COUNTRY STATUS REPORT

ON

INDIA *

Abstract

The nature and problems of small-scale fisheries differ vastly from country to country. India's marine fisheries is formed almost entirely by the small-scale fisheries, comprised by the traditional and mechanised sectors, besides an emerging industrial sector. Among these, the traditional fisheries sector is the largest in terms of crafts, gear, manpower and production. But it has benefitted the least from the development plans. The modern technology has not made any impact on the traditional fisheries except for the introduction of synthetic twine. Save the developments in processing for exports, there has been no improvement on the post-harvest technology. Nor has the sector been provided with adequate infrastructure facilities. The fisheries cooperative have, in most cases, failed due largely to vested interests and lack of motivation and training. Exploitation by middlemen and merchants continues unabated. With all these handicaps, the traditional sector has come in conflict with the mechanised boats on operational problems. While the mechanised sector is recording a steady growth, even tilting the scale of production in some areas, the base of the traditional sector is being silently eroded.

The paper presents a summary of the status of the small-scale fisheries in India and discusses the problems and prospects. Diversification of fisheries and introduction of coastal aquaculture as a component of technology package for the integrated rural development of the coastal fisheries sector have been emphasized. It has been suggested that the fisheries cooperatives be revamped and reconstituted on the model of "Operation Flood" in the dairy sector and an "Operation Small Fisherman" be programmed. A 12-point strategy for the development of small-scale fisheries has been formulated.

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1. INTRODUCTION

The Indian marine fisheries is essentially small-scale in nature with two major components, namely the traditional fisheries and mechanised fisheries. A third component, the industrial sector, is just emerging and at present its contribution to the fish production of the country, as compared to the small-scale sector, is rather limited. India's small-scale fisheries is characterised by its multiple species resources, diverse types of crafts and gear, distribution along the entire east and west coasts of India and in the distant oceanic island groups, and the human force of about a million and a half coastal fishermen population. Even as small-scale fisheries vary from country to country, the conditions from state to state differ vastly in India. Each region also has some endemic type of fishing such as the "dol" net of Maharashtra and Gujarat, "rampani" of Karnataka, "thangu vala" of Kerala and "Kola vala" of Tamil Nadu. The two recent works, "General description of marine small-scale fisheries - India" (FAO/UNDP, 1977) and "Present status of small-scale fisheries in India" (CMFRI, 1978a) provide general information on the small-scale fisheries of the country.

India today is going through its Sixth Five-Year Plan and for the fisheries sector it has so far made sizable investments. The government efforts, coupled with the efforts of private entrepreneurs, have raised the status of fishing from one of subsistence nature in 1951 (when planned development commenced) to that of a recognised industry. The country's marine fish production has increased from 0.55 million metric tons in 1951 to 1.4 million metric tons in 1975. Marine fishery products account for an export earnings of over Rs. 2,000 million. However, this increase in production and value has not reflected in the uplift of the small-scale fisheries. The papers and discussions at the Seminar on the "Role of Small-Scale Fisheries and Coastal Aquaculture in Integrated Rural Development" organised by the Central Marine Fisheries Research Institue at Madras in December 1978 (CMFRI, 1978b , c) to discuss the problems of small-scale fisheries amply testified that the small fisherman who is the actual producer is yet to get social and economic justicecommensurate with his contribution to the fisheries economy of the country and in conformity with the avowed national policies and projections. The Institute has also brought out a publication on the "Present status of Small-Scale Fisheries in India" (CMFRI, 1978a). The present paper is an attempt to summarise the present status of the small-scale fisheries in India, identify the maladies and suggest possible remedies based partly on the experiences gained through the discussions at the seminar mentioned above and partly on the information collected by the Central Marine Fisheries Research Institute.

2. MAGNITUDE OF SMALL-SCALE FISHERIES

Fish production

Fishing is done all along the coastline extending to a length of 6,100 km on the mainland of India and in the Lakshadweep and Andaman and Nicobar islands. The frame survey (1973-77) carried out by the Central Marine Fisheries

Research Institute provides the basic data on the magnitude of small-scale fisheries of India (CMFRI, 1978d). Figs. 1-7 depict production, production means and fishermen population in the small-scale marine fisheries. The marine fish production of India had a recent peak with 1.423 million metric tons in 1975, and after a small decline in 1976 and 1977, touched 1.404 million metric tons in 1978 (Fig. 1). Of this about 62.16% is contributed by the traditional fisheries and the rest by the mechanised sector (Fig. 2). The latter has already started making inroads on the traditional sector (Figs. 3, 4 and 5). In Karnataka where about 200 small purse-seiners have been introduced, the mechanised sector has overtaken the traditional sector in 1978 accounting for 51% of the marine fish landings of the State (George, 1978).

Craft and gear

The fishermen operate about 106,000 indigenous crafts ranging from simple logs (catamaran) to well-built "machwa" boats (Fig. 6). They use a wide range of gear such as hooks and lines, drag net, bag net, gill net, drift net, trawl net, boat seine and shore seine. These units of gear number approximately 739,000.

Besides, the fishing industry is ably supported by the mechanised sector. It has been estimated that about 16,000 small mechanised boats have so far been introduced in the country. The boats are engaged almost exclusively in trawling operations, excepting about 235 in purse-seining in Karnataka and Goa and about 400 in gill netting in Tamil Nadu and Kerala.

Fishermen population

Fishermen live in 1,913 villages. The total marine fishermen population is 1.435 million, of whom 323,000 (22.5%) are actively engaged in fishing (Fig.7). The fishing boats operate from 1,365 landing centres which are nothing but short stretches of open beach.

Capital cost

The approximate investment in fisheries would be Rs. 532 million on the traditional crafts, Rs. 809 million on the small mechanised boats and Rs. 1,158 million on fishing gear of both traditional and mechanised boats, giving an estimated total capital cost of Rs. 2,499 million (excluding the large trawlers).

National product

The Gross National Product (GNP) and Net National Product (NNP) of the country have been estimated at Rs. 780,120 million and Rs. 731,570 million at factor cost respectively for the year 1977-78 (GOI, 1978-79). The per capita NNP was Rs. 1,163 at 1977-78 prices. The natural resources relating to agriculture, forestry and logging, fishing, mining and quarrying have been estimated to contribute to 45.5% (1977-78) of the NNP, that is Rs. 332,860 million. The landed value of marine fishes is estimated at Rs. 3,600 million of which the traditional fisheries at 60% level contributed Rs. 2,160 million. The foreign exchange earned through exports of marine products was Rs. 2,122 million in 1978.

3. PROBLEMS FACED BY SMALL-SCALE FISHERIES

Resource availability

With the advent of mechanisation there has been an imbalance with regard to the availability of fishery resources to the traditional fisheries vis a vis the mechanised fisheries. The capability of the traditional crafts is limited as they have to depend on wind or oars for propulsion. When the mechanised vessels started reaching out grounds farther, the traditional sector has felt that the resources which have normally been available to them have become the "booty" of the mechanised sector. This has given rise to serious conflicts in some of the maritime States. This problem is dealt with in detail in a later section in the paper in view of its strategic importance for the harmonious development of coastal fisheries in the country.

Production means

The production means of the traditional sector are simple crafts and gears. The modern technology has not made any impact on the improvement of these. The wood used for construction of catamarans and canoes is being depleted fast and suitable alternate materials have not been found. Except for a few hundred plank-built boats where inboard engines have been fitted as in Gujarat and Maharashtra, all other indigenous crafts continue in the same style with brutal muscle power required for propulsion. The fishermen have taken to synthetic twine for fabricating nets, but with the scaling down or removal of subsidies on this item, use of modern materials for fishing nets still remains the dream of many. Cotton and hemp form the bulk of the material used in fabrication of nets even today.

Post-harvest technology

No matter what the impressive progress made in fish preservation and processing for the exclusive export sector is, the traditional fisheries has not been benefitted by the sophisticated technology. There has been very little improvement in the handling and processing of fish in the traditional sector. Utilization of the fish catch in the country has been summarised as follows: consumed as fresh - 70%, sun-dried - 12%, salted - 9%, frozen and canned - 5%, and fish meal and others - 4% (Silas, 1977).

Some of the States have established "cold chains" with ice plants, cold storages and refrigerated trucks. Considering the length of coast line, the quantities of fish landed and the vastness of the area served, a few thousand tons capacity of the cold chains cannot meet the requirements. The traditional sector needs simple but effective methods of handling fish hygienically, preservation and diversified processing to reach the consumer with wholesome fish and to get remunerative returns for the product.

