettucaud (Rs. 65). Another likely reason, in this particular case, could be the effect of the pollution of inshore waters by effluents from a titanium factory situated in the village.

10.4 Large mesh driftnet

Large mesh driftnet fishing is undertaken with all types of artisanal craft ard is also fairly extensively carried out by th3 motorized fleet. In recent years, the profitability of motorized large mesh driftnet fishing has declined rapidly due to rising mineral oil prices. Mineral oil prices also affected the artisanal sector, since caprolactum, the base for nylon polymers, is made from mineral oil.

10.4.1 On a regional basis, the rnechanised and artisanal fishing units operating in the two northern districts of Kerala showed better results than those fishing in the southern districts. The gross earnings per trip (Rs. 290) of a mechanised gillnetter fishing off Puthiyakadavu in Kozhikode district was over 50 per cent higher than that of a gilinetter fishing from Sakthikulangara in Quilon district (Rs. 187). It **is of** significance to note that even the artisanal units **off** Puthiakadavu achieved a considerable better average result, on a trip basis, (Rs. 228) than the mechanised gillnetters off Sakthikulangara (Table 24).

10.4.2 Comparing the mechanised gilinetters of Puthiyakadavu with their artisanal counterparts, one does not notice any distinct superiority in the former over the latter: the mechanised gillnetters made 28 per cent more trips and achieved 27 per cent higher gross earnings per trip. However, this could only be attained at far higher costs: the return on investment was negative for the mechanised gillnetters as against a rate of return of 27 per cent for the artisanal large mesh driftnet fishing units.

10.4.3 It has been the practice in Kozhikode district for some years for a mechanised gillnetter or trawler (the latter during the off season) to tow 4 to 6 artisanal dugout canoes out **to** the offshore fishing grounds. The mechanised "mother-boat" gets either a fixed sum or a certain share of the catch as payment for the service. With this arrangement the artisanal dugouts fish in average water depths of 25 metres, nearly **the same depth as the mechanised gillnetters** (28 metres).

10.4.4 On an average, the kattumaram driftnet fishing units performed rather poorly. The average gross earnings per trip (Rs. 74) were considerably lower than for driftnets with dugout canoes fishing in the northern region. (As. 228 and Rs. 136). Most of this difference can be attributed to the smaller amount of gear and thus the smaller quantity of fish landed. The average kattumaram gear weighs between 40 and 50 kg, while it is 110—140 kg in the case of dugouts.*

10.4.5 The variations in gross earnings between *driftnet/kattumaram* units operating from different fishing villages were primarily accounted for by variations in the number of fishing trips over the year. The gross earnings per trip and per man-hour at sea, on the other hand, might have varied as a result of differences in the amount of gear used. In Vettucaud, the average weight of the gear was 84 kg as compared to 53 kg in Pulluvilla and 38 kg in Puthiathura. The corresponding gross earnings per trip were Rs. 143 in Vettucaud, As. 81 in Pulluvilla and As. 53 in Puthiathura.

* The low investment given for the gear in Puthiakadavu is not confirmed by the average weight of the gear which is reported at 110 **kg (average over three fishing** units).

Table 23

Comparison of shore-seine fishing between different fishing villages

	Trivandrum District						Alleppey District
	Cotton shore-seine					Average per fishing unit	Nylon shore-seine with dugout canoe
	with plank canoe				with dug-out canoe		
	Pulluvilla	Poonthura	Thumba	Anjengo	Vettucaud		Punnapra
No. of fishing units selected	2	2	5	4	2	15	4
Investment per unit:							
(a) craft	1975	2650	1170	2575	5750	2460	825
(b) gear	3750	6426	4058	8350	5420	5659	2250
Average No. of crew	23.6	23.6	15.9	23.2	15.3	20.6	14.6
No. of fishing trips per year	269	288	114	64	128	146	49
Average trip time (hrs.)	3	4	3	3	2	3	6
Average water depth in area of operation (m)	17	20	16	12	15	17	6
Gross earnings per man-hour at sea (Rs.)	1.10	1.70	3.50	3.90	2.20	2.10	1.10
Gross earnings during period operated (Rs.)	23672	39744	16130	16128	8320	19237	4544
Per capita crew remuneration (Rs.)	631	1063	478	350	256	513	250
Return on investment (%)	62	81	47	10	9	33	5

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Table 24

Comparison of large-mesh driftnet fishing between different fishing villages

	Trivandrum						Kozhikode/ Cannanore			Quilon/ Kozhikode	
	Kattumaram					Average per fishing unit	Dugout canoe	Dugout canoe		with mechanised gillnetters	
	Puthia-thura	Pullu-villa	Vettu-caud	Thumba	Anjeago		Vettu-caud	Puthia-kedavu	Chalil	Sakthi-kulangara	Puthia-kedavu
No. offishing unitsselected	4	5	2	1	4	16	3	3	2	10	5
Investment per fishing unit:											
(a) craft	1825	1760	2300	600	1938	1816	2883	2167	3400	20600	33000
(b) gear	4375	4860	10000	4000	3725	5044	10360	3833	9750	15750	11600
Average No. of crew	2.2	2.3	2.1	1.3	2.1	2.2	3.0	3.9	3.8	3.7	3.9
No. of fishing trips per year	52	79	10	63	37	50	90	50	77	115	64
Averagetriptime(hrs.)	14	15	16	14	15	15	15	17	17	14	17
Average water depth in area of operation (m)	30	42	27	48	34	38	35	25	22	38	28
Gross earnings per trip (Rs.)	53	81	143	46	88	74	74	228	136	187	290
Gross earnings per man-hour at sea (Rs.)	1.70	2.50	4.60	2.70	2.80	2.40	1.70	3.50	2.20	3.60	4.50
Gross earnings during period operated (Rs.)	2756	6415	1430	2898	2464	3688	6685	11400	10472	21567	18687
Per capita crew remuneration (Rs.)	785	1576	324	526	672	959	1104	1627	1594	2210	1584
Returns on investment (%)	—2	16	—8	5	—2	3	9	27	0	—12	—3

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10.5 Hook-and-line

Hook-and-line fishing, which was monitored in **three different areas off the Kerala coast, can** be separated in two distinctly different methods—hand-line or drop-line fishing and long-line fishing. Hand-line fishing is the dominant hook-and-line method used on kattumarams in Trivandrum district where, except for sharks, hand-line fishing is predominantly done with artificial lures. The investment level in hand-lines is below As. 500.

The long-line fishing units, on the other hand, are on all counts of larger size: the crew is not less than four; the craft a plank or dugout canoe and the investment in the gear is usually not below Rs. 1,000. This method usually employs natural baits on the hooks.

10.5.1 The gross earnings per fishing trip were on an average only around Rs. 50 for a *hook-and-line/kattumaram* fishing unit. On a plank or dugout canoe the gross earnings per trip were between Rs. 203 and As. 841 depending on the size of craft and gear and on the duration of the trip. The plank and dugout canoe operating long-lines off Trivandrum coast stay at sea for more than two days and some fish in offshore areas where the depth is 150 metres. The gross earnings per man-hour (Rs. 0.90) of these units did not, however, compare favourably with hook-and-line combinations fishing in less deep waters (As. 2.50). Apparently, the longer times on passage are not sufficiently compensated by higher catches and/or fish prices. Here motorization may be a distinct advantage (Table 25).

10.5.2 The long-line fishing units operating off Kattoor in Alleppey district and off Puthiakadavu in Kozhikode district showed the highest gross earnings per craft and were very efficient in terms of gross earnings per man-hour at sea. This may reflect a relatively rich resources abundance and a high standard of equipment and skill.

In comparison with driftnet units fishing in the same waters, and partly for the same species, hook-and-line fishing was far more profitable, mainly because of lower investment in fishing gear.

10.52 Among the *hook-and-line/kattumaram* units, those from Marianad and Anjengo showed the highest gross earnings per trip per man-hour at sea and during the period of operation. Both villages are famous for the skills of their hook-and-line fishermen. These hook-and-line fishing units attained far higher returns on investment than the large mesh driftnet units fishing in the same waters.

10.6 Specialised gillnets

Three different types of specialised gillnets were monitored in the study, namely anchovy net,

prawn net and sardine net.

10.6.1 *Anchovy-net*

The anchovy is one of the most under-exploited marine resources off Kerala's coast and accounts for 8 to 16 per cent of the fish landings of Trivandrum district. It has been traditionally caught using a cotton gillnet about 150 metres long and 5 metres deep. The investment in a cotton anchovy net is only about Rs. 600 which is what makes it one of the most widely-owned nets in Trivandrum district and almost the first investment that every kattumaram fisherman makes, if he has not already inherited one.

Anchovies being available relatively inshore, a fisherman can often make more than one trip in a day when the season is **on.** However, with repeated use, the cotton net absorbs water, becomes very heavy, the mesh is stretched and the catch potential is reduced. Furthermore, unless it is completely dried before it is used again, the useful life of the net is drastically reduced. Changes to using nylon for making the anchovy net, that would avoid these shortcoming's, have been very slow. The prime reason seems to be the price of such a net. The present price (1981) is about Rs. 2,800 or over four times that of the cotton net, and since the net in any case can be used for only five months, more capital would be lying idle for the rest of the year.

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Table 25

Comparison of hook and line fishing between different fishing villages

	Trivandrum District								Alleppey District			Kozhikode District
	Kattumaram					Average per fishing unit	Plank canoe		Dugout canoe	Plank canoe	Dugout canoe	Dugout canoe
	Puthia-thura	Pullu-villa	Poon-thura	Maria-nad	Anjengo		Pullu-villa	Poon-thura	Poon-thura	Kattoor		Puthiya-kadavu
No. of fishing units selected	2	5	5	5	4	21	4	1	4	3	1	4
Investment per fishing Unit:												
(a) craft	1400	770	615	1347	2494	**1259**	**2625**	**1000**	7500	3167	3000	4063
(b) gear	350	310	275	356	364	327	1194	500	2000	2500	1500	1313
Average No. of crew	2.1	1.8	1.7	2.3	2.7	2.1	12.3	5.6	4.1	6.6	6.5	4.3
No. of fishing trips per year	163	74	125	108	68	101	5	5	15	25	53	76
Average trip time (hrs.)	8	10	9	10	11	10	78	40	54	24	12	12
Average water depth in area of operation(m)	33	40	39	40	35	38	154	68	117	52	17	39
Gross earnings per trip (Rs.)	36	32	27	71	92	49	841	521	411	476	338	203
Gross earnings per man hour at sea (As.)	2.10	1.80	1.80	3.20	3.10	2.50	0.90	2.30	1.90	3.00	4.50	4.10
Gross earnings during period operated (Rs.)	5868	2318	3364	7710	6210	4926	4415	2605	5960	1.1900	17914	*15327*
Per capita crew remuneration (Rs.)	1924	737	1199	2163	1583	1548	252	289	822	796	1278	2229
Return on investment *(%)*	**20**	**21**	**42**	**53**	**22**	**32**	**20**	**17**	0	13	21	28

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In the survey, both nylon and cotton anchovy-nets were monitored in five different fishing villages with the specific intention of assessing their comparative performance. In Pulluvilia, Vettucaud and Thumba only cotton nets were monitored, in Poonthura only nylon nets and in Anjengo one cotton net and one nylon net. The summary results are presented in Table 26.

The average gross earnings per man-hour at sea (Rs. 4.30) per trip (Rs. 33) and during the period of operation (Rs. 2,772) were highest for the three nylon net units fishing off Poonthura. The number of trips was 31 per Cent higher than for the average. However, compared to Putluvilla and Vettucaud the return on investment was lower, owing to the far higher costs of the net. However, while the profitability of the nylon net may not prove to be much more attractive from the owner's point of view, the net social benefit in terms of higher fish landings and greater incomes must be given attention. The large and almost unexploited resource and the fact that anchovies are primarily eaten by low-income consumers may justify subsidies for nylon anchovy nets.

Table 26

Comparison of anchovy-net fishing with kattumaram fishing in different fishing villages of **Trivandrum District**

	Pullu-villa	Poon-thura	Vettu-caud	Thumba	Anjengo	**Average** per fishing unit
No. of fishing units selected	2	3	2	2	2	11
Investment per unit:						
(a) craft	700	950	475	563	1375	825
(b) gear	550	1850	600	425	1000	973
Average No. of crew	2.3	2.3	2.0	1.8	2.8	2.2
No. of fishing trips per year	47	84	62	41	24	54
Average trip time (hrs.)	5	3	2	3	3	3
Average water depth in area of operation (m)	13	20	16	19	16	**17**
Gross earnings per trip (Rs.)	32	33	19	15	32	27
Gross earnings per man hour at sea (Rs.)	3.00	4.30	4.30	2.70	3.60	3.80
Gross earnings during period operated (Rs.)	1488	2722	984	615	768	1488
Per capita crew remuneration (Rs.)	389	696	272	193	173	384
Return on investment *(%)*	23	21	43	0	—4	14

10.6.2 *Prawn-net*

The artisanal prawn-net fishery was not very profitable in 1980/81. The return on investment was on an average only 6 per cent for *prawn-net/kattumaram* units in Trivandrum district and 17 per cent for the *prawn-net/dugout* units fishing off Tangasserri in Quilon district (Table 27).

The average gross earnings per trip varied between Rs. 20 in Thumba and Rs. 127 in Puthiathura. In prawn fishing with gillnets a lot depends on luck; one or two trips may be successful, as shown in the case of Puthiathura, but may be foltowed by long periods of non-availability or non-accessibility of the prawn resources to this fishing method. In spite **of** the gear being called the prawn-net, the largest part of the catch is of fish species like *lactarius* and *sciaenids.*

On a yearly basis, the average gross earnings varied between As. 254 in Puthiathura (fishing with the kattumaram) and As. 3,463 in Tangasserri (fishing from dugout canoes). The highest gross earnings during the period of operation with kattumaram were attained in Marianad (Rs. 2,258).

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Table *21*

Comparison of prawn not fishing between different fishing villages

	Trivandrum district				Average per fishing unit	Quilon district
	Kattumaram					Dugout canoe
	Puthia-thura	Vettu-caud	Thumba	Marianad		Tangasserri
No. of fishing unitsselected	2	3	2	2	9	2
Investment per fishing unit:						
(a) craft	450	347	**625**	**1338**	**652**	**1725**
(b) gear	750	1083	575	1525	994	900
Average No. of crew	1.8	1.1	1.0	1.7	1.3	3.0
No, of fishing trips per year	2	34	83	65	45	69
Average trip time (hrs.)	6	**7**	**10**	**8**	**8**	**5**
Average water depth in area of operation (m)	14	20	25	29	25	18
Grossearningspertrip(Rs.)	127	23	20	35	26	51
Gross earnings per man hour at sea (Rs.)	11.70	3.00	1.90	2.50	2.40	3.20
Gross earnings during period operated (Rs.)	254	790	1660	2258	1180	3463
Per capita crew remuneration (Rs.)	28	352	**718**	**654**	**423**	**797**
Return on investment (%)	—4	6	22	6	6	17

10.6.3 *Sardine net*

Among the specialised gillnets, the sardine net was one of the better-performing gears. This was in spite of the fact that 1980/81 was a poor year for oil sardines. The average return on investment was 27% for *sardine-net/kattumaram* combinations,, 48% for dugout canoes fishing with sardine nets in Quilon district and 16% for those fishing in Kozhikode and Cannanore districts. The latter ones were monitored only between August and January (Table 28).

Among the kattumarams using this gear, the fishing units off Puthiathura and Vettucaud achieved the highest average gross earnings during the period of operation (As. 2,803 and Rs. Rs. 2,744), largely because they make more trips. On a per trip and per man-hour basis, the fishing units of the same two fishing villages showed the poorest results, which may indicate that the fishermen continued to fish by this method even during those periods of the year when fishermen from other villages had shifted to different and, probably, more rewarding fishing methods. The ability to switch to another fishing method depends of course on the possession of the necessary gear and on knowledge of other fishing techniques.

Among the dugout canoes fishing with sardine nets, the units operating off Tangasserri in Quilon district and Puthiyakadavu in Kozhikode district attained the highest gross earnings during the period of operation (Rs. 9,558 and Rs. 7,038). On a per trip basis the canoes of Tangasserri performed rather poorly. This may be attributed to the smaller net used, as indicated by the far lower investment in fishing gear.

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Table 28

Comparison of sardine net fishing between different fishing villages

	Trivandrum District				Average per fishing unit	Quilon District	Kozhikode/Cannanore Districts			Average per fishing unit
	Kattumaram					Dugout canoe	Dugout canoe			
	Puthiya-thura	Vettu-caud	Thumba	Anjengo		Thanga-sserri	South-bead	Puthiya-kadavu	Chalil	
No. of fishing units selected	2	3	4	2	11	4	4	5	3	12
Investment per fishing unit:										
(a) craft	350	633	588	450	532	1850	2000	2430	1817	2133
(b) gear	1350	1467	988	1500	1277	1425	2750	3480	1933	2850
Average No. of crew	1.5	1.1	1.4	2.0	1.4	4.2	3.0	3.7	2.7	3.3
No. of fishing trips per year	148	131	81	34	98	162	76	68	46	65
Average trip time (hrs.)	8	11	9	9	9	6	6	8	11	7
Average water depth in the area of operation (m)	23	22	30	21	25	14	10	11	13	11
Grossearningspertrip(Rs.)	19	21	23	52	23	59	63	105	68	82
Gross earnings per man hour at sea (As.)	1.60	1.70	1.90	2.80	1.80	2.40	3.80	3.60	2.20	3.30
Gross earnings during period operated (As.)	2803	2744	1852	1768	2260	9558	4757	7098	3151	6396
Per capita crew remuneration (Rs.)	1100	1060	587	422	791	1584	1012	1362	740	1114
Return on investment (%)	34	46	17	9	27	48	16	8	3	16

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11. SEASONAL ANALYSIS

The results of analysis presented so far were all based on the annual aggregation of the data for the various combinations. This chapter presents a more disaggregated picture of some of the important aspects of performance, both of the whole samples and of some of the combinations.

Each of the four parts of this chapter discusses a particular aspect of monthly changes in performance, which may be regarded as seasonal variations. In the first part, the pattern of the aggregated monthly landings is presented in order to give an overall idea of the broad variations in district-wise and sector-wise landings over the year. The second part deals with certain craft-gear combinations and their performance over the four seasons into which the year can be divided. A discussion of the monsoon months in Trivandrum District is presented in the third part. The fourth part will illustrate a different kind of point: the use of the disaggregated analysis to demonstrate that, given a study like the present, operating costs can thereafter be estimated from gross earnings.

11.1 Monthly analysis of landings

11 .1.1 The sample units in the study cannot be used to estimate the overall performance of the aggregated fishing unit population of Kerala, nor was the study intended to be used for such an estimation. However, considering the geographic and technological spread of the sample units, it is fairly reasonable to assume that certain characteristics of the sample will reflect the broad patterns of behaviour of entire fleets during the year under study.

Monthly fluctuations in catch may be caused by the weather or by the availability of fish. The data, consolidated at the monthly level and kept separate for the two sectors— artisanal and mechanised—and also separated into districts, were used to plot the monthly variations in catch landed by all the units in the sample (Figure 8).

11.1.2 The graph highlights the important fact that there are two peaks and two troughs in a fishing year. The two peaks are in April—May and September—November; the troughs in January—February and June—July. The success of a fishing year will depend largely on the heights of the peaks and the depths of the troughs.

The monsoon trough (June—July) is primarily due to the inability of most fishing units to get across the surf. Fishing in general remains suspended during this period. The post-monsoon flush (September—November) can be primarily accounted for and attributed to the shorewards movement of fish as a result of the blooming of plankton caused by the upwelling during the monsoon season.

The decline in catches during January—February is attributed to the offshore movement of fish and to the fact that the sea is generally very calm and clear during this period. Nets, however camouflaged, are visible to the fish and they tend to avoid them.

The revival of catches in the pre-monsoon months (April—May) reflect more favourable oceanographic conditions in respect of oxygen content, water temperature and plankton production prior to the monsoons. Fish move shorewards again and fishing yields better results.

