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PRESENT STATUS OF SMALL-SCALE FISHERIES IN INDIA AND A FEW NEIGHBOURING COUNTRIES

CENTRAL MARINE FISHERIES RESEARCH INSTITUTE
(Indian Council of Agricultural Research)
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Papers released to furnish background information at the Seminar on the Role of Small-Scale Fisheries and Coastal Aquaculture in Integrated Rural Development , 6-9 December 1978, Madras

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CONTENTS

PREFACE

Sea fishing is the traditional occupation of the fishermen living along the coastline. Although started as an avocation for subsistence in the distant past, with the social changes, it became an occupation; people engaged in it formed distinct communities and the produce became a merchandise. The resource enjoying a status among the country's wealth is from comparatively recent times. The development schemes under the Five-Year and Annual Plans and the enterprise of the businessmen have raised the status of fishing to the level of an industry, with an added importance of a sizable export segment in it.

While the entire marine fish catch of the country came from the traditional fisheries prior to 1951—the year when the phase of mechanisation commenced and development schemes were introduced (barring the mechanisation programme developed in Maharashtra in the mid forties)—this sector at present accounts for about 60 per cent of the total marine fish catch. The mechanised sector has already started making inroads on this as in Karnataka. With a predominant rural base of our society, the retention of the ratio of contribution by the small-scale fisheries around this level is essential to protect and improve the employment potential in the coastal sector. It has been realised that the small-scale fisheries offers twice the returns per unit of investment and generate almost seven times direct employment opportunities as compared to the mechanised sector.

Despite these facts, the impact of development programmes has not penetrated the matrix of the society of fishermen. There has not been much of a visible change in the fortunes of the artisanal fishermen. Their operational, living and social conditions remain by and large the same except for the adoption of synthetic fishing twine. It is time that we pay greater attention to this sector and plan and implement programmes with an accent towards uplifting their status through appropriate technological, financial and other infrastructural inputs. There should be a linkage of fisheries development with fishermen develoment. Such a plan would also lead to increased fish production. This realisation is perceptible not only at the national level but has assumed far-reaching significance in the world bodies concerned with fisheries development.

In this context, the Central Marine Fisheries Research Institute organised a Seminar on the "Role of Small-scale Fisheries and Coastal Aquaculture in Integrated Rural Development" at Madras during 6-9 December 1978 to discuss small-scale fisheries in its operational, technological, financial and socio-economic aspects, to consider the coastal aquaculture technologies recently developed in the country and to evolve an action plan for the accelerated development of the coastal rural sector through integration of appropriate technologies, the proceedings of which have already been published as Part A of this volume. Although the discussions at the seminar were based on contributed papers, it was thought necessary to provide background information on the status of small-scale fisheries of the country.

The FAO/UNDP Project on Small-scale Fisheries Promotion in South Asia has prepared a General Description of Marine Small-scale Fisheries of India and a few states. However, a Status Report from the country itself has been lacking. Since the States have a direct responsibility for development of fisheries, it was decided to seek first-hand information from the maritime States and Union Territories. The status papers received from these organisations, were complied and released at the Seminar These have been further edited and published in the present book.

I must record my sincers thanks to Shri P. Basu. Commissioner of Fisheries, Gujarat. Shri A. G. Kalawar, Director of Fisheries. Maharashtra. Shri R. M. Dhawan, Director of Fisheries, Goa, Shri M. Jayaraj, Director of Fisheries, Karnataka. Shri S. N. Rao, Director of Fisheries. Kerala. Shri K. S. Ramakrishnan, Director of Fisheries, Tamil Nadu, Shri E. Purushothaman, Director of Fisheries, Pondicherry, Shri P. P. Williams. Director of Fisheries, Andhra Pradesh, Shri M. M. Mohanty, Director of Fisheries, Orissa, Dr. S. A. H. Abidi, Director of Fisheries, Andaman and Nicobar Islands and Shri George Varghese, Director of Fisheries, Lakshadweep, for their cooperation with us in this project and for the papers. I must also thank Shri A. Sreenivasan (Tamil Nadu), Shri M. S. George (Karnataka) and Shri A. B. Roy (Orissa) for contributing papers for the respective States. It is regretted that the status paper from West Bengal could not be obtained. Dr. K. Alagarswami of this Institute assisted in editing the papers.

E. G. SILAS

PRESENT STATUS OF SMALL-SCALE FISHERIES AND AQUACULTURE AND SCOPE OF THEIR DEVELOPMENT UNDER THE RURAL DEVELOPMENT PROGRAMMES IN GUJARAT STATE

PRABIR BASU

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INTRODUCTION

Gujarat has an excellent marine, estuarine and inland fisheries potential. This State enjoys an enviable position among all the maritime states of the country in view of the long coastline of 1663 km and a vast seaboard. It has about 1,65,000 sq. km of continental shelf of which 65,000 sq. km are within a range of 50 metres. Thus about a third of the coastline and continental shelf of the country is with Gujarat. Further, the discharge of flood waters into the sea in this region enriches the coastline of this State and, as a result, the sea abutting the State sustains some major commercial fisheries, such as the bombay-duck, pomfrets, jewfishes, threadfins, perches and commercially the most coveted shrimps.

Gujarat has about 3,67,000 hectares of estuarine and brackishwater spread, several kilometres of river length, about 16,000 hectares of urban and rural freshwater sheets and about a lakh hectare of minor and major irrigation reservoirs which yield sizable quantity of estuarine and freshwater fishes, such as the grey mullets, perches, threadfins, prawns and major and minor carps.

The State has been in the forefront to exploit and utilise these natural resources and, thanks to its well - planned development programmes, has been able to increase its fish production cosiderably. The fish production which was mere 80,000 tonnes at the inception of the State in 1960 has now increased to about 2.35 lakh tonnes which amounts to about a tenth of the nation's total fish production.

The increased fish production and an expanded fisheries trade have been achieved not by the modern trawlers alone. The traditional small-scale fisheries has made a substantial contribution to the achievements of the fisheries sector of the State. Therefore, the fisheries development agencies cannot afford to ignore the conventional and traditional small - scale fisheries and the persons involved therein while planning for the development of fisheries sector in the State.

THE SMALL-SCALE FISHERIES OF GUJARAT

Gujarat has a fishing fleet consisting of about 7,600 boats scattered all along the coast. Of these, about 34% are mechanised and the rest are non-mechanised boats ranging from dugout and flat-bottomed boats to plankbuilt *Hodis, Lodiyas, Machwas and Wahans*. These boats operate many types of conventional fishing gears such as cotton and hemp bagnets, castnets, dragnets and gillnets. It is estimated that out of the 3.39 lakh units of fishing gears operated along the Gujarat coast, about 41% are conventional fishing gear including traps and cast nets. Thus it can be seen that in spite of a great thrust of sophistication on the craft, gear and fishing methods, the conventional small - scale fisheries still plays a very important role in the State. The National Commission on Agriculture observed that "the marine fishing in India has progressed during all these years using indigenous crafts for the exploitation of the waters immediately near the coastline". It has been very much so in Gujarat and it continues to be so as, other than a few coastal pockets in Junagadh and Bulsar Districts, by and large, the fisheries of

of Gujarat is supported by the traditional, conservative, small-scale fisheries.

