CMFRI
Special Publication
Number 45

MOTORIZATION OF COUNTRY CRAFT IN KERALA

an impact study

Central Marine Fisheries Research Institute
(*Indian Council of Agricultural Research*)
P. B. No. 2704, E. R. G. Road, Cochin 682031, India

MOTORIZATION OF COUNTRY CRAFT IN KERALA

an impact study

K. Balan, K. K. P. Panikkar, T. Jacob,
Joseph Andrews and V. Rajendran

CMFRI Special Publication
Number 45

Central Marine Fisheries Research Institute
(Indian Council of Agricultural Research)
P. B. No. 2704, E. R. G. Road, Cochin 682031, India

Published by
P. S. B. R. JAMES
Director
Central Marine Fisheries
Research Institute
P. B. 2704
E. R. G. Road
Cochin - 682031
India

Printed at
Amarakerala Industries, Cochin-18

MOTORIZATION OF COUNTRY CRAFT IN KERALA - AN IMPACT STUDY

K. BALAN, K. K. P. PANIKKAR, T. JACOB,
JOSEPH ANDREWS AND V. RAJENDRAN

INTRODUCTION

Kerala occupies the foremost position in marine fish production in India, accounting for almost a quarter of the total landings of 1.6 million tonnes. Marine fishing using artisanal tackle is an age old tradition of the State. Mechanization was experimented in late fifties under the Indo-Norwegien project in Quilon area. The early sixties witnessed an important technological development, in gear, the shift from cotton to nylon nets. By mid sixties individual entrepreneurs entered the scene, paving way for a fast development of trawl fishery in the coastal waters. Commercial purse-seining started during the late seventies and the process of large scale motorization of country craft began in early eighties eventhough, expermental projects on motorization were tried much earlier (Jacob et al; 1987).

Experiments conducted on motorization of country craft under the Indo-Norwegien Project in mid fifties found that the programme would not be feasible. It was during

seventies that attempts were made for motorising traditional craft in the south west cost of India. In 1970, under Indo-Belgium Fisheries Project about 100 boats were fitted with outboard engine at Muttom in Kanyakumari District (John Kurien and Jayakumar 1980). In 1974, the Marianad Fisheries Co-operative Society in Trivandrum district initiated a similar experiment (Gillet, F. P, 1981.). Unlike in Gujarat, where motorization of country craft started in the fifties, the experiments in Kanyakumari and Trivandrum districts were not a success. The results of the Purakad trials conducted in 1980 showed encouraging trends. The successful trials carried out at the fishing village Kannamaly (Ernakulam district) during 1979-80 attracted the fishermen of this region. Soon, motorization programme picked up acceleration in Kerala and fishermen of Alleppey, Ernakulam and Quilon districts were credited for the initiative and large-scale adoption. From about 50 outboard engines during 1979-80, the number has now gone upto about 10000.

About two thirds of the fish landings of Kerala was accounted for by the artisanal sector till 1979. This pattern has been fast changing due to large-scale motorization programme which in the present form has merits and demerits leading to a number of questions. Has motorisation helped in increasing the total fish production in Kerala? Has the revenue of fishermen increased? Has it affected employment? Several such questions arise. In this context it is felt necessary to collect and examine the related data and to assess the impact, if any, of motorization of craft, especially on the traditional fishery. The present paper deals with the overall trends in production, major resources exploited, productivity and economics of operation of the motorised craft and attempts to answer some of the major issues emerged. Before the production trend is presented the definitions and classifications followed are dealt with briefly.

Traditional craft such as plank built boats, dug-out canoes and catamarans fitted with outboard engines are

termed motorised craft. Here, human labour power is substituted by mechanical power for propulsion. Fishing continues to be done through human labour. The engine is fixed to a bracket fitted on the starboard side of the craft. Most of the engines used in the eariler periods were of Yamaha make with 12 HP and 7 HP. The fuel is kerosene oil, while petrol is used for starting. The 12 HP engine weighs about 37 kg and the 7 HP engine 27 kg. The engine is removed from the craft as soon as it returns to the shore and fishermen carry the same home where the engine is washed and decarbonised.

Landings of mechanised craft are contributed by three types of units, namely, those with inboard engines where mechanization is used for propulsion as well as fishing (trawler, purse seiner), those with inboard engine where mechanical power is used only for propulsion (drift/set gill net) and those with outboard engines where again mechanization is used only for propulsion. Thus the landings of mechanised craft include those from the motorised craft also. However, the landings of motorised craft are separately dealt with at length as they are of prime importance in this paper. The motorised country craft used boat seine (an encircling net called 'thanguvala' in central Kerala and 'kollivala' in northern Kerala), drift/set gill net and hook and line for fishing.

Total as well as areawise fish landings are detailed in this paper. Area 1 refers to southern Kerala (Vizhinjam to Thankassery), Area 2 central Kerala (Thankassery to Munabam) and Area 3 northern Kerala (Munambam to Manjeswar). Areawise distribution of landings is made because of the differential growth in the motorisation process in different areas.

Extent and Nature of data

Two types of data have been used for the investigation namely, detailed fish landings data from the regular survey programme of the Institute and secondly, the data on cost

and earnings collected through special surveys by the Institues' scientists.

The Institute collects regular data on fish landings and related aspects through a stratified multistage random sampling technique. The data collected from 1980 to 1987 pertaining to Kerala were taken for the study. Specieswise, areawise and gearwise data have been presented. To study the cost and earnings, data were collected from selected sample units. Thus 48 boats with outboard engines were selected from Pallithode, Kattoor, Punnapra and Chennangara in Alleppey district, 22 boats from Munambam and Saudi in Ernakulam district and 29 boats from Azhikkal and Sakthikulangara in Quilon district. The samples include different craft-gear combinations selected on the basis of stratified sampling design. A few control boats were also selected for comparison.

Suitable performae were designed and pretested for final use at the field level. Two types of proformae were designed, one for general information such as type of craft, make of engine, H. P. of engine, gear used and source of finance. A separate proforma was used for collection of data on items such as daily catches, price of fish, operating expenditure, fuel expenditure and wages paid. A copy of the set of proformae used are given in the Appendix.

Through the special survey, specieswise catch and revenue realised and operating costs were collected by direct observation at the landing centre with the help of enumerators locally recruited and trained. The fixed costs and expenditure on repairing and maintenance have been collected through careful enquiry. The field observations were made during 1982 and 1983. In addition, a number of spot visits were made to collect information on impact of motorization. These visits were made during 1984 to 1987, not only in the central coastal area, where the motorization picked up during the early eighties, but also in the southern and northern districts of Kerala where it started only later. The field work was intensively supervised by the officials of CMFRI. The

information on length of boat, size of gear, mesh size, life expectancy of craft/gear/engine, number of fishing days and number of persons engaged for fishing have also been collected by direct observation and enquiry.

The collected data were critically analysed and the results are discussed in the following paragraphs.

MARINE FISH LANDINGS IN KERALA

Since the mid seventies the total fish landings of Kerala has been generally on the decline, touching the level of 2.7 lakh tonnes in 1981. But it then steadily increased to 3.9 lakh tonnes in 1984, with fluctuations thereafter as can be seen from the following table.

Marine fish landings ('000 tonnes) in Kerala 1973-1987

Year	1973	74	75	76	77	78	79	80	81	82	83	84	85	86	87
Landing.	448	420	421	331	345	373	331	280	274	325	385	393	326	383	330

Estimated region-wise landings for the period 1980-87 are given in Table 1. As seen from the table, the central region accounted for about half of the total landings of the State followed by northern and southern regions. The trends in the areas over the years were more or less similar to the overall State trend.

The fish landings in different seasons over the eight year period (1980-87) showed high fluctuations (Table 2). However, in general, it can be stated that total landings were highest during monsoon (July to September) and post-monsoon (October to December) seasons followed by summer (January to March) and pre-monsoon (April to June) seasons. Areaswise, highest landings are seen to be in monsoon for

southern and central regions while it is post-monsoon for the northern region.

The landings from trawlers and gill netters (inboard engines) almost doubled during the period 1981 to 1984 while those from motorised craft increased by six-fold (Table 3). Purse-seiners also had increased landings during 1982 to 1984; but thereafter declined sharply. After 1984, the landings of trawlers further increased while the gill netter landings fluctuated. The landings by motorised craft reached a peak in 1986. The catches by non-motorised craft steadily declined after 1983. Eventhough the total production has not reached the mid seventies level, motorization appears to have partly contributed for the temporary boosting up of the sagging production level.

Oil sardine is by far the most important fish caught in terms of quantity accounting for 16 per cent of the total catches (average of 1985, 86 and 87). Other important resources are mackerel (5%), whitebaits (8%), cat fishes (2%), carangids (11%), croakers (3%), seerfishes (2%), tunnies (3%), ribbon fishes (5%), perches (11%), sharks (1%), penaeid prawns (12%) and cephalopods (3%).

The percentage contribution of landings from mechanised units including motorised fishing craft was 35 in 1981, 46 in 1982, 51 in 1983, 67 in 1984, 76 in 1985, 83 in 1986 and 87 in 1987 thus showing a steady increase over the period. This is mainly due to the increase in catches from motorised country craft as well as those from trawlers. The contribution of motorised craft to the landing by mechanised boats was 1% in 1980, 24% in 1981, 59% in 1986 and 43% in 1987.

Landings of Motorised Craft

Motorization of country craft started in 1980 in central Kerala, picked up fast by 1982. It spread to the northern and southern areas by 1983. The total catch from motorised

craft increased from 23,000 tonnes in 1981 to about 1,87,000 tonnes in 1986. However, it reduced to 1,12,000 tonnes in 1987 (Table 4). The percentage contribution of central Kearla to the motorised landings was almost 100 during 1981 and 1982. It reduced thereafter reaching a figure of 30 in 1987. On the other hand the contribution of southern Kerala increased from 1 to 11% during 1983 to 1987 period and that of northern Kerala from 5 to 59%.

An increasing trend in landings was observed in southern and northern Kerala during 1983 to 1987 period. However the landings in central Kerala where motorization started in 1980 showed a parabolic growth almost reaching a plateau indicating growth stagnancy in that region.

As stated earlier, the craft-gear combinations are plank built boats operating boat seine, plank built/dugout canoes using gill nets and canoes and catamarans operating hook and line.

Boat seines accounted for about 98% of the landings by motorised boats in 1981 which reduced to 71% in 1987. This is mainly due to the fact that initially only craft using boat seines (central Kerala) were fitted with outboard engines. Motorised craft operating drift/set gill net accounted for 2% of the landings in 1981 which increased to 19 in 1987. The hook and line landings were about 6% of the total catches of motorised boats in 1987. About 4% comes under the miscellaneous category.

In the central coastal Kerala, catches by boat seine increased from 22,000 tonnes in 1981 to 67,000 tonnes in 1986 and reduced to 12,000 tonnes in 1987. This sudden reduction was mainly due to the failure of oil sardine and carangids fishery in 1987 compared to pervious years. In addition, plank built boats operating ring seine caught 23,000 tonnes in 1986 and 14,300 tonnes in 1987. In the

northern region catches by boat seines increased from 2,000 tonnes in 1983 to 50,000 tonnes in 1986 eventhough there was a decline in 1987. Ring seine accounted for 17,000 tonnes in 1987 in the northern region.

Gill net catches in the central region increased from 500 tonnes in 1981 to 8,000 tonnes in 1986 which however reduced to 2400 tonnes in 1987. This is mainly due to the decline in catches of mackerel in 1987 compared to 1986. In the northern region, gill net catches increased from 3,000 tonnes in 1983 to 15,000 tonnes in 1986. In the southern region, the gill net catches increased from 300 tonnes 1983 to 10,000 in 1986. There was a decline in 1987.

Landings by hook and line in the central region increased from about 3,000 tonnes in 1982 to 5,500 tonnes in 1986. In the northern region the catches increased from 600 tonnes in 1983 to 3,000 tonnes in 1986 while the corresponding figures were 500 tonnes to 1,300 tonnes in the southern region. A decline has been observed in central and northern regions during 1987.

An interesting development by the end of 1985 was the introduction of a new gear called ring seine in the Alleppey area of Kerala. This is a versatile gear which operate very similar to that of a purse-seine but smaller in size. The ring seine is also known as mini purse-seine. A similar gear was introduced during 1986 in the Kasargod area locally known as 'Kudukkuvala' and being operated from motorised plank built boat. The landings of motorised craft operating ring seine was estimated at 32,000 tonnes in 1987.

Oil sardine formed the most important species caught in the motorised boats during the period 1980 to 1985 accounting for about 78% of the total catches of motorised boats while carangids formed a major group in 1986 (34%). Whitebaits and mackerel (14% and 5% respectively) formed

the next important groups followed by penaeid prawns (4%) and catfishes (3%). Upto 1983, oil sardine dominated the catch, but, thereafter, till 1986 white baits and carangids also contributed substantially to the total catch. However, a decline was observed in 1987. The pattern is almost similar in the northern Kerala, while in the southern area, ribbon fishes and tunnies dominated.

Landings of Non-Motorised Craft

The landings in the central coastal Kerala by the non-motorised boats operating boat seines reduced from about 19,000 tonnes in 1981 to 1000 tonnes in 1987 (Table 5). Similarly the landings in northern Kerala reduced from about 88,000 tonnes in 1983 to 2,500 tonnes in 1987. However, in the southern region the landings increased from about 5,000 tonnes in 1983 to 25,000 tonnes in 1985 which declined thereafter to 8,000 tonnes in 1987. The number of non-motorised units has come down due to motorization thereby reducing the landings.