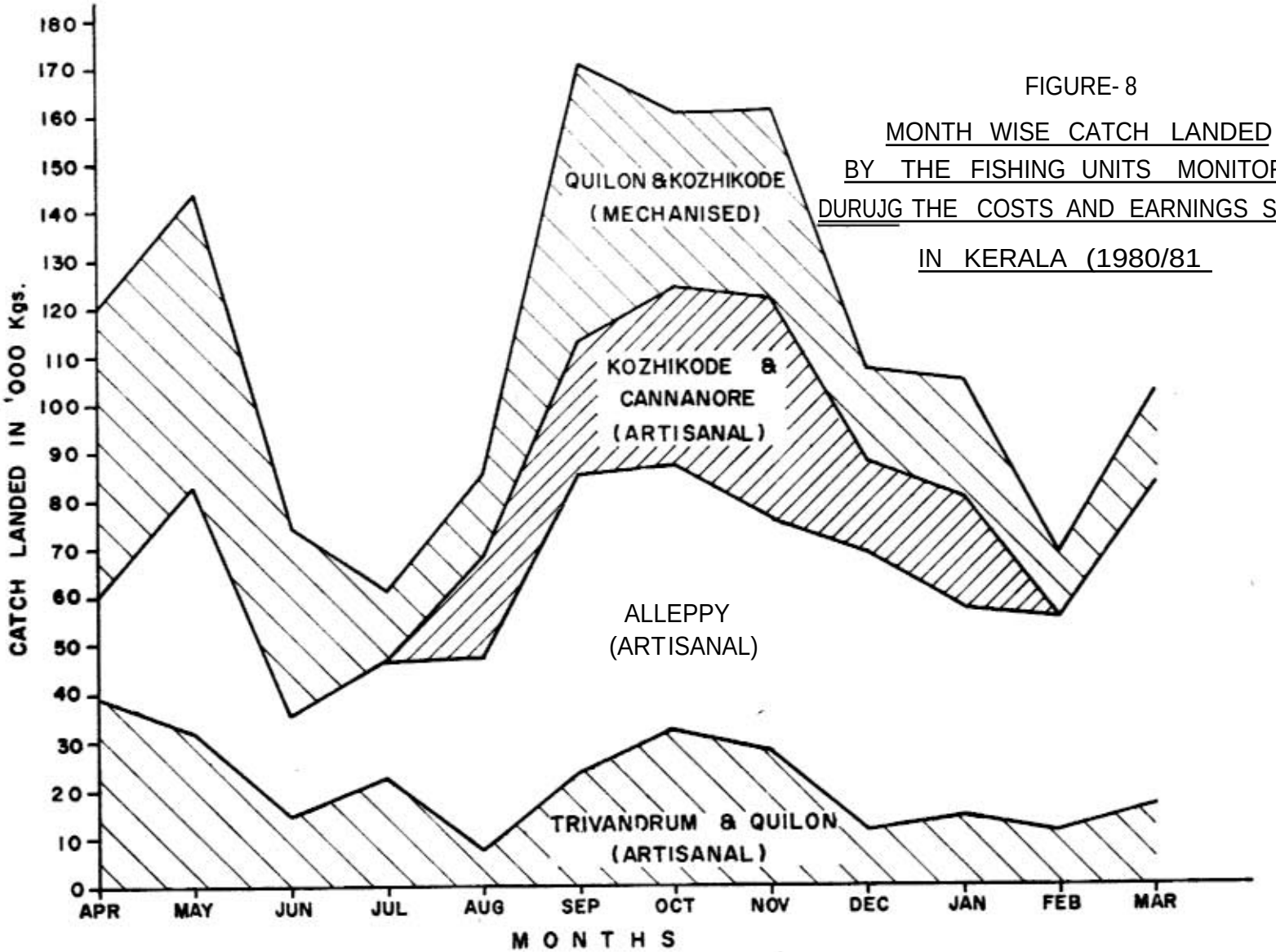
11.2 Variations in catch and gross earnings over the seasons

11.2.1 The seasonal variations in catches in the small fisheries of Kerala described earlier above have been analysed in greater detail by dividing the year into four seasons based on the phenomenon of the monsoon. They are (i) the pro-monsoon period from March to May (ii) the monsoon peak period from June to August (iii) the post-monsoon period from September to November and (iv) the calm period from December to February.

Six different craft-gear combinations have been analysed as regards the variations in their catch, costs, prices received and gross earnings during the four quarters of the year. The figures in the

FIGURE- 8

MONTH WISE CATCH LANDED BY THE FISHING UNITS MONITORED DURUJG THE COSTS AND EARNINGS STUDY IN KERALA (1980/81



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tables are for the average (mean) month of the particular quarter. The performance of a craft-gear combination during any season is primarily a function of the number of fishing trips it can undertake, the availability of fish and the prices at first sales.

11.2.2 The *driftnet/kattumaram* (Table 29) operates all the year round. As regards catch and gross earnings the performance is fairly good during the pro-monsoon, monsoon peak and post-monsoon periods. Average catch varies from 96 kg to 238 kg and average earnings from Rs. 315 to Rs. 410 for the mean month. The smaller variations in the earnings is due to the strong inverse relationship between price and catch. The price during the peak catch of the pre-monsoon period is on the average only Rs. 1.72 and this increases by 90 per cent to Rs. 3.28 while the average catch drops by about 60 per cent during this period. The total operating costs during these three periods vary a little less than the gross earnings,, by about 15 per cent.

Table 29

Seasonal variations **in catch, gross earnings and operating costs for** driftnet-kattumaram units

Items \ Seasons	Monthly averages for the quarter per fishing unit			
	Pro-monsoon (March—May)	Monsoon-peak (June—Aug.)	Post-monsoon (Sept.—Nov.)	Calm (Dec.—Feb.)
No.oftrips ..	7	2	6	1
Catch (kg) ..	238	96	176	8
Price (Rs.) ..	1.72	3.28	2.07	2.50
Gross earnings (Rs.) ..	410	315	364	20
Operating costs (Rs.)	80	79	69	6

The calm season results in a drastic drop in the average catch, gross earnings and operating costs. Price shows a relative increase, moving from Rs. 2.07 to Rs. 2.50. Operating costs decrease with the drop in gross earnings; the main reason for this is the reduction in the number of trips undertaken during this period. The reduction in trips is an indication of the non-availability of fish and possibly also of the fishermen switching to other craft-gear combinations which give higher returns.

11.2.3 *Hook-and-line/kattumaram* combinations (Table 30) operate all the year round, but only very few fishermen do so: the most popular months of operation are during the post-monsoon months of September to November till the middle of the pro-monsoon period.

Table 30

Seasonal variations in **catch, gross earnings and operating costs for hook and** line kattumaram units

Items \ Seasons	Monthly averages for the quarter per fishing unit			
	Pre-monsoon (March—May)	Monsoon-peak (June—Aug.)	Post-monsoon (Sept.—Nov.)	Calm (Dec.—Feb.)
No. of trips ..	**10**	**3**	**12**	**9**
Catch (kg) ..	124	88	268	99
Price (Rs.) ..	**2.66**	**2.63**	*2.56*	**3.12**
Grossearnings(Rs.) ..	330	230	680	309
Operating costs (Rs.)..	70	53	109	58

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Average catch and gross earnings are at low levels in the pre-monsoon months: 124 kg and As. 330 respectively for the mean month of the quarter. This further declines to 88 kg and Rs. 230 in the monsoon period with the reduction in the number of trips from 10 **to** 3. The doubling of the catch and gross earnings on a trip basis during the monsoon period indicates that there is probably more fish to catch provided one can cope with the monsoon seas.

In terms of the average earnings and catch for the mean month, the post-monsoon period is the best. The more favourable weather and the fact that this is the cuttlefish season makes hook-and-line fishing more widespread. The average number of trips per month increases from 3 during the monsoon period to 12 in the post-monsoon period, It is interesting to note that price remains fairly steady during the pre-monsoon, monsoon and post-monsoon periods.

In calm season, while the number of trips drops from 12 to 9 per month, the average catch drops by 63 per cent. Since the price rises from As. 2.56 to Rs. 3.12 per kg the drop in average gross earnings is only 50 per cent. The average operating costs also drops to Rs. 58, half the post-monsoon level of Rs. 109.

11.2.4 *Boat-seine/kattumaram* combinations (Table 31) rarely operate for more than 7 to 8 months of the year. Boat seines are brought into operation normally during the last week of May and continue in operation normally until October and sometimes into November. The data confirm that the results of the boat-seine fishing, judging from the number of fishing trips undertaken, must have been very poor in 1980. The analysis in the earlier chapters bears this out.

Table 31

Seasonal variations in catch, gross earnings and operating costs for boat-seine-kattumaram units

Items \ Seasons	Monthly averages for the quarter per fishing trip			
	Pro-monsoon (March—May)	Monsoon-peak (June—Aug.)	Post-monsoon (Sept.—Nov.)	Calm (Dec.—Feb.)
No. of trips ..	1	6	3	0
Catch (kg) ..	20	448	128	0
Price (Rs.) ..	2.15	2.00	2.06	0
Gross earnings (As.) ..	43	899	264	0
Operating costs (Rs.) ..	8	164	39	0

In the month of May in the pre-monsoon period the average unit operated only for a single fishing trip, caught 20 kg of fish at As. 2.15 per kg and earned (gross) Rs. 43 at an operating cost of As. 8. The number of trips in the monsoon months increased to 6 and the total catch to 448 kg for the month or about 75 kg for the trip. With the price remaining steady the average gross earnings for the mean month were about Rs. 900 for a fishing unit. The average operating costs increased to Rs. 164 or about As. 27 per trip. The ratio of operating costs to gross earnings in the pro-monsoon and monsoon periods remained the same at 18 per cent. In the post-monsoon months there is a reduction in the fishing trips to 3 per month and of the average catch to 128 kg or only 43 kg for a trip. This 70 per cent decline in catch results in an equal reduction in average gross earnings although there is a marginal increase in the price. This tapering away of catch and gross earnings results in the stoppage of the boat-seine activities during the calm months of December to February. Once boat seining with kattumarams stops, fishermen shift to hook-and-line, shore seines and other small gillnets.

11.2.5 *Shore-seine/plank canoe* combinations (Table 32) operate during all except the three peak monsoon months. Number of trips, catch, gross earnings and operating costs are

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highest in the pre-monsoon months. The monthly average catch for this quarter is just over 1200 kg or about 64 kg per trip. Average earnings at a price of As. 2.47 amount to just above Rs. 3000 or Rs. 158 per trip. Average operating costs total As. 738 and are around a quarter of the earnings. Fishing operations are completely suspended during the monsoon. The shore-seine is brought out into operation again during September. In this post-monsoon period number of trips, catch, price and gross earnings are lower than during the pre-monsoon period. On a trip basis, although the catch is higher — 68 kg — average gross earnings for the mean month drop by 37 per cent because of a fall in price to As. 1.98 per kilogram, inspite of the fact that this is the period when the larger varieties of fish are caught. The ratio of operating costs to earnings remains nearly the same.

Table 32

Seasonal variations in catch, gross earnings and operating costs for shore-seine-plank canoe units

Seasons / Items	Monthly averages for the quarter per fishing unit			
	Pre-monsoon (March—May)	Monsoon-peak (June—Aug.)	Post-monsoon (Sept.—Nov.)	Calm (Dec.—Feb.)
No. of trips ..	19	0	14	16
Catch (kg) ..	1217	0	960	509
Price (As.) ..	2.47	0	1.98	3.48
Gross earnings (Rs.) ..	3006	0	1904	1774
Operating costs (Rs.) ..	738	0	488	480

In the calm season more fishing operations are possible but the average landing from a single operation and for the mean month is less than in the previous season. There is however a marked improvement in price which is primarily a reflection of the supply and demand situation during this season. Hence, though average monthly catch drops by about one half, the gross earnings decline only by 7 per cent. Average operating costs and earnings are more or less in the same ratio, the former being one quarter of the latter.

11.2.6 *Encircling net/plank canoe* combinations (Table 33) operate all the year round in Alleppey district, where the monsoon surf is not as rough as in Trivandrum. They are used when shoating fish moves inshore into the shallow water. Catches for the mean month are lowest in the pre-monsoon season (1625 kg) and increase through the monsoon (1977 kg) to reach a peak in the post-monsoon months (2910 kg) and drop again in the calm season (2270 kg). Average gross earnings for the mean month follow a different pattern because prices are highest during the monsoon, reflecting partly the supply and demand position and partly the landing of prawns during this period. They increase about 250 per cent with a mere 22 per cent increase in catch between the pre-monsoon and monsoon periods. The average gross earnings in the post-monsoon period fall as the price declines. Prices and catches drop further in the calm season.

The drop in the catch during the calm season and the further decline into the pre-monsoon season are indications of diminishing availability of fish, During these periods fishermen shift occasionally to the small mesh driftnets, which can be used in deeper waters.

11.2.7 Mechanised trawlers (Table 34) fish all the year round. Being mechanised and proceeding to sea from protected harbours, they are relatively less susceptible to rough weather and heavy surf.

The maximum number of fishing trips — 15— was for the mean month of the pre-monsoon period. The number of trips gradually fall through the subsequent periods to 9 trips in the calm season.

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Table 33

Seasonal variations in catch, gross earnings and operating costs for encircling nets-plank canoe units

Items \ Seasons	Monthly averages for the quarter per fishing unit			
	Pre-monsoon (March—May)	Monsoon-peak (June—Aug.)	Post-monsoon (Sept.—Nov.)	Calm (Dec.—Feb.)
No. of trips ..	7	12	10	7
Catch (kg) ..	1625	1979	2910	2270
Price (Rs.) ..	1.17	3.30	1.66	0.98
Gross earnings (As.) ..	1909	6540	4832	2237
Operating costs (Rs.) ..	425	977	684	539

Table 34

Seasonal variations in catch, gross earnings and operating costs for trawl net-mechanised boat units

Items \ Seasons	Monthly averages for the quarter per fishing unit			
	Pre-monsoon (March—May)	Monsoon-peak (June—Aug.)	Post-monsoon (Sept.—Nov.)	Calm (Dec.-Feb.)
No. of trips ..	15	13	12	9
Catch (kg) ..	1426	3452	1003	497
Price (As.) ..	6.25	3.50	5.57	7.12
Gross earnings (As.) ..	8907	12439	5593	3540
Operating costs (Rs.) ..	7004	6595	5585	4970

The average landings for the month were 1452 kg in the pre-monsoon period and rose by 142 per cent to 3452 kg during the monsoon. The average catch per trip of 265 kg during the monsoon was the highest during the year; it was 83 kg for the mean month of the post-monsoon period and 55 kg per trip during calm periods. Average gross earnings follow the same pattern as the catch. They increase during the average pre-monsoon month from Rs. 8,900 to As. 12,440 in the monsoon — a 40 per cent increase. Thereafter they decline to Rs. 5,590 and then to Rs. 3,540 for the mean month of the calm period.

The decline in average gross earnings after the peak monsoon period is less than the decline in the catch. This is due to the increase in the price from Rs. 3.60 to Rs. 7.12 during this period.

In contradistinction to the non-mechanised fleets, the total operating costs of the trawlers constitute a high percentage of gross earnings. In the calm season they are as much as 40 per cent more than gross earnings.

11.3 The monsoon months — further discussion

11.3.1 While during the monsoon period rough seas affect the whole coastline of Kerala, the Trivandrum district experiences higher waves and stronger littoral currents, partly owing to the sharper gradient and configuration of the continental shelf.

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11.3.2 However, although crossing the surf is difficult and dangerous, once at sea the fishermen are assured of a good catch. Several factors contribute to this. Firstly, in the monsoon months there is a general shoreward shift of fish because of the upwelling and the consequent increase in plankton production: pelagic plankton feeders move in, followed closely by their predators, Second, in the churned-up seas, nets are less easily avoided. Third, the fact that fewer fishermen are at sea may lead to an increase in the catch of those fishing units that do brave the elements.

11.3.3 The likelihood of better catches and the high prices during the monsoon period drives fishermen to take greater risks, and this is particularly true for the kattumaram fishermen in Trivandrum. They are willing to push their loaded kattumaram off high piers or to spend Rs. 30 every day to transport their craft to a protected bay from where they can launch them in safety. The number of trips made by a typical unit during these months is generally very low, but if a trip is made, the catch is generally higher than in the other months; this and the high prices at first sales during the monsoon months justify the effort and risk. This is illustrated with the help of Figures 9—11.

11.3.4 From Figure 9 it can be seen that with the exception of the *boat-seine/kattumaram* combination, the combinations studied make a smaller number of trips during the peak monsoon period. Kattumarams operated with the prawn net, driftnet and hook-and-line during the monsoon make only half the number of trips as compared with their yearly average.

11 3.5 From Figure 10 it can be seen that the average landing per trip by all combinations during the monsoon is nearly double their annual average. That the same is true of the average gross earnings per man-hour at sea can be seen in Figure 11.

11.4 Predicting operating **costs from** gross earnings

11.4.1 In industries where the production process is standardized and supplies of raw materials and other inputs are readily available, it is possible for the industry, or the individual firm, to control the level of output. The direct costs of production per unit of output either do not vary much with level of output, or vary in a predictable way. Total costs are thus strongly correlated with total output and are thus predictable and controllable provided costs of inputs are predictable.

In the capture fisheries very little control **of** the production process is possible and it is not possible to predict even within wide limits what the catch will be on a single trip, or (in many cases) the duration of the trip, or the prices that will be paid at first sales. Neither is it possible to predict total output from a fishery in the short term, or to control it; even in the longer term the methods of prediction and management so far developed, and applied in some fisheries, are not by any means precise.

It might therefore be assumed, at first sight, that the relationship between output and operating costs is also stochastic. However, over the longer term, some definite relationship between average costs and average gross earnings is likely to become established. (Operating costs are defined here as those costs remaining after the fixed (capital-related) costs and crew remuneration have both been deducted from total costs). In a marine fishery, with free entry, the entry of additional vessels will tend to continue until average profits are driven down **to** some acceptable norm, or even to the barely-tolerable level where the average profit is approaching zero, as the classic economic analysis of the free-entry common-resource fishery suggests. In such cases, since average profits bear some such normal relationship to capital, so **do** gross earnings and total costs. Labour costs are usually strongly correlated with earnings through the system of remuneration of the crew. Hence operating costs should also exhibit a correlation with capital and with gross earnings. In the case of mechanised vessels, a great part of the operating costs are those of fuel and maintenance, strongly correlated with capital cost. Hence if average profits tend to some norm, operating costs will have a strong correlation with gross earnings.