The State has been aware of this fact and therefore, has been quite sensitive to the problems of the traditional fishing. This can be seen from the fact that during the first three Five-Year Plans, the main concentration was on the mechanisation of the indigenous fishing crafts and on improvements of the traditional fishing crafts. About 50.5% of the financial outlay under these Plans was earmarked and spent for these purposes alone. Liberal loans and subsidies were made available and, because of this, the State could add 1304 mechanised boats and 408 boats of improved design to its fleet during the first three Five-Year Plans.

Although the main emphasis of the Fourth and Fifth plans was on the introduction of small and medium trawlers which could operate beyond the coastal waters, the conventional small-scale fisheries was given a due share in the financial apportioning, especially in the backward areas where trawling had not been and could not be adopted by the fishermen. This has resulted in adding another 1582 mechanised and 834 non-mechanised boats of improved design to the State's fishing fleet. Now that the State has done away with the scheme of subsidising the fishing boats, it has introduced a system of advancing Rs. 25,000 as interest-free loan per boat with an initial moratorium of seven years. However, Governmental aid in the form of subsidy is made available for the fishing gears and gear material.

Intensification and strengthening of the capture equipment alone cannot help the fishermen improve their trade. Side by side, it is also essential to guarantee a proper distribution of fish and proportional and reasonable returns from the trade to the fisherman. This can be assured only if the fishermen are relieved of their indebtedness towards the middlemen and merchants who appropriate a major share and cause a large dent on the income of the fishermen. This problem has been tackled to a fair extent in Gujarat by organising and strengthening the primary co-operatives and linking their activities to the Apex Co-operative Organisation with an extensive sphere of operation. In addition to this, there are as many as 148 primary co-operatives and federation of about 15 primary societies in South Gujarat, which have extensive operations including boat builiding. It has now been decided to set up district level federations in all maritime districts which will meet the requirements of primary societies, and also serve as a link between the primary societies and the Apex Organisation. Gujarat has now one Apex Co-operative Organisation.

SPECIAL PROGRAMMES

Fisheries is, by and large, confined to the rural coastal areas. However, unlike agriculture, animal husbandry, poultry, etc., fisheries was not given much attention so far in the rural development programmes or special area development programmes such as DPAP, SFDA, SFAL, etc. However, owing to the Fisheries Department's sustained efforts, the concerned agencies are now considering the rural fisheries sector on par with the other sectors and the development of small-scale fisheries has also been included in the DPAP and SFAL programmes of Kutch and Jamnagar District and in the Integrated Rural Development Programme for Kutch.

Although a good many such small fishermen have been benefitted and they have procured the basic capture equipments such as boats and gears, these schemes are dependent on the institutional finance. As the fishermen may not be able to satisfy the rigid terms and conditions of the financing agencies, many of them are not able to raise the necessary loans for the purchase of boats and other materials. This results in their inability to take advantage of the subsidies available under the special programmes.

It is, therefore, very clear that these special programmes - which envisage liberal subsidy facilities - cannot be taken advantage of by fishermen unless the nationalised banks and other financing agencies liberalise their rigid terms and conditions. It is high time that we think about the formation of a special fisheries financing agency at all-India level to cater to the needs of the small rural fishermen, as in the case of agriculture.

There has been a modest beginning in

Gujarat in this direction. A fisheries bank has just been floated very recently in Veraval and the same is awaiting clearance of the concerned authorities.

COASTAL AQUACULTURE

As indicated in the earlier paragraphs, the potentialities of coastal aquaculture are excellent in Gujarat with a sea coast having many creeks, bays, mangrove swamps, estuaries and brackish water sheets. However, it is only recently that attempts have been initiated to utilise them for fish farming.

The first ever attempt in these lines was made in 1973 when M/S. Tata Chemicals Ltd, with the technical knowhow from this department, established an eight hectare farm in Aramda near Okha to rear euryhaline fishes. As it was difficult to get the juveniles of prawns such as *Penaeus monodon* and *P. indicus*, the farm concentrated on the culture of grey mullets, milk-fish and cock-ups. An elaborate survey of the coast line from Mianj creek in the Saurashtra Peninsula fo Pindara Bay in the southern coast of the Gulf of Kutch was made by a technical team. The team gave an excellent report on the grey mullet fry resources in the said area and also, for the first time, observed milk-fish fry from the Gomti estuary of Dwarka.

Since the establishment of a marine fish farming project by the private sectors other coastal areas of the State have also been surveyed with a view to assessing the seed resources and physical potentialities of these areas. The surveys resulted in the selection of another site for a brackishwater fish farm at Jodiya. This project costing about Rs. 16 lakhs, initiated as a centrally sponsored scheme, covers an area of 50 hectares and is progressing rapidly.

The Department also has plans to develop brackishwater fish farms at Mundra in Kutch District and Megham in Broach District and the necessary proposals have already been submitted to the Government.

INTEGRATED RURAL DEVELOPMENT PROGRAMME

The Government of India have drawn up an intensive Integrated Rural Development Programme (IRDP). Ninety-six Development Blocks have been selected from the State under this programme for employment generation in the rural areas through productive schemes. Fisheries sector of the State has an important role to play in the programme. Fifty Blocks identified under this programme in the South Gujarat area have been selected for the development of inland fisheries in the rural water sheets spread over 1,075 hectares. An amount of Rs. 86,00,000 is expected to be expended in this programme for the capital cost towards improvement of village tanks and for recurring inputs. At least 33 1/3% of the above cost is expected to be met from the I. I. R. D. finances as subsidy and the rest by the Nationalised Banks in the form of loans. In addition, about Rs. 3.25 lakhs (Institutional finance and subsidy put together) is expected to be invested in the development of traditional riverine fisheries in about 4 Blocks of Broach District and about Rs. 3 lakhs will be spent in developing the traditional coastal fishing of Okhamandal, Mangrol and Kutch.

Further to the above, a 22-hectare demonstration farm has also been proposed to be constructed in the Rupen Creek of Okhamndal under this programme. This farm is expected to demonstrate marine fish farming to the local coastal fishermen in order to enable them to undertake marine farming and earn a livelihood. It is estimated that the implementation of the Intensified Rural Development programme would provide direct employment to about 2,500 persons and to about 5,000 more Indirectly.