In the case of gill net, the catches reduced from 11,000 tonnes in 1981 to 2,700 tonnes in 1987 in the central Kerala. In the northern Kerala, the landings reduced from 11,000 tonnes in 1983 to about 3,000 tonnes in 1987. In southern region, the landings reduced from 27,000 tonnes in 1983 to 7,000 tonnes in 1987.

Landings by hook & line in central Kerala generally reduced over the years without indicating any regular trend. In the northern districts it reduced from 5,000 tonnes in 1983 to a mere 10 tonnes in 1987, However, in the southern region the catches redneed only from 10,000 tonnes in 1983 to 3,000 tonnes in 1987, indicating ccmparatively slow proceas of motorisation of country craft there.

The total landings of non-motorised craft reduced from about 1.8 lakh tonnes in 1981 to 40,000 tonnes in 1987. However, the landings from the non-motorised and motorised

craft put together did not show any regular trend during the period 1981 to 87 indicating that perhaps it was more of a shift to the motorised sector rather than increassng the total production due to the introduction of outboard engines for propulsion.

Landings of Craft with Inboard Engine:

This group consists of trawls, pursc-seines and gill nets operated by specially built craft with inboard engines. The total catches from trawls reduced from about 1 lakh tonnes in 1980 to almost half in 1981. Thereafter, there has been a steady increase and reached the level of 1.44 lakh tonnes in 1987 (Table 3). Prawn catches reduced from about 46,000 tonnes in 1980 to 16,000 tonnes in 1981. Thereafter the production was almost stationary around 23,000 tonnes till 1986. In 1987 the prawn catches have shot up to 47,000 tonnes. The non prawn component on the other hand increased steadily from about 41,000 tonnes in 1982 to 97,000 tonnes in 1987. Fish component appears to gain more impoitance in trawlers when compard to theearlier years.

Purse seine cetches increased from 15,000 tonnes in 1980 to 21,000 tonnes in 1984 with fluctuations in between. Thereafter the landings reduced and reached an all time low level of 900 tonnes in 1987. Major components are oil sardine and mackerel. But during 1985 and 1986 tunnies also contributed substantilly.

Landings of gill netters increased till 1985. From 6,000 tonnes in 1981 it steadily reached the level of 16,000 tonnes in 1985 eventhough it declined thereafter reaching a level of 5000 tonnes in 1987. Catfishes, Sharks, tunnies and seer fishes formed the major resources caught.

The catch trend did not indicate any influence on the landings of craft with inboard engines due to the operation of motorised country craft.

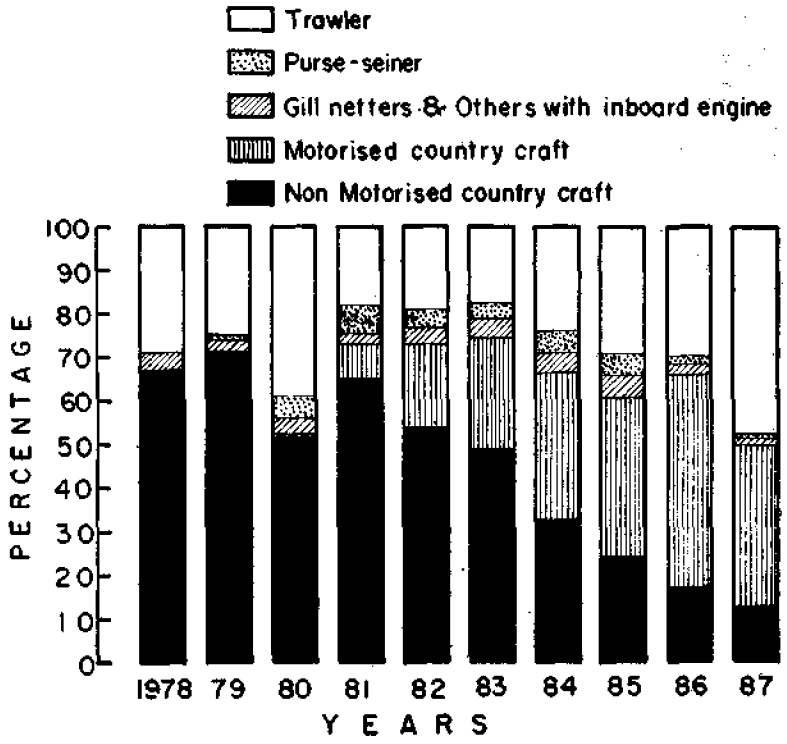

Fig (1) Year-wise percentage composition of marine fish landings in Kerala by different types of craft.

EFFORT EXPENDED AND CATCH PER UNIT EFFORT OF MOTORISED AND NON-MOTORISED CRAFT

The number of boat trips made by the motorised country craft was about 3800 in 1980 which steadily increased to 7 lakh trips in 1987 indicating the fast growth of this sector. Eventhough the total landings from motorised craft also increased during this period, the overall catch per boat trip decreased from about 420 kg in 1980 to 200 kg in 1986. The catch per boat trip in 1981 was almost 1430 kg. This was due to bumber catch of oil sardine using motorised craft with boat seine.

The catch per boat trip for motorised boat seines reduced from 530 kg in 1982 to about 280 kg in 1987. However, if catches of ring seine which came into operation in 1986 from central and northern Kerala are included, the catch per unit effort works to 400 kg in 1986 which reduced to 318 kg in 1987. In 1986 there was a bumber catch of carangids compared to 1987. If the ring seine alone is considered the average catch rate was as high as 770 kg in 1986 which reduced to 380 kg in 1987. The catch per unit effort of gill net reduced from 235 kg in 1981 to 66 kg in 1987 while the landings of hook & line ranged from 54 to 93 kg without showing any trend. Motorised boats operating boat seine caught about 50 to over 100% more per trip than non-motorised boats while in gill nets the motorised boats yield 50 to 200% more. The catch rate difference was still more pronounced in the case of motorised boats with hook & line as follows:

Gear-wise catch/unit effort (kg/boat trip) of motorised (M) and non-motorised (NM) craft in Kerala.

	Boat seine		*Gillnet*		*Hook & line*	
Year	*M*	*NM*	*M*	*NM*	*M*	*NM*
1980	423	171	—	48	—	23
1981	1604	252	235	47	—	22
1982	529	209	168	43	75	31
1983	401	352	197	47	89	33
1984	359	230	86	31	90	18
1985	441	201	55	30	54	15
1986	362	198	73	22	93	15
1987	280	134	66	18	60	12

The number of non-motorised boat trips reduced from about 19 lakhs in 1981 to about 12 lakhs in 1987. This reduction is more dominant in boat seine where the number of boat trips reduced from 4.7 lakhs in 1981 to almost less than 1 lakh in 1987. In the case of gillnet, the reduction was from 8.7 lakh

boat trips to 7 lakh trips. There was no such trend in hook & line. The catch rates of non-motorised units also reduced over the years especially since 1984. The detailed gear-wise catch rates for motorised craft are shown in Table 6.

ECONOMIC EVALUATION OF DIFFERENT CRAFT GEAR COMBINATIONS

The data on cost and earnings have been collected from different craft-gear combinations namely, plank built boat operating boat seine fitted with 12 HP engine and the same with 7 HP engine, plank built boat operating gill net with 7 HP, catamaran with 7 HP operating hook & line and canoe with 7 HP engine operating hook & line. Data have also been collected for all these craft-gear combinations without out-board motors.

Cost Structure

The components of fishing costs are classified as variable cost and fixed costs. Those cost items which vary with the level of production are considered as variable costs and those which are not related to the level of production constitute the fixed costs.

Variable cost constitute labour, fuel, auction commission, maintenance and repair and other operational expenses. The revenue is shared between the owner and workers after deducting the variable costs other than the cost of maintenance and repair. The variable cost per day was maximum at Rs. 522/- for boat seine with 12 HP followed by Rs. 412/- for boat seine with 7 HP engine and the minimum of Rs. 256/-

for gill net operating with 7 HP engine during 1982-83. (Table 7). The number of crew required for operation of boat seine is 16, gill net 6, and hook & line 6 for both motorised and non-motorised units. The share of the workers is equally divided among themselves. Owner operators also get the share accordingly if they are actually involved in fishing operatian. Wages constitute the maximum portion of the operating cost. In the case of boat seine with 12 HP it is 70%, boat seine with 7 HP 68%, gill net 63%, catamaran with hook & line 71% and canoe with hook & line 57%. The percentage of wages to operating cost is lowest for canoe with hook & line because the total operating costs include other expenses which constitute mainly the cost for baits used. The expenditure on baits in the catamaran operation with hook & line is comparatively less because they use artificial baits. In the operating cost next to labour, fuel is the major component which varies from 16 percent for boat seine with 7 HP and catamaran (hook & line) to 20% for hook & line with canoe. The higher percentage of fuel expenditure of canoes using hook & line is mainly due to the longer distance covered for the operations.

For non-motorised units, operating cost mainly constitute labour except for canoes operating hook & line in which case cost of baits forms an important component. The percentage contribution of labour to the operating cost varied from 56 for canoe with hook & line to 87 for both boat seine and gill net (Table 8).

Fixed cost include depreciation of craft, gear and engine and the interest on the investment. Depraciation is computed by straight line method, dividing the initial investment by the life expectancy of the equipment. The annual interest for all types of fishing units is calculated at the rate of 15%. Even for own money invested, interest is included in the fixed cost as the opportunity cost of the capital. The initial investment was maximum at Rs. 65.000 for a boat seine unit with 12 HP and minimum Rs. 14,000 for a catamaran with 7 HP using hook & line.

Aunual fixed costs of boat seine (12 HP) worked out to Rs. 20,000 whereas for hook & line with catamaran (OBE) Rs. 5,800/- (Table 9). The average fixed cost per day of operation is calculated by dividing the annual fixed cost by number of boat–days which is taken as 220.

The total cost per day of operation for the motorized unit was maximum for boat seine having 12 HP, at Rs. 613/- per day of operation and minimum of Rs. 311/- for gill net. The percentage contribution of variable cost to the total cost ranged from 82 (boat seine operatod with 7 HP and gill net) to 92 (hook & line).

Total cost for non-motorised boats per day of operation varied from Rs. 111/- for catamaran with hook & line to Rs. 408/- for boat seine. The percentage contribution of variable cost to the total costs, varied from 81 (canoe with gill net) to 89 (catamaran with hook & line).

Comparative Economic Efficiency

Among the motorised units the average revenue per day of operation ranged from Rs. 343/- for catamaran with hook & line to Rs. 679/- for boat seine with 12 HP. For non-motorised unit average revenue was maximum at Rs. 456/– for boat seine and minimum of Rs. 124/- for catamaran with hook & line.

Net income per day was Rs. 71/– for boat seine with 7 HP and Rs. 66/- for boat seine with 12 HP. For non-motorised boat seine it was Rs. 48/–. Rate of return (Table 10 and 11) was maximum (41%) for boat seine with 7 HP followed by boat seine with 12 HP (37%), and boat seine without engine (24%).

Fuel efficiency was found better for boat seine with 7 HP compared to boat seine with 12 HP. Average cost for producing 1 kg of fish was highest for non-motorised boat seine (Rs. 1.41) and lowest for boat seine with 7 HP (Rs. 1.12).

Net income for motorised gill net was Rs. 39 as against Rs. 20 for non-motorised gill net. Returns to labour worked out at Rs. 34 for motorised unit and Rs. 28/- for non-motorised unit. However, rate of returns for non-motorised gill net (50%) was higher than that of motorised gill net (36%). The average cost to produce 1 kg of fish worked out at Rs. 3.53 for motorised gill net against Rs. 2.10/- for non-motorised unit.

Net income per day of operation for motorised catamaran with hook & line was Rs. 25/- against Rs. 13/- for non-motorised catamaran. For motorised canoe net income was Rs. 64/- and for non-motorised it was Rs. 24/-. Rate of return was maximum for non-motorised unit operating catamaran and minimum for non-motorised canoe with hook & line. Returns to labour was highest for motorised catamaran (Rs 77/-per day) compared to non-motorised catamaran (Rs 29/- per day). For motorised canoe, it was about Rs. 48/- compared to Rs. 23/- for non-motorised canoe. Regarding fuel efficiency, canoe was superior to catamaran. For motorised catamaran, price realised per kg of fish was Rs. 6.73 against Rs. 6.20 for non-motorised. Despite the higher initial investment in motorised canoe, the average cost of producing 1 kg of fish (Rs 3.32) was less than that of non-motorised canoe (Rs. 4.09)

For boat seine with 12 HP engines, the operator should get 613/- worth of fish per day of operation to cover opportunity costs of all inputs. The same for boat seine, with 7 HP gill net, hook & line (catamaran) and hook & line (canoe) were Rs. 500/-, Rs. 311/-, Rs. 318/- and Rs. 431/- respectively. For non-motorised boat seine, gill net, catamaran with hook & line the break-even revenue worked out at Rs. 408/-, Rs. 212/-, Rs. 111/- and Rs. 237/- respectively.