Infrastructure facilities

If any single factor could be pin-pointed for the economic ills of

of the traditional sector, it is the absence or inadequacy of infrastructure facilities. Their based of operation is still the open beach. The few fishing harbours available in the country serve only the needs of the mechanised boats. The landing centres of traditional fisheries are located in the hamlets themselves for ensuring safety of crafts and gears, facility of operation and for getting the help of the family members in handling the catch on arrival. During adverse weather conditions beach landing of the crafts becomes very difficult. What is needed is simple but safe landing facilities such as platforms and guide lights in all the important landing centres.

Distribution and marketing systems are grossly under developed. This is the domain of middlemen and merchants and fishermen has no role to play after the catches are landed. Except for cities where established fish markets exist, by and large, hawkers and cyclists are responsible for the distribution and marketing of fish in the hinterland. Potable water and power are scarce in the fishing villages.

Fisheries cooperatives

Although the Fisheries Cooperative System was established in the country to help the primary producers, that is the fishermen, it is an admitted fact that it has not fulfilled the objectives. Fisheries Cooperative is a three tier system - the Primary Societies at the village level, the Federation at the district or regional level and the Apex body at the State level. The Primary Fisheries Cooperative Societies with fishermen themselves as members are supposed to be engaged in fishing operations, marketing, providing credit facilities for acquisition of production means, house construction, etc. The District Cooperative Federations have the primary societies as members including individual operators and provide credit facilities and assistance to improve the organisational set up of the primary societies.

The Apex body supports and controls the federations granting required financial assistance. There are about 5,000 fishermen cooperative societies with 6 apex societies in the country with a membership of 530,000 and a total paid-up share capital of Rs. 36 million, the Government share being Rs. 22.4 million (Bapat and Kurien, 1978). According to these authors, about two-thirds of the societies are reported defunct or dormant. The working of 2,759 primary societies in the maritime States have shown that 27.1% of the societies make profit, 61.5% show loss and the rest make no profit and no loss (FAO/UNDP, 1977). The ills of the Cooperative sector have mainly been brought about by the vested interests and lack of proper training of those who manage it. To a majority of the traditional fishermen, the cooperatives are as good as non-existent. Exploitation by the middlemen and merchants continue to haunt the traditional fishermen.

Financing

At the time of introduction of the mechanisation programme liberal subsidies and soft loans were provided by the Governments for purchase of boats,

engines and gear materials. As the programme caught up and when the private enterprise took to mechanised fishing on a large scale, the subsidies and loans were scaled down. The traditional fishermen could enjoy the benefits only with respect to synthetic twine for the nets. The public financing system in the country is operated through Cooperative Banks, Rural Banks, Commercial Banks, Financial Corporations, Industrial Development Corporations, Industrial Development Bank of India and Agricultural Refinance Development Corporation, the last two essentially being refinancing agencies; these are helping the growth of the fishing industry to some extent but the benefit has gone only to the mechanised sector. The traditional sector has so far remained outside the scope of financing by the above agencies. In the last one or two years a few commercial banks have shown some interest in financing the traditional sector. The banks have drawn up schemes for providing assistance for the purchase or replacement of fishing nets, catamarans, canoes and nylon nets. Loans are provided to experienced groups of fishermen and payments towards boats, nets, etc. are made direct to the suppliers. Differential interest of 4% is allowed under certain schemes. Besides this benefit, subsidies ranging from 25% to 33.1/3% are provided in areas covered under the Integrated Rural Development Programme. Thus there is some awareness of the need to assist the small fishermen. But the benefits are reaching only a few.

Socio-economic conditions

It is distressing that there is no reliable data to assess the improvements, if any, on the socio-economic conditions of the fishermen resulting from development plans. A few socio-economic surveys conducted relate to some selected fishing villages at distant points of time and are not related to assessing the impact of the development programmes. The Fisheries Department of the government of Maharashtra conducted a socio-economic survey in 1968 in Thane District, one of the four maritime districts of the State (Kalawar, 1978). The Programme Evaluation Organization of the Planning Commission conducted a limited survey in 1968-69. The Centre of Development Studies, Trivandrum recently carried out a survey in some fishing villages in Kerala (Kurien, 1978). A few case studies have been attempted by private organisations (Valiakandathil, 1978). Some studies on the nutritional status of fishermen population have been made (Mammi, 1978; Devadas and Murthy, 1978).

Based on these limited studies, one could form a general picture of the socio-economic conditions of the fishermen communities as follows. Among the fishermen are those who own boats and gear, gear alone and those who do not have either, but work as labour. The ownership of boat ranges from 27.8% in Kerala to 66.7% in Gujarat. Usually catch-share basis exists among the boat owners and workers. Very few are in salaried employment. In fishermen families there are at least 4-5 dependents for each earning member. The average annual income ranges from about Rs. 1,480 in Orissa to Rs. 8,813 in West Bengal for families employing country crafts and from Rs. 2,374 in Maharashtra to Rs. 5,165 in Gujarat for families employing mechanised boats. Most of the households (60-70%) are in debts, some perenially. They take

consumption loans, loans for family functions and also for procurement of fishery requisites. Saving habit is conspicuous by its absence. Under-employment and idle labour are major problems. For most families, huts form the abodes and very few own houses which can be called so. Some State Governments have housing schemes for fishermen. Literacy among the fishermen is very low. Even in Kerala which has the highest literacy rate in the country, literacy among the fishermen is only about 20-25%. Fish and cereals form the staple food and the fishermen spend very little on protective foods. The most commonly observed nutritional disorders are calorie-protein malnutrition, Vitamin A and B-complex deficiencies and deficiency of essential fatty acids. Protected water supply, roads and other essential services are available only to a fraction of the fishermen population.

What is needed is a national bench-mark survey on the socio-economic conditions of the fishermen community and based on the data, to evolve micro-level planning strategies for implementation in targetted periods. Besides facts and figures, the distinct social behaviour of the community which is the heritage derived from a hard job in the sea should be taken into account in planning programmes for the socio-economic uplift of this sector.

Education and extension

Steeped in illiteracy, the fishermen are unaware of most of the schemes aimed at their development. They are static and immobile. The few educated youth in the community would not like to continue fishing but prefer to seek salaried jobs elsewhere. With the exception of a few who have contacts with the outside world, the majority are confined to a narrow sphere of their profession and communal life. Non-formal education must be given high priority to teach them ways and means of improving their life style, nutritional standards, hygiene and family welfare, and also to understand elementary accountancy, organisation of cooperative units to avail benefits of various schemes, etc. Social welfare organisations and voluntary agencies can play a significant role in this effort. Extension programmes should devote attention to the total needs of the community - professional improvement, family welfare and community development.

4. CONFLICTS BETWEEN TRADITIONAL AND MECHANISED FISHERIES SECTORS

During the last few years, a disturbing development has taken place in certain parts of the country where serious conflicts have occurred between the traditional fishermen and the mechanised sector. Several instances of law and order problems arising out of burning of boats and loss of life and property have been reported from different coastal areas. No doubt, an overlapping of fishing effort by the mechanised boats on the fishing grounds traditionally exploited by the artisanal fishermen has triggered several instances of the conflict.

In Maharashtra, the conflict has been reported from Ratnagiri District, especially in the southern areas of Malvan and Vengurla (Kalawar, 1978).

Trawlers congregate in centres such as Dabhol, Harnai, Ratnagiri, Beogad, Vengurla and Malvan for prawn fishing. The trawlers come in conflict with the local fishermen operating gill nets. In Goa, the conflict is between the shore seines (Rampanies) and purse-seiners because both are exploiting the same pelagic resources of oil sardine and mackerel.

In Karnataka, although the State has the largest purse-seine fleet in the country today, there is no conflict between the 'Rampanies' and the purse-seiners due to the judicious planning of involving the 'Rampan' operators in the introduction of purse seiners (George, 1978). In Kerala, periodic conflicts occur between the trawler operators and the traditional fishermen. The State has a plan for large-scale introduction of purse-seiners for oil sardine and mackerel. This is likely to create another area of conflict between the boat seine and shore seine operators on the one hand and the purse-seiners on the other.