As can be seen from the above, the State and the Central developmental programmes have taken into account the potentialities and the manpower available in rural coastal areas of the State and have been striving for the improvement of rural economy through the fisheries sector. The extension activities of the Department, through various effective media, have enabled the beneficiaries in this sector to understand the methodology of organising and developing the rural fisheries. It is heartening that the traditional fishermen have come forward to co-operate in all the developmental programmes of the State.

PRESENT STATUS OF SMALL-SCALE FISHERIES OF MAHARASHTRA WITH A NOTE ON THE SOCIO-ECONOMIC SURVEY OF THANE DISTRICT

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INTRODUCTION

Maharashtra occupies an important place in the fishing industry of India. It stands second in terms of production of marine fish in India with an estimated annual output of 2.94 lakh tonnes in the country's marine fish production of 13.52 lakh tonnes. Most (87%) of the fish production of the State is contributed by motorised boats. The contribution by non-powered boats is rather insignificant though their number (7,536) is more than double the number of motorised boats (3,107).

Fishing as an industry is fairly ancient in Maharashtra where the existence of a thriving fishing community has been reported in the chronicles as early as 1138 A.D. From time immemorial, these fishermen have been evolving their skill and foresight by long experience handed down from father to son and at present have reached a remarkable stage of ingenuity in operating their nets. They depend on the power of their muscles and their hereditary skill.

Small-scale fisheries occupied a prominent place during pre-Plan period. Earlier reports say that fishing methods were highly efficient around Bombay area. The fishermen used very strong and well built traditional boats, known as "Machawa", "Balyao" and "Kota". There are no catamarans in Maharashtra, the smallest boat being a dugout vessel of about half a ton. Fishermen used traditional methods of fishing namely bag net *(Dol* or *Kavi)*, gill net *(Daldi, Budi)*, hooks and lines, *Bokshi* and *Rampan*.

The Maharashtra Fisheries Act, 1960, enacted in January, 1961, provides for the protection, conservation and development of fisheries in the State of Maharashtra. It extends to the whole of the State of Maharashtra. The main object of this legislation is to enable the State Government to take suitable action for conservation of fisheries resources in case they show any sign of depletion.

CURRENT STATUS OF SMALL-SCALE FISHERIES

The status of small-scale fisheries has remained unchanged through the years. The contribution of small-scale fisheries towards the marine fish production of the State is very small (13%). Thus, it plays a minor role in the welfare of the community. The methods of fishing, the net and the type of boats have not undergone any change in recent years. The impact of mechanisation has been so great on small-scale fisheries, that a number of non-mechanised boats are now getting fitted with engines.

A large number of people are engaged in small-scale fishing with non-powered boats. Their fishing is done near the coast (maximum up to 30 metre depth), the estuaries and the creeks. During off season many of these fishermen are also engaged as agricultural labour. The fishermen fishing in creeks have now been faced with the problem of pollution; the fishermen of Thane creek have given up their profession and sold their boats and equipments. The economic and social uplift of these small fishermen should find a place in integrated rural development programmes, since almost entire fishermen population belongs to coastal rural sector. This sector which has remained neglected so far needs proper attention. Some development

schemes which bring their social and economic uplift and thus welfare of the community and fishing industry are necessary.

Fishery resources

Maharashtra has a coastline extending between latitudes 15°45'N and 20°10'N and the 200-metre contour lines at longitude 72°40'E at the former latitude and 69°28'E at the latter. The coastal strip of Maharashtra lies on a 720km line. while considering the natural fishery resources of Maharashtra only the continental shelf having an area of 87,000 sq. km is considered. However, the area outside the continental shelf also holds enough potential for exploitation.

The continental shelf is arbitrarily divided into 3 zones. *viz*, inshore zone (0-17m), offshore zone (17-75 m) and deepsea zone (75-190)m. The distribution of the continental shelf is given below in Table 1.

TABLE 1. *Regionswise distribution of the continental shelf.*

District	Inshore (0-17 m)		Off shore (17-75 m)		Deep-sea (75-190 m)		Total
	km²	%	km²	%	km²	%	km²
Thane	1,000	16	13,000	34	14,000	33	28,000
Greater Bombay	700	11	3,800	10	5,500	13	10,000
Kulaba	2,000	32	8,000	21	11,000	25	21,000
Ratnagiri	2,500	41	13,000	35	12,500	29	28,000
Total	6,200		37,800		43,000		87,000

At present fishing is restricted to the inshore and offshore zones only. It is estimated that only 50 % of the continental shelf up to 100 m is being exploited. The surveys of Department of Fisheries and the Government of India have estimated that the harvest potential of the shelf area at 4,61,000 tonnes. Table 2 indicates how the harvest potential is distributed over the continental shelf.

TABLE 2. *Fishery potentials of Maharashtra on the continental shelf in tonnes.*

District	0-70m	70-200m	0-200m
Thane	95,000	27,000	1,22,000
Greater Bombay	57,000	11,000	68,000
Kulaba	1,54,000	22,000	1,76,000
Ratnagiri	68,000	27,000	95,000
Total	3,74,000	87,000	4,61,000

Exploitation by non-powered boats

As per 1977 census of marine fishermen population, boats and nets, Maharashtra has a fishing fleet of 10,645 boats consisting of 7,538 non-powered boats and 3,107 powered boats. Of the non-powered boats 2,861 are plank built and 4,677 dugout canoes. The non-powered boats in all districts (except Ratnagiri) exploit the areas up to 17 metres depth only because of their limitations in cruising range. In some centres of Ratnagiri District (where non-powered boats are 10-14 metres long) the area of exploitation extends up to 30 metres.

TABLE 3. *Exploitation of fishery resources by non-powered boats in Maharashtra.*

District	Harvest potential in 0-17m depth (tonnes)	Estimated landings by non-power boats (tonnes)	percentage of exploitation
Thane	50,808	8,337	16%
Greater Bombay	40,296	9,029	22%
Kulaba	1,24,976	11.378	9%
Ratnagiri	24,300	*11,785	48%
Total	2,40,380	40,529	17%

* Catches up to 17 metres only.

Figures in Table 3 would show that exploitation by non-powered boats is very small and it may also appear that the area is not fully exploited. However, as a matter of fact this area is exploited properly since the mechanised boats are also fishing in this area.

Production

During the pre-Plan period the estimated marine fish production of Maharashtra was roughly 1.49 lakh tonnes. By the end of Fifth Plan, the average leval of marine fish production rose to 3.61 lakh tonnes. This tremendous increase in fish production was due mainly to the impact of mechanisation since the number of mechanised boats increased to 3,107 by the end of the Fifth Plan. The contribution of non-powered boats to marine fish production of the state is small (13% as compared to that of powered boats.

Table 4 gives year-wise and district-wise break-up of marine fish production in Maharashtra during the Fifth Plan period (1974-75 to 1977-78)

The marine fish production in Maharashtra crossed the 4 lakh tonne mark in 1975-76 which was an year of abnormal fish production. However, the trend in fish production has been declining one since then.