On the basis of data pertaining to 1986, for boat seine, gill net and hook & line the economics of operation have been worked out. Data covered only the central coastal region of the State where motorization started as early as

1980. The detailed figures are given in Table 12. The initial investment of Rs. 65000/- for a boat seine unit (with 12 HP) in 1982, increased to Rs 87000/- in 1986. The operating cost per fishing day increased from Rs. 522/- in 1982 to Rs. 1142/- in 1986. This increase in operating cost was mainly due to the wages which was about 80% of the total variable cost. However this increase in wages, since it is a fixed percent of revenue, is only due to the increase in revenue, The rvenue realised per day of operation was Rs. 679/- in 1982. In 1986 it increased to Rs. 1585/-. This is mainly due to two reasons; continuous increase of the prices of all varieties of fishes, including prawns and the other, change in the catch composition having a better proportion of quality fishes. Net profit of boat seine of Rs. 66/-in 1983 is increased to Rs. 311/- in 1986.

For gill net the revenue per day of operation was Rs. 350/- in 1983 which increased to Rs. 434/- in 1986. The decline in net profit over the years was mainly due to the tremendous increase in effort year after year and the resultant decline in the CPUE. The reduction in CPUE could not sufiiciently be compensated by the increase in the fish prices over the years.

For canoes operating hook & line revenue per day of operation increased from Rs. 495/- in 1982 to Rs. 728/- in 1986 and the net revenue from Rs. 64/- to Rs. 119/-. There has not been much change in cost structure.

In order to have a comparative study of catch rate, revenue and value over the years indices have been worked out taking the year 1982 as the origin. The indices are shown in Table 14. It is seen that even though the catch rate has declined to 68 and 43 for boat seine and gill net respectively, over the years 1982 to 1986, the value realised per kg of fish has increased to 326 and 352 respectively. The increase in value realised is due to change in the composition as well as the increasing trend in the unit price. The reduction in catch rates have been more than compensated by the value realised resulting in better revenue in 1986 compared to 1982.

Economics of Ring Seine Operations:

As stated earlier, ring seines started operating towards the end of 1985 in the Alleppey region. The gear used has about 450 m. length and 100 m. depth. The economics of operation of ring seine has been worked out based on 1986 data and the results are given in Table 13. The average catch per day of operation per unit of a ring seine operated by motorised craft worked out at 770 kg. and the average revenue realised per day at Rs. 2400/-. Total operating costs which include wages, auction commission, fuel charges and maintenance and repair worked at Rs. 1738/-per day of operation and fixed cost at about Rs. 239/-. The net income of a unit per day of operation after deducting both variable and fixed cost worked out at Rs. 423/-. On an average a wage earner in a ring seine unit received about Rs. 78/- per day of operation. Returns to labour worked out at Rs. 101/-. Rate of return worked out at 70%. Based on these economic indicators given in the table, ring seine is economically and technically more efficient than the conventional boat seines. This has been made possible only with the introduction of outboard motors.

DISCUSSION

Marine fisheries play an important role in the economy of Kerala. About one lakh families in the costal villages are engaged in fishing and allied activities. Even though trawlers and gill-netters (with inboard engine) were in operation since mid sixties, two thirds of the fish landings of Kerala came from the traditional sector using non-mechanised country craft until late seventies. Introduction of few purse-seiners did not produce any significant effect on the landings. But since 1980, with motorization of the country craft using

outboard engines, the landings of non-mechanized sector steadily decreased and by 1986, the contribution from that sector was only less than one-seventh of the total landings of Kerala. Motorised craft (with OBE) accounted for about 50 per cent of the total landings of Kerala in 1986 eventhough it reduced by about 10 per cent in 1987.

Strangely, early experiments on motorization of country crafts carried out in Quilon area in mid-fifties under the Indo-Norwegien Project ended with the conclusion that motroization of the traditional canoes would not be technically feasible. Interestingly, similar canoes were successfully motorised in the Saurashtra coast of Gujarat almost at the same time. Two studies on motorisation are made by the Indo-Belgium Fisheries Project in Kanniyakumari district in 1970 and the other by Marianad Fisheries Co-operative Society in Trivandrum district in 1974 did not bring out definite conclusions. Experiments conducted at Purakkad in Alleppey District (John Kurien and S. R. J. Jayakumar, 1980) and at Thankassery and other areas in Quilon district Gulbrendsen, 1984) brought out the merits and demerits of motorization and indicated, in general, encouraging trends. It was again during 1979–80 the fishermen of Alleppey–Ernakulam belt started fitting outboard engines to their country craft after getting intrested by the results of the trial runs at Kannamaly village using outboard engines. Ironically, this time it picked up so well that there was a spree for motorization, first in the districts of Quilon, Alleppey and Ernakulam followed soon by the northern and southern districts. There are about 10,000 such craft now operating and the stage has almost come that the fishermen who are used to motorised craft cannot even think of sailing or rowing of boats.

Before some of the basic questions often posed are taken up, the findings arising out of the analysed data of the foregoing sections are highlighted. The study mainly concentrated on the period 1980-87. Also, the craft covered under the detailed study are those with outboard engines.

Production Trends

Motorised craft landed about 1.86 lakh tonnes of fish in 1986, registering almost a nine-fold increase during the six-year period. However the landings declined to 1.12 lakh tonnes in 1987. This is mainly due to the general reduction in catches of pelagic group of fishes. 54 percent of the landings of motorised craft in 1986 was accountd for by Quilon, Alleppey and Ernakulam districts, 39 percent by the northern districts and 7 percent by the southern districts. However in 1987, the districts in the central region accounted for only 20% while the northern districts accounted for 59% of the catches of motorised craft. In 1982 on tbe other hand almost all catches were accounted for by the central region.

Maximum catches of motorised craft were observed during the monsoon and post-monsoon seasons. 88 percent of the landings from motorised boats were accounted for by craft using boat seines, 7 percent gill nets and 4 percent hook and line in 1982. The corresponding figures wer 76, 18 and 5 in 1986. A similar pattern was observed in 1987 also.

Oil sardine formed the most important resource caught by boat seine followed by whitebaits, carangids, mackerel and penaeid prawns. Gill net catches were dominated by seer fishes, mackerel, catfishes and tunnies. Carangids, catfishes, tunnies and ribbon fishes dominated the catches of hook and line. It may however be noticed that there has been variation in the composition of catches between years, especially in 1985, 1986 and 1987 when the oil sardine fishery almost crashed. Changes in the composition of the catches by motorised craft were observed over the years 1980 to 1987. In the early eighties the catches of motorised craft operaing boat seines were mostly oil sardine. But by 1985 white baits, mackerel and carangids also figured in good quantities. Catches by motorised boats using gillnets and hook & line also indicated changes in the composition. Seer fishes, tunas, sharks and carangids were seen in better proportion in addition to mackerel and oil sardine in gill nets. Increased catches of carangids and tunas were observed in hook & line.

Even though catches by motorised craft were steadily increasing, the catch rates were declining over the period. The average catch per motorised boat trip was about 370 kg in 1982 which reduced to 170 kg in 1987. About 530 kg of fish was caught by motoirsed craft using boat seines in 1982 which reduced to 280 kg in 1987. In the case of giil nets the catch per trip reduced from 170 kg to 66 kg. Hook and line catches fluctuated over the years without any trend.

Corresponding to the increased production by the motorised sector there has been a steep fall in the landings by the non-motorised sector. From about 1,77,000 tonnes in 1982 it reduced to 40,000 tonnes in 1987. The catch per trip decreased since 1984 for all the gears.

Catches by trawl nets showed an increasing trend, raising from 62,000 tonnes in 1982 to 1,17,000 tonnes in 1986. It may be noticed that while the prawn component increased only from 21,000 tonnes to 25,000 tonnes during the period, the fish component increased from 42,000 tonnes in 1982 to about 90,000 tonnes in 1986. In 1987 prawns landings increased to 47,000 tonnes and non prawns to 97,000 tonnes. These indicate that trawlers are now giving importance to resources other than shrimp also mainly because of the good income they get from fish and cephalopods, the prices of which have been showing spiraling increase during the last eight years. The fact that trawlers are changing over to diversified fishing is definitely an encouraging trend.

The purse seine catches also showed an increasing trend till 1974; but thereafter started declining fast and reached the level of 4,800 tonnes in 1986 and 900 tonnes in 1987. Gill net (with inboard engine) catches increased from 11,000 tonnes to 16,000 tonnes in 1983, then slowly decreased and reached the level 9,000 tonnes in 1986 which further reduced to 5300 tonnes in 1987.

Cost and Earnings

Studies on the cost and earnings of motorised boats showed that wages formed the bulk of the variable cost (70%

in the case of craft operating boat seines). Fuel formed the next important component. Annual fixed cost of a boat seine unit (12 HP engine) was about Rs. 20,000/-during 1982-83 which increased to Rs. 27,000 in 1986. The average net income & motorised boats has been found to be higher than that of the non-motorised craft.

Fuel efficiency, rate of return, labour productivity and net income were found to be higher in the case of motorised craft with 7 HP engine operating boat seines as compared to that with 12 HP. Total revenue for 12 HP engine-fitted craft operating boat seine was higher than that of 7 HP engine so that the wage earners in the former get more income than the latter.

It may be stressed here that unlike crops, fish production in quantity and quality are highly unpredictable and the risk involved is heavy. The prices vary drastically between species and even high day-to-day variation is observed not only because of the changes in the market mechanism but more so of the highly inelastic supply due to perishable nature of the commodity. Because of the multi-species character of the fishery, the revenue from each depends not only on price levels but also on composition. Any cost and earning study is to be viewed in this background. It is therefore desirable to have frequent monitoring of information of economics of operations for decision making.

Expectations and Actual Performance:

The advantages from motorisation of traditional craft by fitting outboard engines are too many. The motor replaces human labour power for propulsion of the craft. This reduces time taken to reach the grounds and scouting for shoals thereby increasing fishing time and labour efficiency, as they will have full energy at the time of fishing. In the case of boat-seine (thangu vala) because of engine power, encircling of shoals can be effected speedily which in turn increases the efficiency of the fishing operations. Because of the mechanical power, going beyond the conventional limits can be done

with ease, thus widening the operational area and making it possible to tap additional resources. Due to time saving it may be possible to make more than one trip in a day. Also fish can be brought to the shore in shorter time thereby retaining the freshness of the fish to a good extent and fetching a better price. Because of the portable nature, the outboard engine can be declamped easily at the close of operation and removed to the fisherman's house. Thus beachlanding does not create any special problem and the safety of the engine is ensured, Above all, the physical strain in rowing is almost eliminated and this helps in better health and more leisure time for social engagements. Considering many of these aspects, motorization is expected to help in increasing total fish production and improving the socio-economic conditions of fisbermen families.

There are several schemes sponsored by central and state governments and some of the developmental agencies like the Marine Products Export Development Authority, National Co-operative Development Corporation and National Bank for Agriculture and Rural Development for promotion of motorization of country craft. The main facility provided are subsidy and loan on liberal terms. The State Department also give technical advice and provide kerosene at control prices.

A major question posed is whether motorization has really increased the total fish production in Kerala State? No doubt, production showed an increasing trend since 1981, upto 1984, but thereafter fluctuated. From 2.8 lakhs tonnes in 1981 the production steadily increased to 3.9 lakhs tonnes in 1984. This period, 1981-84 also saw the motorization programme picking up. It would therefore appear that the increase in production directly is correlated with the motorization pragramme. However, a more critical analysis is required before making any judgement.

While catches by motorised sector sharply increased, those of the non-motorised sector steeply decreased, clearly

indicating a shift in catches from the non-motorised to the motorisdd sector. In fact if the two sectors are put together, eventhough a spurt is observed during the years 1982 to 84, no specific trend has been seen over the ten years, 1978 to 1987.The short duration & increasing trend in total production starting from 1982 has been realised through the contribution from different sectors including motorised craft. The trawl catches showed an increasing trend reaching the level of 144,000 tonnes in 1987 compared to 49000 tonnes of 1981. The gillnet catches also showed an increasing trend till 1985. The spurt in production during 1982 to 1984 when it touched the figure 3.9 lakh tonnes, has been particularly noticed because the level of production was sagging and reached a low level of 2.8 lakh tonnes in 1981, a figure which was never seen in the previous two decades. When we look at the annual landing figures, a production of more than 3.9 lakh tonnes has been

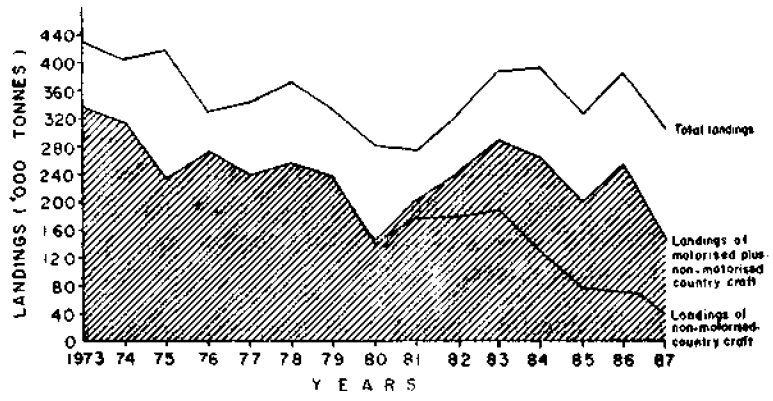

Fig. 2 Trends of total marine fish landings and landings of motorised and non-motorised country craft (600 t) in Kerala.

observed even earlier to the introduction of motorised craft and also production has reached level of less than 3.9 lakh tonnes after 1984 when the motorization spree still continued. Thus the overall picture tells that no sustained increase in total production of fish has been observed so far due to the motorization of country craft. The saturation level already noticed in the conventional near shore

fishing grounds, would have been a reason for the continued stagnancy in production level even with the introduction of outboard engines.