Conflicts of serious nature have taken place in Tamil Nadu (Gillet, 1978). Pondicherry has also experienced such disturbances (Purushothaman, 1978). In Andhra, Orissa and West Bengal, so far there has not been any problems.

The Governments of the maritime states have tried to solve these problems by taking local measures. Most of the states have adopted delimitation of fishing zone. The inshore waters within 5 km are to be exclusively used for the operation of the traditional crafts. In parts of Tamil Nadu an attempt was made to restrict the days of fishing for the mechanised boats and traditional crafts.

Although a central legislation on delimitation of fishing zone has been under discussion, it has been realised that the problem must be tackled in its operational and socio-economic aspects. The example of Karnataka where the benefit of improved technology (purse-seine) has been bestowed on the groups of fishermen who were using the indigenous 'Rampanies' for catching the pelagic stocks is worth adopting under similar conditions in other states. Goa is about to follow this example. Whenever an improved or new technology is introduced, the traditional fishermen must be considered first as the beneficiary. Coastal aquaculture which is an emerging new field of fishery operations has the greatest potential in this direction.

5. DEVELOPMENT OF COASTAL AQUACULTURE IN INDIA

Traditional practices

Aquaculture in its traditional form has been in vogue in India for quite some time but had not been cared for in the schemes of development till recently. The "pokkali" fields of Kerala, "bheries" of West Bengal, "gazani" farms of Karnataka and "khazan" lands of Goa represent this traditional system. These are natural systems operated with tidal resources of water and organisms. About 5, 120 ha of low-lying coastal areas in Kerala

are used in paddy-cum-prawn culture. The North Kanara District in Karnataka has about 2,320 ha of brackish water areas where prawn/fish rearing is done alternating with the production of paddy or salt as the case may be. Similarly prawn culture is done in about 1,800 ha area of "khazan" lands in Goa. West Bengal has the largest estuarine area of about 20,000 ha in the Hoogly-Matlah estuarine system used for the culture of fishes and prawns (Alagarswami, 1978). The production in these traditional culture systems has always been low as it depends on natural stocking and harvesting.

Recent developments

Coastal aquaculture, in terms of modern practices, is a very recent development in the country. The technologies for the culture of several commercially important organisms have been developed mainly at the Central Marine Fisheries Research Institute (CMFRI, 1978e). Techniques for the breeding and culture of prawns have been developed. Penaeus indicus and P. monodon are cultured on commercial scale in the coastal areas of Kerala and Tamil Nadu. Based on the economic success achieved in the demonstration farms, large areas are being brought under intensive prawn culture.

Mussel culture in the open sea has shown enormous potential for increasing the production by adopting raft culture method. It is estimated that a production rate of about 750 metric tons of mussels per hectare area in a column water of about 10 metres per season of 5 months could be achieved. Mussel culture is being taken up by fishermen on commercial scale with some assistance in Kerala and Madras.

The techniques of farming edible oysters have been developed and the estimated production rate is about 150 metric tons per hectare per annum. The fishermen of Tuticorin in Tamil Nadu have taken up commercial production of oysters on a limited scale with some assistance.

Considerable advances have been made in the culture of crabs and lobsters and the former has a promise as a commercial proposition. Lobsters have been bred and reared in the laboratory to commercial size in 18 months' time.

Finfish culture programme for species such as mullets, milkfish, pearl spot, "bhekti", sandwhiting, siganids and groupers in the coastal lagoons and brackish water areas is making good progress. Pen-culture and cage-culture of fishes have great possibilities in the inshore waters and lagoons.

Simple techniques for growing seaweeds in coir frames have been developed and the fishermen are practicing seaweed culture in their spare time in the Mandapam area in Tamil Nadu.

India has developed the techniques of pearl culture indigenously. Demonstration and training programmes are carried out at the Central Marine Fisheries Research Institute. A pilot project on pearl culture has been taken

up at Vizhinjam in Kerala. A large-scale commercial project is being actively considered in the private sector.

Thus, a range of technologies is now available in India for commercial coastal aquaculture operations. The fishermen are being assisted in several ways to take up the new avocations. Free training programmes are offered. A few hundred coastal fishermen and farming families are presently engaged in various practices of coastal aquaculture. Their success will have far-reaching beneficial implications for the coastal fishermen community as a whole. It has been estimated that along the Indian coast about 1.7 million hectares of estuarine and brackish water area are available. The potential inshore area (within 18 metres depth) available for open sea farming has been estimated to be 8.9 million hectares (CMFRI, 1978d).

6. INTEGRATED RURAL DEVELOPMENT IN COASTAL SECTOR

Fishermen do little else than fishing as they are traditionally conditioned to a life in the sea. The womenfolk, excepting a few who are involved in marketing the catches, idle away their time after attending to the domestic chores. There are several possibilities to engage the fishermen and their families in additional avocations which they can attend to in their spare time. Similarly the agricultural farmers who own pieces of land and water areas along the lagoons, estuaries and backwaters could profitably engage themselves in supplementary avocations. Such a change would not only break the monotony of single operations throughout the year but would markedly improve the economy of the coastal sector. There will be additional self-employment opportunities and increase in production of various commodities.

Coastal aquaculture

The instruments to bring about such changes could be many. Coastal aquaculture can be one of the major components. While some can be engaged in the seed collection trade, others could do production. Relatively cheap technologies are available for adoption. The fishermen can judiciously blend their capture fishery avocation with coastal aquaculture. A pilot scale project on these lines, termed "Operational Research Project" is functioning in the fishing village of Kovalam near Madras where the fishermen are assisted to take up mussel culture in the open sea and prawn culture in the backwaters. Similarly fishermen in other areas have been encouraged to take up the culture of prawns, mussel, edible oyster and seaweed. The fishermen have shown a great deal of interest in these additional occupations.

Livestock

The livestock component will be an added dimension in integrated farming. Depending on the local marketing potential the fishermen could take up poultry, duckery, piggery, cattle rearing and dairy farming. In composite fish culture system in the inland water areas, the benefit of keeping a few of the fowls or animals as a source of yield of organic fertilisers to the fish

ponds has been proved, besides being a source of additional income to the fish farmers. A similar system could be adopted in fish culture in brackish-water ponds.

Coastal plantation and forestry

Yet another component of the integrated system would be plantation crops and village forestry. There are vast coastal stretches which are lying fallow. At least those within and adjacent to the coastal villages could be utilised for this purpose. The coastal lands receive an annual rainfall ranging from 4,000 mm on the west coast to 1,500 mm on the east coast. Crops suitable for rainfall and soil conditions should be selected. Casuarina, a coastal woody plant, cashew nut, a soil binder and deep rooted plant and coconut, a shallow rooted crop could be the choice (Kumar et al., 1978). Acacia is another tree which grows in the semi-arid coastal tract. These crops will provide additional income, support the fuel needs of the village and prevent wind and soil erosion. Nutrition gardens with fruit trees and vegetable plants at the family and village level are not to be overlooked.

An integrated farming system already exists in Kerala to some extent. The paddy-cum-prawn culture is a typical example of alternation of crops to suit the water conditions. Prawn culture in the canal systems of coconut groves is fast catching up. Some fowls are also maintained by the farmers. Because of the high rainfall coconut is cultivated extensively in the coastal areas. Thus the concept of integrated farming is already there. A technology-package comprising various components suitable for each fishing village will have to be identified. Implementation of such programmes must be planned in detail and technically and financially supported.

7. PROSPECTS FOR SMALL-SCALE FISHERIES IN INDIA

The small-scale fisheries of India has shown a steady increase in terms of both inputs and production. Compared to 1961-62 data, the number of fishing villages has increased by 6.5%, fishermen population by 49.7%, active fishermen by 40.6%, fishing crafts by 26.7% and the average (1961-65 to 1971-75) marine fish production by 44.1% by 1975. While the trend of increase can be expected to continue for some more years, the small-scale fisheries (both traditional and small mechanised) is likely to be stabilised at a particular point based on dictates of economic returns. Already, the Government subsidies and assistance to the small mechanised boats have been scaled down or withdrawn and a substantial increase in number could be expected only in certain states where the mechanisation programme has not made much headway.