A further break-up of the annual average marine fish production in quarterly period and by type of boats powered and non-powered is given in Table 5.

As expected the fish production is lowest during the monsoon period. It is at the peak during October-December period followed by a slack period and again a peak in the April-June quarter. The contribution of non-powered boats to the total marine fish production of the State does not exceed 16% in any of the quarters. In Thane and Greater Bombay districts the impact of non-powered boats is hardly felt. Mechanised boats are dominant in this region. In Kulaba and Ratnagiri districts non-powered boats contribute significantly to the marine fish production.

Craft and Gear

Maharashtra has a fishing fleet of 10,645 boats of which 7538 crafts are non-powered. A district-wise break-up of non-powered crafts in the State is given in Table 6.

The fishing gear employed by the non-powered boats in inshore waters, estuaries, creek and backwater are fixed nets (bag nets), seine nets (shore seine-Rampan), drift nets inshore drag nets, cast nets or hand-thrown nets, scoop nets, long lines and hooks and lines.

In Maharashtra both mechanised and non-mechanised boats use the traditional gears like bag net and gill net, but those used by the mechanised boats are larger and are operated in comparatively deeper waters. Trawl net used is

TABLE 4 *District-wise estimated fish production in Maharashtra for the period 1974-75 to 1977-78*
(Figures in tonnes)

District	*Estimated fish production* 1974-75	1975-76	1976-77	1977-78*	Annual Average
Thane	1,85,467	1,50,712	1,69,054	95,080	1,50,078
Bombay Greater	1,22,188	1,68,522	1,39,394	1,32,585	1,40,672
Kulaba	18,325	36,751	43,784	27,223	31,521
Ratnagiri	38,178	46,027	39,913	32,854	39,243
State Total	3,64,158	4,02,012	3,92,145	2,87,742	3,61,514

* Provisional

TABLE 5. *Quarterly average marine fish landings by the powered and non-powered boats during the Vth Five-Year Plan period in Maharashtra.*

(Figures in tonnes)

District	Jul. to Sep.			Oct. to Dec.		
	Power	Non-Power	Total	Power	Non-Power	Total
Thane	8,775 (89.3)	1,048 (10.7)	9,823 (100.0)	72,474 (92.9)	5.528 (7.1)	78,002 (100.0)
Greater Bombay	22,311 (91.1)	2,189 (8.9)	24,500 (100.0)	49,578 (93.2)	3,618 (6.8)	53,196 (100.0)
Kulaba	1,827 (58.2)	1,312 (41.8)	3,139 (100.0)	7,036 (71.5)	2,798 (28.5)	9,834 (100.0
Ratna-giri.	456 (21.9)	1,628 (78.1)	2,084 (100.0)	11,223 (58.7)	7.880 (41.3)	19,103 (100.0)
State Total	33,369 (84.4)	6,177 (15.6)	39,546 (100.0)	1,40,311 (87.6)	19,824 (12.4)	1,60,14 (100.0)

Jan to Mar.			Apr. to Jun.		
Power	Non-Power	Total	Power	Non-Power	Total
34,263 (96.6)	1,199 (3.4)	35,462 (100.0)	26,229 (97.9)	562 (2.1)	26,791 (100.0)
30,457 (95.1)	1,578 (49 5)	32,035 (100.0)	29,263 (94.7)	1,644 (5.3)	30.907 (100.0)
5,395 (57.5)	3,994 (42.5)	9,389 (100.0)	5,883 (64.2)	3,274 (35.8)	9.157 (100.0)
5,593 (62.1)	3,414 (37.9)	9,007 (100.0)	3,911 (43.2)	5,132 (56.8)	9,043 (100.6)
75,708 (88.1)	10,185 (11.9)	85,893 (100.0)	65,286 (86.0)	10,612 (14.0)	75,898 (100.0)

Figures in parantheses denote percentage to total in each quarter.

only by mechanised boats. Some of the gears operated by non-mechanised boats are described below.

Bag net (Dol or *Kavi)*: The bag net is roughly funnel-shaped and is mainly fabricated from monofilament twine. It is a fixed type of net operated at the bottom and can be used where sea current are appreciable as in the case of Thane Kulaba Districts. Like the trawl net it has a mouth and cod end;

TABLE 6. *District-wise distribution of non-powered boats in Maharashtra State.*

District	*Non-powered boats (Number)*		
	Plank built	Dugout	Total
Thane	388	615	1,003
Greater Bombay	256	932	1,188
Kulaba	769	876	1,645
Ratnagiri	1,448	2,254	3,702
State Total	2,861	4,677	7,538

the mesh size is largest (typical is 22.25cm) at mouth and smallest (typical is 1·25/2 cm) at cod end. A typical net is 50 metre long. At the net mouth, the length is about 5.5m and the height 3·2 m. For setting net, stakes are firmly embedded and the net is fixed through two stakes by rings, after which the foot and head ropes are kept in position setting the net against the tide. At the end of the tide the net is emptied and reset in opposite direction. Non-powered crafts operate the gear up to 30 metres depth and usually stay out for the collection of the catches. The bag net operation is a unique demonstration of extraordinary skill in traditional gear. A majority of the mechanised boats at Versova, Arnala and Madh and a few at Sassoon Docks and Worli are engaged in Dol net operation. The catches mainly comprise bombay-duck (Bombil) and the shrimp *Acetes* (Javla).

Gill nets: Gill nets are made of nylon mono as well as multifilament. Formerly cotton twines were used. A piece of webbing is usually 200 metres long and 5.6 m wide. The mesh size varies from 10 cm to 20 cm (stretched). The hanging factor is 50%. Depending upon the area of operation, size and nature of vessel, as many pieces of nets as needed are joined, with a little widthwise overlapping so as not to permit any open space between pieces. The net can be allowed to drift when it is called drift net (*Dladi* or *Tarati*) or fixed at bottom when it is termed as bottom-set gill net (*Budi*).

Fishes like pomfret, dara, ghol, surmai, etc. are caught by this gear. The catch by this gear therfore, is qualitatively rich.

Shore seine (Rampan): The Rampan is the most efficient instrument for the capture of shoaling fishes such as sardines and mackerel that periodically appear in large quantities, in the near-shore waters. The Rampan net, used with non-powered country crafts, is made of hemp or cotton twine and is 600 - 800 metres long. The height of the net increases towards the middle of the net, while the mesh size decreases from 4 cm to 1 cm. The net is pulled collectively by 40 - 60 fishermen. The fishermen groups engaged in Rampan operations are known as "Rampan Sangh". The catch mainly consists of mackerel and sardine and sometimes prawns also. The Rampan is operated in the southern part of Ratnagiri District.