The pelagic group of fishes generally caught in boat seine is an important factor in the total production of fish in Kerala. While the total by motorised craft has increased tremendously, the bulk of it is by gill netters whose catch rates are much less than craft with boat seines catching mostly pelagic species. Thus the increase in landings by motorised boats has not been commensurate with the increased effort as one normally expects.

The decrease in the catch per boat trip indicates that caution has to be exercised in advocating indescriminate increase in the number of motorised boats. The redeeming feature today is that the revenue per boat trip is increasing, thanks to the spiraling price of fish and fovourable change in the composition of catch observed during the last eight years.

This has saved the sector till now. Motorization could be a success in terms of catch quantum if it is ensured that the boats extend their activites beyond the conventional range 20–50 m so that additional resources can be harvested.

In the late sixtees when trawlers were introduced in good numbers, the total production increased substantially. A similar trend was not observed in the case of motorized country craft. A reason may be that the trawlers were operating in a wider coastal area concentrating on an under-exploited demersal group while the motorised craft continued to operate in the areas which have been fished already heavily. A few boats would have gone beyond the conventional grounds. But by and large the tendancy, especially for the craft operating boat seines is to remain closer to the shore to reduce the expenditure on fuel and because of a feeling of uncertainty in getting good catches in areas farther off.

It is noticed that motrised boat owners are not inclined to go for fishing when they feel that fish availability is poor.

This was seen during the post-monsoon period of 1985 when the oil sardine fishery suffered e serious set-back. The number of boat trips in the central region of Kerala reduced substantially during that period as the fishermen were not prepared to take risks against the heavy operational cost they have to incur.

As stated earlier that unless the motorised craft, especially those operating boat seines substantially extend their area of operation, it would not be possible to increase the total production. But a question arises. While good resources are available in the comparatively deeper waters, whether an encircling pelagic gear like the existing type of boat seine and ring seine would be able to harvest them. This feeling of uncertainty is an impediment to take risks. Perhaps changes may be needed in the craft and gear designs for diversified fishing.

Changes in Practices

During the course of the past eight years a number of changes have taken place in the size and shape of the craft and gear. Some of the boats, especially, gill-netters the rearside is made flat so that the engine can be fitted there conveniently thereby improving the propulsion efficiency. Some of the craft operating boat seines have been made bigger in size. Man power requirement has also been increased. In Thankassery area craft made of marine plywood are in operation with good performance record. These boats are comparatively cheaper also. In Trivandrum area catamarans and fibreglass canoes fitted with outboard engines are getting popular. In Alleppey area mini trawlers have started operating using canoes with engines.

The size and shape of the gears also have been changing. Introduction of mini purse-seines (ring seine) in the Alleppey area in 1985 end has been a new development. The net is over 450 meters long and is operated like a purse-seine. A similar gear locally known as 'Kudukku Vala' started operating

in Kasargode area also. The catch per boat trip for the ring seine is more than double that of the conventional boat seine. With the increase in size of craft and gear the fishermen are going for 20 and 24 HP engines which would make the motorised sector more capital intensive. Sometimes they use even two engines of 12 HP each.

In the Malabar area 'Kollivala' (boat seine) operation are common and the operation needs two boats. With the advent of motorization, both the craft are fitted with outboard engines. For reaching the grounds both the boats now work on engines. While for actual fishing operation both boats have to work on engine power simultaneously, for taking them to the grounds one boat whose engine alone need work can tow the other one and save some cost of fuel.

Major Constraints :

Problems associated with the maintenance of the engine form a major hindrance in the operation of motorised craft. Lack of easy availability of spares and exorbitant price for the same, high service charges and considerable delay in getting the repairs done are the factors seriously affecting fishing operations. Spark plug and bearing are two components which are more prone to defects resulting in costly repair, especially for the bearing.

The investigations show that the fishermen often get into difficulty regarding kerosene oil especially in certain seasons. Even though, the Kerala Government supplies kerosene oil at control price, the general complaint is about quantity and timeliness. Sometimes fishermen do not get sufficient quantity of kerosene and at times they are not able to purchase the full quota at one time due to lack of money and storage facilities.

CONCLUSIONS

Based on the foregoing results the conclusions arrived at are as follows :-

1. Motorization of country craft with outboard engines does not appear to have so far resulted in sustained increase in total fish production of Kerala. It would have partly helped to effect an immediate spurt in production when the general production level was at the lowest in two decades.

2. Motorization can be encouraged if it is ensured that the motorised craft extend their operations beyond the conventional limit to the region 20-50 m depeth. At the present juncture, as the catch rates are dwindling, caution has to be exercised in promoting indiscriminate expansion of the motorization programme unless it is coupled with measures for increasing productivity. To-day, the encouraging feature to the fishermen is the better catch composition and sharp increasing trend of fish price.

Resources like carangids, catfish, seerfish, ribbonfish and sharks have good potential in the 20 to 50 m depth upto which the motorised boats can go. Gill-netters and hook and line operators can exploit these resources with advantage and in fact such units are already fishing in that area. But success of the boat seine operations in the present form where it is meant for encircling pelagic fishes need to be established so that the fishermen can go for fishing with confidence. Thus extending the area of operation and diversified fishing would be two pre-requisites for enhancing total production through motorization of country craft.

3. An important point in favour of motorization is that it almost eliminates the physical strain of rowing and increases, leisure time so that the fishermen will have better health and social life. It has been observed that motorization has brought an element of dignity to the fishing profession. The youngsters

in the fishing villages were reluctant to take up their traditional way of living. With the introduction of outboard motors, the younger generation has showed an enthusiastic inclination towards this profession.

4. Even though motorization is spreading fast, it is likely that the strictly artisanal sector may continue even though in reduced numbers, due to various reasons. Thought has to be given to provide a coastal fringe-zone exclusively for the sector using non-motorised traditional craft. This wauld also act as a compelling feature for motorised boats to go beyond the near-shore waters.

Not much conflict has been reported between the fishermen operating motorised and non-motorised craft and between owners of motorised craft with varying engine powers (7 HP to 24 HP). Even then, it is essential to think in terms of suitable demarcation of the region between the sub sectors. Suitable modification may have to be considered in the Fisheries Regulation Act.

5. Kerosene may be supplied by the State Department to the fishermen to meet their full requirements and they should be allowed to draw the same in instalments.

6. As a fuel saving measure it is desirable to use sails whenever favourable wind blows. The engine-cum-sail boats are found to be thriving well in the Tamil Nadu coast and it is worthwhile trying it seriously along the Kerala coast also.

7. When two boats are simultaneously used for fishing as the case of 'kollivala', only one engine need to work towing the other boat till they reach the fishing ground and starts actual fishing. This will definitely save some fuel thereby reducing the operational cost.

8. There has been no adverse effect onthe employment position with the advent of motorization. The boats carry at least the same number of persons, if not more, as in the case of

non-motorised craft. With enlarged area of operation and additional expected production, the job opportunities will increase.

9. In order to reduce the capital investment and to improve the availability position of engines and spares, Government should encourage setting up of factories to manufacture engines and spare parts, with foreign collaboration in the initial stages, if need be. Even though it is learnt that some firms have been given licences, there has not been any output so far in terms of engines or spare parts.

More repairing workshops should be established in the co-operative sector, especially in the interior villages for which local fishermen can be trained. Also the spares could be channelised through these co-operatives so that exploitation by middlemen can be avoided.

10. The avevrage net income of motorised boat has been found to be higher than that of the non-motorised craft. Returns to labour is also higher for motorised craft compared to non-motorised for all craft-gear combinations.

11. Boats with 7 HP engine are found to be economically more efficient as compared to those with 12 HP. But, to-day, the tendency is to go in for higher powered engines. This may be partly because of the spirit of competition and urge for speed and partly because of the changes in the structure of craft and gear. Research needs to be undertaken for determining the optimum size and shape of craft and gear and engine power to suit fishing on extended grounds and to harvest additional resources. However, while designing it is essential to integrate modern ideas, with the vast accumulated knowledge of the fishermen on different aspects of fishing. This will promote easy adoption of modern technology by fishermen and help to percolate its benefits down to the hundreds of toiling fishermen.

12. The motorised craft has better mobility which can facilitate selective fishing so that the increase in revenue can

be effected not only through increase in catch but also by change in catch composition having a larger share of high priced fishes subject to availability.

13. The increasing discharge of effluents from industriay establishments to the backwaters and sea is posing serious threat to the fish resources, especially in the areas covered bl the traditional craft with or without outboard engine. Efforts should be made to enforce measures for reducing pollution and to safeguard the ecosystem.

14. A good data bank is a pre-requisite for evaluation research, planning and decision making. This is all the more important in the motorization programme which is spreading fast and where a large number of traditional fishermen are deeply involved. It is therefore essential to maintain the requisite information base by continuous monitoring of the various factors associated with the motorised and allied sectors.

ACKNOWLEDGEMENT

The authors are grateful to Dr. P. S. B. R. James, Director, Central Marine Fisheries Research Institute, for the encouragement given and facilities provided in conducting this study. The authors are also thankful to Dr. E. G. Silas, former Director of CMFRI for suggesting this problem and support given in initiating the programe of work. Thanks are also due to Shri S. Natarajan, Field Officer for the help rendered during the study and to S/shri. P. P. Pavithrans K. P. George and M. Ramachandran, Punch Card operator. for their help assistance in tabulating and processing the data,

Table 1 Regionwise marine fish landings (in tonnes) in Kerala (980-87)

	A1	A2	A3	TOTAL
1980	50,891	1,65,982	62,147	2,79,020
1981	29,151	1,19,114	1,25,713	2,73,978
1982	53,970	1,62,035	1,09,362	3,25,367
1983	59,595	1,82,099	1,43,588	385,282
1984	47,457	2,15,742	1,29,696	3,92,895
1985	58,764	1,79,623	87,342	3 25,729
1986	43,877	2,04,248	1,34,673	3,82,798
1987	38,972	1,51,219	1,13,095	3,03,286

A1: Southern, A2: Central and
A3: Northern regions
* Excludes off-shore catches by G. O. I. Vessels

Table 2: Quarterwise, marine fish landings (in tonnes) in different regions of Kerala (1980-87)

A1 (Southern Region)

Quarter	1980	1981	1982	1983	1984	1985	1986	1987
Q1	3,665	3,868	7,106	10,912	7,367	8,580	6,349	4,423
Q2	21,425	7801	17,379	16,881	11,826	13,152	12,684	7,377
Q3	17,588	8856	16,668	15,798	18,836	19,502	14,456	19,193
Q4	8,213	8626	12,817	16,004	9,428	17,530	10,388	7,979
TOTAL	50,891	29,151	53,970	59,595	47,457	58,764	43,877	38,972

Table 2 contd.

A2 (Central Region

Quarter	1980	1981	1982	1983	1984	1985	1986	1987
Q1	26,525	18,953	35,974	48,858	39,326	46,973	23,342	25,469
Q2	38,912	23,766	31,994	27,092	39,568	32,442	23,921	33,759
Q3	71,416	30,550	56,389	57,884	66,362	56,946	81,978	60,965
Q4	29,129	45845	37,678	48,265	70,486	43,262	75,007	31,026
TOTAL	165,982	119 114	162,035	182,099	215,742	179,623	204,248	15,51,219

A3 (Northern Region)

Quarter	1980	1981	1982	1983	1984	1985	1986	1987
Q1	23,163	19.593	29,767	35,637	45,991	21,097	41,802	21,150
Q2	8,117	7,603	10,130	13,679	17,689	7,895	15,631	19,013
Q3	8746	35,629	26,588	19,368	33,427	27,576	31,737	44,203
Q4	22,121	62,888	42,877	74,944	32,588	30,774	45,493	28,279
TOTAL	62,147	1,25,713	1,09,362	1,43,588	129,696	87,342	13,4663	1,13,095

Table 3. Specieswise and regionwise landings (in tonnes) by mechanised boats for different year & (1980-S7)
Year : 1980

Species	Trawl net	Purse seine		Gill net (IBE)			Boat seine, Gillnet, Hook & Line (OBE)			Mecha-nised Total	Non. mech. Total	Grand Total
	A2	A3	A2	A1	A2	A3	A1	A2	A3			
Elasmobranchs	991	580	17	26	1740	575	—	—	—	3993	2760	6753
Catfishes	6306	166	47	—	1382	938	—	—	—	11209	2573	13782
Oil sardine	750	32	9758	—	1	—	—	1185	316	12042	57625	69667
Other sardines	66	4	194	—	—	—	—	2	—	266	10751	11017
Anchoviella	265	4	340	—	—	—	—	—	—	609	7162	7771
Perches	16150	160	1	—	45	—	—	—	—	16356	1450	17806
Croakers	4268	644	2	—	6	71	—	—	—	4991	1172	6163
Ribbon fishes	48	86	9	—	28	108	—	—	—	279	12657	12936
Mackerel	295	111	4220	2	226	95	—	93	25	5067	13406	18473
Seer fishes	—	149	—	5	924	253	—	—	—	1331	2432	3763
Tunnies	—	—	122	7	2247	—	—	—	—	2376	8235	10611
P. prawns	43520	2641	1	—	—	—	—	—	—	46162	6463	52623
Others	26528	2297	147	2	714	413	—	—	—	30101	17552	47653
TOTAL	99,187	6,874	14,858	42	7,313	2,453	—	1,280	341	1,34,782	1,44,238	2,79,002