11.4.2 The foregoing, however, relates to the longer term. What has become apparent in the present study is that it may be possible **to** predict operating costs from gross earnings over quite short periods and after much shorter surveys than the present one. It will never be possible to predict the relationship between costs and earnings for an individual fishing trip, except perhaps

FIGURE 9

AVERAGE TRIPS PER CRAFT OPERATING IN THE RESPECTIVE MONTHS

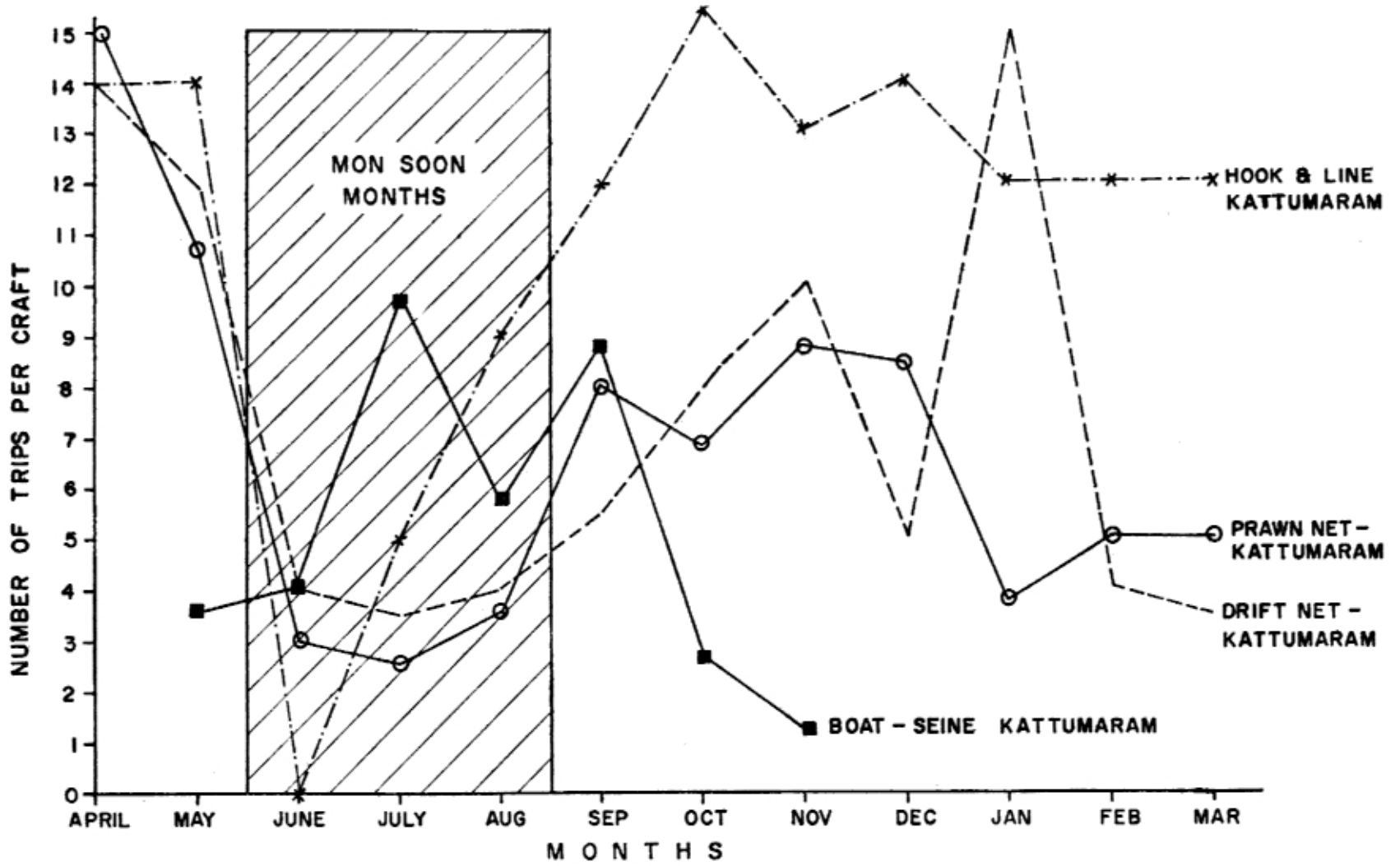

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FIGURE - 10

AVERAGE CATCH PER TRIP IN THE RESPECTIVE **MONTHS**

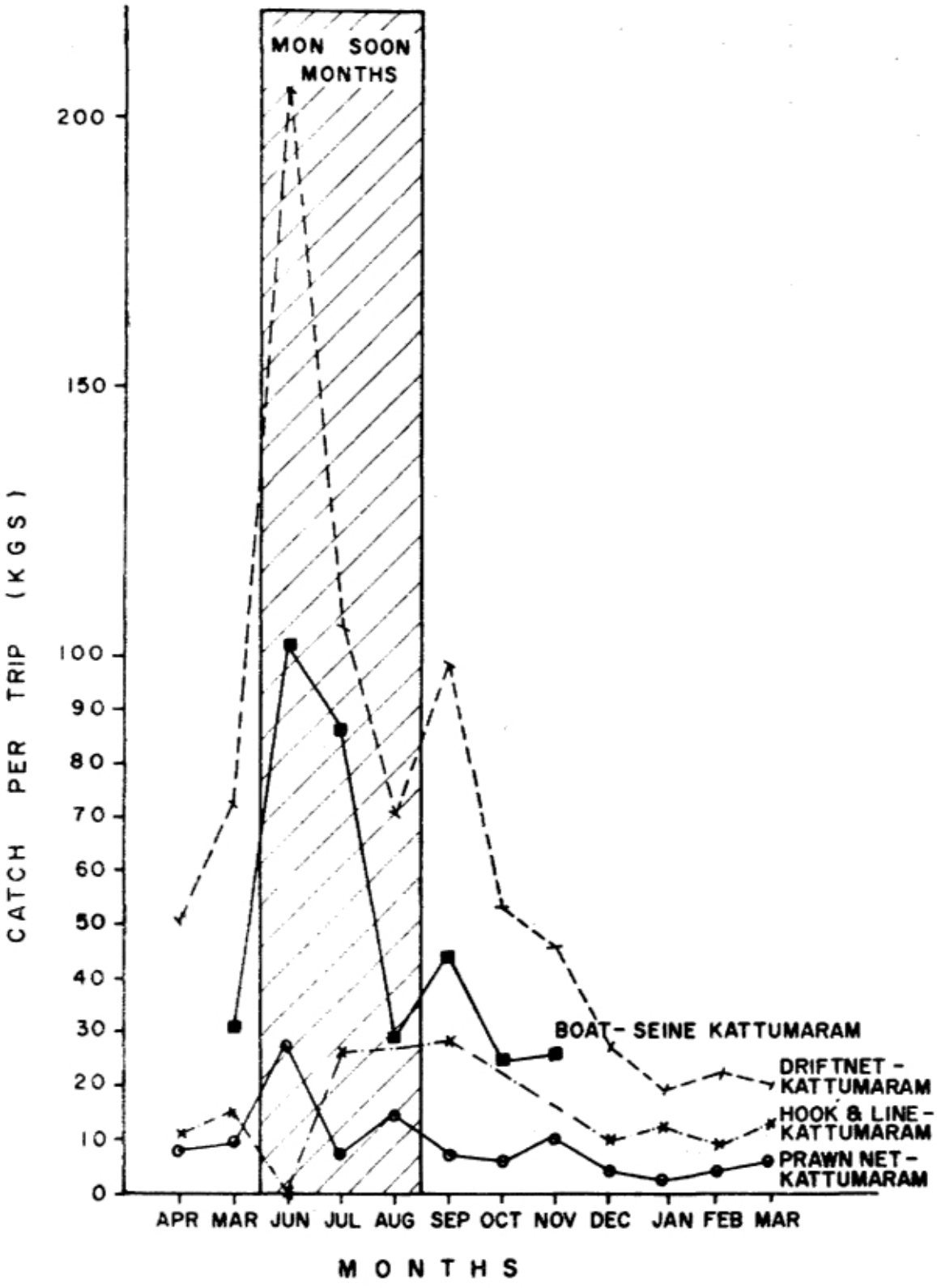
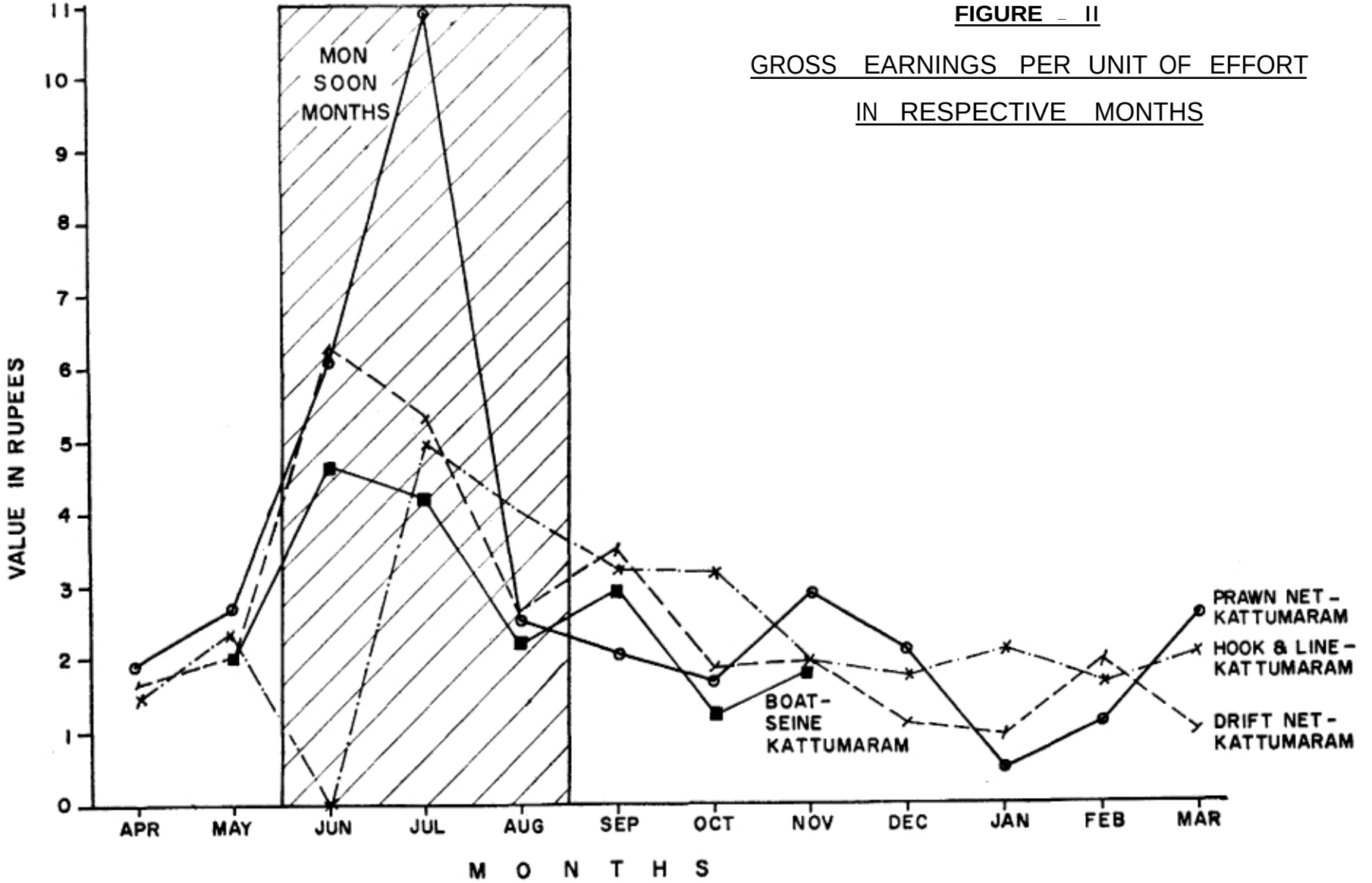


FIGURE – II

GROSS EARNINGS PER UNIT OF EFFORT IN RESPECTIVE MONTHS



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as a probability distribution, but the study suggests that the relationship between the average operating costs and average gross earnings for a number of units is constant from month to month and can therefore be deduced from gross earnings over periods as short as a month.

Two factors account for this: (a) there is an adjustment process between operating costs and earnings. Operating costs in fishing are incurred at two points in time — before and during the fishing trip when the gross earnings are still not finally known, and after the trip, when the value is realised. Costs incurred during the fishing trip such as expenditures on bait and fuel are probably not fully 'controllable' at the level of the individual trip. However, the prevalence of the sharing system, which in Kerala includes a sharing of operating costs as well, ensures that these costs are closely monitored, managed and minimised by the crew even in the absence of owners. For example, on a mechanised boat, if after trawling for a while the crew find the returns rather low, they think very hard before making further tows; they know fully well that costs without returns will only reduce their own earnings. This process of 'self-supervision' leads to a strong relationship between operating costs and gross earnings although the latter are not completely predictable; (b) there are many operating costs which are always proportional to gross earnings. as they are incurred only after the completion of the trip and the realisation of the gross earnings, commission for marketing the fish; traditional taxes; food and drink for the crew, and repair and maintenance of the craft and gear are the main items of expenditure. It is an observable fact that these items are either directly or notionally proportional to the earnings. It is interesting to note that in these circumstances, in Keala, major maintenance and repair jobs, if they can possibly be postponed, have to wait for a period with higher gross earnings. (In other fisheries with sharing systems differing in detail from those prevailing in Kerala, the annual lay-up for maintenance is in the season of lowest earnings.)

11.4.3 The month-wise data on total operating costs and gross earnings for six craft-gear combinations are given in Table 35. In Figures 12—17 the linear regression lines are plotted and the co-efficient of determination (r^2) indicated: these show that a very significant amount of the variation in the costs is determined by variations in the gross earnings.

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FIGURE -12

RELATIONSHIP BETWEEN TOTAL OPERATING COSTS AND GROSS EARNINGS FOR THE ENCIRCLING NET PLANK CANOE

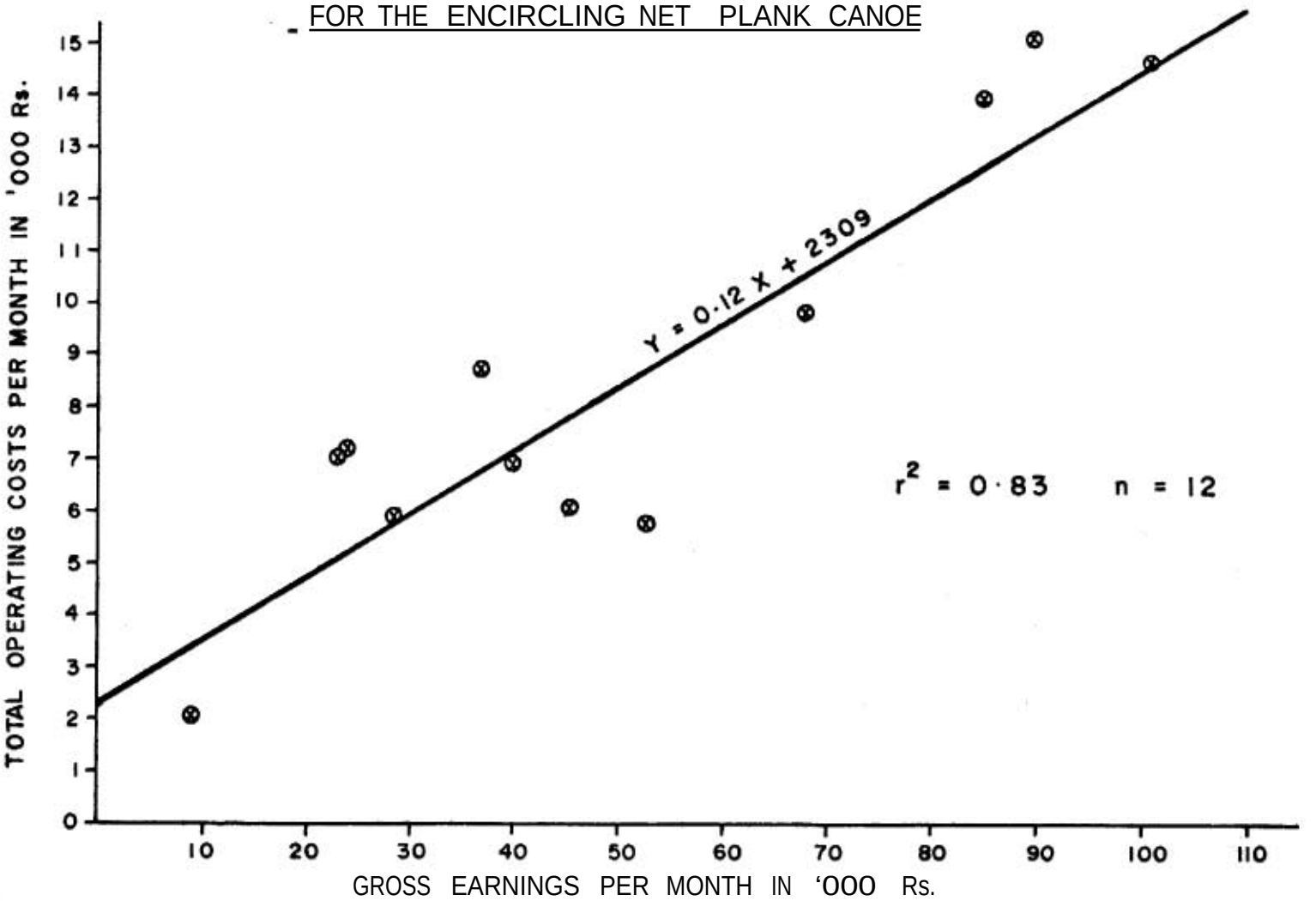

Table 35

Relationship between total operating Costs and gross earnings for certain select craft-gear combinations *(in Rupees)*

		April 1980	May	June	July	August	September	October	November	December	January 1981	February	March
Trawl mechanised boat	Total operating cost	194,071	258,434	119,274	250,107	224,196	193,305	149,324	160,037	164,169	148,961	134,218	177,898
	Gross Earnings	195,877	461,333	183,504	528,959	407,090	272,362	103,175	127,941	85,299	115,736	117,613	144,532
Hook & line-dugout canoe	Total operating cost	590	622	—	—	830	1.988	1,995	1,457	253	497	336	66
	Gross earnings	3,350	4,162	—	—	2,605	6,855	5,665	1,813	349	1,142	1,281	1,959
Canoe	Total operating cost	2,058	5.796	13,854	14.492	9,768	14,986	5,725	5,971	6,875	7.033	7,134	8.737
	Grossearnings	9,144	28.632	85.611	101,400	68,047	89,907	52,880	45,780	40,375	22,900	24,005	36,973
Cotton shore seine-plank canoe	Totaloperating cost	11,444	8,455	—	—	—	4,849	5,591	8.602	5.088	8,266	5,355	8.885
	Grossearnings	53,121	27,192	—	—	—	9,285	27,183	37,811	13.586	32,375	23,238	37,020
Prawn net-kattumaram	Total operating cost	656	511	97	103	136	96	156	213	140	19	23	21
	Grossearnings	2,050	2,193	312	520	439	320	568	1.268	803	61	136	415
Driftnet-kattumaram	Total operating cost	1,975	1,752	2,453	643	703	1,080	1,005	1,226	250	24	20	95
	Gross earnings	9,901	9,410	9,613	2,228	3,279	5,933	5,338	6,306	761	114	88	407