Fishing operations

As stated earlier the number of non-powered boats in Maharashtra is 7,538. Of these 2,861 are plank-built and 4,677 dugout canoes. A composition of these boats in terms of construction and length is given in Table 7. This table will give a fair idea regarding the scope of operation of these vessels, which is generally restricted to 20-30 metre contour from shore line. Some of the larger non-powered boats are used for operating shore seine, where the vessel size is mainly required for storing and carrying "Rampan". Kulaba and Ratnagiri districts share major part of non-mechanised boats in the State The engine power in all cases excepting trawling is used for propulsion rather than operation of gear.

Areas of operation

For traditional fishing (bag net) the non-powered boats do fishing up to 10-12 fathoms. Boats fishing in creeks (Bokshi) go for 5-7 fathoms. The gill net boats can go farther in different areas. The Rampan operations are done within 2 km of the shore. In seasons the sailing vessels work inshore for fishing. During monsoon, fishing by non-powered boats is restricted to creeks and estuaries.

INFRASTRUCTURE

Landing and berthing facilities

There are 185 landing centres in the coastal area of the four maritime districts of the State. In 69 landing centres (which are minor) only non-powered crafts land and in the remaining 116 centres both mechanised as well as non-mechanised crafts land fish. The landing and berthing facilities are inadequate at present. With the exception of Sassoon Docks and Kasara, none of the centres can be termed as fishing port. Even in Sassoon Docks there is a problem of great congestion and the entry and exit of the vessels are subject to tide. The quay is inadequate and there is water shortage. Maharashtra with the largest fleet of mechanised vessels has, therefore, no fishing port worth the name.

TABLE 7. *Distribution of Non-powered boats by length.*

District	*Plank— built (No.)*					*Dugout (No.)*			
	Below 4m	4-6 m	6-10m	1-108m	Total	Below 4 m	4-6m	6-10m	Total
Thane	6	112	235	35	388	120	417	78	615
Greater Bombay	1	92	155	8	256	157	658	107	932
Kulaba	—	157	576	36	769	32	485	359	876
Ratnagiri	1	349	904	194	1448	184	1936	134	2254
State Totals	8	710	1870	273	2861	493	3506	678	4677

For providing landing, berthing and navigational facilities at various centres in the four maritime districts of the State, 64 proposals were prepared by the Fisheries Department based on priority of needs. Priority means intensity of landing and potential. Out of the 64 proposals, 35 estimated at Rs. 5 crores have been forwarded to the Government for clearance from the Central Government. Five works costing Rs. 23.20 lakhs out of these have been cleared by the Central Government for completion during Fifth Five Year Plan.

As regards proposals for major fishing ports, the State Government is of the opinion that there should be at least one full-fledged fishing harbour for each of the maritime districts. The technical project reports (prepared in close collaboration with Pre-Investment Survey Unit) for expansion of Sassoon Docks in Greater Bombay District and construction of a fishing port at Mirkarwada in Ratnagiri District have been cleared by the Government of India. Work is in progrees at Mirkarwada. Technical report prepared by Pre-Investment Survey Unit, Bangalore, on Agardanda fishing harbour in Kulaba District has been forwarded to the Government of India. The project envisages a fishing port mainly for deepsea fishing. The project when completed will go a long way in reducing the congestion in Sassoon Docks.

The management of all fishing ports, major and minor, excepting for Sassoon Docks, is done by the port Department of the State. Sassoon Docks and Kasara are managed by the Bombay Port Trust.

In addition to the aforesaid facilities provided under the Centrally sponsored schemes, the State Government has also provided facilities, such as coustruction of fish drying platforms, open sheds and rubble land-cum-approach roads, removal of rocks, erection of guide lights etc. at 77 landing places in the State.

Preservation and processing

In Maharashtra a number of ice factories and cold storages have come up both in private and co-operative sector. At the end of 1977 there were 146 ice factories with a capacity of 2,386 tonnes of ice per day and 76 cold storages with a capacity of 45,033 tonnes per day and storage for fish 1,157 tonnes. Eighteen of the ice factories are in cooperative sector, 7 in corporate sector and rest in private sector. About 85 ice factories and 54 cold storages are wholly for fishery purposes and they are located from Dahanu to Vengurla. There is scope for establishment of more ice plants and cold storages in the coastal districts. The Department has a scheme to financially assist the fisheries co-operative societies which are ready to establish such units. The National Co-operative Development Corporation is also likely to assist financially such units.

At present there are 30 freezing plants. Five are in co-operative sector and the rest in private sector. The total capacity of these plants is to freeze 210 tonnes of fish a day with a storage capacity of 1975 tonnes. There are 6 canning plants with one in co-opevertia sector (District Federation) and five in private sector. The latter are used for fruit canning alsor There is only one fish meal plant in the co-operative sector (Apex body) with anunal

capacity of 1000 tonnes. About 6-7 plants are in private sector for fish manure.

Marketing

As per a study team as much as 97% of marketing of fish is in private hands. In Maharashtra, the co-operative sector has not made much headway in marketing of fish.(Out of Rs. 33.21 crores worth of fish catch only Rs.2 crores worth have been marketed through co-operatives). Although a few co-operative societies have been found individually excellent so far as marketing is concerned, by and large co-operative sector has yet to reach the desired level of achievement. At Mirkarwada (Ratnagiri) a co-operative society of retailers is operating. Unregistered women's association for sale of dry and fresh fish is also functioning in Bombay. In order to promote sale of fish through co-operatives the Government had formulated integrated fisheries projects at Thane, Kulaba and Ratnagiri which would be involved from catching fish to its handling, preservation, transport, marketing and export.

The position of fish markets is not satisfactory even in a city like Bombay. Bare necessities like adequate water supply, proper drainage and ventilation are wanting. Bombay has 5 wholesale major markets including the quay at Sassoon Docks and Kasara Bunder and 60 Corporation-authorised retail markets.

A number of private parties have organised themselves into "Dry Fish Merchants Association". It has been estimated that the city's annual intake of fish is 1.75 lakh tonnes (1.40 lakh tonnes fresh and 0.35 lakh tonnes dried.)

Boat building

Boat building facilities are available throughout the entire coastline of the State. The wooden hull construction is undertaken at various centres like Dahanu, Satpati, Bassein, Versova, Alibag, Ratnagiri and Deogad. There are 7-10 registered boat building yards in the State. Boat building at majority of the landing centres is an un-organised industry in the State in the sense that fishermen generally call the carpenters at their places and get the hull constructed as per their requirements. Some private firms take construction up to 17 metres OAL though majority of the boats are in 12-14 metre range; The capacity of boat building yards in private sector is 10 wooden hulls each at a time, the work taking 4 months for completion.