IBE Inboard engine
OBE Outboard engine

Table 3 contd. Year - 1981

Species	Trawl net A2	Trawl net A3	Purse Seine A2	Gill net (I B E) A1	Gill net (I B E) A2	Boat seine, Gill net, Hook & line (OBE) A3	A1	A2	A3	Mechanised Total	Non-mech. Total	Grand Total
Sharks	22	269	1	19	949	452	—	—	—	1714	1837	3551
Catfishes	3666	178	135	1	683	333	—	2	—	4999	4440	9439
Oil Sardines	476	—	12334	—	2	—	—	22732	—	35544	111438	146982
Other sardines	—	—	376	—	—	—	—	—	—	376	7236	7612
Anchovies	605	29	85	—	—	17	—	6	—	742	3563	4305
Perches	6454	19	4	1	27	—	—	47	—	6552	1898	8450
Croakers	1743	562	3	—	6	163	—	1	—	2478	667	3145
Ribbon fishes	60	11	6	—	1	14	—	—	—	105	6945	7050
Mackerel	14	5	3932	—	81	—	—	19	—	4051	12148	16199
Seer fishes	—	79	1	22	346	401	—	—	—	852	2478	3330
Tunnies	—	—	222	15	1306	97	—	—	—	1642	3863	5505
P. prawns	3195	3110	1	—	—	—	—	3	—	16309	5959	22268
Other	15292	3524	573	19	612	454	—	38	—	20540	15602	36142
TOTAL	41,527	7,786	17,673	77	4,013	1,931	—	22,848	—	95,904	1,78,074	2,73,978

Table 3. contd. Year-1982

Species	Trawl net A2	Trawl net A3	Purse Seine A2	Boat Seine, Gill net, Hood & line (IBE) A1	Gill net (OBE) A2	Gill net (OBE) A3	Gill net (OBE) A1	Hood & line A2	Hood & line A3	Mecha-nised Total	Non-mech. Total	Grand Total
Sharks	35	243	—	11	1033	1510	—	58	1	2891	1467	4358
Cat fishes	2882	143	74	8	674	774	—	615	1	5172	4325	9497
Oil sardine	1199	68	8222	—	1	—	—	49417	—	58907	84298	143205
Other sardines	—	1	165	—	—	—	—	17	—	183	7205	7388
Anchovies	1060	109	210	—	—	—	—	381	—	1760	11819	13579
Perches	9124	109	5	—	73	14	—	21	—	9396	1671	11067
Croakers	1863	408	1	—	6	13	—	67	—	2359	1222	3581
Ribbon fishes	142	9	2	—	25	32	—	111	—	321	10708	11029
Mackerel	19	6	2145	4	113	33	—	1542	—	3852	6855	10717
Seer fishes	1	72	1	26	590	1912	—	42	4	2648	2968	5616
Tunnies	1	—	53	66	1208	989	—	215	—	2532	4749	7281
P. prawns	13501	7476	237	—	—	—	—	606	—	21821	4886	26707
Others	16033	7797	381	8	632	1567	—	9948	4	36388	34954	71342
Total	45,860	16,441	11,496	123	4,355	6,844	—	63,040	10	148,240	177,127	325,367

Table 3, contd. Year-1983

Species	Trawl net A2	Trawl net A3	Purse Seine A2	Purse Seine A1	Gill net (I B E) A2	Boat Seine, Gill net, Hook & line (OBE) A3	Boat Seine, Gill net, Hook & line (OBE) A1	Boat Seine, Gill net, Hook & line (OBE) A2	Boat Seine, Gill net, Hook & line (OBE) A3	Mechanised Total	Non-mech. Total	Grand Total
Sharks	27	271	6	—	1382	2324	45	485	584	5210	2522	7732
Catfishes	2472	124	97	—	785	2595	45	1761	1190	9069	6091	15160
Oil sardine	2595	39	11228	—	16	—	35	70411	1019	85343	69529	154872
Other sardines	1	3	421	—	—	—	—	252	7	684	4630	5314
Anchovies	1015	1656	131	—	—	—	—	6368	1050	10220	44809	55029
Perches	7325	220	2	—	15	70	107	154	5	7920	1894	9814
Croakers	2479	758	14	—	9	64	1	237	15	3577	2533	6110
Ribbon fishes	51	74	—	—	—	—	—	15	20	161	948	1109
Mackerel	20	—	1529	—	166	102	13	2448	5	4283	8392	12675
Seer fishes	2	8	—	—	937	2711	93	190	452	4393	2606	6999
Tunnies	—	—	5	—	1761	291	108	133	50	2348	3402	5750
P. prawns	12384	10715	111	—	—	—	—	1271	248	24729	5024	29753
Others	15196	10469	730	—	802	1750	330	9092	843	39215	35750	74965
Total	43,567	24,337	14,274	—	5,873	9,907	777	92.817	5,488	197,152	188,130	385,282

Table 3. contd. Year - 1984

Species	Trawl net A2	Trawl net A3	Purse seine A2	Gill net (I B E) A1	Boat Seine, Gill net, Hook & line (OBE) A2	A3	A1	A2	A3	Mechanised Total	Non-mech. Total	Grand Total
Sharks	66	144	I	—	1132	2092	15	1512	530	5496	758	6254
Catfishes	3014	227	318	—	1227	1802	8	1592	2295	10490	992	11482
Oil sardine	129	73	16392	—	—	3	—	68837	7969	93403	53727	147130
Other sardines	—	10	664	—	—	—	—	322	16	1012	5010	6022
Anchovies	758	329	57	—	—	—	—	20943	1145	23232	18269	41501
Perches	20736	830	1	—	56	26	183	2444	112	24642	2139	26781
Croakers	4503	1535	30	—	10	56	—	725	146	7005	2670	9675
Ribbon fishes	16	206	—	—	6	57	7	2	3	297	6129	6426
Mackerel	19	2	2448	—	359	375	90	1178	1587	6058	5654	11712
Seer fishes	—	6	1	—	1501	1799	355	256	1106	5024	1150	6174
Tunnies	—	—	2	—	1652	301	925	298	100	3283	2877	6160
P. prawns	17564	7407	1	—	—	—	—	8371	553	33896	1633	35529
Others	21172	15089	884	—	9085	1378	374	5792	3522	49116	28933	78049
Total	67,977	25,858	20799	—	6,848	7,889	1,957	112,272	19,084	262,954	129,941	392,895

Table 3. contd. Year --1985

Species	Trawl net A2	Trawl net A3	Purse Seine A2	Purse Seine A1	Gill net (I B E) A2	Gill net (I B E) A3	Boat seine, Gill net, Hook & line (OBE) A1	Boat seine, Gill net, Hook & line (OBE) A2	Boat seine, Gill net, Hook & line (OBE) A3	Mechanised Total	Non-mech. Total	Grand Total
Sharks	86	172	1	—	1869	1802	14	142	372	4458	481	4939
Catfishes	987	89	2	—	1222	1185	23	215	1185	4805	365	5170
Oil sardine	209	10	7207	—	—	—	—	39143	20834	67403	11518	78921
Other sardines	—	—	743	—	—	—	58	555	258	1614	1154	2768
Anchovies	1046	189	18	—	—	—	5	25474	707	27439	8883	36322
Perches	24542	922	7	—	105	5	737	583	623	27584	2804	3038[8]
Croakers	4449	1759	52	—	25	2	1	622	804	7714	924	8638
Ribbon fishes	343	196	13	—	178	22	1225	1061	20	3058	22097	25155
Carangids	1350	472	51	9	416	159	953	3286	310	7006	5605	12611
Mackerel	35	—	5101	10	171	100	1120	1483	2993	11013	6393	17406
Seer fishes	—	—	—	4	2969	1761	689	306	2185	7914	544	8458
Tunnies	2	—	1328	127	1924	501	3608	564	244	8298	1492	9790
P. prawns	14726	8674	40	—	—	—	—	1946	156	25542	1134	26676
Others	23028	13751	549	3	780	378	584	4125	1554	44754	13733	58487
Total	70,803	26,234	15,112	153	9,659	5,812	9,017	79,505	32,245	248,602	77,127	325,729

Table 3. contd. Year 1986

Species	Trawl net A2	Trawl net A3	Purse seine A2	Purse seine A1	Gill net (I B E) A2	Boat seine, Gill net, Hooks & line (OBE) A3	A1	A2	A3	Mecha-nised Total	Non-mech Total	Grand Total
Sharks	144	122	—	—	1236	640	52	348	1714	4256	393	4649
Cat fishes	655	28	261	—	882	478	20	2713	3382	8419	122	8541
Oil sardine	30	—	325	—	—	—	131	8114	15380	23980	16154	40134
Other sardines	8	43	260	—	—	—	10	909	1290	2520	6412	8932
Anchovies	2280	201	11	—	—	—	511	11462	5844	20309	8585	28894
Perches	38274	1650	10	—	14	5	369	3341	424	44087	1914	46001
Croakers	2317	1063	1	—	17	1	7	7814	503	11723	1035	12758
Ribbon fishes	2057	711	—	—	142	—	1345	1786	817	6858	5022	11880
Carangids	2321	1421	329	—	439	118	1528	44365	17359	67890	3605	71495
Mackerel	223	2	1053	—	272	51	2626	10269	5713	20209	1667	21876
Seer fishes	—	—	2	—	1928	267	252	205	2082	4736	119	4855
Tunnies	3	—	2326	—	1181	467	4919	568	2496	11960	2824	14784
P. prawns	12875	12211	—	—	217	—	22	3208	6908	35441	1889	37330
Others	22677	14180	68	—	726	293	1260	6372	8099	53688	16981	70669
Total	83,864	31,632	4,646	—	7,064	2,329	13,052	101,474	72,011	316,076	66,722	3,82,798

Table 3. contd. Year-1987

Species	Trawl net		Gill net (IBE)		Purse-seine	Hook & line (IBE)	Boat seine	Gillnet, & line O B.E.	Hook	Mecha-nisd Total	Non-mech Total	Grand Total
	A2	A3	A2	A3	A2	A2	A1	A2	A3			
Sharks	330	361	594	234	—	99	51	113	1176	2958	156	3114
Cat fishes	1562	19	75	158	4	2	21	879	1852	4572	88	4660
Oil sardine	27	1	—	—	109	—	30	5565	36269	42001	2716	44717
Other sardines	30	12	—	—	—	—	21	4995	1244	6302	2395	8697
Anchovies	4268	821	—	1	—	—	86	2478	2419	10073	9862	19935
Perches	21078	4756	—	59	—	832	468	1355	454	29002	1131	30133
Croakers	3680	1271	3	1	—	—	37	970	842	6804	1357	8161
Ribbon fishes	1816	1591	54	2	—	—	4767	367	67	8664	6631	15295
Carangids	4148	3611	179	47	137	18	1726	5495	2176	17537	5235	22772
Mackerel	304	80	28	64	394	—	760	3693	3058	8381	1682	10063
Seer fishes	51	3	546	460	—	—	203	231	3498	4992	189	5181
Tunnies	3	—	2089	160	100	51	4063	1361	1605	9432	1179	10611
P. prawns	37611	9812	—	—	4	—	70	2398	2035	51930	936	52866
Others	29938	16738	449	138	156	9	529	3031	9750	60738	6343	67081
Total	104846	39076	4017	1324	904	1011	12832	32931	66445	263386	39900	303286

Table-4. Specieswise, regionwise and gearwise landings (in tonnes) by motorised craft in different years (1981 to 1987)

1981

Gear	Boat Seine				Gill net				Hook & Line (canoe)					Other gears (A1A2 &A3)	Grand Total
Name of fish	A1	A2	A3	Total	A1	A2	A3	Total	A1	A2	A3	(catam)* A2	Total		
Sharks	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Cat fish	—	—	—	—	—	2	—	2	—	—	—	—	—	—	2
Oil sardine	—	22298	—	22298	—	434	—	434	—	—	—	—	—	—	22732
Other sardines	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Anchovies	—	2	—	2	—	4	—	4	—	—	—	—	—	—	6
Perches	—	31	—	31	—	16	—	16	—	—	—	—	—	—	47
Croakers	—	1	—	1	—	—	—	—	—	—	—	—	—	—	1
Ribbon fishes	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Mackerel	—	19	—	19	—	—	—	—	—	—	—	—	—	—	19
Seer fishes	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Tunnies	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Penaeid prawns	—	3	—	3	—	—	—	—	—	—	—	—	—	—	3
Others	—	25	—	25	—	13	—	13	—	—	—	—	—	—	38
Total	—	22379	—	22379	—	469	—	469	—	—	—	—	—	—	22848