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FIGURE– 13

RELATIONSHIP BETWEEN TOTAL OPERATING COSTS AND GROSS EARNINGS FOR THE SHORE SEINE-PLANK CANOE

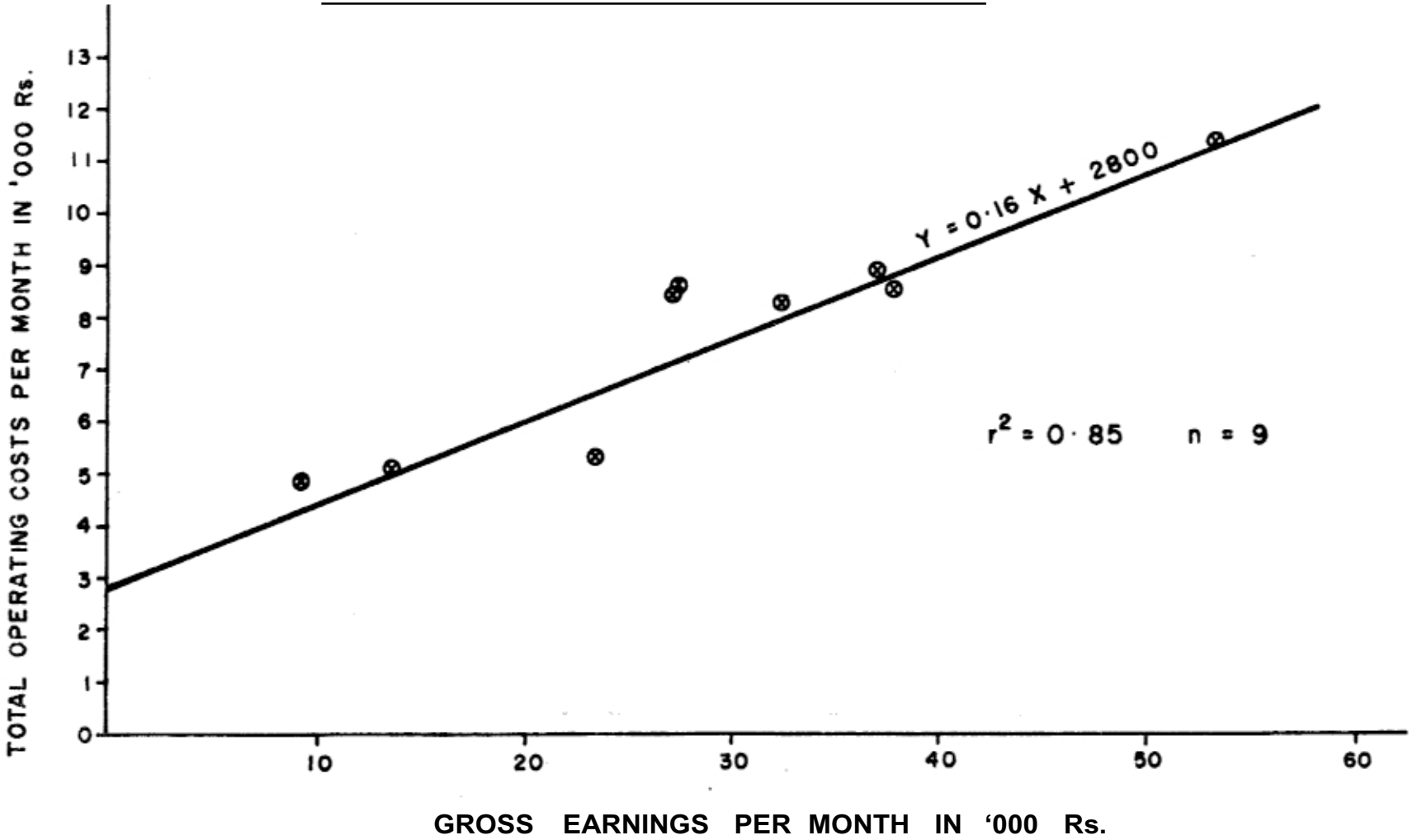

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FIGURE- 14

RELATIONSHIP BETWEEN TOTAL OPERATING COSTS AND GROSS EARNINGS FOR THE DRIFTNET-KATTUMARAM

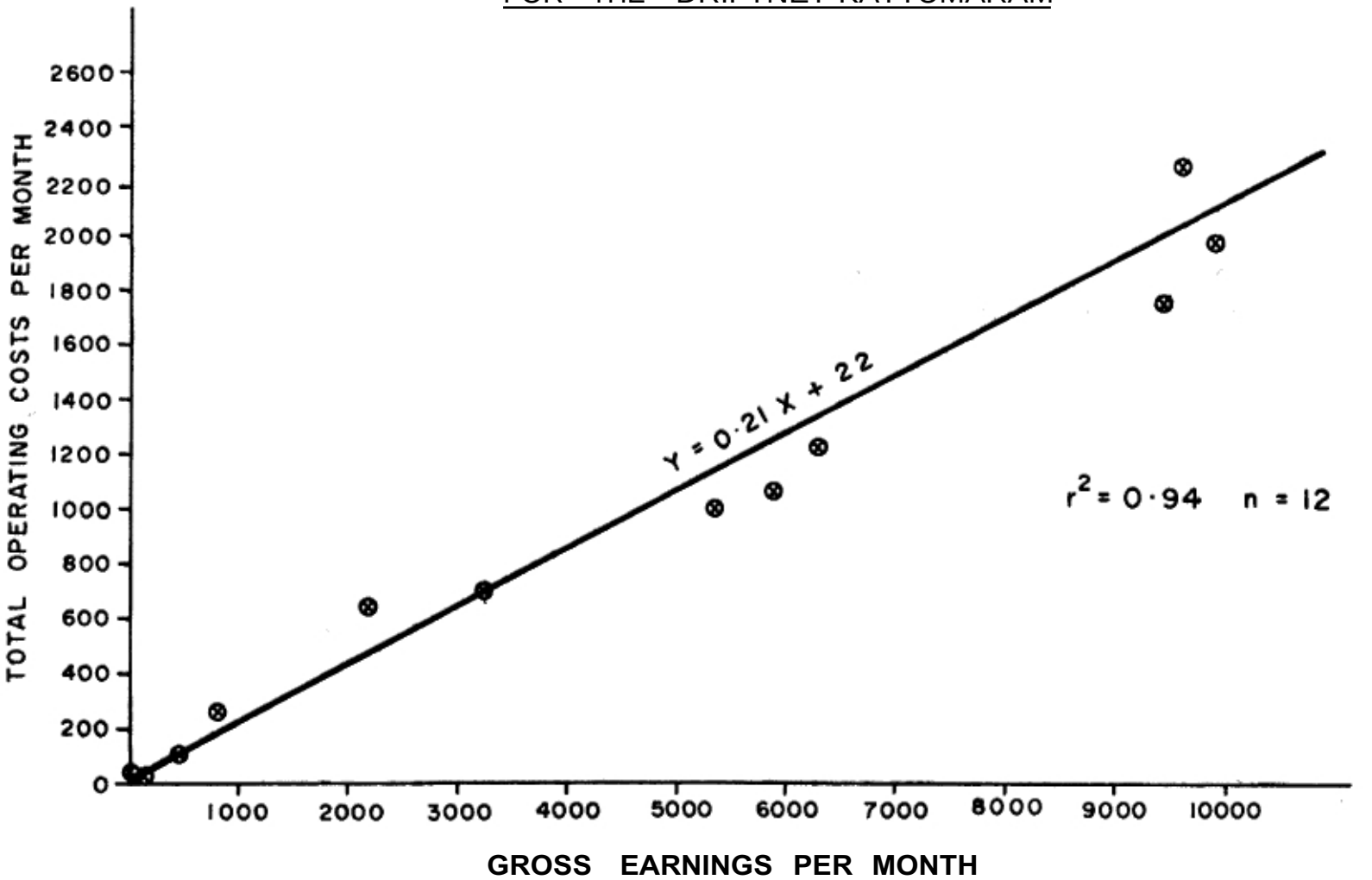

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FIGURE -15

RELATIONSHIP BETWEEN OPERATING COSTS AND GROSS EARNINGS FOR THE PRAWN NET-KATTUMARAM

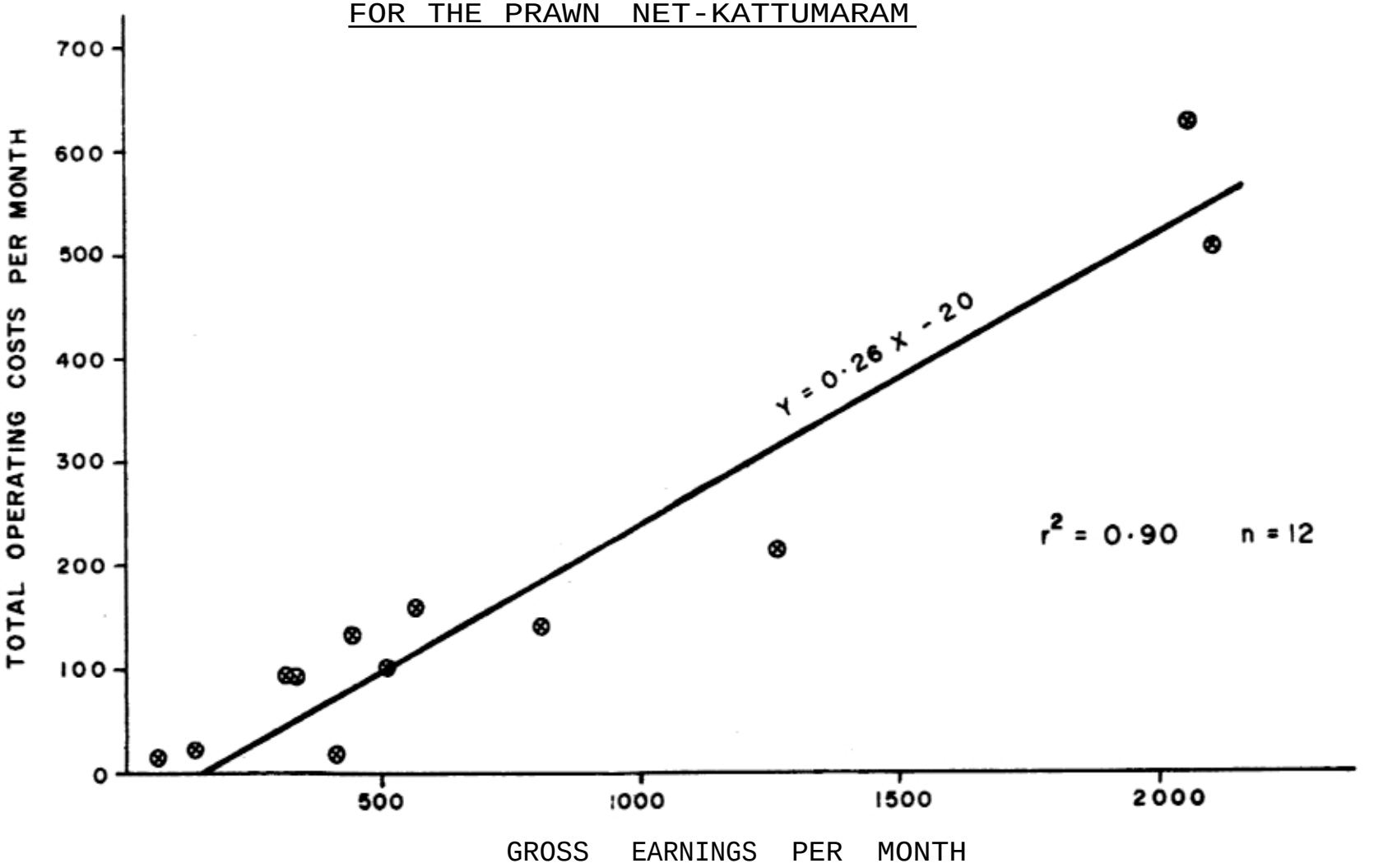

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FIGURE -16

RELATIONSHIP BETWEEN TOTAL OPERATING COSTS AND GROSS EARNINGS FOR THE TRAWLNET—MECHANISED BOAT

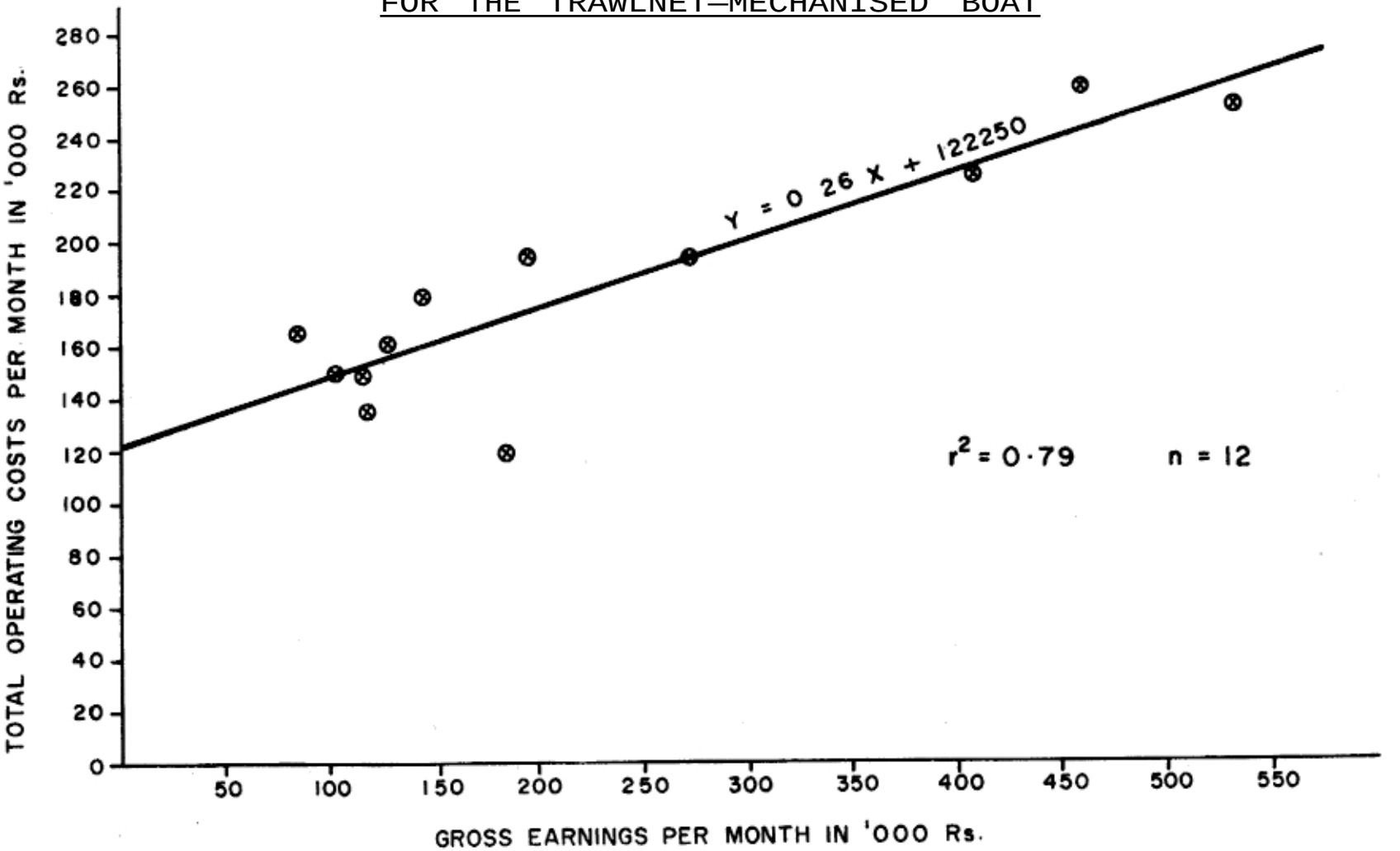

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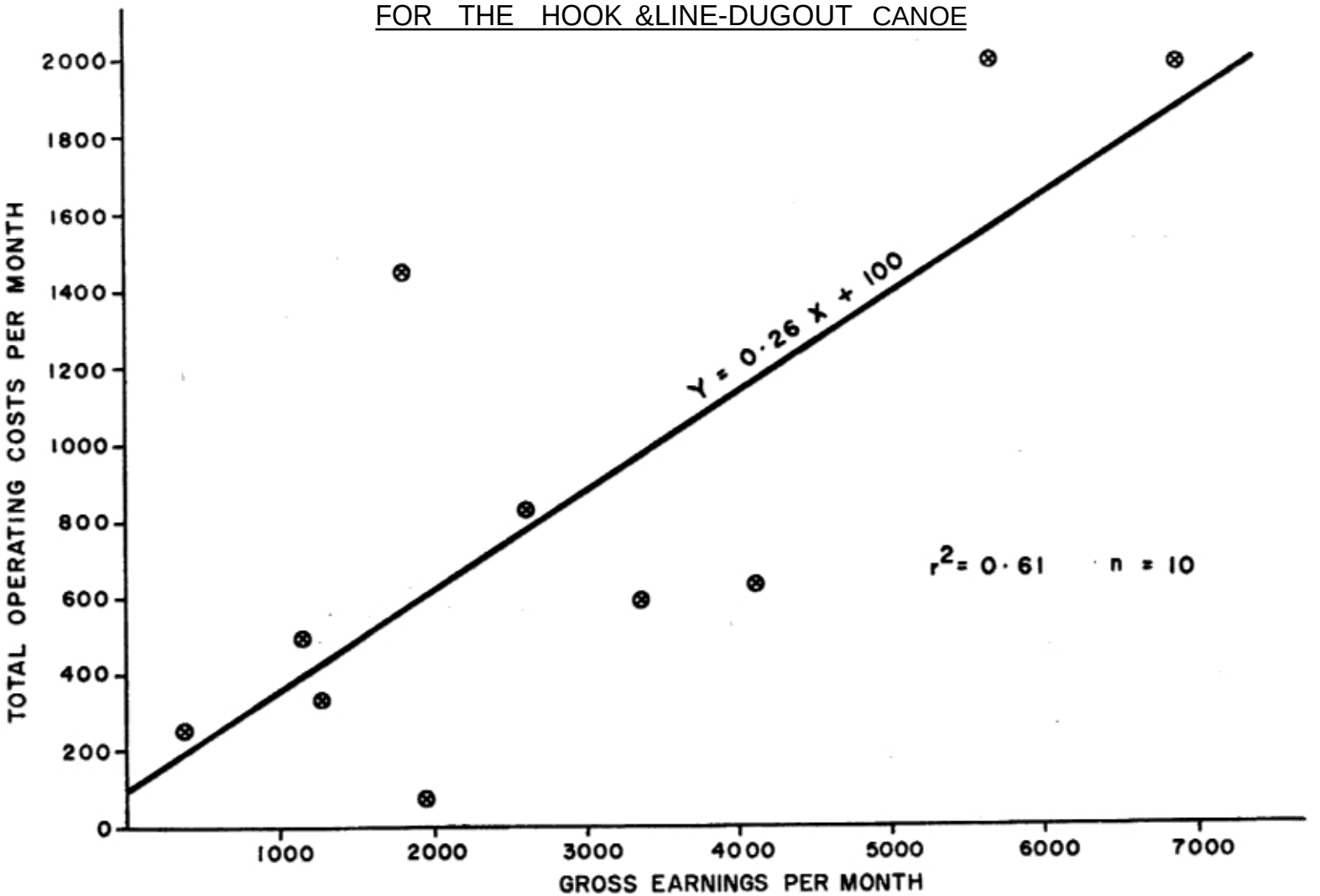
FIGURE -17

RELATIONSHIP BETWEEN TOTAL OPERATING COSTS AND GROSS EARNINGS FOR THE HOOK &LINE-DUGOUT CANOE



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12. FURTHER COMMENT, CONCLUSIONS AND RECOMMENDATIONS

12.1 The year under review

12.1.1 The results should be regarded as complementary to, and not a substitute for, the official statistics on the fisheries of Kerala.

12.2 Interpretation of results

12.2.1 One of the outstanding characteristics of the artisanal sector of the Kerala fishing industry is its flexibility in respect of craft and gear according to season, weather and other operational conditions. This must be borne in mind when interpreting the results. For example, although one craft-gear combination may have been found to perform better than another (in some sense), it does not necessarily follow that the former should be more widely adopted and the latter be allowed to become obsolete: there may be sound operational reasons or local circumstances which justify the use of the poorer - performing combination or which make the choice of the "better" one inappropriate or impracticable.

12.2.2 Because of seasonal changes from one craft-gear combination to another, the figures quoted for earnings of fishermen are not generally their total annual incomes, except in cases where the combination is in use all the year round. Similarly the seasonal earnings of craft-gear combinations do not necessarily represent the total annual earnings of the craft itself. The methods used in the study could be developed to allow estimates to be made of total landings and total earnings for an entire village from which estimates of average individual incomes and their range of variation could be derived. Elaboration of the methods could likewise yield estimates of the costs and earnings of individual craft for the year. In essence such estimates would have been possible if the resources had been available to ensure that the selection of units being monitored at any given time in a particular village was always an accurate model of the active fleet operating from that village, and if there was a knowledge of the likely range and distribution of performance of individual units. This should be possible in future studies.

12.2.3 1980—81 was a year of exceptionally bad weather and poor fishing, and the figures for performance, productivity, cost-effectiveness and profitability of the fleets should be viewed accordingly. The comparisons between the different combinations and the different sectors may also have been affected. The study does not show whether the fall in catches was partly or wholly compensated by higher prices as compared with earlier years, but it does indicate that such compensatory adjustments occur over the shorter term.

12.2.4 The fishing time allegedly lest through bad weather was a very substantial fraction of the season in many types of artisanal fishing. A programme of technical development therefore seems justified, covering *inter a/ia* the following: development of craft with superior surf-crossing performance; provision of physical infrastructure or systems that will allow launching of the craft beyond the surf zone or in a place protected from the surf; investigatcn of mechanisation to reduce dependence on winds and currents; further development of the 'mother-boat' system. Mechanization would in turn probably require the development of a beach-landing boat to conserve the present decentralised structure of the artisanal sector, which is beneficial from a production and from a physical distribution point of view.

12.2.5 A graph of monthly landings exhibits two peaks and two troughs in the course of a year. Prices rise when supplies fall and *vice-versa* but the increases in price by no means fully compensate for the reduction in catches, so that monthly gross earnings also exhibit seasonal peaks and troughs. The seasonal variations differ in detail for different combinations and also are modified according to the species composition of the catch.