Generally, the experts form themselves into groups and construct hulls to any given design. Construction of a vessel to given design costs more than construction of a traditional vessel, hull of which is capable of being mechanised. The hulls are made of seasoned teakwood when timber is cheap. In view of the rising price of timber, a tendency has developed to construct underwater part of a vessel with seasoned teakwood, the superstructure being constructed with less costly material. A plank built boat, on an average, costs Rs. 7,000 and a dugout canoe Rs. 3,000. A 14 metre OAL wooden hull costs Rs. 90,000; with the costs of engine, accessories and gear added, the capital cost at current prices comes to about Rs. 2. 50 lakhs.

Gear fabrication

Gear fabrication has come in practice very recently in the State. There is one recognised factory for gear fabrication at Ahmednagar. One more is functioning near Alibag in Kulaba District. There is at present no great demand for fabricated nets as fishermen prefer to use their own nets. Fishermen find readymade nets useful when nets are lost by accidents. At present about 3,550 persons are engaged n net making and net repairing in the State.

SOCIO-ECONOMICS

As per 1977 census, there are 375 fishing villages/hamlets in the four maritme districts of the State. There are 38,178 fishermen households with a total fishermen population of about 2,24,040. Totally 1,20,273 workers are engaged in marine fisheries (Table 8); this is less than 1% of the population of marine districts.

TABLE 8. *Workers engaged in fisheries(1977)*

Active fishermen	- 42,237
Workers engaged in drying/ curing	- 21,182
workers engaged in marketing	- 31,841
workers engaged in net making	- 3,543
Others	- 1,608

The literacy rate in marine districts is more or less the same as the all Maharashtra rate (392).

The fishermen are either Hindus,Christians or Muslims. The Khar, Machis and Bhois are the principal fishermen communities in Maharashtra.

Fishermen engaged in small-scale fishing

It is estimated that about 58,300 persons are in the non-powered sector. Of these, 9,951 persons are active fishermen. A total of 9,036(i,e. 91%) out of 9,951 active fishermen use plank built boats and the rest dugout canoes.

A districtwise break-up of fishermen population as per 1977 census is given in Table 9.

Ownership of boats

The non-powered boats are owned by individual fishermen themselves. They hire crew for fishing. In certain areas like Vasai (in Thane District) fishing is done on non-powered boats by a group of 6-7 fishermen. These fishermen own their, nets but fishing operations are done jointly and the total catch of fish is shared equally by them. One or two more shares are given to boat owner. In Ratnagiri District the non-powered boats used in shore seine are owned by the Rampan Sangh with membership of 50 to 100.

Fishermen's Income

Fishermen's Income varies from district to district and is totally dependent on the type of fishing operations. A non-powered boat owner at Shriwardhan engaged in bag net fishing may get annually Rs. 5,300 (gross income) whereas the boat owner engaged in mixed fishing gets roughly Rs. 12,000 (gross). Since statistics on boat owner's income are not available, no general conclusions can be drawn about the income of fishermen engaged in non-powered fishing. Some of these fishermen are also engaged in subsidiary occupations such as salt-curing, sun-drying, net making, and marketing of fish.

CONFLICTS BETWEEN TRADITIONAL AND MECHANISED FISHING OPERATIONS

One of the unfortunate results of mechanisation is the beginning of conflicts between mechanised boat owners (the trawlers) and the traditional fishermen engaged in gill netting, shore seine operations in Ratnagiri District, especially in Malwan and Vengurla. Many times clashes have taken place between the mechanised boat operators and traditional boat owners. The sea off Vengurla and Deogad in Ratnagiri District has some rich prawn fishing grounds' Naturally, a large number of trawlers assemble there for prawn fishing in this area. In other centres like Dabhol, Harnai, Ratnagiri, Deogad and Malvan also large number of trawlers congregate for fishing. In fact, the trawlers migrate from one place to another when prawn catches are abundant in the area.

In such cases, the local fishermen complain against the trawler operators. Their main con-

TABLE 9. *Fishermen population in maritime districts of Maharashtra State as per 1977 Census*

District	Fishing villages	*Fishermen population*				Total
		Powered boats		*Non-powered boats*		
		Total population	*Active fishermen	Total population	Active fishermen	
Thane	82	58,057	10,783	13,072	1,733	71,129:12,516
Greater Bombay	23	34,172	3,996	1,299	136	35,471:4,132
Kulaba	102	36,487	8,940	15,320	2,540	51,807:11,480
Ratnagiri	108	37,027	8,567	28,606	5,542	65,633:14,109
Total	315	165,743	32,286	58,297	9,951	224,040:42,237

* Some non-powered boats' active fishermen are included in this.

tention has been that the mechanised boats operate in shallower waters and hence small fishermen engaged in traditional fishing (gill nets, hooks and lines) do not get fish. Their nets also get damaged by the trawlers. They also complain that their catch bring low returns since the volume of catch by mechanized boats is more.

Taking into consideration the situation at such ports, the State Government appointed "Bunder Samiti" (Port Committee) under the chairmanship of the Deputy Collector ,Vengurla. The District Fisheries Development Officer, Ratnagiri, was the Member-Secretary of this Bunder Samitis One representative each of the trawler operators and local fishermen was also taken into the committee. Such committees try to solve the problem of fishermen by regulating the fishing operations of mechanised and traditional non-powered boats by prescribing a code of conduct.

At present, there is no legal provision to restrict the operational limits for the different types of boats. The Government of India has issued some directives or guidelines 'regarding delimitations of the fishing zones for different types of fishing boats. As per this, the mechanised trawlers may have to operate beyond 5-km line.

DEVELOPMENT PLANS

The objectives of the development of fisheries in the State have been increase of fish production and the socio-economic upliftment of the fisherman who form the mainstay of the industry. Till the end of the Fourth Five Year Plan, development of fisheries has been more or less on cottage industry level. With the beginning of the Fifth Plan, it has assumed an industrial outlook, earning substantial foreign exchange. Keeping this wider outlook of fisheries development, an outlay of Rs. 5.50 crores was made in the State's Fifth Five-Year Plan.

Marine fisheries

Mechanization of fishing crafts was introduced in the First Plan, in 1951-52, to augment the marine fish production in the State. Before that there were very few boats fitted with engines. The Government encouraged the fisherman a great deal to take up mechanisation Large incentives were offered to the fisherman so much so that cost of engines were subsidised to the extent of 50 per cent and remaining 50 percent offered as loan so that almost 100 percent of the investment was borne by the Government. This had immediate effect on the fishermen who were convinced about the advantages of the mechanised boats. The advantages were wide cruising range and exploitation of vast areas of the seas, resulting in higher fish catches as compared to non-powered boats. Since the advent was on introducing something new, the traditional non-powered boats did not receive any incentives and were neglected. However, as a part of deveopment programmes the fishermen engaged in fishing with non-powered boats also shared the advantages of loans and subsidy for purchase of nylon and other accessories, etc. along with fishermen having mechanised boats.