*Catam—Catamaran

Table 4 (contd)
1982

Gear	Boat Seine				Gill net				Hook & Line (canoe)			Hook & Line (catam)		Other gears	Grand
Name of fish	A1	A2	A3	Total	A1	A2	A3	Total	A1	A2	A3	A2	Total	(A1, A2 & A3)	Total
Sharks	—	1	—	1	—	2	1	3	—	3	—	52	55	—	59
Cat fishes	—	450	—	450	—	25	1	26	—	78	—	62	140	—	616
Oil sardine	—	46025	—	46025	—	3120	—	3120	—	—	—	—	—	272	49417
Other sardines	—	15	—	15	—	2	—	2	—	—	—	—	—	—	17
Anchovies	—	379	—	379	—	1	—	1	—	—	—	—	—	1	381
Perches	—	16	—	16	—	3	—	3	—	—	—	2	2	—	21
Croakers	—	61	—	61	—	6	—	6	—	—	—	—	—	—	67
Ribbon fishes	—	—	—	—	—	10	—	10	—	—	—	101	101	—	111
Mackerel	—	733	—	733	—	355	—	355	—	—	—	438	438	16	1542
Seer fishes	—	—	—	—	—	1	4	5	—	—	—	41	41	—	46
Tunnies	—	—	—	—	—	19	—	19	—	—	—	196	196	—	216
Penaeid prawns	—	62	—	62	—	544	—	544	—	—	—	—	—	—	605
Others	—	7799	—	7799	—	450	4	454	—	—	—	1698	1698	1	9952
Total	—	55541	—	55541	—	4538	10	4548	—	81	—	2590	2671	290	63050

Table-4 (contd.)
1983

Gear	Boat Seine				Gill net				Hook & Line					Other gears	Grand
									(canoe)			(catam)			
Name of fish	A1	A2	A3	Total	A1	A2	A3	Total	A1	A2	A3	A2	Total	(A1,A2 & A3)	Total
Shark	—	49	—	49	44	16	360	420	1	124	224	296	645	—	1114
Cat fish	—	2	—	2	13	24	799	836	32	1272	391	463	2158	—	2996
Oil sardine	—	59768	333	60101	35	10643	399	11077	—	—	—	—	—	287	71465
Other sardines	—	252	7	259	—	—	—	—	—	—	—	—	—	—	259
Anchovies	—	6368	991	7359	—	—	57	57	—	—	—	—	—	2	7418
Perches	—	117	2	119	—	—	3	3	107	4	—	31	142	2	266
Croakers	—	224	1	225	—	10	14	24	1	—	—	3	4	—	253
Ribbon fish	—	15	15	30	—	—	2	2	—	—	—	—	—	3	35
Mackerel	—	1796	—	1796	9	129	5	143	4	—	—	523	527	—	2466
Seer fish	—	30	—	30	93	91	450	634	—	46	2	23	71	—	735
Tunnies	—	—	—	—	79	7	50	136	29	3	—	123	155	—	291
Penaeid prawns	—	1268	248	1516	—	1	—	1	—	—	—	—	—	2	1519
Others	—	7158	256	7414	37	363	543	943	293	122	—	1447	1862	46	10265
Total	—	77047	1853	78900	310	11284	2682	14276	467	1571	617	2909	5564	342	99082

Table-4 (contd.)
1984

Gear	Boat Seine				Gill net				Hook & Line (canoe)			Hook & Line (catam)		Other gears	Grand
Name of fish	A1	A2	A3	Total	A1	A2	A3	Total	A1	A2	A3	A2	Total	(A1,A2 & A3)	Total
Shark	—	1	6	7	15	143	320	478	—	1133	202	235	1570	2	2057
Cat fish	—	15	875	890	2	289	237	528	6	1288	1160	—	2454	23	3895
Oil sardine	—	65915	6060	71975	—	2922	1899	4821	—	—	—	—	—	10	76806
Other sardines	—	205	13	218	—	117	3	120	—	—	—	—	—	—	338
Anchovies	—	20762	922	21684	—	181	199	380	—	—	—	—	—	24	22088
Perches	—	2398	76	2474	16	1	—	17	167	9	—	36	212	36	2739
Croakers	—	699	13	712	—	16	3	19	—	—	1	10	11	129	871
Ribbon fish	—	—	1	1	7	—	2	9	—	—	—	2	2	—	12
Mackerel	—	640	36	676	55	170	1544	1769	35	—	—	368	403	7	2855
Seer fish	—	54	2	56	345	77	1100	1522	10	18	4	107	139	—	1717
Tunnies	—	—	—	—	641	212	100	953	284	—	—	86	370	—	1323
Penaeid prawns	—	8362	483	8845	—	9	32	41	—	—	—	—	...	38	8924
Others	—	2845	1515	4360	131	596	1483	2210	243	251	46	2100	2640	478	9688
Total	—	108196	10002	111898	1212	4733	6922	12867	745	2699	1413	2944	7801	747	133313

Table-4 (contd.)
1985

Gear	Boat Seine				Gill net				Hook & Line (canoe)			Hook & Line (catam)		Other gears	Grand
Name of fish	A1	A2	A3	Total	A1	A2	A3	Total	A1	A2	A3	A2	Total	(A1,A2, A3)	Total
Shark	—	8	—	8	14	90	301	405	—	41	71	3	115	—	528
Cat fish	—	1	—	1	21	53	206	280	2	161	970	—	1133	9	1423
Oil sardines	—	34442	19781	54223	—	4701	276	4977	—	—	—	—	—	777	59977
Other sardines	—	314	258	572	58	241	—	299	—	—	—	—	—	—	871
Anchovies	5	24884	707	25596	—	590	—	590	—	—	—	—	—	—	26186
Perches	18	508	576	1102	400	11	10	421	319	1	—	63	383	37	1943
Croakers	1	584	727	1312	—	32	45	77	—	6	—	—	6	32	1427
Ribbon fish	567	—	—	567	652	21	14	687	6	—	—	1040	1046	6	2306
Carangids	17	320	214	551	696	361	76	1133	240	4	3	2601	2848	17	4549
Mackerel	—	774	1633	2407	928	520	1360	2808	192	1	—	188	381	—	5596
Seer fish	—	—	—	—	689	197	2185	3071	—	—	—	109	109	—	3180
Tunnies	—	—	4	4	3041	22	238	3301	567	—	—	542	1109	2	4416
Penaeid prawns	—	1944	105	2049	—	2	8	10	—	—	—	—	—	43	2102
Others	16	3067	606	3689	323	911	860	2094	245	13	6	134	398	82	6263
Total	624	66846	24611	92081	6822	7752	5579	20153	1571	227	1050	4680	7528	1005	120767

Table-4 (contd.)
1986

	Boat Seine				Gill net				Hook & Line (canoe)		Hook & Line (catam)			Ring seine	Other gears	Grand
	A1	A2	A3	Total	A1	A2	A3	Total	A1	A2	A3	A2	Total	(A2 & A3)	(A1,A2 & A3)	Total
Shark	—	9	45	54	37	246	1291	1574	15	91	366	2	474	—	12	2114
Cat fish	—	2	28	30	20	42	683	755	—	2334	2661	61	5056	274	—	6115
Oil sardine	—	5690	12965	18656	131	269	2197	2597	—	—	—	—	—	2372	—	23625
Other sardines	—	121	822	943	10	162	421	593	—	—	—	6	6	620	47	2209
Anchovies	350	5758	5678	11786	161	5	13	179	—	—	—	—	—	5846	6	17817
Perches	—	3005	228	3233	171	5	7	183	198	202	—	37	437	278	3	4134
Croakers	—	7655	433	8088	7	32	33	72	—	—	—	—	—	134	30	8324
Ribbon fish	789	—	714	1503	450	1	88	539	106	—	—	1785	1891	5	10	3948
Carangids	79	33459	15078	48616	1118	512	433	2063	331	83	19	212	645	11103	825	63252
Mackerel	—	3619	306	3925	2588	5654	5119	13361	38	—	—	62	100	1015	207	18608
Seer fish	—	45	—	45	248	152	2078	2478	4	3	4	5	16	—	—	2539
Tunnies	—	2	1416	1418	4460	127	988	5575	459	31	—	408	898	12	80	7983
Penaeid prawns	—	3031	6723	9754	22	23	62	107	—	—	—	—	—	168	109	10138
Others	789	4632	5921	11342	277	1211	1227	2715	194	23	116	91	424	676	574	15731
Total	2007	67028	50358	119393	9700	8441	14650	32791	1345	2767	3166	2669	9947	22503	1903	186537

Table-4 (Contd.)
1987

	Boat Seine				Gill net				Hook & Line				Ring seine			Other gears				Grand
	A1	A2	A3	Total	A1	A2	A3	Total	A1	A2	A3	Total	A2	A3	Total	A1	A2	A3	Total	Totol
Sharks	—	—	3	3	46	57	1006	1109	5	56	165	226	—	—	—	—	—	2	2	1340
Catfishes	—	—	4	4	20	15	1065	1100	1	109	776	886	755	3	758	—	—	4	4	2752
Oil sardine	30	2598	21255	23683	—	29	1938	1967	—	48	—	48	3090	12387	15477	—	—	689	689	41864
Other sardines	—	3244	603	3847	21	642	271	934	—	1	—	1	1108	370	1478	—	—	—	—	6260
Anchovies	83	1750	2224	4057	3	426	172	601	—	—	—	—	302	16	318	—	—	7	7	4983
Perches	12	337	142	491	38	3	56	97	418	30	4	452	985	134	1119	—	—	118	118	2277
Croakers	9	595	760	1364	28	60	42	130	—	—	—	—	315	20	335	—	—	20	20	1846
Ribbon fishes	4342	45	10	4397	387	21	56	464	38	301	—	339	—	1	1	—	—	—	—	5201
Carangids	151	911	1001	2063	823	78	377	1278	752	1920	—	2672	2586	659	3245	—	—	139	139	9397
Mackerel	1	905	345	1251	684	686	1394	2764	75	104	—	179	1998	918	2916	—	—	401	401	7511
Seer fishes	—	1	—	1	183	81	3167	3431	20	149	66	235		227	227	—	—	38	38	3932
Tunnies	—	1	—	1	3438	225	1336	4999	625	1135	3	1763		256	256	—	—	10	10	7029
Penacid prawns	—	342	1113	1455	70	13	90	173	—	—		—	2042	309	2351	—	1	523	524	4503
Others	234	1259	4319	5812	225	411	1402	2038	70	173	10	253	1187	1881	3068	—	1	2138	2139	13310
Total	4862	11788	31779	48429	5966	2747	12372	21085	2004	4026	1024	7054	14368	17181	31549	—	2	4089	4091	112208

Table 5. Estimated Specieswise and regionwise landings (in tonnes) by non-motorised boats in different years (1980-87)

1980

	Boat Seine			Gill net			Hooks & lines			Other Gears	Total
	A1	A2	A3	A1	A2	A3	A1	A2	A3		
Elasmobranchs	5	114	641	146	104	778	425	6	528	13	2760
Cat fishes	69	—	81	38	26	569	330	292	1148	20	2573
Oil sardine	—	11669	35345	5709	2793	896	—	—	—	1213	57625
Other sardines	262	5443	13	1928	1760	1	100	56	—	1188	10751
Anchoviella	768	1153	483	1170	80	3	—	—	—	3505	7162
Perches	3	15	—	579	11	1	716	7	—	118	1450
Croakers	188	234	147	145	303	74	6	17	—	58	1172
Ribbon fishes	11313	—	23	89	3	7	125	985	47	65	12657
Mackerel	66	836	1224	3919	1558	2709	415	35	—	2644	13406
Seer fishes	—	—	—	781	680	925	15	6	8	17	2432
Tunnies	—	—	—	7334	24	4	529	34	—	310	8235
P. prawns	11	4765	1123	65	36	33	—	—	—	430	6463
Others	2634	2072	2473	2276	1350	960	2693	159	31	2904	17552
Total	15319	26301	41553	24179	8728	6960	5354	1597	1762	12485	144238

Table 5. contd. Year-1981

	Boat seine			Gill net			Hook & line			Other gears	Total
	A1	A2	A3	A1	A2	A3	A1	A2	A3		
Sharks	—	—	63	75	101	921	85	5	580	7	1837
Cat fishes	46	138	53	143	86	1111	167	77	2031	588	4440
Oil sardine	—	13286	80705	626	5861	10358	2	—	—	600	111438
Other sardines	11	3403	—	2348	1133	139	3	—	—	199	7236
Anchovies	795	13	473	209	93	34	2	—	—	1944	356[3]
Perches	6	55	405	76	10	—	1245	3	4	94	1898
Croakers	34	108	184	40	99	141	22	—	—	39	667
Ribbon fishes	6550	5	97	13	12	236	18	—	—	14	6945
Mackerel	—	744	379	1176	1594	6942	107	—	—	1206	12148
Seer fishes	—	1	17	635	37	1637	16	133	—	2	2478
Tunnies	—	—	—	2699	—	33	308	—	—	823	3863
P. prawns	—	304	5329	25	254	44	—	—	—	3	5959
Others	705	1426	1814	2277	1282	2115	3070	17	90	2806	15602
Total	8147	19483	89519	10342	10562	23711	5045	235	2705	8325	178074