For those fishermen able and willing to risk putting off to sea during the monsoon season, catches are good and prices are high. This reinforces the desirability of technical development to enhance the fleet's abilities to operate during the monsoon.

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12.3 Economics

12.3.1 The results relate to the fishing activities of the various types of combinations over the season when these combinations were in use, which is not necessarily a whole year. Bearing this in mind, the following comments can be made:

12.3.2 The use of mechanised vessels of non-traditional design does not necessarily produce the biggest return in terms of weight of fish caught for the manpower expended: this is true of the gillnetters in the food-fish fishery as well as of the trawlers fishing primarily for prawns for export. The trawlers do produce higher gross earnings per man-hour than any other combination. The *encircling net/canoe* combination fishing for shoalirig pelagic species in inshore waters attained the best average figures among the artisanal craft.

12.3.3 Intensive use of assets can result in high levels of labour productivity even with simple technology as seen in the cases of *cast-net/canoe* and *hook-and-ilne/kattumaram.* Except when used with hook-and-line or with sardine nets, kattumarams exhibit low levels of capital productivity and labour productivity, reflecting partly the technical limitations of this type of craft and partly the exceptionally bad weather conditions during the survey year.

The combinations fishing shoaling species (encircling net, shore-seines, small-mesh driftnet) exhibited high capital productivity, but the labour productivity of the shore seine is low.

Hook-and-line showed higher capital productivity than large-mesh driftnets fishing partly for the same species. The far higher gear investment in the driftnet fishery is not fully compensated through increased gross earnings when compared with hook-and-line fishing.

The capital productivities of the mechanised sector are comparatively poor: there are probably too many trawlers; the existing gillnetters may not be of the most suitable design.

In summary, the artisanal units on the whole made better use of invested capital than the mechanised units.

12.3.4 Of the twenty-two craft/gear combinations studied all but five operated at a profit, on average; the highest average returns on investment were made by the *encircling net/plank canoe,* cotton *shore-seine/plank canoe* and *hook-and-/ine/kattumaram* combinations. By far the biggest average losses were made by the mechanised sector, although the crews did better than other fishermen on average. The average figures do however conceal the real situation as the range of performance of the individual units in many combinations was wide (as can be concluded from Chapter 10): in the combinations that on the average made a profit, some, perhaps a substantial proportion, of the units may have made a loss; the more successful units among those in the combinations that, on average, made a loss, may have made a profit. It is at least possible that an investigation into how many units of all kinds made a loss and what proportion of the sample they represent, may give more cause for concern than a review of the profitabilities based on the average as presented in the report. This question should be investigated as soon as practicable.

During the year of the study, only one combination attained average returns on investment higher than the interest rate that prevails on the informal credit market in the artisanal fishing villages of southern Kerala. This was an artisanal fishing unit.

As most of the artisanal fishermen depend on the informal credit market to satisfy their capital needs, the high interest rates have presumably a twofold effect: (i) they tend to slow down the development of a more capital intensive but less profitable fisheries in deeper waters and, (ii) they tend to work against over-capitalisation of the inshore fleet and thus stabilise the economic net returns of the fisheries at a high level.

12.3.5 To go fishing, costs have to be incurred — i.e. costs of operation (fuel and food **for** example) — that would not be incurred if the unit were not in active use. The *boat seine! dugout canoe* and the *nylon shore seine* were the most effective combinations as regards weight of fish caught per unit of expenditure on operating costs; the mechanised vessels were among the least effective. In terms of value of catch per unit of expenditure on operating costs, the mechanised vessels were also the poorest despite the fact that the trawlers fish primarily for prawns. The most effective by this criterion is again the *boat seine/dugout canoe* combination.

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The figures could be examined in more detail, to reveal the effectiveness of the various combinations in terms of the inputs of various scarce resources, such as for example mineral hydrocarbons, and manufactured or imported items including synthetic fibre.

12.3.6 Although the mechanised vessels made the biggest losses the earnings of the individual fishermen in these vessels were among the highest: a trawlerman earns on average about double the fisherman on a kattumaram using hook-and-line the whole year round, but the latter, on average, earns about four-fifths as much as a man on a mechanised gillnetter. If the range of performance of individual units is at all wide, some hook-and-line kattumaram fisherman may well earn more than some of the men on the mechanised boats. Again, although the average *per capita* income of a fishing family may be less than half the Kerala average, this may conceal wide variations. The average remuneration received by a crew member per fishing day was above Rs. 10 for the majority of combinations, and over Rs. 20 per fishing day for the crew of mechanised vessels and for those fishing by hook-and-line from dugout canoes; the prevailing daily wage rate for a landless agricultural labourer is just over Rs. 10. In the case of the fishermen, there are likely to be wider variations, owing to the variations in performance between individual units.

12.3.7 The share of gross earnings accruing to the owner varies, as might be expected, with the amount of capital invested. After deducting from the owner's remuneration that part of it due to him as a working member of the crew (where this is applicable) and the operating costs exclusively borne by him, the remaining gross profits were in most cases not greater than the remuneration of a crew member, even for the mechanised vessels. This was not sufficient in some cases to cover owner's allocations against depreciation, as an examination of profitability shows. This in turn may account for the fact that large expenditures on maintenance and repairs are postponed until the season of high earnings instead of being carried out during the season of poor fishing, as in many other fisheries.

12.3.8 Of the sample studied, the mechanised sector produced 59 per cent of the gross earnings but only 29 per cent of the added value. In terms of gross added value per unit of investment, cast-net fishing from dugouts and hook-and-line fishing from kattumarams gave the best results. Most artisanal combinations achieved average (annual) gross added values greater than the initial capital investment, two of them three times as much; in contrast, the mechanised vessels averaged one-sixth to one quarter of their invested capital.

12.3.9 High private profitability and high added value per unit of investment can be associated with both collective and individual ownership.

In cases whore the technology is labour-intensive, as for example the shore-seine, high profitability and high added value per unit of investment may be achieved while at the same time the remuneration of individual fishermen may be comparatively low. The sharing system in this case is the exception to the rule that the gross profit is roughly equal to the remuneration of a fisherman; if it were, the individual earnings would be substantially higher. As it is, they were not the lowest among the different combinations.

12.3.10 The figures quoted for performance, productivity, cost-effectiveness and profitability are in every case average figures for a number of individual fishing units. The analysis of variations over different fishing centres (Chapter 10) indicates for those craft-gear combinations which were monitored in more than one village a considerable variability of performances. An exceptional high variation in gross earnings was observed in the *prawn net/kattumaram* combination (9 to 1). In most of the other combinations the range varied between 2 to 1 and 4 to 1. It is desirable that the range and the distribution of the values of the various parameters, relating to individual units, are further analysed for all the craft-gear combinations. The implications of such an analysis for the interpretation of the present results, and for the conduct of future studies, will in turn need to be examined.

12.4 Other observations

12.4.1 There seems to be a correlation between the probability of no catch and the shortness of the distances from the base to the fishing grounds; or else between the distances that have to be run to the fishing ground and the degree of risk that the fisherman is willing to take that there will be no catch if he puts out to sea.

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124.2 Fish prices at first sales vary not only according to species and seasonal plenty or scarcity, but also from district to district. Near Trivandrum they tend to be high. The proximity of the state capital may not be the only reason, and the point requires further investigation.

124.3 Whore the landings from individual units are small, the units of the associated distribution system are also small. Where landings are bigger, larger-scale marketing enterprises operating over longer distances are evident.

12.4.4 Differences exist in average economic performance between similar craft-gear combinations from different villages. These should be examined with a view to ascertaining whether they suggest transfer of skills from village to village; re-deployment of effort where catch per unit effort is low; meehanisation to shorten passage times; or other remedial action.

12.5 Further **work**

12.5.1 1980 was not a typical year. The study should therefore be repeated in the near future, with the scale of the effort, size of sample and methodology modified as may be deemed to be necessary or desirable in the light of further analysis of the data obtained from the existing study.

12.5.2 A further study should not be attempted, however, until facilities are available for electronic storage and processing of data.

12.5.3 Since fisheries are vulnerable to various kinds of external change, and since the fisheries of Kerala will probably be undergoing technical development and perhaps also socio-economic development over the next several years, it will be necessary to repeat such studies at intervals of, say three to five years. Supplementary and intermediary studies, whether regular or *ad hoc,* can be carried out with less effort to the extent that certain relationships determined by the triennial studies can be assumed to hold good in the intervening period, as for example in the case of operational costs (see 12.6.2 below).

12.6 Methodology

12.6.1 The methodology, especially the methods of selecting the sample for study, had to be developed *ab initlo* to suit the especially complex situation. They proved practicable but are capable of refinement.

12.6.2 For at least some of the combinations studied, the relationship between the average operating costs and average gross earnings is fairly constant month-to-month, as well as over longer periods; operating costs can therefore be estimated from gross earnings for periods of as short as a month.

In future supplementary studies, therefore, it should not be necessary **to expend** effort **on** ascertaining average operating costs until the time comes when there is reason to believe that the numerical value of the ratio has changed. The relationship relates to the average costs and average gross earnings of a sufficiently large number of units, not to individual units.

12.6.3 The range of variation in performance of individual units (12.3.10 above) needs to be examined not only in relation to the conclusions that can be drawn, but also, and first, in relation to the size of sample that should be selected for study, in order to produce results within acceptable confidence limits relating to craft, gear, village, district, trip, month, season and other bases of comparison.

12.6.4 The full potential benefits of the study will not be realised until electronic data processing can be made available.

12.6.5 If studies of this kind continue, and after sufficient experience and understanding has been gained, consideration should be given to amalgamating the nucleus of such study initiatives with the organisation responsible for the collection of the official statistics.

12.7 Summing up

12.7.1 This is one of the first studies of small-scale fisheries of its kind to be mounted on such a big scale and dealing with such a variety of craft, gear and fishing seasons. It is to be hoped that

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the information and insights gained will facilitate the planning and management of fisheries development in Kerala. It is also to be hoped that the results so far obtained will demonstrate the potential usefulness of such studies and that this report may be helpful in the planning and execution of similar studies elsewhere.

12.7.2 The study illustrates the technical variety of the Kerala fisheries, especially of the artisanal (non-mechanised) sector. In spite of certain technical limitations which should be amenable to improvement through technical development, the artisanal sector is on the whole at least as economically viable as the mechanised sector is at present, and in many cases more so; it also has socially desirable features.

12.7.3 In planning the development of the Kerala fisheries, the effects of particular systems of ownership, and particular systems of sharing of costs and of earnings, need to be examined from several points of view: remuneration to the individual; social profitability (value added per unit of capital investment); productivity in terms of scarce resources such as hydrocarbon fuels; employment opportunities; return on investment; adequate provision for repairs, maintenance and depreciation. Sharing systems in other fisheries differ in detail from those in Kerala, specially in mechanised fisheries. In particular improved technology may imply somewhat greater capital investment; this implies that provision for maintenance, repair and depreciation would have to be somewhat greater than in traditional systems. If this cannot be done without at the same time improving individual earnings then the development may have little point, unless it provides additional employment.

12.7.4 In considering fisheries development from the various points of view mentioned above, and particularly social profitability and productivity in terms of scarce resources, due regard should be given to the performance of the fishing industry vis-a-vis alternative opportunities for investment where these exist. The results of the study suggest that the performance and potential of the artisartal fisheries mayjustify greater attention and support than has been accorded in the past.

12.7.5 To what extent long-term improvements can be achieved depends upon the scope available for beneficial technical and socio-economic changes, and this needs further examination. Improved returns and standards of living will depend upon higher labour and capital productivity; the extent to which the resource base can sustain higher yields in the long term will determine whether higher labour productivity means bigger annual landings or a reduction in the numbers of people engaged in the fisheries.

12.7.6 Those concerned with the study of the economics of fisheries or with the development of the theory and practice of fisheries management, may find that some of the practices and relationships described are different from those obtaining in other, more thoroughly studied fisheries, and one or two of the concepts and results may be novel. It is to be hoped that the report may thereby provoke discussion and further inquiry that may Tead to fresh insights and deeper understanding of fisheries economics, fisheries management and fisheries development tailored to solving the needs of small-scale fishermen.

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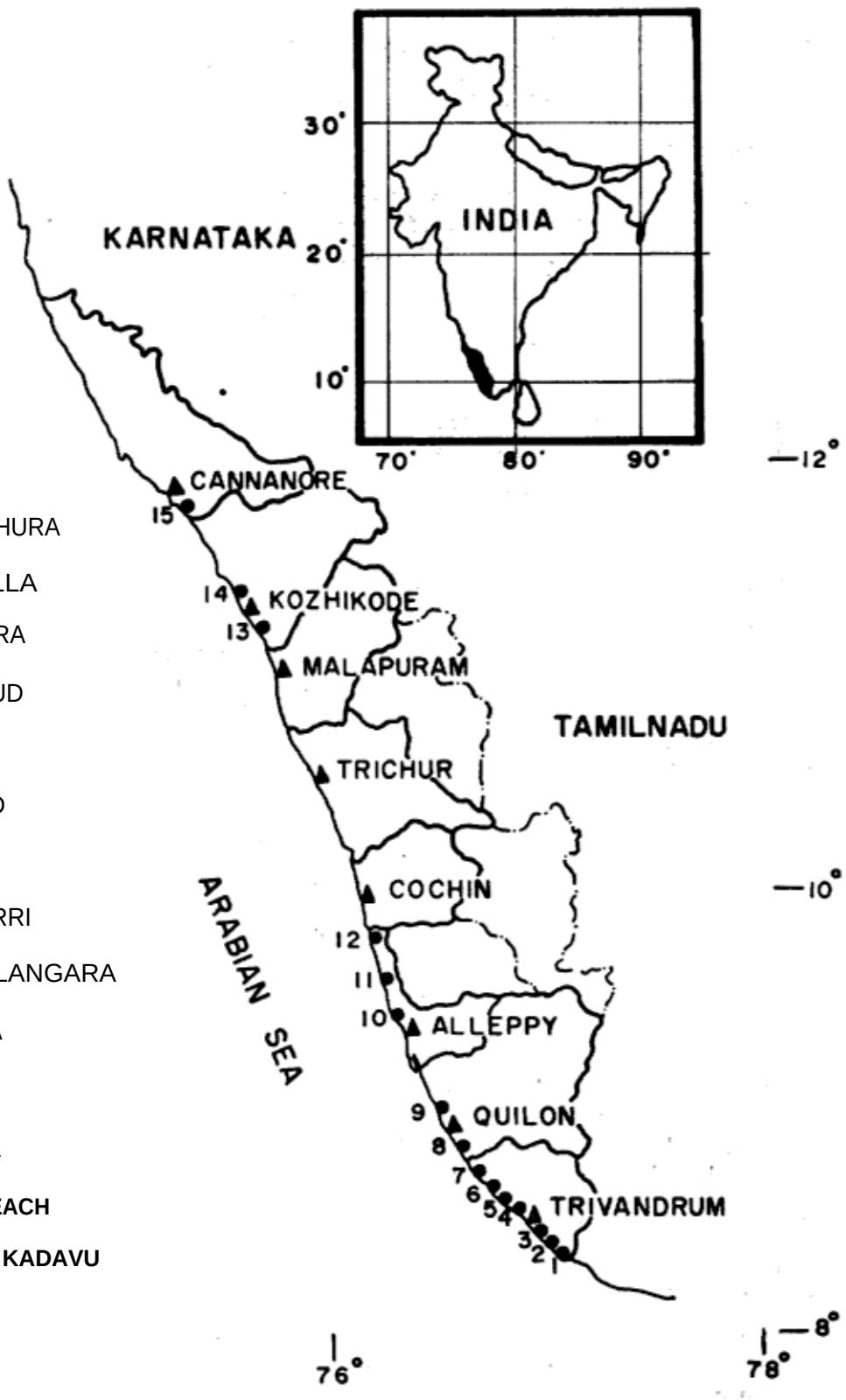
Appendix 1

MAP OF KERALA SHOWING THE FISHING CENTRES CHOSEN FOR THE STUDY



1 PUTHIYATHURA
2 PULLUVILLA
3 POONTHURA
4 VETTUCAUD
5 THUMBA
6 MARIANAD
7 ANJENGO
8 TANGASERRI
9 SAKIHIKULANGARA
10 PUNNAPRA
11 KATTOOR
12 AZHEEKAL
13 SOUTH BEACH
14 PUTHIVA KADAVU
15 CHALIL

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Appendix 2

TOOLS FOR DATA COLLECTION

Two main tools were used to collect data for the Kerala costs and earnings study: a Questionnaire (see Appendix 2A & 28) and a Schedule (see Appendix 2C). Each item in these documents was printed first in Malayalam, then in English.

Questionnaire

The purpose of the questionnaires was to gather facts about the characteristics of individual sample units monitored during the study. Questionnaires were used by the enumerators at two points in time — at the beginning of the study, and before the end.

The questionnaire administered at the beginning of the study (Appendix 2A) contained three parts.

The first part related to the identification of the sample Unit (craft and gear), giving the code assigned to the unit and the name of the owner.

The second part gave in summary form the dimensions and specifications of the craft and gear and showed identification marks, if any.

The third part sought information required to work out the annual depreciation and the interest paid on loans taken for productive investments, Eighteen questions intended to assess initial costs; substantial changes; sources of incomes; rates of payment of interest; expected lifetime; and current price, were listed to make these calculations.

The questionnaire at the end of the study (Appendix 2B) contained two parts. As in the earlier one, the first part pertained to identification of the unit. Part two had 11 questions. Most of these questions were sub-divided into several parts. The first nine questions were a mere reassessment of details sought in the first questionnaire. The 10th and 11th questions were intended to assess the period of diversion of the craft/gear from use on the existing combination that was being monitored in the study.

Schedules

There were basically two types of schedules used for the data collection — one for the artisanal or non-mechanised sector, another for the mechanised sector.

Both schedules were identical in structure and were composed of five parts: identification, general information, costs, fish marketing and earnings. The schedule for the mechanised sector differed from that of the non-mechanised sector only on the itemisation of costs/expenditures.

1. *Identification*

The first sheet of the schedule was intended to provide the basic identification of the unit being monitored. It showed at a glance the type of combination; the district and the centre; the period to which the date in the schedule related; the number of fishing days and trips monitored during the period; and the signatures of the enumerator and the field coordinator.

2. *General information*

Aspects of the fishing trip that had an indirect bearing on costs and earnings and which were closely related to the overall practice and performance of fishing were included under this head.

The 14 items were split into four major groupings. They were—the prevailing conditions of weather at sea and land ; the time factor in the operation ; the depth of fishing; and the manpower expended.

All the above information were recorded for every trip monitored.

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3. *Expenditure*

(a) *For non-mechanised artisanal sector combinations*

The 15 cost items were broadly divided into three groups—owner's expenses; owner's losses; and common expenses. The first and third are the groupings which add up to make the total operating costs of a trip. The item on owner's losses was incorporated to assess the extent to which capital loss (destruction of craft or net) occurs, considering that **for this the** artisanal fishermen frequently claim assistance from the state.

(b) *For mechanised sector combinations*

Seventeen items of cost are divided into two groups: owners' expenses and common expenses. As against the artisanal sector, expenditure items like fuel, harbour charges, etc. were included for the mechanised units.

4. *Marketing*

This page is devoted totally to marketing details. Species-wise quantities, mode of selling, purchaser-analysis and final market analysis, are recorded—all on a trip-wise basis.

5. *Earnings*

The section on earnings and their distribution is the most elaborate part of the schedule. Twenty-four items are grouped under three heads: (1) earnings from fish sales, (2) other income from craft and gear and (3) distribution of earnings. The head "distribution of earnings" is further sub-divided into earnings for "persons involved in fishing" and "persons not involved in fishing".

The detailed analysis of distribution of earnings was incorporated to assess how incomes are shared between workers and owners as also between working owners and non-working owners The owners' class was further broadly sub-divided into owners of craft and owners of gear.

6. *Incorporated items*

The amount of fish used for consumption — the portion taken by the crew and owners for home consumption and the portion given away in charity or as payment for services — was specially recorded on the second page with the details of costs. When the quantity sold is added to the quantity taken for consumption, we get the total fish landed during the trip.