Being aware that operation of mechanised vessels required proper training to the fisher youths in navigation, working knowledge, maintenance and repairs of the marine diesel engine, and fabrication and operation of gear, training centres were simultaneously established for the purpose and a vessel was attached to each training centre to demonstrate fishing operations. Scheme to subsidise costly raw material like nylon, so as to introduce more effective gear without overburdening the fishermen, was also introduced in 1959. As a resutl of these schemes and the fishery surveys undertaken from 1962 to 1977, the marine fish production in this State has shown a steady rise in level of production.

Inland fisheries

Inland fisheries production in this State was 17,500 tonnes by the end of Fourth plan. It now stands at 23,500 tonnes in 1977-78. The basic scheme for development of inland fisheries is the "Fishseed production project" under which fish farms/units are established at suitable sites in the State, where very badly needed quality fish seed is produced through induced spawning. At present, four fish seed units and seventeen fish seed farms are functional. Seventeen fish seed farms are under construction. Annual level of spawn produced has been raised from 5.45 crores in 1973-74 to 10.13 croes in 1977-78.

Another important inland scheme is "Fish Farming in Impounded Waters". Under this scheme carp fry, imported from West Bengal and locally produced, is supplied to the pisciculturists in the State to enable them to stock suitable water sheets. The fishermen and their co-operatives are eligible for subsidy at 25 to 33% on the cost of carp fry. Similarly, suitable reservoirs are stocked.

Small Farmers Development Agency

Although no new Plan schemes have been taken up in the Sixth Five-Year Plan for non-powered traditional boats, a new scheme under the "Small Farmers Development Agency" has been approved by the Government of India. The scheme is applicable to all the coastal Taluks of the State. It has come under implementation in Ratnagiri District recently.

The SFDA scheme aims to benefit fishermen residing on the banks of creeks. Such fishermen conduct fishing with limited resources. Their working conditions are very hard; they have to wade through knee-deep water and make strenuous efforts to catch handful of small fish by means of a piece of netting. Most of these fishermen do not have agricultural land also. Therefore, their economic condition is very poor and they can be compared with the landless agricultural labourers. Under this scheme (SFDA) it is proposed to provide such fishermen with small boat and fishery requisites like twine in order that he may be able to move in deeper water and reach more distances so as to catch sizeable quantity of fish by using a net like "Bokshi" or gill net, etc.

For availing benefits of the SFDA scheme, a marginal fisherman is defined as one deriving an annual income of Rs. 3000 from fishing alone and having off-fishing income up to Rs. 200 per month. He would be entitled to a subsidy of 33⅓ % from SFDA.

A fisherman deriving an annual income of Rs. 3000 from fishing alone and having off-fishing income of Rs. 200 per month and agricultural land up to 2.5 acres only would be entitled for a subsidy of 25% from SFDA. Under the scheme financial assistance of Rs. 6000 will be given to the beneficiary. Of these Rs. 3000 are for purchase of small boat of about 3' width and 15'-20' length and Rs. 3000 for purchase of gear and accessories. Out of Rs. 6000 capital expenditure, a sum of Rs. 4000 would be loan and Rs. 2000 subsidy from the SFDA.

About 18 beneficiaries have been financed under this scheme in Ratnagiri District. This scheme may bring increased fish production especially during off season when creek catches are high and fetch good price. The scheme is also expected to bring economic uplift to the fishermen engaged in small-scale fishing.

Fish Farmers Development Agency

In order to give more scope to the fishermen for accelerating fish production in inland waters, Fish Farmers Development Agency was initiated in Bhandra District in 1977-78 at a total cost of Rs. 9.33 lakhs with the assistance from Government of India. A similar scheme for Chandrapur District was initiated in 1978-79 at a cost of Rs. 7.98 lakhs.

Education and Training

Under the scheme "Training of Fisher-youths", eligible youngsters, who have alredy completed the preliminary training at the departmental training centres, are deputed outside the State to receive further training in both marine and inland fisheries at the Central Institue of Fisheries Nautical Engineering and Training, Cochin, and Regional (Inland) Training Centre at Hyderabad and Agra. Under another scheme "Training of Staff in Country and Abroad" two departmental officers are deputed for training every year at the Central Institute of Fisheries Education, Bombay.

Co-operative Societies

The fisheries co-operative structure in the State is a three-tier system; the basal primary society, intermediate district or regional co-operative bodies and the top state-level Apex Society. The co-operatives are assisted financially and technically by the State Co-operative and Fisheries Departments. Training facilities in respective fields are also provided by the concerned departments. Quite a number of societies, from the primary to apex, have taken to supply of fishery requisites and marketing of fish. Some societies own preservation and transport units. A couple of societies in Greater Bombay are purely engaged in transport activity.

The only societies which have also taken fish production are the District Federations in Thane, Kulaba and Ratnagiri, implementing integrated projects. Although a few societies have been individually found excellent, by and large the co-operative sector has yet much scope for improvement.

Corporation

Maharashtra Fisheries Development Corporation was established in February 1973 and commercial projects of the Fisheries Department was transferred to it. These projects have subsequently been transferred to the State agencies or co-operatives, and the corporation is now planning to promote new schemes pertaining to marine and inland fisheries such as collaboration project of deepsea fishing, integrated fisheries project, supply of carp fry to fishermen by importing it from West Bengal, etc.

SIXTH FIVE-YEAR PLAN PROGRAMME

The Sixth Five-Year Plan (1978-83) has now been drawn with an outlay of Rs. 720.98 lakhs for the fisheries sector. It is proposed to introduce about 368 mechanised boats, expecting an increase in fish production of about 20,000 tonnes per month. It is also proposed to take up new schemes to utilise brackishwater areas for fish farming by setting up pilot brackishwater farms and by assisting the fish farmers and their co-operatives financially and technically in establishing such farms. Thirteen ice factories will be set up in co-operative sector and they will be helped financially to purchase 50 trucks during this plan period. Local bodies will be continued to be assisted in construction of fish markets. Marketing of fish in the co-operative sector will be on a substantial scale. The Maharashtra Fisheries Development Corporation which is planning to expand its activities will be assisted financially for undertaking deep sea fishing project. A Fish Formers Development Agency will be started in the State sector.

Credit Facilities

For the purpose of financial assistance clear, comprehensive rules and regulations have been formed under State Aid to Fisheries Rules, 1962. Financial assistance in the form of loans and subsidies for all items pertaining to development of fisheries and particularly for the following are given:-

1. Purchase of yarn, twine or net.
2. Construction of and repairs to fishing vessel and fish carrier launches.
3. Purchase of spares to engines
4. Purchase of motor trucks
5. Erection of ice and cold storage plants
6. Manufacture of yarn and twine
7. Purchase of stakes, hooks, lines, etc.
8. Establishment of ancillary industries

The proposals for financial assistance are received from the District Fisheries Development Officers after completing all formalities. The proposals are submitted to the Regional Fisheries Development Officer with the clearance certificates received from the concerned District Central Co-operative Bank.