A recent case study made by this Institute (Noble and Kutty, 1978) on the economics of indigenous fishing units at Cochin has shown that traditional fishing with dug-out canoe (12-13 m long) and "Thangu vala" (boat seine) gives a very high return of 171.7% on a catch composition of 66.93% oil sardine (Sardinella longiceps), 12.80% mackerel (Rastrelliger Kanagurta), 17.14% other fish and 3.13% prawns. Similarly, another net "Ayila vala" (gill net) gives

70.66% returns. However, the success of these units depends on the availability of shoals of oil sardine and mackerel and the types of fishing are restricted to a narrow area between Ouilon and Cochin. The economics of the vast majority of the traditional fisheries are far different.

As at present, the Indian marine fisheries is constituted by three sectors - the traditional fisheries, the mechanised fisheries and the industrial fisheries. The last category is a very recent introduction and in all accounts for less than a hundred trawlers. The industrial sector is managed by big business houses of the country. In view of the proposed programmes for the survey and exploitation of the fishery resources of the Exclusive Economic Zone this sector is given liberal assistance by the Government of India.

The mechanised sector with a preponderant trawler base is being managed by small entrepreneurs and fishermen. The exportable varieties of prawns form the mainstay of this sector and any imbalance in the prawn exports would cause considerable strain to this sector. Hardly about 400 boats are gill-netters (mainly Tamil Nadu and Kerala) and about 235 are purse seiners (Karnataka and Goa). Diversification is an urgent need for the future growth of this sector.

The traditional fisheries need a good deal of attention to improve productivity and to increase production. Their contribution to the marine fish production of the country is showing signs of decline in contrast to the increasing trends in the mechanised fisheries. The traditional sector would need a stronger technological base, liberal financial assistance and better management practices to stabilise its tottering base and to make further contributions to the fishing industry.

Technological base

The catamarans, canoes and plank-built boats evolved by the rule of thumb have virtually remained the same without any improvement. Recently a commercial organisation has developed a Fibreglass catamaran which is under trial and further improvement. The Government of Tamil Nadu have plans to introduce these improved crafts to the fishermen at subsidised cost. Gujarat has proposed to give fibreglass sheathing to the canoes under World Bank assistance. In Karnataka, soft wood boats are proposed to be upgraded using radiation technique (Mammen, 1978). The erstwhile Indo-Belgian Fisheries Project at Muttom (Tamil Nadu) introduced 21-ft flat-bottomed and 24-ft surf-crossing boats but they did not become popular among the local fishermen in spite of their proven efficiency in fishing (Gillet, 1978).

The first attempt to mechanise the catamaran with outboard engine was made by the Indo-Belgian Fisheries Project. One hundred 18 H.P. Evinrude engines powered by petrol and kerosene were introduced in Kanyakumari District, Tamil Nadu. Due to a combination of technical, social and economic factors, the experiment proved a failure (Gillet, 1978). Some work is now being done by the Indian firms to develop suitable outboard and inboard engines for the canoes and plank-built boats.

The traditional fishermen should be assisted with appropriate post-harvest technologies for handling the catch. The Marine Products Export Development Authority has developed a fish box for bringing the fish to shore without spoilage (Mammen, 1978). The Central Institute of Fisheries Technology is engaged in developing processes for diversification of fishery products. Special attention is being given to non-conventional products.

The marine products export industry depends mainly on frozen products (71.2% in 1978) and therefore the process of freezing is well established. Next in importance is the dried fish which contributes 8.1% of the total quantity exported. This sector has not received adequate technical support for improving the quality of the products through cheap technology. Tunnel driers and drum driers are not within the means of ordinary fishermen unless the technology is fully assisted by government. Recently the Central Marine Fisheries Research Institute introduced a cheap solar drier made of wooden reapers and polythene sheets in a fishing village near Madras and fish could be dried hygienically in a very short duration. The most practicable solution would be introduction of cheap solar driers in every fishing village.

The peeling and deveining part of the processing industry (for prawns and lobsters) is run as a cottage industry in Kerala but in other states its organisation is diffused. There is considerable scope to improve the hygienic standards in this sector. Quality control should receive the greatest attention at this stage. Organised training programmes should be conducted for the people engaged in these operations.

Coastal aquaculture programmes should be encouraged by the State Governments. The states can have some officials trained in the required technologies and organise demonstrations at the development block-level to induce the fisherment and fish farmers to take up coastal aquaculture. The research and developmental agencies must strive to improve upon the techniques, develop low-cost technologies and provide continuous technical and monitoring support.

The wind energy in the coastal areas has not so far been tapped. Recently, following the introduction of a windmill by the Central Marine Fisheries Research Institute for pumping sea water into the coastal culture ponds, a great awareness has been created and several models of windmills to suit the local wind conditions are under development. This will be an asset for coastal aquaculture. The solar and wind energies should be harnessed through appropriate cheap technologies for aiding production, improving products and for providing general services and facilities in the rural areas.

Transfer of technology

The mechanism of transfer of information and technology is as important as the development of the technology itself. The Fisheries Departments of the States have extension wings which are responsible to educate and assist the fishermen while introducing improved or new technologies. Such key areas which form the linkage between the R & D agencies and the fishermen must be manned by

competent technologists and extension workers. Demonstrations of fishing and culture in the fisherman's boat or farmer's field must form the basis of technology transfer. Issuing leaflets and audio-visual education should form only a secondary function.

The Indian Council of Agricultural Research (ICAR) has organised in 1979 an Experimental Transfer of Technology programme, styled as "Lab-to-Land" programme, to benefit an estimated 50,000 farm families belonging to the weaker sections of the society in the agricultural, animal husbandry and fisheries sectors. The scientists of ICAR Institutes and Agricultural Universities will train the farming families in proven technologies, guide and monitor the operations in the farmers' fields and demonstrate the economic benefits of the technologies. In the field of fisheries, the Central Marine Fisheries Research Institute, Central Institute of Fisheries Technology and Central Inland Fisheries Research Institute are involved in the programmes. Integrated and community approach is being given great importance (CMFRI, 1979a).

The Farm Science Centre (Krishi Vigyan Kendra) concept has already been extended to fisheries and one centre for mariculture at Narakkal and another for inland fish culture at Dhauli have been established. The small fishermen, fish farmers and farm women are trained by the principle "learning by doing". More such organisations must be set up in different districts to train the local fishermen in diversified activities. The Trainers' Training Centres play an important role in creating a cadre of qualified and competent teachers to man the Krishi Vigyan Kendras.

The Fishermen Training Centres in different states could have a broader base than at now. Today it offers training only in mechanised fishing. The centres could include subjects such as diversification of fishing and coastal aquaculture. The fisher youth must be trained in self-employed and income-generating avocations.

Information service

Fisheries Information Service (FIS) is vital for the growth of the fishing industry. Today the only information given to the fishermen is the weather warning. In most areas, the mechanised boats are migrant moving from base to base, and state to state, guided by their own judgements of fishery conditions. Even the traditional crafts are migratory within short distances. A well-organised FIS at regional and operational base levels to scout, collect, process and provide day-to-day information to the fishermen on fishery conditions, sea and weather conditions and periodic forecasts arising from research organisations will go a long way in guiding the fishing operations. Such services are well established for the agricultural sector. It is time that the fisheries sector also gets the benefit. The media of radio and local newspapers can be of immense help in transmitting fisheries information.

Financial assistance

Introduction of improved and new technologies must be linked up with liberal subsidy and credit facilities. The Government of India have recently introduced Integrated Rural Development Programmes (IRDP) such as the Small Farmers' Development Agency (SFDA), Fish Farmers' Development Agency (FFDA) and Drought Prone Area Development Programme (DPAP) under which small fishermen and fish farmers can avail subsidy and credit facilities for viable schemes. However, the fishermen face some problems in matter of producing securities for the credit part of the assistance and there is need for liberalising the rules further in order that the fishermen can avail these facilities more easily. Besides the above centrally sponsored schemes, the States also provide assistance through the Fisheries Departments for specific schemes. The Indian Council of Agricultural Research provides subsidy to the farmers under the "Lab-to-Land" programme.

The seminar on "Small-scale Fisheries and Coastal Aquaculture in Integrated Rural Development", noting that the fishing industry has unique characteristics different from land-based industries and that the financing agencies will have to take these characteristics and the general illiteracy of fishermen into consideration, recommended that separate provisions and guidelines be made by the commercial banks for providing financial assistance through simplified procedural formalities and with minimum delay to help quick development of the fisheries sector, eventually leading to the establishment of Fisheries Banks analogous to Agricultural Banks (CMFRI, 1978f).