Appendix 2A: Questionnaire at beginning of study

Fisheries Research Cell—Food and Agriculture Organisation (F.A.O.)

Costs and Earnings Study of Fishing Craft and Gear
1980—81

Questionnaire

1. Name of craft	I. Identification Particulars Kattumaram Dugout canoe Plank canoe Boat Register No.
2 Name of the owner of the craft	
3. Name of the gear	
4. Name of the owner of the gear	
5. Code No. of the sample	
6 Name and signature of the enumerator	
7 Place and date	Place Date

	II. Summary details	
	Craft	Gear
1. Code		
2. identification marks	a) Length Meter b) Breadth Meter c) Depth Meter d) Material	a) Length Meter b) Weight Kg c) Breadth Meter d) Material

III. Questions **end** answers

	Craft	Gear
1 a) When did you buy this?	Date Month Year	Date Month Year
b) When did you make this/	Date Month Year	Date Month Year
2. What was the expected life then?	Year Month	Year Month Days
3. With what materials is it made?		
4. Was it old or new when bought?	New Old	New Old
5. If old, how many years old when purchased?	Year Month	Year Month Days
6. At what price did you buy? (Rs.)		
7. Have you made any substantial changes or additions to the shape or form?	Yes **No**	Yes No
8. If yes, how much did you spend? When? (Year)	Rs. Date	Re. Date
9 What is the present market price after effecting changes in the form or shape?	Rs.	Rs.
10. What price will it fetch you now?	Re.	Rs.
11. How did you finance the purchase/making this? (entries in code)	Code	Code
12 How did you finance the changes effected in its shape or form? (entries in code)		
13. Whether any loan is still outstanding?	Yes / No	Yes / No

Item 12, 13 Source of money invested Code 1. Own funds 2. From individuals 3. From financial institutions 4. From Government

III. Questions and answers (Continued)

		Craft	Gear
14.	Total amount of loan now outstanding?	Rs.	Rs.
15.	Rateofinterestoftheloan?	%	%
16.	Are you repaying the loan regularly?	Yes / No	Yes / No
17.	Number and amount of instalments in which loan is repaid?	Months	Months

Appendix 2B: Questionnaire at end of study

Fisheries Research Cell— Food and Agriculture Organisation (F.A.O.)

Costs and Earnings Study of Fishing Craft and Gear
1980—81

Questionnaire

1. Identification Particulars

1. Code No. of the sample

2 Name of the craft

3 Name of the gear

4. Name of the owner of the craft

5. Name of the owner of the gear

II. Questions and answers

1.		Craft			Gear		
		Purchased	Made	Others*	Purchased	Made	Others
(a)	How did you possess the craft-gear?						
(b)	In which year did you possess?						
(c)	How much did you spend?						
(d)	Condition at the time of possession? (Now/old)						

*Enter in codes

Code 1. As dowry 2. By inheritance 3. Others, describe

For other moans of possession note the estimated price at the time of possession.

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		Craft	Gear
2	What was the expected number of years of fishing operation at the time of possession?		
3. (a)	Have you made any substantial changes or additions to the shape or form?	Yes / No	Yes / **No**
(b)	If yes, how much did you spend? When? (Year)	Year **Rs.**	**Year** **Rs.**
4.	How did you finance the purchase/ making this? (entries in code)		
5.	How did you finance the changes effected in its shape or form? (entries in code)		
6.	If loan is taken for this		
	(a) amount of loan taken? (Rs.)		
	(b) the year in which loan is taken?		
	(c) period of loan (year)		
	(d) rate of interest		
	(i) daily		
	or (ii) monthly		
	or (iii) yearly		
	or (iv) other rate (describe)		

Item 4, 5 Source of money invested Code

1. Own funds
2. From individuals
3. From financial institutions
4. From Government

	Craft	Gear
7 Amount paid during April 1980—March 1981		
(a) Principal amount (Rs.)		
(b) Interest		
(c) Number of instalments		
8. (a) Whether any loan is still outstanding?	Yes / No	Yes / No
(b) If yes, what amount? (Rs.)		
9 (a) Have you insured?	Yà / **No**	Yes / **No**
(b) If yes, what is the amount? (Rs.)		
(c) Amount of premium paid during 1980—'81 (Rs.)		
(d) Arrears of premium to be paid for the year 1980—'81 (Rs.)		

10. (a) Did the craft of the sample unit operate with another type of gear (other than the type **of the gear** of the same sample) during 1980—81? Yes / **No**

(b) If yes (i) Howmanydays?

(ii) With what type **of** gear?

11. (a) Did the gear of the sample unit operate with another type of craft (other than the type of the craft **of the** same sample) during 1980—81? Yes **/ No**

(b) If yes (i) How many days?

(ii) With what type of craft?

Place

Name and Signature of the enumerator

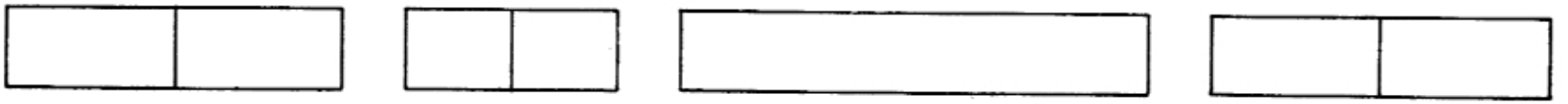
Date

Appendix 2C: Schedule

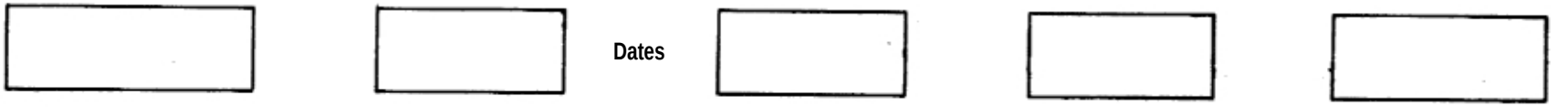
Costs and Earnings Study of Fishing Craft and Gear

KERALA — INDIA
1980—81

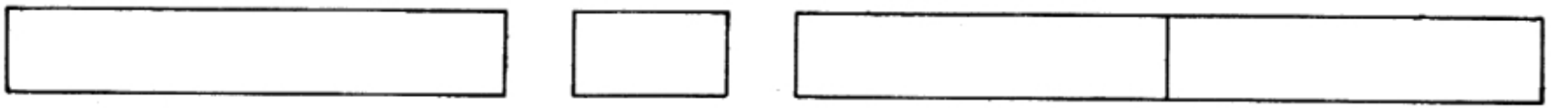
Identification



District Centre | Code | **Name of Craft and Gear** | **Sample Number** Code



Month | **From** | **Dates** | **To** | **Total number of days** | **Total number of trips**



Enumerator's Name and Signature | **Date** | Supervisor's Signature and Date

								Total F	Total U	Average/ Trip
	Date									
	Trip									
1 Prevailing conditions	(i) Sea (F or U)									N. A.
	(ii) Wind (F or U)									N. A.
	(iii) Current (F or U)									N. A.
	(iv) Weather on land (F or U)									N. A.
2 Timings of operation	(i) Starting time							N. A.		N. A.
	(ii) Starting of fishing							N. A.		N. A.
	(iii) Stopping of fishing							N. A.		N. A.
	(iv) Time of return							N. A.		N. A.
	(v) Time spent for fishing 2(iii)—2(ii)									
	(vi) Total time 2(iv)—2(i)									
3 Depth of the Sea	Depth of the sea at the place of catching (in meters)									
4 Man power and fishing effort	(i) Total number of persons involved in fishing operation									
	(ii) Number of non-owners involved in fishing operation									
	(iii) Total fishing effort* 2(v) × 4(i)									

('Do it **at the end)**

F— Favourable U— Unfavourable NA.— Not applicable

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Non-Mechanised Craft

Date		
Trip		
1 Owner's expenses (Rs.)	(i) Bait	
	(ii) Hook and line	
	(iii) Repairs and maintenance of craft	
	(iv) Repairs and maintenance of gear	
	(v) Interest on capital invested*	
	(vi) Depreciation of craft and gear*	
	(vii) Other expenses (describe)	
2 Owners loss (Rs.)	(i) Loss on gear	
	(ii) Loss on craft	
	(iii) Other losses (describe)	
3 Common expenditure before sharing the catch (Rs.)	(i) Bait	
	(ii) Food	
	(iii) Other common expenses for workers/partners	
	(iv) Traditional taxes offerings etc.	
	(v) Other expenses (describe)	

(*Do it at the end)

Mochanised Fishing Craft

Date		
Trip		
1 Owner's expense (Rs.)	(i) Repair and maintenance of boat	
	(ii) Repair and maintenance of gillnet/trawl net	
	(iii) Interest on capital invested	
	(iv) Insurance etc.	
	(v) Depreciation*	(a) Hull
		(b) Engine
		(c) Gear etc.
		(d) Total
	(vi) Jetty/Harbour parking charges	
	(vii) Other expenses	
2 Common expense (Rs.)	(i) Diesel and other fuel	
	(ii) Batta/Ration/Food	
	(iii) Ice etc.	
	(iv) Basket	
	(v) Landing charges	
	(vi) Auction fees	
	(vii) Other expenses	

('Do it at the end)

<<

Date				
Trip				
Details of Fish Marketing 1	(i) Species	(a) Main species		
		(b) Other species		
	(ii) Measure	(a) Main species	(1) Local unit	
			(2) Standard unit (kg)	
		(b) Other species	(1) Local unit	
			(2) Standard unit (kg)	
	(iii) Mode of selling (B, A, F or 0)	(a) .Main species		
		(b) Other species		
	(iv) Purchaser (E,S,H,C, L, M or 0)	(a) Main species		
		(b) Other species		
	(v) Final market (Ex. IN or ID)	(a) Main species		
		(b) Other species		

B: Bargaining

A: Auction

F: Fixed price

0: Others (describe)

E: Exporter's agent

5: Co-operative Society

H: Headloader

C: Cycle loader

M: Middlemen

L: Lorry merchants

O: Others (describe)

Ex: Export

IN : internal neighbouring market

ID : Internal district market

<<

Date		
Trip		
1 Earning from fish sales (Rs.)		(i) Price stated
		(ii) Ready cash received
		(iii) Cash received after settlement
		(iv) Time taken for final settlement
2 Other income from craft and gear		(i) Income from rent
		(ii) Income from other sources
3 Distribution of Earnings		(i) Total divisible earnings (Rs.)
		(ii) Total number of shares*
		(iii) Value of one share (Rs.)*
		(iv) (a) Proportion of earnings to boat owner (Rs.)†
		(b) To net owner (Rs.)
		(c) To workers (Rs.)
		(d) To others (Rs.)

* These items need not be filled if the income is not divided in terms of shares

† For mechanised boats and shore seine only

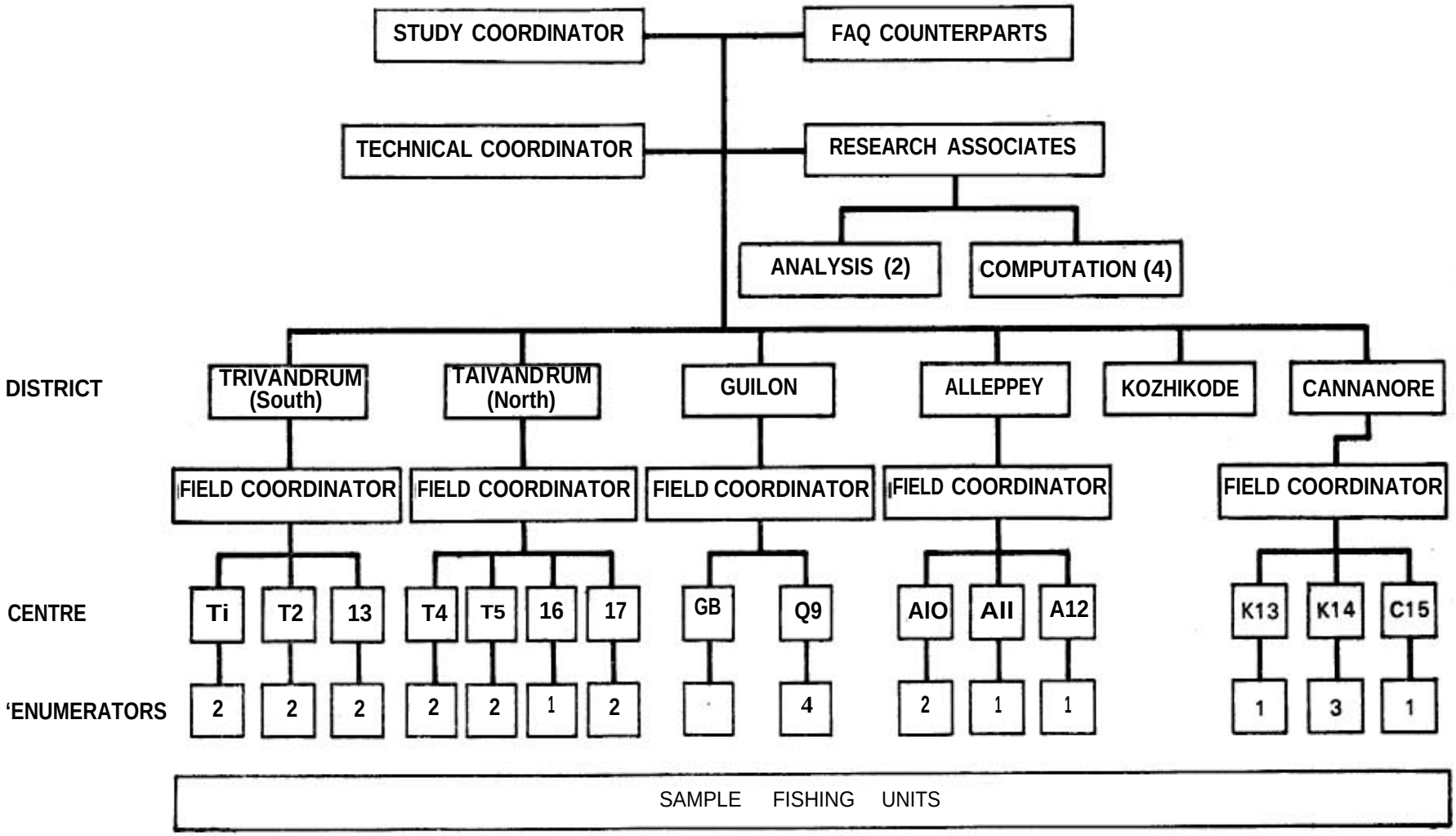
Date		
Trip		
3 Distribution of Earnings (Continued)	(v) Persons involved in fishing	(a) No. and value of worker's share
		(b) No. and value of craft owner's share*
		(c) No. and value of gear owner's share
		(d) No. and value of total shares
	(vi) Persons not involved in fishing	(a) No. and value of other shares
		(b) No. and value of craft owner's share
		(c) No. and value of gear owner's share*
		(d) No. and value of worker's share*
		(e) No. and value of total shares*
	(vii) Value of smallest share	
	(viii) Value of largest share	

* If the income is not divided as shares, express them as proportions

<<

APPENDIX 3

ORGANISATIONAL CHART OF THE STUDY TEAM



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summary data on the craft-gear combinations

	1	2	3	4	5	6	7
	ENCIRCLING NETS			**BOAT** SEINES			SHORE SEINES
	with plank canoe	with dugout canoe	**Total** (1) + (2)	'with dugout canoes	with kattu-maranr	cotton seine-plank canoe	cotton seine-dugout canoe
1. Number of units selected for monitoring	13	4	17	5	28	13	2
2. Investment per unit in							
(i) Craft	8558	12750	**9544**	7560	2763	1954	5750
(ii) Gear	11038	14500	11853	7600	2084	5695	5420
3. Nature of the ownership of the average unit (Individual (0/Collective (C)	C	C	C	C	I	I	I
4. Average number of crew members per unit	15	15	15	16	5	21	15
5. Estent of owner's participation as crew member (percentage)	92	100	94	21	45	100	100
6. Total expected months of operation during the year (months)	12	12	12	6	**7**	**9**	**9**
7. Percentage of fishing days during these months	32	25	34	57	14	38	36
8. Average number of fishing trips per unit per annum	108	81	102	105	28	149	128
9. Average trip time (hrs.)	540	5.70	5.45	8.50	7.20	3.10	2.00
10. Average water depth in area of operation (metres)	9	6	8	14	19	16	16
11. Total effort per trip (men-hours)	81	86	81	135	40	66	30
12. Ratio of trips without catch to total trips (Index of uncertainty)	0.21	0.42	0.25	0.40	0.13	0.10	0.14
13. Catch landed per trip (kg)	243	191	233	173	62	53	17
14. Fish taken for consumption per trip (kg)	16	18	16	7	4	2	1
15. Catch landed per man-hour of fishing effort (kg/man-hour)	5.3	5.8	5.4	2.5	2.3	1.4	1.0
16. Catch landed per man-hour of total effort (kg/man-hour)	3.0	2.2	2.9	1.3	1.6	0.8	0.6
17. Catch landed per fishing unit per annum (kg)	26360	15415	23785	18109	1749	8064	2202
18. Price of fish sold per trip (Rs./kg)	1.89	1.99	**1.90**	1.28	2.38	2.53	3.80
19. Gross earnings per trip (Rs.)	456.59	355.85	436.18	228.69	137.96	140.33	65.34
20. Gross earnings per fishing unit per ennum (Ps.)	49312	28824	44491	24012	3863	20910	8364
21. Gross earnings per man-hour of total effort (Ps/man-hour)	5.70	4.20	5.40	1.70	3.50	2.10	2.20
22. Total operating costs per trip (As.)	72.70	92.28	76.35	25.67	21.65	34.24	11.26
23. - of which owner's operating costs	4.03	11.11	5.35	6.74	2.72	8.43	3.40
24. and common operating costs	68.67	81.17	71.00	18.93	19.18	25.81	7.86
25. Catch landed per Ba. 100 operating costs in weight (kg)	334	206	305	674	286	157	153
26. Catch lartded per Ps. 100 operating costs in value (Rs.)	631	410	582	856	614	397	581
27. Total divisible earnings per trip (Rs.)	360.90	262.70	342.58	192.00	106.25	106.57	54.59
28. (a) crew's share	212.72	195.85	209.57	139.61	82.00	69.70	29.56
29. - of which to non-owner workers	117.40	136.55	120.97	136.26	78.74	67.48	28.45
30. (b) owner's share	238.30	126.15	217.38	55.74	25.25	37.00	22.53
31. — of which to owner workers	95.32	59.30	88.60	3.35	3.28	2.22	1.12
32. (c) other's share	5.20	—	**4.23**	—	**2.28**	**2.09**	**3.62**
33. Catch landed per crew member per annum (kg)	1781	1028	1603	1137	320	379	144
34. Gross earnings per crew member per annum (Rs.) (labour productivity)	3332	1922	2998	1507	646	982	548
35. Per capita crew remuneration per unit during the year in cash (Ps.)	1330	815	1208	915	369	489	241
36. Per capita crew remuneration per unit during the year in kind (In cash terms) (Rs.)	360	95	297	114	58	55	15
37. Per capita crew remuneration (total) per day (Rs.)	15.90	11.30	15.00	10.00	14.30	5.30	2.60
38. Gross profit per unit per annum to the owner (Rs.)	15160	4221	12586	4794	604	4193	2290
39. Net returns on investnrent (96)	61.3	4.7	443	20.8	—2.0	39.0	8.81
40. Investment per crew member (capital intensity) (Rs.)	1324	1817	1442	952	886	359	732
41. Gross earnings per unit of investntent (capital productivity) (Ba.)	2.50	1.00	2.00	1.67	0.83	2.50	0.77
42. Capital invested per man-hour of total etfort (Rs.)	2.24	**3.94**	**2.58**	**1.07**	**4.35**	**0.77**	**2.89**
43. Gross value added per unit per annum (Rs.)	45922	24680	40924	22372	3470	17179	7041
44. Gross value added as a ratio of gross earnings (Rs.)	0.93	0.86	0.92	0.93	0.90	0.82	0.84
45. Gross value added as a ratio of total investment (Rs.)	2.34	0.91	1.91	1.48	0.72	2.25	0.63

Note:—This summary table is a compilation from several tables constructed at the end of the calculations using these figures hare may give slightly different results due to the fact tha and/or weighted to make them consistent within each row.