Table 5. contd. Year-1982

	Boat Seine			Gill net			Hook & Line			Other gears	Total
	A1	A2	A3	A1	A2	A3	A1	A2	A3		
Sharks	—	5	87	84	74	513	101	53	524	26	1467
Cat fishes	31	—	7	144	164	500	292	269	2686	232	4325
Oil sardine	14	4758	60011	2334	13674	2380	—	56	—	1071	84298
Other sardines	43	—	41	2054	2862	17	7	—	—	2181	7205
Anchovies	2785	138	195	3286	430	—	—	—	—	4985	11819
Perches	12	—	3	144	12	3	1382	59	3	53	1671
Croakers	131	36	258	388	93	115	32	16	—	153	1222
Ribbon fish	10466	—	3	149	5	25	21	38	—	1	10708
Mackerel	18	760	829	904	1886	1635	247	308	—	268	6855
Seer fish	—	—	8	951	146	1381	78	342	58	4	2968
Tunnies	—	—	—	3120	822	6	533	202	—	66	4749
Penaeid prawns	3	36	4491	61	130	48	—	—	—	117	4886
Others	891	118	6829	4430	2996	2944	8296	3650	2	4798	34954
Total	14394	5851	72762	18049	23294	9567	10989	4993	3273	13955	177127

Table 5. contd. Year-1983

	Boat Seine			Gill net			Hook & line			Other gears	Total
	A1	A2	A3	A1	A2	A3	A1	A2	A3		
Sharks	—	1	57	159	74	300	1033	202	666	30	2522
Cat fishes	29	—	424	274	2	125	314	1558	3331	34	6091
Oil sardine	1	988	55569	2871	5278	2855	40	—	—	1927	69529
Other sardines	50	—	318	3215	2	53	46	—	—	946	4630
Anchovies	2835	105	16487	6704	11575	1875	139	—	—	5089	44809
Perches	72	2	25	346	27	32	1045	30	2	313	1894
Croakers	140	19	363	196	1631	100	12	—	—	72	2533
Ribbon fish	327	—	69	91	1	49	22	—	—	389	948
Mackerel	25	—	187	4403	234	1273	814	4	—	1452	8392
Seer fish	2	—	13	1631	106	474	15	2	342	21	2606
Tunnies	34	—	—	2300	—	32	555	27	—	454	3402
Penaeid prawns	10	24	3907	108	70	804	—	—	—	101	5024
Others	1325	855	10278	4572	1059	3203	5446	406	358	8248	35750
Total	4850	1994	87697	26870	20059	11175	9481	2229	4699	19076	188130

Table 5. contd. Year-1984

	Boat Seine			Gill net			Hook & Line			Other gears	Total
	A1	A2	A3	A1	A2	A3	A1	A2	A3		
Sharks	—	—	36	5	43	309	66	—	297	2	758
Cat fish	14	—	42	162	11	53	37	26	596	51	992
Oil sardine	—	—	46424	362	2302	4346	1	—	—	292	53727
Other sardines	13	—	1091	2631	461	36	55	—	—	723	5010
Anchovies	1674	—	5990	5581	28	20	—	—	—	4976	18269
Perches	256	—	327	275	10	14	1045	5	1	206	2139
Croakers	1535	—	648	70	116	123	39	—	—	138	2670
Ribbon fish	5843	—	3	189	13	71	3	—	—	7	6129
Mackeral	—	—	184	2858	245	1414	307	—	3	643	5654
Seer fish	2	—	—	416	122	475	13	62	44	16	1150
Tunnies	3	—	—	1659	6	35	934	—	—	240	2877
Penaeid prawns	2	1	1094	116	128	106	—	—	—	186	1633
Others	1736	—	10009	3277	2374	1951	5083	163	8	4332	28933
Total	11079	1	65848	17601	5859	8953	7583	256	949	11812	129941

Table 5. contd. Year-1985

	Boat scine			Gill net			Hook & line			Other gears	Total
	A1	A2	A3	A1	A2	A3	A1	A2	A3		
Sharks	—	—	15	88	44	220	1	11	97	5	481
Catfishes	—	—	—	9	13	58	14	6	180	85	365
Oil sardine	1	35	8643	734	210	1725	—	—	—	170	11518
Other sardines	41	—	—	522	167	56	2	—	—	366	1154
Anchovies	838	28	1612	1838	529	578	—	—	—	3460	8883
Perches	36	1	269	602	46	205	1287	4	1	353	2804
Croakers	79	57	85	356	148	127	—	12	—	60	924
Ribbon fishes	21459	—	—	216	130	4	43	202	—	43	22097
Carangids	330	3	1225	1155	133	131	1147	139	42	1300	5605
Mackerel	89	—	435	3755	71	1660	204	5	3	171	6393
Seer fishes	—	—	—	64	3	95	4	74	303	1	544
Tunnies	—	—	—	696	—	33	466	—	—	297	1492
P. prawns	42	29	793	16	15	57	—	—	—	182	1134
Others	1917	81	1628	2569	781	2279	1866	264	8	2340	13733
Total	24832	234	14705	12620	2290	7228	5034	717	634	8833	77127

Table 5 contd. Year-1986

	Boat Seine			Gill net			Hook & Line			Other gears	Total
	A1	A2	A3	A1	A2	A3	A1	A2	A3		
Shark	—	1	4	167	25	122	16	—	58	—	393
Cat fish	—	—	—	—	3	47	6	12	38	16	122
Oil sardine	—	—	14551	284	88	868	2	—	—	361	16154
Other sardines	61	3	1148	3181	813	161	34	—	—	1011	6412
Anchovies	1079	83	1513	1528	521	47	—	—	—	3814	8585
Perches	15	7	64	162	18	9	801	7	2	829	1914
Croakers	111	138	65	168	86	147	2	—	—	318	1035
Ribbon fish	4211	25	83	172	—	145	196	123	—	67	5022
Carangids	506	2	1150	482	93	212	638	10	9	503	3605
Mackerel	—	—	175	801	46	283	212	—	—	200	1667
Seer fish	—	—	—	24	10	15	27	3	29	11	119
Tunnies	—	—	1233	580	—	—	378	9	—	624	2824
Penaeid prawns	—	52	1017	141	21	259	—	—	—	399	1889
Others	4944	559	2857	888	982	1556	1953	21	30	3221	16981
Total	10927	870	23780	8578	2706	3871	4265	185	166	11374	66722

Table 5. contd.

Year-1987

	Boat seine			Gill net			Hook & line			Other			Grand
	A1	A2	A3	A1	A2	A3	A1	A2	A3	A1	A2	A3	Total
Sharks	—	—	5	3	62	60	19	—	2	—	1	4	156
Cat fishes	21	—	—	1	—	1	42	—	—	—	—	23	88
Oil sardine	104	30	1447	143	181	615	2	—	—	105	87	2	2716
Other sardines	—	—	—	1236	69	101	8	—	—	840	141	—	2395
Anchovies	371	375	21	3581	678	180	—	—	—	3380	1232	44	9862
Perches	1	10	48	29	57	15	530	54	—	19	351	17	1131
Croakers	48	599	144	87	212	108	—	—	—	6	134	19	1357
Ribbon fish	6396	23	—	139	15	—	56	—	—	—	2	—	6631
Carangids	254	3	8	613	18	261	669	270	—	2573	553	13	5235
Mackerel	68	5	—	347	549	296	70	54	—	181	27	85	1682
Seer fishes	—	—	—	1	21	73	—	55	7	12	6	14	189
Tunnies	1	—	—	213	1	6	731	53	—	174	—	—	1179
P. prawns	—	91	163	318	90	76	—	—	—	1	167	30	936
Others	569	234	615	368	546	1329	718	18	2	1092	436	366	6343
Total	7833	1370	2501	7079	2499	3121	2845	504	11	8383	3137	617	39900

Table 6. Gearwise and areawise catch (tonnes) and catch per unit (kg/boat trip) of motorised (MT) and non-motorised (NMT) units in different years

Gear	Area	Motorised/ Non-motorised (MT/ NMT)	1982		1983		1984		1985		1986		1987	
			Catch	Catch/E	Catch	Catch/E	Catch	Catch/E	Catch	Catch/E	Catch	Catch/E	Catch	Catch/E
Boat Seine	A1	MT	—	—	—	—	—	—	624	281	2007	93	4862	228
		NMT	14394	115	4850	91	11079	134	24832	269	10927	142	7833	155
	A2	MT	55541	529	77047	406	101896	393	66846	502	67028	540	26158	246
		NMT	5851	191	1994	246	1	29	234	31	870	47	1370	135
	A3	MT	—	—	1853	270	10002	191	24611	336	50358	274	48960	394
		NMT	72762	252	87697	424	65848	261	14705	151	23780	283	2501	93
Gill net	A1	MT	—	—	310	123	1212	97	6822	63	9700	83	5966	65
		NMT	18049	28	26870	33	17601	28	12620	26	8578	22	7079	17
	A2	MT	4538	168	11284	196	4733	64	7752	44	8441	45	2747	36
		NMT	23294	59	20059	77	5859	26	2290	16	2706	14	2499	16
	A3	MT	10	185	2682	217	6922	109	5579	68	14650	100	12372	81
		NMT	9567	65	11175	77	8953	51	7228	66	3871	33	3121	27
Hook & line	A1	MT	—	—	467	90	745	44	1571	27	1345	43	2004	41
		NMT	10989	23	9481	24	7583	17	5034	13	4265	14	2845	11
	A2	MT	2671	75	4480	80	5643	96	4907	67	5436	90	4026	79
		NMT	4993	41	2229	48	256	11	717	26	185	133	504	25
	A3	MT	—	—	617	466	1413	126	1050	145	3166	208	1024	119
		NMT	3273	128	4699	93	949	9	634	32	166	45	11	12

Table 7

Average cost and Earnings per day of operation of motorised units

A)	Type of gear	Boat Seine	Boat Seine	Gill net	Hooks & Line (catamaran)	Hooks & Line (canoe)
	H. P. of engine	12 HP	7 HP	7 HP	7 HP	7 HP
B)	Quantity produced (Kg)	536	445	88	51	130
C)	Revenue (Rs)	679	571	350	343	495
D)	Variable cost					
	Fuel (Rs.)	94	64	48	48	78
	Labour (Rs.)	364	282	162	207	226
	Auction commission (Rs.)	30	25	19	10	5
	Maintenance (Rs.)	25	28	18	11	17
	Other expenses (Rs.)	9	13	9	15	69
	Total	522	412	256	291	395
E)	Fixed cost					
	Interest (Rs.)	44	41	27	10	16
	Depreciation (Rs.)	47	43	28	17	20
	Total	91	88	55	27	36
F)	Total cost (D+E) (Rs.)	613	500	311	318	431
G)	Net income (C-F) (Rs.)	66	71	39	25	64
	Net returns including wages (Rs.)	430	353	201	232	290

Table 8

Average Cost and Earnings per day of operation of non-motorised units

A)	Type of gear	Boat Seine	Gill net	Hook & line (catamaran)	Hook & line (canoe)
B)	Quantity produced (kg)	290	103	20	58
C)	Revenue (Rs.)	456	232	124	261
D)	Variable cost				
	Labour (Rs.)	296	149	75	116
	Auction commission (Rs.)	23	12	4	14
	Maintenance and other expenses (Rs.)	20	10	20	78
	Total	339	171	99	208
E)	Fixect cost				
	Interest (Rs.)	34	20	3	13
	Depreciation (Rs.)	35	21	9	16
	Total	69	41	12	29
	Total cost (Rs)	408	212	111	237
	Net income (Rs)	48	20	13	24
	Net returns including wages	344	169	88	140

Table 9. Initial Investment and annual capital cost of motorised units (1982-83)

Sl No.	Craft Gear		Initial investment	Life (years)	Interest on capital (Rs)	Depreciation (annual) (Rs)	No. of boat days per year
1.	Plank built/Boat Seine	Craft	Rs. 25000	7		3571	
	(with 12 HP OBE)	Gear	Rs: 25000	6	9750	4166	220
		OBE	Rs. 15000	6		2500	
2.	Plank built/Boat Seine	Craft	Rs. 25000	7		3571	
	(with 7 HP OBE)	Gear	Rs. 25000	6	9000	4166	220
		OBE	Rs. 10000	4		2500	
3.	Plank built/Gill net	Craft	Rs. 20000	7		2857	
	(with 7 HP OBE)	Gear	Rs. 10000	6	6000	1667	220
		OBE	Rs. 10000	6		1667	
4.	Catamaran/Hook & Line	Craft	Rs. 3000	3		1000	
	(with 7 HP OBE)	Gear	Rs. 1000	1	2100	1000	220
		OBE	Rs. 1000	6		1666	
5.	Canoe/Hook & Line	Craft (small)	Rs. 10000	7		1428	
	(with 7 HP OBE)	Gear	Rs. 3600	3	3540	1200	220
		OBE	Rs. 10000	6		1666	

Table 10

Key Economic Indicators (Motorised units)

	Boat Seine 12 HP	Boat Seine 7 HP	Gill net	Hook & line (catamaran)	Hook & line (canoe)
Rate of returns (%)	37	41	36	54	65
Operational costs profit ratio (%)	13	17	15	9	16
Returns to labour (Rs)	27	24	34	77	48
Fuel efficiency (Rs)	4.2	5.7	4.8	3.8	4.9
Price realised per kg	1.27	1.28	3.98	6.73	3.81
Average operational cost (excluding labour per kg (Rs)	0.29	0.29	1.07	1.65	1.30
Average fixed cost per kg (Rs.)	0.17	0.20	0.63	0.53	0.28
Average total cost per kg (Rs.)	1.14	1.12	3.53	6.24	3.32
Average total costs (excluding labour) per kg (Rs.)	0.46	0.49	1.69	2.18	1.58
Mandays required to produce one tonne of fish	56	43	159	274	169
Fuel Ltr required to produce one tonne of fish	30	34	68	59	46

Table 11

Key Economic Indicators (Non-motorised units)

	Boat Seine	Gill net	Hook & lines (catamaran)	Hook & lines (canoe)
Rate of returns (%)	24	50	87	43
Operational costs-profit ratio	14	12	13	12
Returns to labour	23	28	29	23
Price realised per kg	1.57	2.25	6.20	4.50
Average operational costs (excluding labour) per kg (*Rs*)	0.15	0.21	1.20	1.59
Average fixed costs per kg (*Rs*)	0.24	0.40	0.60	0.50
Average total costs per kg (*Rs*)	1.41	2.10	5.55	4.09
Average total costs (excluding labour) per kg (*Rs.*)	0.39	0.61	1.80	2.09
Mandays required to produce one tonne of fish	52	58	150	103

Table 12

Average costs and earnings per day of operation of motorised crafts operating different gears (central region-1986).