"Operation Small Fisherman"

Considering the scatter of the small-scale marine fisheries being run as individual operations by about one-third million active traditional fishermen all along the 6,100 km long coast line of India, the cooperative system would be the best to bring benefits to the actual operators no matter how miserably the system has performed in the past. A thorough re-vamping of the fisheries cooperative organisation is necessary. The success of the "Operation Flood-I" in the dairy sector, which has many parallels to the small-scale fisheries sector, has shown how cooperatives could usher in an era of prosperity. "Operation Flood-II" aims at bringing the small dairy owners of the entire nation under a National Milk Grid based on a three-tier cooperative system. On the model of "Operation Flood", an "Operation Small Fisherman" (OSF) must be planned to assist the small fishermen to become economically viable and prosperous.1/

The form, functions and linkages of the Fisheries Cooperative should be clearly defined and effectively implemented. The entire spectrum of activities of the small-scale fisheries, including production, handling, distribution,

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1/ The first author is grateful to Dr. M.S. Swaminathan, Secretary to Government of India, Ministry of Agriculture and Irrigation for the original suggestion.

marketing, credit, services and infrastructure should be brought under the *cooperative fold*. The illiterate fishermen and fish farmers must be made to realise the benefits of cooperative organisations through non-formal education. The educated youth of the society should be properly trained to man the cooperatives at the basic tier. The more qualified among them should be given higher training to work in the second and third tiers. Competent professional and technical support should be provided at all levels. The role of bureaucracy should be limited to the act of triggering the cooperative movement and coordinating it. Its domination will be an antithesis.

Socio-economic benefits

The recent Madras Seminar on small-scale fisheries (CMFRI, 1978f), realising that the uplift of the fishermen community, socially and economically, is an urgent need so that they are not left out of the main stream of national development, recommended that the State Governments accelerate their fishermen-welfare programmes and encourage and provide necessary technical and infrastructure facilities for taking up employment and income-generating additional avocation in the coastal areas.

The fishermen suffer heavy loss of life and property due to natural calamities such as cyclones and tidal waves. In the last three years, the coasts of Andhra Pradesh and Tamil Nadu have been badly hit by cyclones. In July 1979 there was a major fire disaster at the Malpe fishing harbour in Karnataka with an estimated total loss of Rs.23 million (CMFRI, 1979b). Realising the need to provide succour to the affected fishermen, the Madras Seminar (CMFRI, 1978f) recommended that they be provided adequate compensation promptly under all circumstances of natural calamities and appropriate accident reliefs be instituted, and that the function of compensation in case of injuries, loss of life and equipments be taken over the Government of India.

The State Governments have several fishermen welfare schemes. Housing, electricity, water supply, roads, fisheries schools, academic schools and medical facilities are some of them. The progress in implementation of the schemes varies from state to state. The Government of India have sanctioned schemes for providing infrastructure facilities in coastal fishing villages. The National Adult Education Programme (NAEP) aims at providing both formal and non-formal education including some vocational training programmes. There is a high rate of un-employment and under-employment in the coastal rural sector The Government of India have started a programme for Training Rural Youth for Self Employment (TRYSEM). Also certain Area Development Programmes have fisheries as one of the major components for the integrated system for development.

In a vast and populous country like India, the Government alone cannot solve all the social and economic problems of the people. The people themselves can do a lot for improving the conditions. The social welfare organisations and voluntary agencies can play an important role in this. Today we find some of these organisations, including students of educational institutions, working in the fishing villages to help provide a better life for the small fishermen and their families.

Legal and leasing problems

In the small-scale fisheries sector problems relating to law have already started cropping up. In one case the conflict between the traditional and mechanised sectors had been taken to the judiciary for decision. When the fisheries sector expands its activities, there may arise several such instances. Of particular importance would be those arising out of coastal aquaculture where culture operations will have to be carried out in areas chosen and specified. At present there is no leasing policy in the country with regard to estuaries, brackishwater areas, lagoons and the coastal waters. Kerala has a licensing system for prawn culture. Tamil Nadu has recently decided that the lands/areas suitable for prawn culture shall be exploited by the Government only or allotted on lease basis to Fishermen Cooperative Societies consisting of actual fishermen as members. Some states have regulations for leasing out sedentary resources such as Xancus, Trochus and Turbo. Tamil Nadu and Gujarat enjoy monopoly over the pearl oyster resource.

Sea farming will bring in navigational problems. Also situations might arise when the interests of sea farmers and fishing boats converge on some areas leading to conflicts. In shore-based aquaculture, problems of right of waterways and feeder canals and trespassing would arise. There will be clash of interests in exploiting seed production grounds. Conservation measures would be required to protect the nursery grounds. Prevention of pollution would be another dimension of the problem.

Legal measures would be required in the capture fisheries too. Conservation and management of fishery resources would need enforcement of closed seasons for fishing and regulation on number of crafts, type of gear and size of mesh.

The time is considered opportune to lay down major national policies and enact laws on leasing of water areas, delimitation of fishing zones, rights and responsibilities of the different sectors of the fishing industry, conservation and management of resources and management of the environment. A comprehensive Fisheries Act is necessary to guide and regulate the development and growth of the fishing industry.

8. STRATEGIES FOR DEVELOPMENT OF SMALL-SCALE FISHERIES

The status, problems and prospects of the small-scale fisheries highlighted in the paper lead to identifying strategies for the development of the sector in the country which are enumerated here.

(i) Identification of area-specific technological and operational problems of the small-scale fisheries sector and development and introduction of appropriate harvest and post-harvest technologies within the economic means and technical competence of the fishermen.

(ii) Coastal aquaculture to form a major component in the technology package for integrated rural development of the coastal fisheries sector.

(iii) Harnessing of solar and wind energies through appropriate cheap technologies for assisting the fishermen in fish production and processing and for providing general services and facilities to the coastal villages.

(iv) Transfer of technology with support of training and critical inputs.

(v) Building up efficient extension and information services on a regional basis to serve as linkage between R & D organisations and fishermen for providing technical assistance and advice, conducting demonstrations, publishing and broadcasting fishery information and for collecting and providing feed-back information.

(vi) Provision of subsidy and credit facilities for stabilising the present base and for adoption of new technologies on easy terms relevant to the existing conditions of the fishermen.

(vii) The processing and export industry, which at present remains a mere procurer of raw materials from the small-scale sector for processing, to play a reciprocal benefactory role by recycling part of the export profits towards development programmes for the small-scale fisheries sector.

(viii) Strengthening the programmes for creation of necessary infrastructure facilities and services in the coastal fishing villages.

(ix) Planning and implementation of appropriate long-term measures for solving the conflicts among different fisheries sectors without sacrificing fish production.

(x) Conducting a national bench-mark survey on the socio-economic conditions of the fishermen community and planning and implementation of programmes for their improvement based on social cost-benefit studies.

(xi) Formulation and implementation of an "Operation Small Fisherman" programme on the model of "Operation Flood" in the dairy sector for assisting small fishermen to become economically viable and prosperous.

(xii) Laying down national policies on leasing of water/land areas to coastal aquaculture predominantly for the benefit of the coastal fishermen and formulation of legal measures for management of fisheries.