<<

Appendix 4 (Summary Table)

monitored during the costs and earnings **study of fishing units** in **Kerala State during 1980—1981**

8	9	10	11	12	13	14	15	16	17	18	19	20
		DRIFTNETS			SPECIALISED GILLNETS					CAST **NETS**	BOTTOM SET	**HOOK**
Total (6)+(7)0	nylon anions	small mesh with plunk canoe	large mesh with — duçjout canoe	kattu maram	Anchovies net with kattu-maram	Sardine net with kattu-maram	dugout canoe	**Prawn** nets with kattu-maram	dugout canoe	with dugout canoe	lobster net With dugout canoe	with plank canoe
15	4	13	8	16	11	11	16	9	2	**3**	2	8
2460	*825*	2746	2744	1816	825	532	2063	652	1725	**1233**	**850**	**2625**
5659	2250	4838	7760	5044	973	1277	2463	994	900	633	600	1597
1	1	C	1	1	1	1	1	1	1	1	1	C
20	15	7	4	2	2	2	4	2	3	4	**2**	**8**
100	100	72	20	44	58	98	**100**	**90**	**33**	100	78	40
9	6	8	8	12	5	12	**12**	**12**	6	6	**9**	**10**
45	27	42	34	20	25	**41**	26	**14**	**35**	**59**	**53**	**10**
147	49	99	72	50	54	98	8.9	**45**	**69**	**113**	**117**	**13**
300	6.00	6.80	15.70	15.50	8.30	9.50	680	**870**	**5.30**	5.00	11.00	3580
16	6	15	27	38	17	25	13	25	18	6	**5**	**74**
62	87	45	55	31	7	13	25	11	16	**19**	**21**	**277**
0.11	0.04	0.26	0.04	0.06	0.18	0.05	009	0.06	**0.07**	**0.13**	**0.21**	**0.09**
49	80	91	38	31	*19*	*9*	28	8	17	**24**	1	189
1½	1	7	2	2	1	1	1	1	1	1	0	10
1.3	1.8	5.0	1.1	1.6	**4.8**	**1.0**	**2.1**	**0.9**	**1.9**	**2.0**	**0.3**	**1.6**
0.8	0.9	2.0	0.7	1.0	2.6	0.7	1.1	**0.7**	**1.0**	**1.3**	rag.	**0.7**
7282	3890	9073	2731	1557	1015	830	2525	**342**	1151	2755	99	2391
2.57	1.16	1.74	3.44	2.33	1.45	2.60	2.51	**3.40**	**3.00**	**2.18**	**33.38**	**2.96**
130.86	92.73	157.55	130.38	73.74	27.55	23.06	71.86	26.22	50.19	53.34	28.32	538.15
19237	4544	15598	9388	3687	1488	2260	6396	1180	3463	6028	3314	6996
2.10	1.10	3.50	2.40	2.40	3.80	1.80	**2.90**	**2.40**	**3.20**	**2.70**	1.40	2.00
31.55	13.48	24.60	42.11	14.05	3.34	3.86	**8.46**	**5.39**	**3.92**	**7.64**	4.02	190.80
7.84	3.65	5.25	6.28	2.08	0.34	0.56	2.62	**1.19**	0.90	1.38	2.45	27.30
23.72	9.83	10.35	*35.83*	11.96	3.00	3.30	5.84	4.19	3.02	**6.25**	1.57	163.50
155	594	371	90	222	560	219	334	148	428	320	21	**99**
399	689	646	311	517	812	567	838	505	1280	698	707	293
100.51	81.75	126.70	87.84	54.82	23.15	16.54	62.05	18.36	45.36	44.75	26.87	367.10
65.02	70.14	83.55	53.07	86.73	13.71	8.09	44.82	8.79	33.68	37.04	16.10	330.21
62.93	64.67	73.15	49.63	31.57	11.78	5.13	37.13	6.40	.29.36	27.62	13.06	232.85
35.31	17.08	51.95	38.21	23.24	11.36	11.41	24.83	11.95	16.00	17.13	13.81	118.14
2.09	5.47	10.40	3.44	2.09	1.93	2.96	7.69	**2.39**	**4.32**	9.42	3.04	10.63
2.27	—	1.60	*	—	—	—	**0.10**	—	—	—	—	16.11
354	266	1370	794	724	454	615	682	272	384	706	53	309
934	310	2356	2729	1715	680	1674	1729	936	1154	1546	**1772**	905
462	233	912	1106	716	340	581	1078	304	769	1069	1000	336
51	18	249	385	243	44	210	110	118	**28**	**133**	0	145
5.00	5.20	11.70	15.50	13.00	10.30	7.30	10.70	8.10	12.70	11.20	7.00	17.30
3939	384	3557	2054	954	496	776	1300	373	740	713	973	1014
334	5.4	28.4	10.0	**2.6**	**14.1**	27.3	16.3	6.4	16.9	15.8	21.0	—1.8
430	210	1146	3053	3190	821	1340	1231	1306	875	**332**	775	546
2.50	1.43	2.00	0.90	0.53	0.83	1.25	1.43	0.71	1.25	3.33	2.50	**L67**
0.89	0.72	1.70	2.68	4.40	4.58	1.44	2.06	**3.38**	**2.39**	**0.85**	**0.61**	**1.21**
15827	4102	14490	7496	3395	1399	2089	5158	1053	3295	5710	2846	5604
0.82	0.90	0.93	0.80	0.92	0.94	0.93	0.93	0.89	0.95	0.95	0.86	0.80
1.95	1.33	1.91	0.71	0.50	0.78	1.15	1.31	0.64	1.26	3.06	1.96	1.33

study all of which are not included in this *volume,* Making
ıı items incorporated here have been separately rounded-off

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21	22	23	24
AND LINES		TRAWL NETS	LARGE-MESH GILLNETS
with dugout canoe	with ksttu msrsm	with mechanised boats	with mechanised boats
8	21	30	15
4381	1259	128500	24733
1350	327	3973	14367
		1	1
4	2	5	4
68	82	0	0
9	11	12	12
19	35	44	27
50	101	157	98
14.30	9.30	11.30	14.60
41	38	34	32
66	19	56	55
0.02	0.07	0	0
129	16	124	67
2	11	2	3
4.0	1.3	3.5	1.9
2.0	0.8	2 2	1.2
6751	1653	19397	6581
1.67	2.97	4.79	3.05
229.30	48.77	588.00	210.27
11468	4926	92331	20607
3.50	2.50	10.50	3.80
55.67	8.10	387.00	126.50
7.87	1.90	45.00	61.50
47.80	6.10	342.00	65.00
240	201	32	53
400	595	154	162
164.30	37.49	241.00	134.70
113.24	27.56	76.00	53.00
99.96	17.63	76.00	53.00
60.38	19.86	165.00	81.70
13.28	9.93		
3.95			
1497	791	3903	1746
2543	2357	18578	5466
1273	1325	2415	1401
229	222	991	603
26.40	14.70	21.60	20.40
1774	826	3562.	1795
15.2	32.2	9.8	8.7
1271	759	26055	10371
2.0	3.33	0.71	0.52
1.73	0.81	15.11	7.19
9459	4412	20923	9835
0.83	0.90	0.23	0.48
1.65	2.78	0.15	0.25

<<

FIGURE I

ENCIRCLING NET WITH CANOE

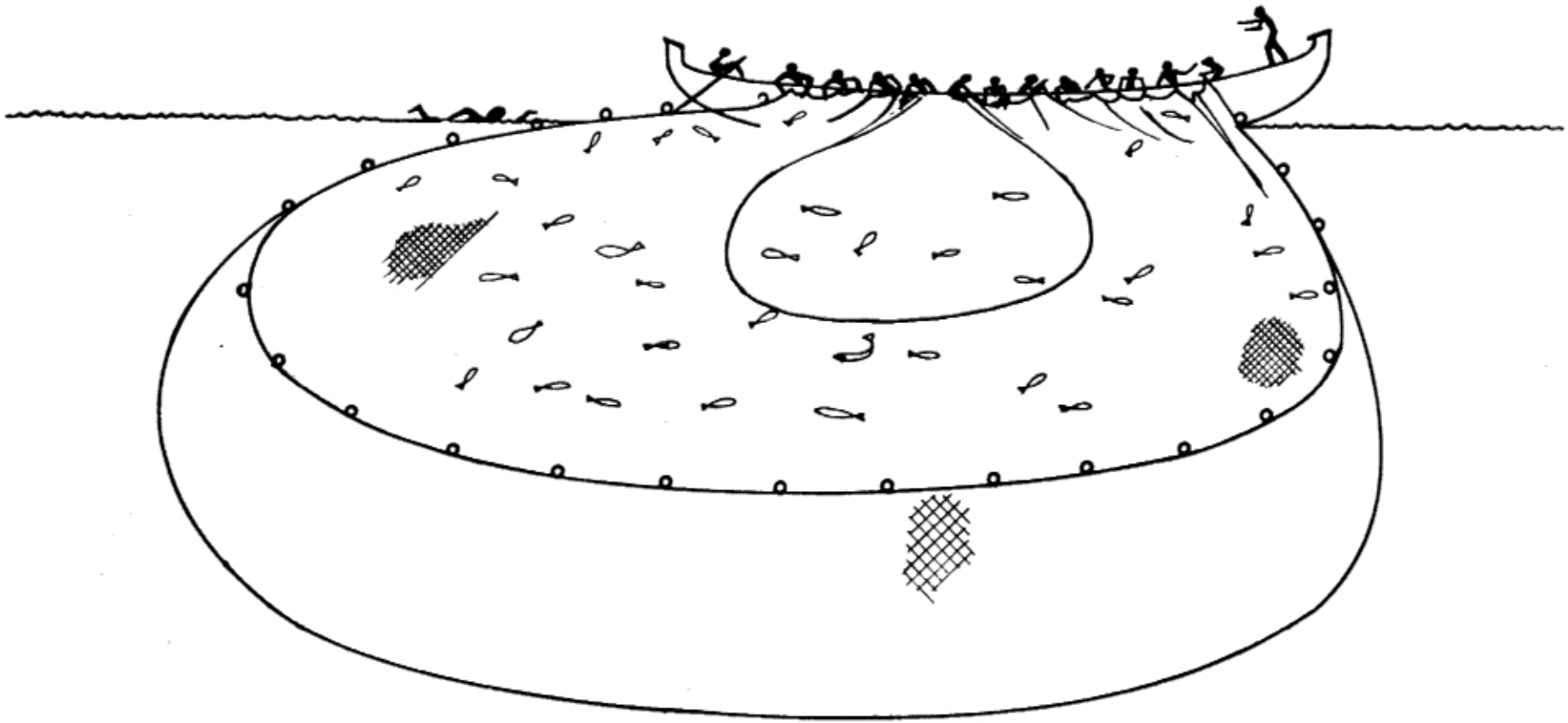

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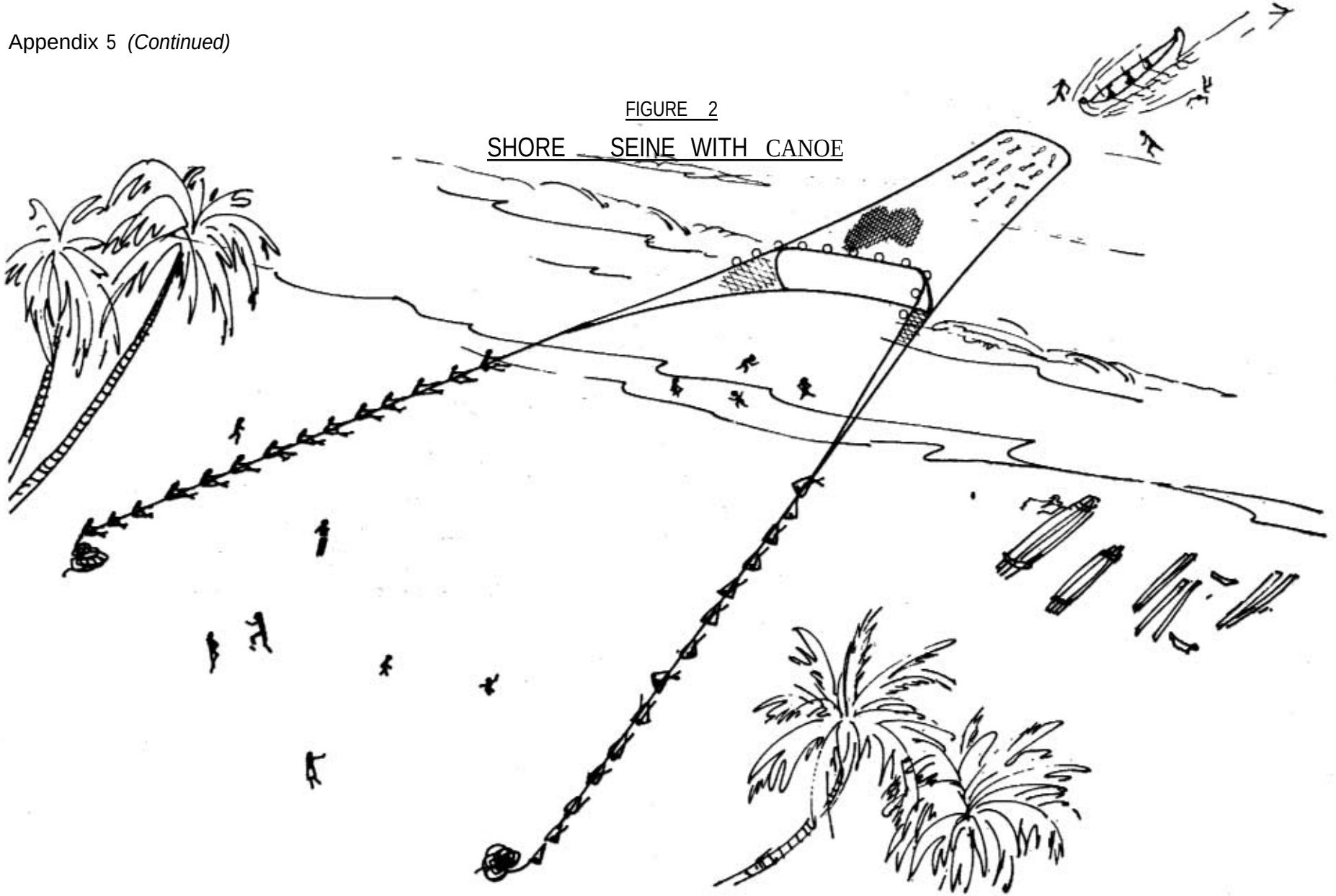
FIGURE 2

SHORE SEINE WITH CANOE



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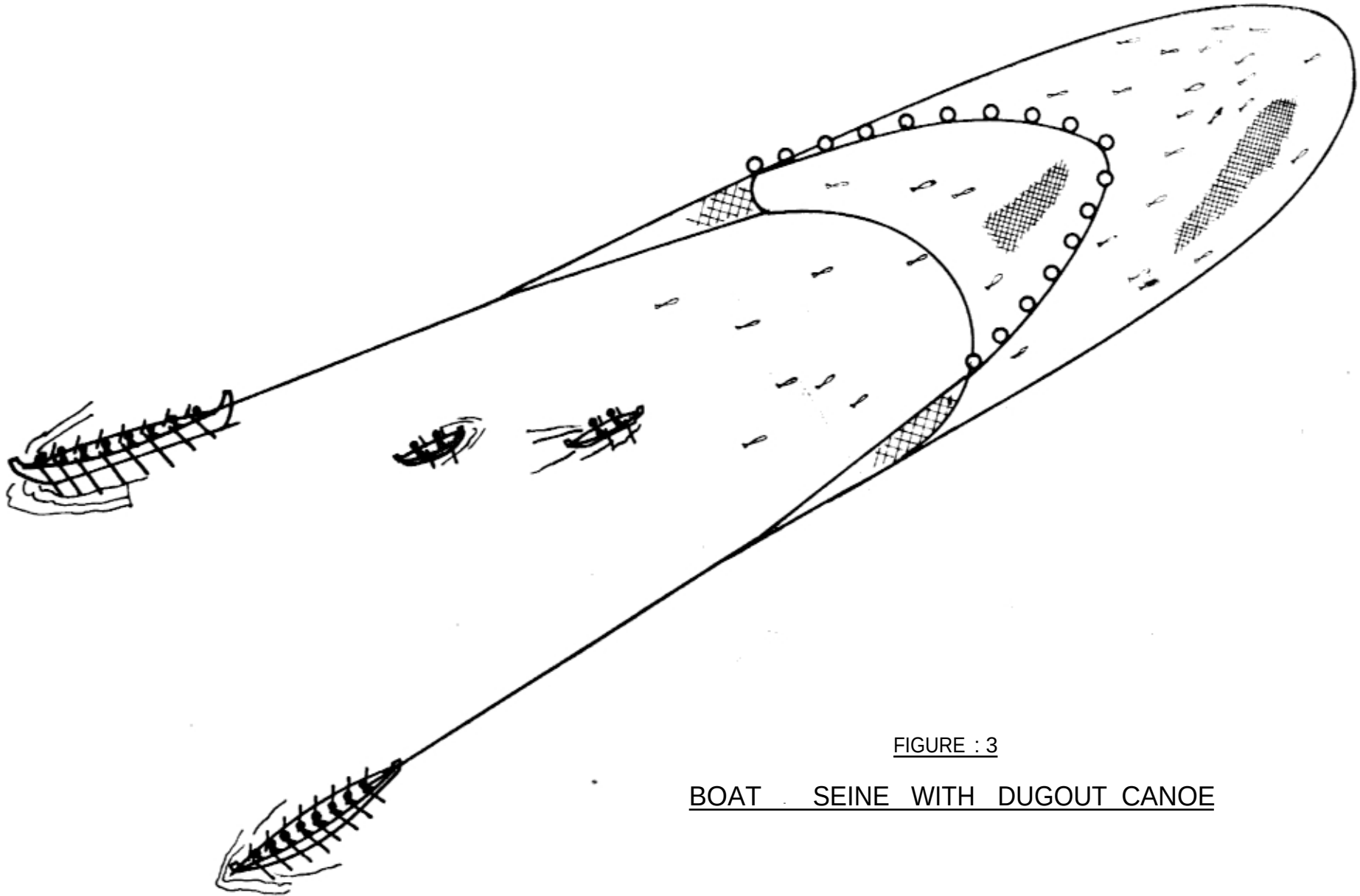