Type of gear	Boat Seine	Gill net	Hook & Line
Revenue (*Rs*)	1585	434	728
Variable cost :			
Fuel (*Rs*)	100	70	80
Labour (*Rs*)	914	223	352
Auction commission (*Rs.*)	79	21	36
Maintenance (*Rs.*)	35	20	18
Other expenses (*Rs*)	14	10	70
Total	1142	344	556
Fixed cost ;			
Insterest (*Rs.*)	60	38	21
Depreciation (*Rs*)	62	40	32
Total	122	78	53
Total cost (*Rs.*)	1274	422	609
Net income (*Rs.*)	311	12	119

Table 13

Economics of ring seine operation-1986.

		Annual	Per day
A	Average revenue per unit (*Rs.*)	432000	2400
B	Variable costs (*Rs*) :		
	Fuel	22140	123
	Auction commission	21600	120
	Wages	252369	1402
	Maintenance & repairing	14000	78
	Others	2700	15
	Total	312809	1738
C	Fixed costs (*Rs*) :		
	Depreciation		
	Craft & Engine	10500	58
	Gear	11667	65
	Interest @ 15 %	20850	116
	Total	43017	239
D	Total costs	355826	1977
E	Net income	76174	423
	Rate of return	70%	
	Investment turn over ratio 3.1		
	Returns to labour (*Rs*) = 101/-		
	Average wages per manday = *Rs* 78/-		
	Price realised per kg of fish = *Rs* 3.1/-		
	CPUE (catch per day of operation) = 773 kgs		
	catch permanday = 43 kgs.		

Initial investment (*Rs.*)

Craft	42000
Gear	70000
Engine	27000
Total	139000

Total catch (tonnes) = 22503

No of unit effort = 29106

Table 14

CATCH, REVENUE AND PRICE INDICES OF OBE

INDICES	1982			1983			1984			1985			1986		
	BS	GN	HL	BS	GN	HL	BS	GN	HL	BS	GN	HL	BS	GS	HL
Catch	100	100	100	76	117	119	67	51	120	83	35	72	68	43	124
Revenue	100	100	100	108	122	164	134	112	202	182	87	114	225	152	182
Price	100	100	100	146	104	138	198	220	168	217	254	158	326	352	146

Central Marine Fisheries Research Institute, Cochin-31,

Study on the introduction of outboard engines and its impact on socio-economic aspects of fisherfolk of Kerala coast.

Schedule – I

1. Date of enumeration :
2. Name of

Landing Centre	Village	Taluk	District

3. Name (if any) of boat fitted with outboard engine/owner :
4. Length of boat (in metres) :
5. Breadth (at centre) of boat :
6. Type of Craft : Plank built/dugout/catamaran
7. Make of engine :
8. H. P. of engine :
9. Type of fuel : Petrol/Kerosine/Diesel/Petrol + Kerosine
10. Capacity of fuel tank (in litres) :
11. Gear (s) used :

Type of gear	*Mesh size (in cms)*	*Total length (in metres)*	*Number (units)*
a)			
b)			
c)			
d)			

12. *Date of purchase/ Lease in* | *Purchase value/ Lease in value* | *Life expect- ancy* | *Present value*

a) Engine
b) Craft
c) Gear (s)

13. Source of finance :

Self financing | Co-operatives | *Govt. loan* | *Bank loan* | *Private loan* | *Others (specify)*

a) Engine
b) Craft
c) Gear (s)

14. If loan,

a) *Receipt of loan*

Amount | *Date of receipt* | *Rate of interest*

b) *Repayment of loan*

Number of instalments | *Period of loan* | *Mode of repayment* Monthly/Quar-/Yearly terly

15. Have you received subsidy from Govt: Yes/No.
16. If 'Yes', the amount and name of agency through which obtained:
17. Type of ownership: Single/Share (specify number of shareholders)
18. Persons engaged in operation:

No. of owner operators | *No. of wage earners* | *Total*

19. Distance of fishing ground from shore (in Kms):
20. Time of the boat departure and arrival:

Departure | *Arrival*

21. Duration of actual fishing (in hrs):

22. No. of days of operation in a week:
(specify weekly holiday, if any):

23. No. of days so far operated:

24. *Details of catch on the day of observation*

	Species	*Quantity (in Kgs)*	*Value*
1.			
2.			
3.			
4.			
5.			
6.			
7.			

25. Mode of disposal: By Auction/Negotiation

26. Type of disposal: Fresh/Salted/Dry:

27. To whom the fish is sold: Middleman/wholesale trader/ retail trader:

28. Are you indebted to the purchaser?

29. Wages paid:

30. Auction Commission:

31. Source of Fuel: K. S. F. W. C/Any other Govt. Agency/ open market

32. Fuel Expenditure/day

	Quantity	*Value*
Petrol		
Diesel		
Kerosine		
Lubricating Oil		

33. Repair charges so far incurred (in Rs.)
Engine (details in Appendix-I)
Craft
Gear (s) (including replacement)

34. Otner maintenance charges (insurance premium etc)
35. What type of fishing craft you were using earlier? Mechanised/Plank built/Catamaran/Dugout.
36. What was your occupational status?
37. When did you shift to outboard engine boat?
38. Efficiency of outboard engine boat:

	With outboard engine	*Without outboard engine*
a) Distance of operation from shore (in Kms)		
b) Duration of operation (hrs)		
c) Actual fishing (hrs)		
d) No. of gears used		
e) size of the gear		
f) Mesh size		
g) No. of crew required		
h) No. of trips in a day		
i) Composition of catch, quantity, value.		

39. What was the reason jor introducing outboard engine?

40. What are the advantages and disadvantages of outboard engine?

41. What is your opinion about introducing motor to all, indigeneous craft?

42. *Remarks*:

33. a) Repair charges so far incurred for the engine Rs.

b) Parts of the engine became defective or malfunctioned

i) Spark plug

ii) Bearing

iii) Coil

iv) Locking pin

v) Tank leak

vi) Carburettor

vii) Any other parts (mention)

c) What are the recurring repairs and how often ?

i)

ii)

iii)

d) Whether the repair and maintenance service is done through Engine mauufacturers agency, private or self.

e) Whether the repair/servicing is carried out at the base or at agency's workshop.

f) What is the time loss due to repairs of engine

g) What do the crew do during the period when the engine is under repair ?

Do they go for fishing with other boat ? or are they idling ?

h) Any difficulties arose in getting the engine repaired for want of mechanic or communication etc.

i) Any difficulties in getting spare parts.

j) Are you able to do day to day maintenance of the engine like cleaning with fresh water, filter cleaning, carburettor cleaning, spark plug cleaning, greasing etc.

Schedule II

(Appendix – II)

Expenditure and returns of Craft with/without outboard engine

(Data to be collected on selected days)

Centre..... Date..... Time of observation .....

1. Name of the boat/owner:
2. Type of craft–Plank built/ Dugout/Catamaran : With/Without outboard engine
3. Number of persons engaged in fishing:
4. Number of trips :
5. Duration of actual fishing (hrs)
6. Time of departure and arrival : Dep: Arr:

   I trip.....

   II trip.....

   .....

   .....
7. Gear used (mention local name) :
   In the case of Hook & Line, specify Long Line/ Hand Line/Trolling Line
8. Number of hauls/trip

9 *Catch Details*:

Local name of fish	Quantity (in kg)	Value (in Rs.)
i)		
ii)		
iii)		
iv)		
v)		

10. Fuel expenditure:-

Fuel	Quantity (in lit.)	Value (in Rs)
Kerosine		
Petrol		
Diesel		
Lubricating oil		

11. Remarks:-

Name & Signature of Investigator

PREFACE

Marine fisheries play an important role in the economy of Kerala. About two-thirds of the marine fish landings of the State was accounted for by the purely artisanal sector till the late seventies, eventhough mechanization picked up as early as mid-sixties. This pattern is fast changing due to large-scale motorization of county craft using outboard engines, since 1980. While landings of motorised craft has substantially increased during the last eight years that of the non-motorised showed a declining trend. The number of motorised craft is continuously increasing. In this context, it was felt necessary to critically examine the available data at the Central Marine Fisheries Reaearch Institute to bring out the underlying implications of motorization. In the present publication, the authors have attempted to assess the impact of motorization on production, productivity, earnings of fishermen and other related aspects and also made suggestions for suitable management measures.

I thank S/sri. K. Balan, K. K. P. Panikkar, T. Jacob, Joseph Andrews and V. Rajendran for the concerted efforts taken in bringing out this publication.

P. S. B. R. JAMES
Director,
Central Marine Fisheries Research
Institute, Cochin.

SELECTED REFERENCES

ASARI, T. R. T. (1969) The impact of the Indo-Norwegion Project on the growth and development of Indian Fisheries.

ASARI, T. R. T, (1981). Mechanised Fishing in Kerala, Fisherman Vol. 2. April-December, Quilon.

ANON ( ). Small Scale Fisheries in South Asia - A regional FAO/UNDP Project: General Description of Marine Small Scale Fisheries, Kerala, India-August, 1969.

ANON (1988). Fisheries Technologies for Developing Countries: Report of an Ad Hoc Panel of the Board on Science and Technology for International Development. National Academy Press, Washington.

ANON (1984). Motorisation of Country Craft, Bangladesh, Bay of Bengal Programme Development of Small Scale Fisheries BOBP/REP/18.

GILLET, F. P. (1981). Small-scale fisheries development projects at Muttom, Kanyakumari District-a case study. Proceedings of the Seminar on the role of Small-scale Fisheries and Coastal Aquaculture in Intergrated Rural Development. CMFRI, Bulletin 30-A.

GULBRANDSEN, O. (1984). Fishing Craft Development in Kerala: Evaluation Report. Bay of Bengal Programme, Working Paper BOBP/WP/25, Madras.

JACOB T., RAJENDRAN V., MAHADEVAN PILLAI, P. K., JOSEPH ANDREWS AND SATHYAVAN, U. K. (1987). An Appraisal of the Marine Fisheries of Kerala. CMFRI Special Publication No. 35.

JOHN KURIEN (1980). Fishermen's Co-operatives in Kerala: A critique. FAO/SIDA Bay of Bengal Programme, Working Paper BOBP/MIS/1, Madras.

JOHN KURIEN (1985). Technical Assistance Projects and Socio-Economic Change - Norwegian Intervention in

Kerala's Fisheries Developent. Economic and Political Weekly Vol. XA, Nos 25 and 26.

JOHN KURIEN AND JAYARUMAR, S. R. J., (1980). Motorization of Traditional Canoes, the Purakkad Experiment.

JOHN KURIEN AND WILLMAN, R. (1982). Economics of Artisanal and Mechanized Fisheries in Kerala: A Study of Costs and Earnings of Fishing Units, FAO/UNDP Small Scale Fisheries Promotion in South Asia, Working Paper No. 34, Madras.

KLAUSEN, A. M. (1968). Kerala Fishermen and the Indo-Norwegian Project, Allen and Unwin, London.

PANIKKAR, K. K. P., AND SATHIADHAS, (1985). Fishermen's share in consumer's rupee - A case study. Harvest and post harvest technology of fish.

PANIKKAR, K. K. P., SATHIADHAS AND T. JACOB, (1988). Comparative Economic Efficiency of different types of Mechanized fishing units operating along Kerala Coast.

PANIKKAR, K. K. P. AND K. ALAGARAJA, (1981). Socio-economic status of fishermen community of Calicut area, Mar. Fish. Infor Serv. T & E Ser, 38 17-29.

RICHARD. B. POLLNAC, (1981). Socio-cultural aspects of developing small-scale fisheries: delivering services to the poor. World Bank Staff Working Paper No. 490.

SATHIADHAS, R., AND VENKATARAMAN, (1981). Impact of Mechanized fishing on the socio-economic conditions of the fishermen of Sakthikulangara-Neendakara, Kerala. Mar. Fish. Infor. T & E ser 29: 1-18.

SRIVASTAVA, U. K. AND DHARMA REDDY, M. (1983). Fisheries Development in India: (Ed): Some Aspects of Policy Management Concept Publishing Company, New Delhi.