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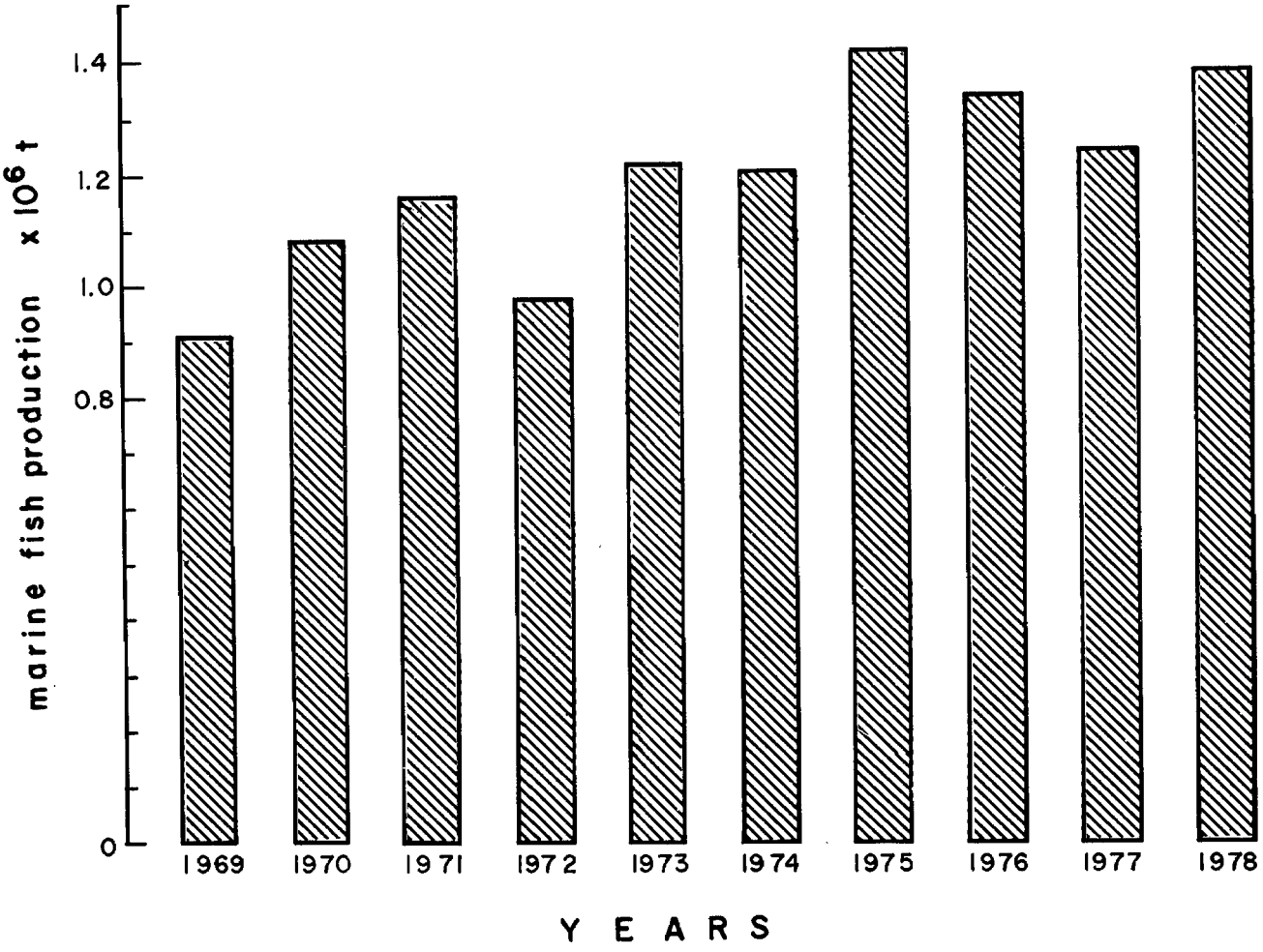

Fig. 1. Total marine projection of India from 1969 to 1978.

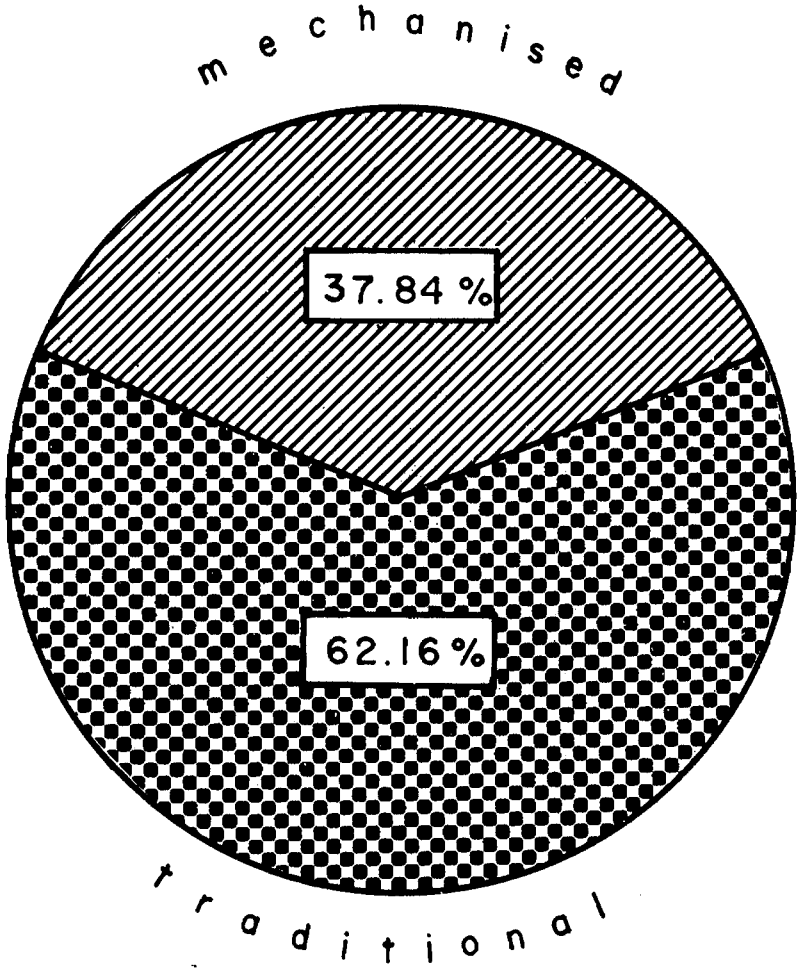

Fig. 2. Percentage composition of marine fish catch by the traditional and mechanised sectors.

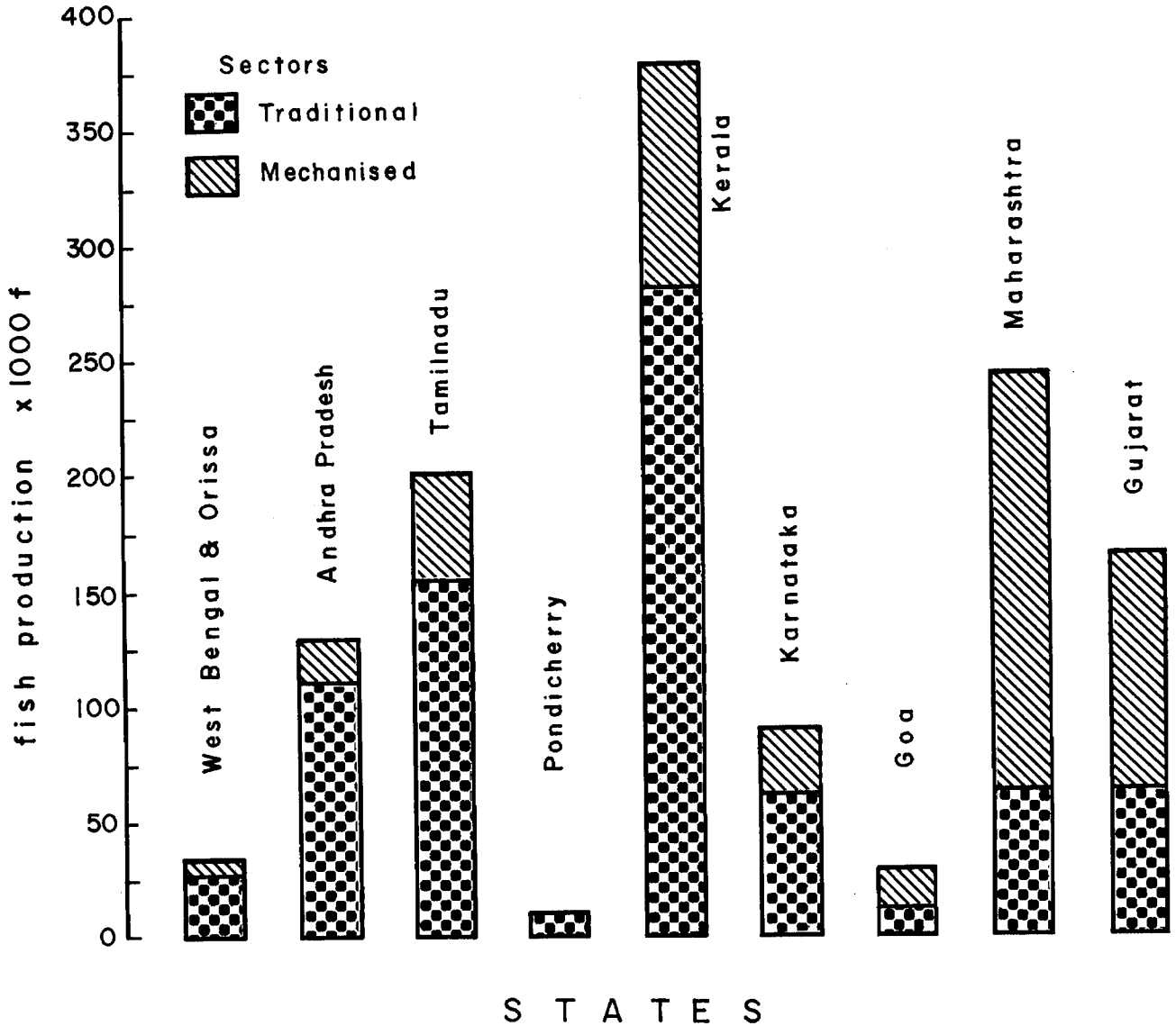

Fig. 3. Marine fish production by the traditional and mechanized sectors in the maritime States.