FIGURE : 3

BOAT SEINE WITH DUGOUT CANOE

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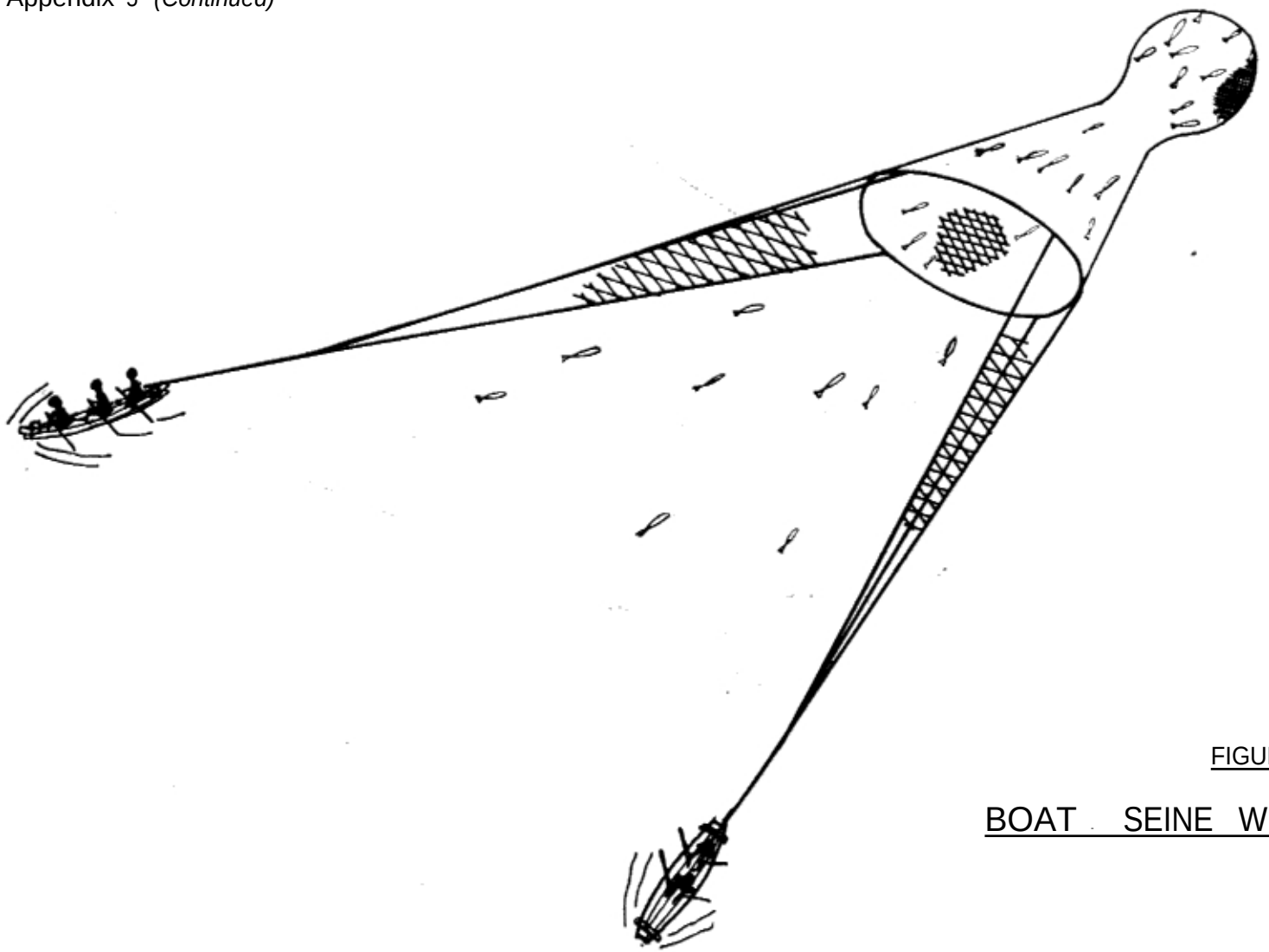

FIGURE 4

BOAT SEINE WITH KATTUMARAM

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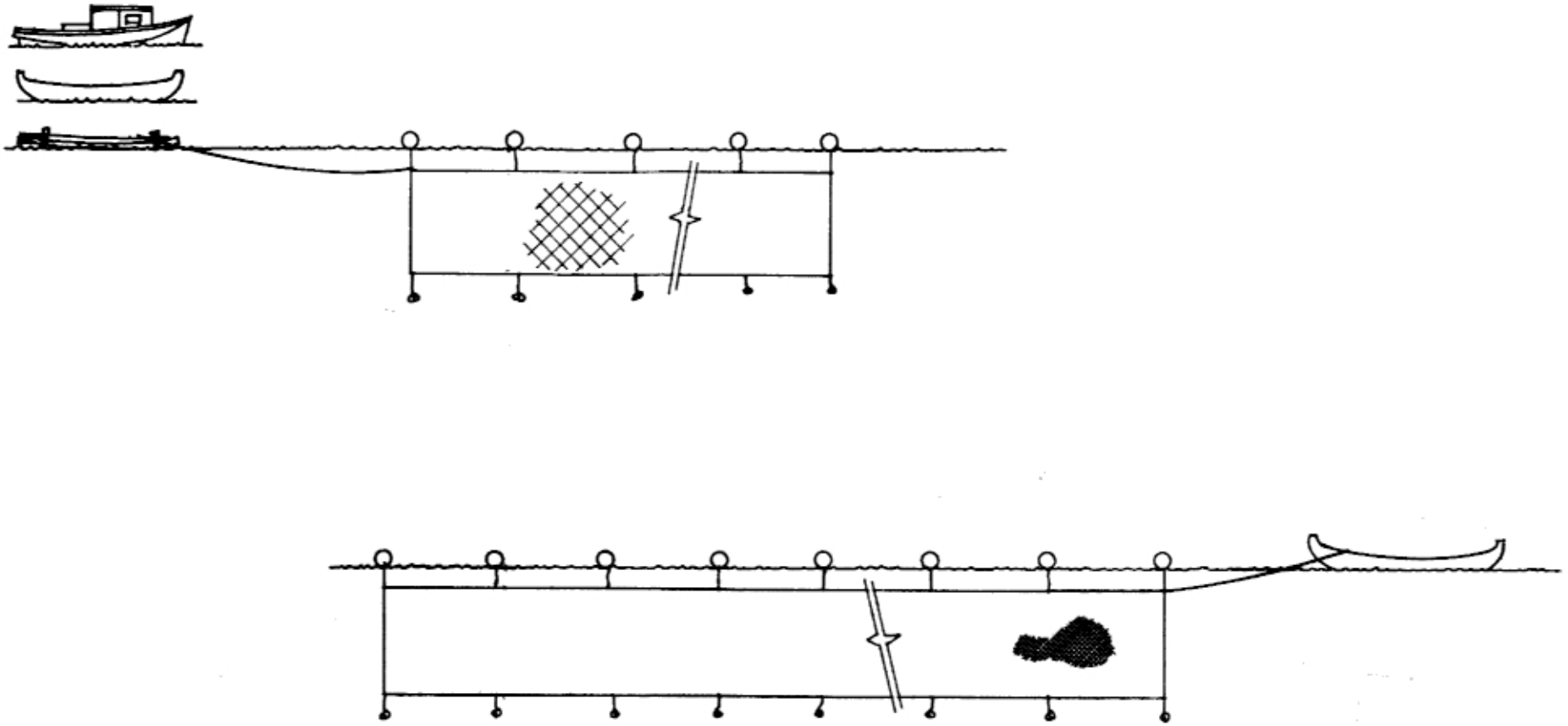

FIGUREt5

LARGE MESH DRIFT NET WITH KATTUMARAM CANOE OR

MECHANISED BOAT AND SMALL MESH DRIFT NET WITH PLANK CANOE

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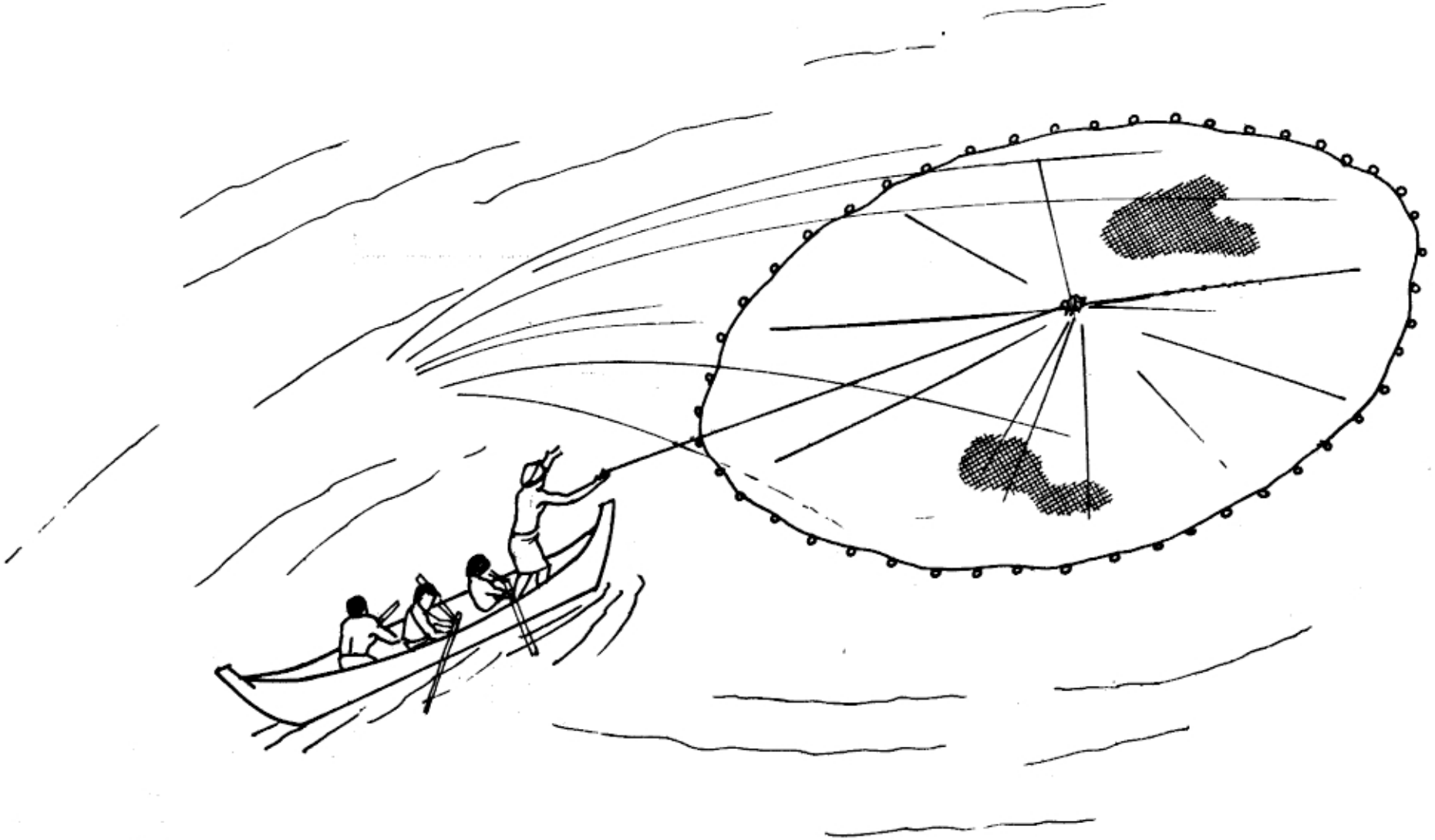

FIGURE 6

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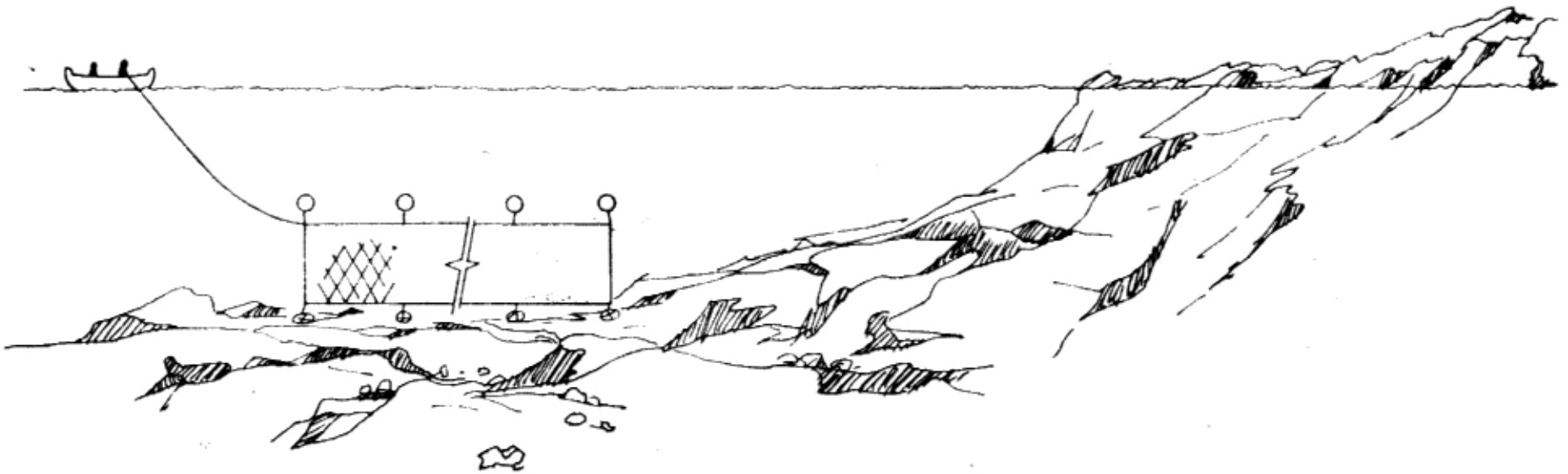

FIGURE :

BOTTOM SET LOBSTER NET WITH DUGOUT CANOE

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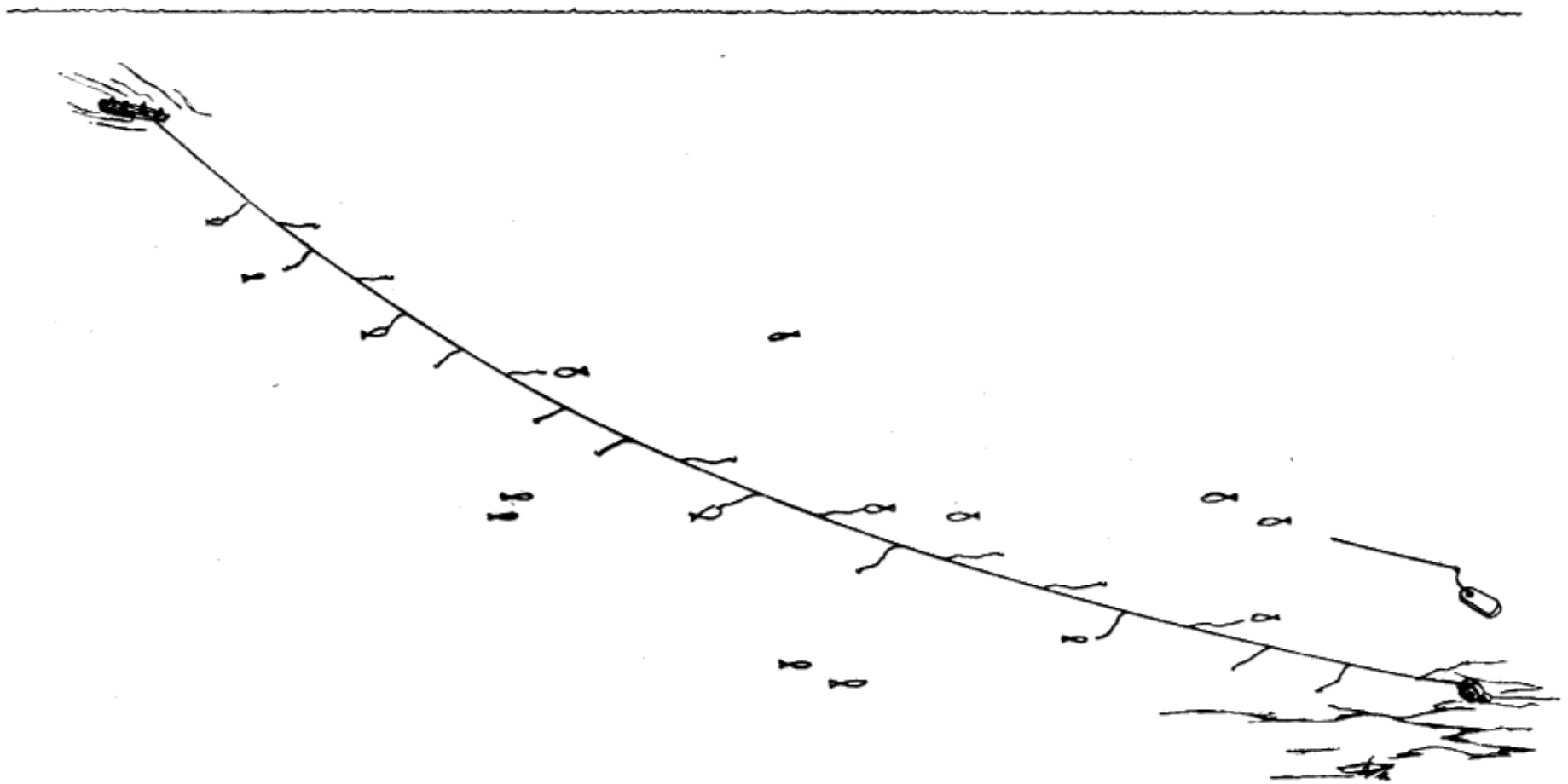
Appendix 5 *(Continued)*

FIGURE :8

HOOKS AND LtNE WITH KATTUMARAM

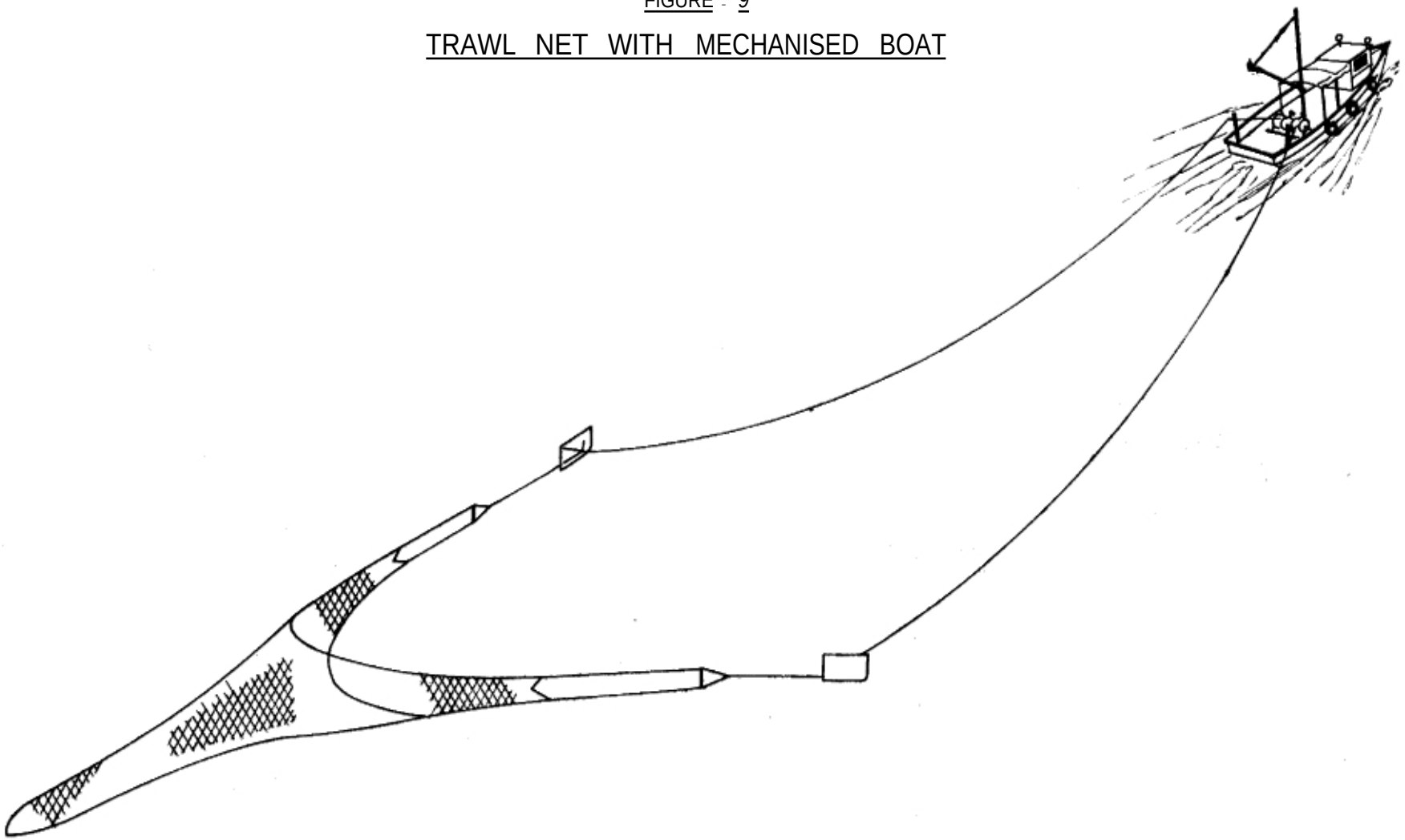


[110]

Appendix 5 *(Continued)*

FIGURE - *9*

TRAWL NET WITH MECHANISED BOAT



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Appendix 6

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