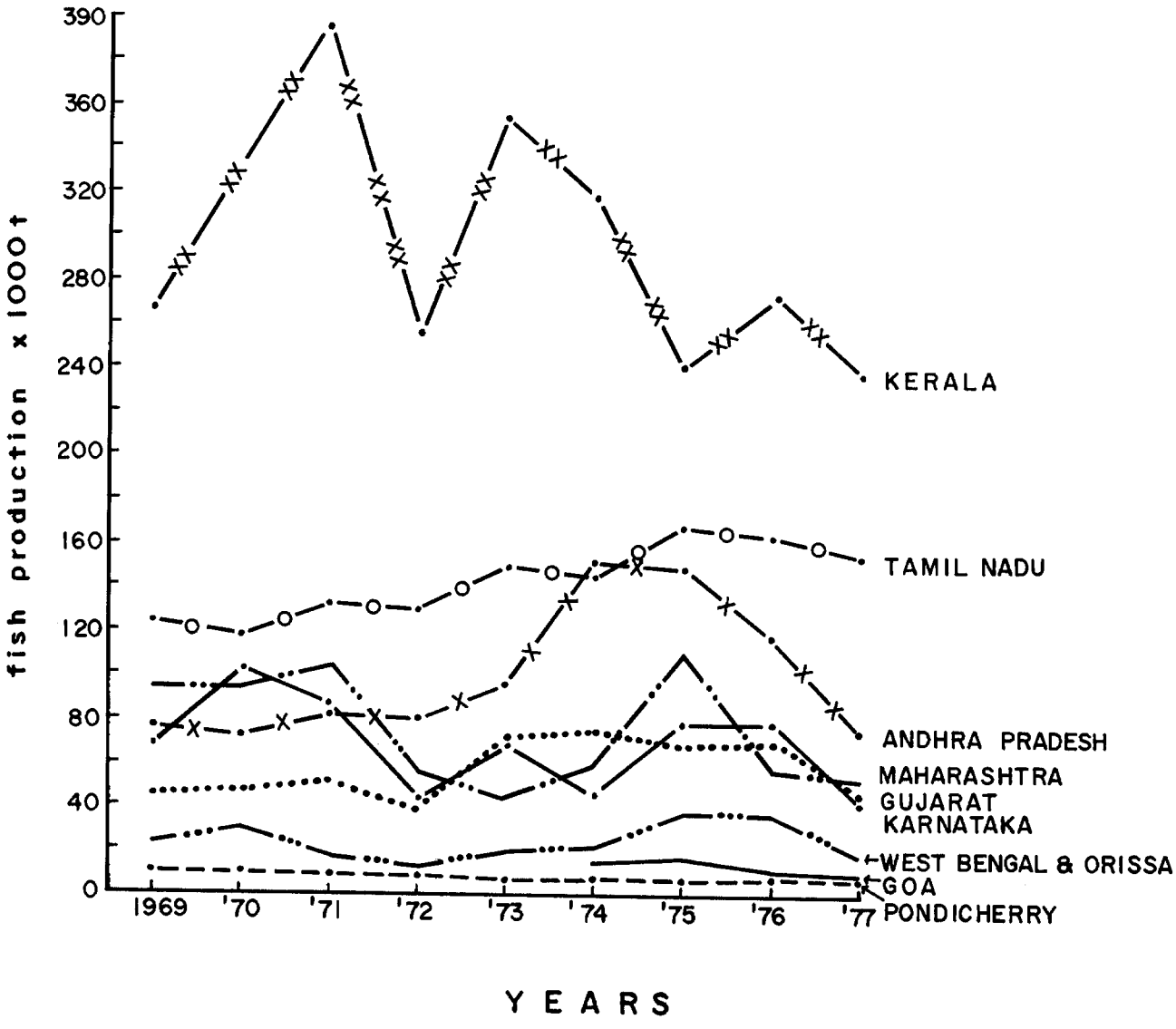

Fig. 4. Trends in fish production by the traditional sector in the maritime States during 1969-1977.

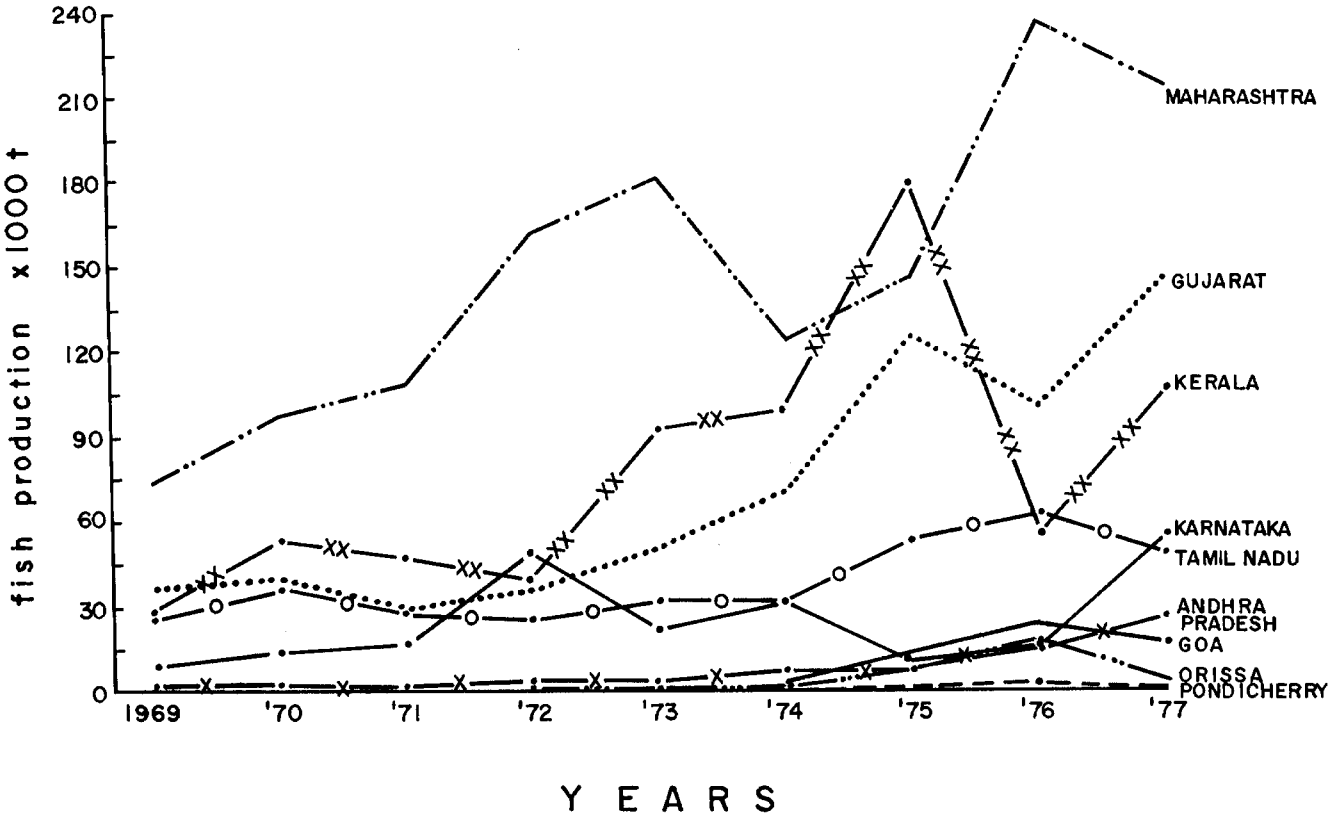

Fig. 5. Trends in fish production by the mechanised sector in the maritime States during 1969-1977.

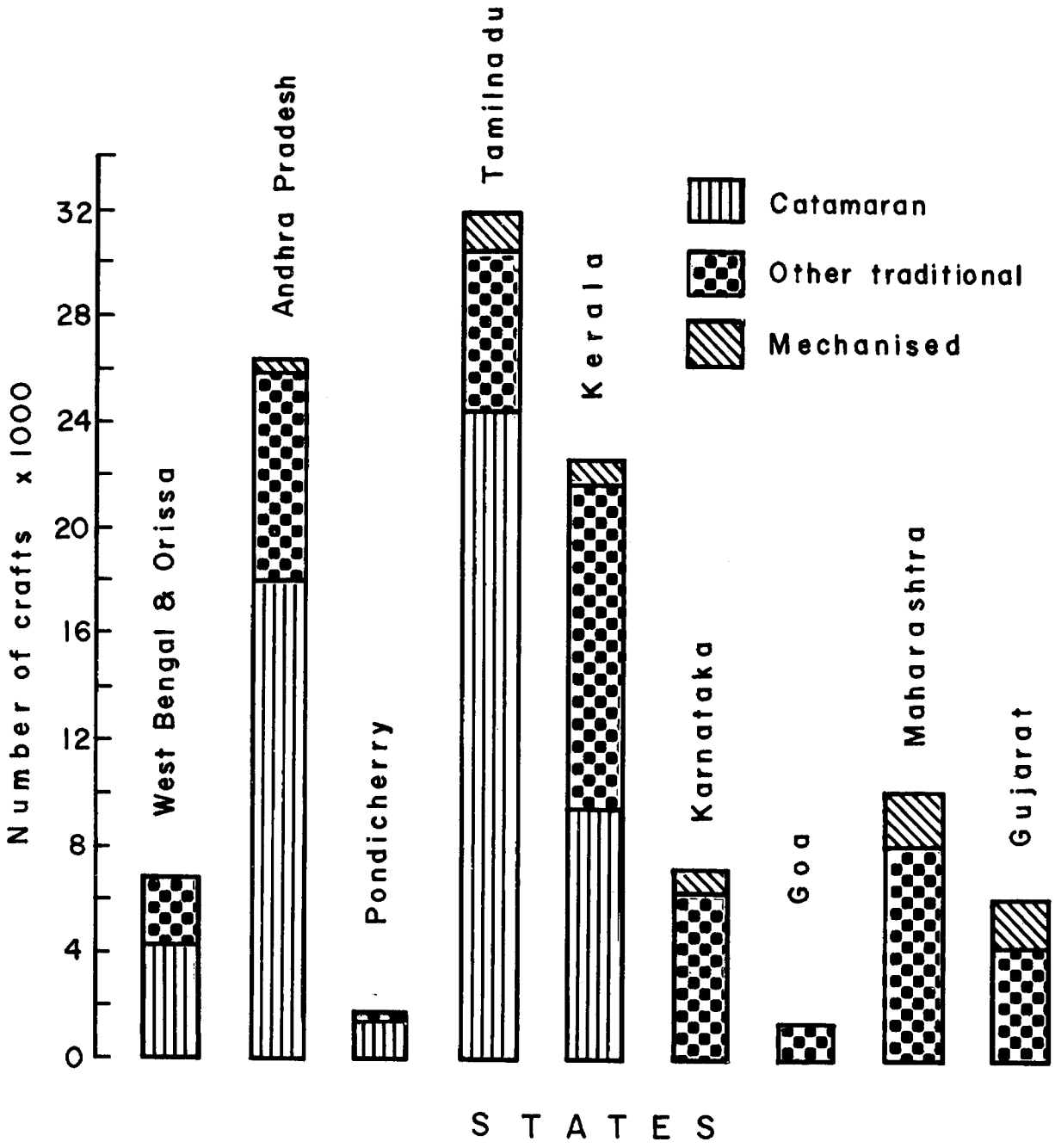

Fig. 6. Composition of the fishing crafts (Catamaran, other traditional and mechanised crafts) in the maritime States in 1977.

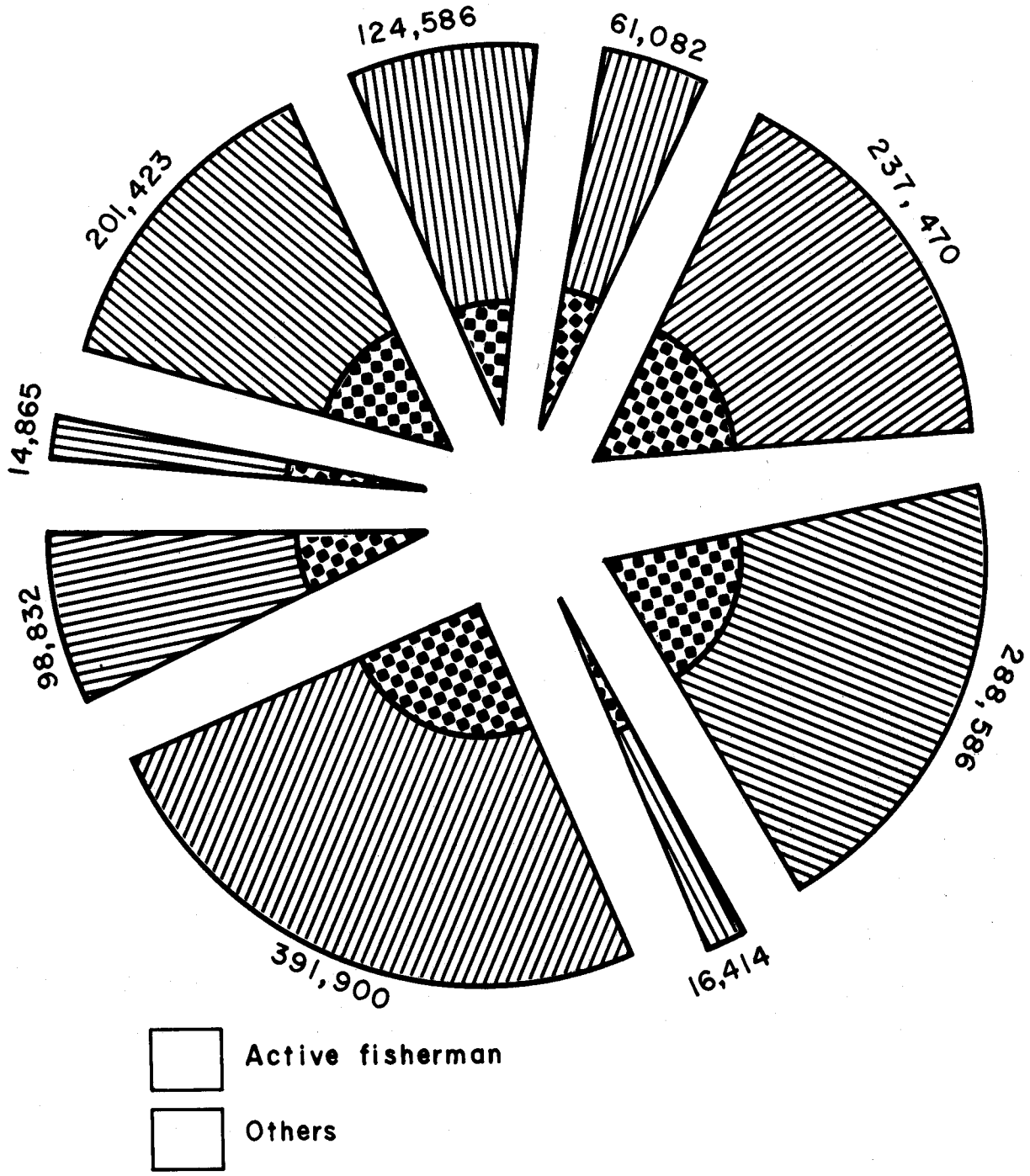

Fig. 7. Marine fishermen population (numbers) and active fishermen in the maritime States. Clock-wise from x-West Bengal & Orissa, Andhra Pradesh, Tamil Nadu, Pondicherry, Kerala, Karnataka, Goa, Maharashtra and Gujarat.