Interest

The rate of interest of loans for development of fisheries shall be 4½% per annum simple interest provided the mortgaged assets are insured A rate of 7½% per annum simple interest shall be charged if the assets are not insured.

Period of repayment of loans

The period of repayment of loans does not ordinarily exceed seven years, except in the case of indigenous engines where the repayment period does not exceed 15 years. The period of repayment is mentioned in the loan agreement.

Financial assistance from NCDC for development of fisheries

For accelerating the development of fisheries co-operatives for the uplift of the fishermen in the State the Maharashtra Government has accepted the National Co-operative Development Corporation's pattern of financial assistance.

According to this pattern, assistance will be given to the co operatives in the form of share capital for marketing, supply and distribution activities, purchase of mechanised fishing boats and transport trucks, establishment of ice plants, cold storages, fish meal plant, service stations, net making plants, construction of godowns/ sheds, development of fish tanks, etc.

Under the pattern, 80% of the project cost would be available to the State Government from the NCDC in the shape of loan and subsidy (20%), the remaining 20% being borne by the State Government as subsidy.

Under the scheme 100% financial assistance for construction of mechanised boat is available to groups of fishermen sponsored by the fisheries co-operative societies and to the sponsoring fisheries co-operative societies. (This group should not have availed previous financial benefits by way of subsidy/Special Redeemable Share Capital in the past under the scheme "Mechanisation of fishing craft"). 20% of the cost will be granted as subsidy to be reimbursed by NCDC. Amount equal to 25% of the cost of the mechanised boat will be granted as share capital to the sponsoring society which it will invest in the mechanised boat of the fishermen group. Out of this 20% of the share capital is to the society which it should advance to the fishermen group as loan to be recovered in 12 years. The State Government will grant loan to the fishermen group and society and will get the amount reimbursed to the extent of 60% from the NCDC. The entire finance will be routed through the Department of Fisheries, Government of Maharashtra. This amount will be repayable in 12 years in equal monthly instalments. The effective rate of interest charged by NCDC for timely repayment of principal and interest on loan was 9½% and normal rate of interest on loan was 12½% in the year 1975-76. The State Government would charge ½% more.

This is regarding the medium-term and long-term loans. But the fishermen also require short-term loans every year for repairs to boats, engines and for purchase of nets etc. before the fishing season commences. This short-term loan, or the production loan as it is called, is provided by the co-operative banks. The District Central Co-operatice Bank advances short-term loan to the primary co-operative societies of fishermen taking into consideration the actual requirements of the members of the society and their performance in the past. This loan is to be repaid within 11 months.

NOTE ON THE SOCIO-ECONOMIC SURVEY OF THANE DISTRICT

A sample survey to study the socio-economic conditions of fishermen community was conducted in Thane District in July-Augus 1968. Such surveys help to ascertain the socio-economic indications and the effect of developmental schemes on the welfare of the fishermen. A summary of the survey is given in this section.

Out of the 42 fishing villages in Thane District 40 were selected for the survey vide Appendix I. The definitions adopted are:

Household - A group of persons who usually live together under the same roof and take their meals from a common kitchen constituted the household.

Fishermen household — A household in which at least one person was engaged in active fishing or the allied occupations, viz. drying, curing, fish marketing, net making, or other related occupations was treated as a fisherman's household.

Gainful employment — A person who was paid in cash for both his services or production was treated or kind as gainfully employed.

Capital assets — Fishery requisites of a nature of duration of one year or more were treated as capital assets.

Average household size

The total number of persons in 216 sample households surveyed was 1558. The average household size worked out at 7.21 as compared to 6.49 as per census 1965.

Sex composition

Sexwise distribution shows that the population was evenly distributed. The number of females per thousand males worked out at 977.

Age composition

The age group 15 to 59 (forming the labour force) consisted of 50% of the persons. Age group below 15 years formed 45%, and persons above 6% formed only 5%.

Education

The percentage of illiteracy was 54. Illiteracy in females was higher than in males-at 67%

against 40%. The higher educational levels were observed for age group 18-30. The development seems to have taken place in the last decade. The percentage of female children not attending school in the schooling age group of 6 to 17 was higher than that of male children at 33% as against 10%.

The information as to the attitude of the parents/guardians to the male children taking up fishery industry was also collected by enquiring preference to fishery industry. Of the boys under 18 who constituted 52% of the male population, 20% did not want to take up hereditary occupation; 43% would do fishery work, but would take up alternate occupations if they are better.

Principal industry

In the case of households having two or more occupations, the one that fetched maximum income was treated as principal industry. Of the 86% households having fishery as principal industry, 26% households had another subsidiary occupation falling under other than Fishery Industry. Of the households having subsidiary occupation falling under other than fishery industry, 79% had occupations falling under agriculture and 13% falling under services (public and private).

Land owned, possessed and cultivated

Land owned is judged by heritable right of occupancy. Land possessed is land owned plus land leased in minus land leased out. The reference period for land cultivated was 1967-68 Table 10 gives the percentage distribution of households owning lands.

TABLE 10. *Percentage distribution of the households by land owned, possessed and cultivated.*

Area ranges (acres)	*Percentage of households* Land owned	Land possessed	Land cultivated
0—0.09	4.2	3.2	77.3
0.10—0.99	83.3	83 9	9.7
1.00—1.99	6.9	6.9	8.3
2.00—2.99	2.8	3.2	1.8
3.00—3.99	0 9	1.4	1.4
4.00—4.99	0.5	...	0.5
5.00—9.99	0.9	0.5	0.5
above 10.00	0.9	0.5	0.5
Total	100	100	100

Out of 84% of cases of land owned and/or possesed in the range 0 acres to 0 99 acres, 77% are cases of house sites. 23% households have land cultivated.

Income

Income to the households was classified as income from gainful activities and income from non-gainful activities. Income from gainful activities is remuneration or receipt–from production of goods and services. Income from non-gainful activities are rents from buildings, land, boat, etc., interest receipts, divident, etc. Percentage distribution of the households by income is given in Table 11.

TABLE 11. *Percentage distribution of the households by income.*

Income ranges Rs.	*Percentage of households by income from* Gainful activity	Non-gainful activity	Total income
0-499	—	71.5	—
500-999	5.6	14.3	5.6
1000-1499	11.1	7.1	11.1
1500-1999	20.4	7.1	19.9
2000-2999	24.0	—	24.5
3000-3999	14.7	—	14.3
4000-4999	6.9	—	6.5
5000-5990	6.5	—	7.3
6000-6999	4.2	—	4.2
7000-7999	1.9	—	1.9
8000-8999	0.5	—	0.5
9000-9999	2.3	—	2.3
Above 10000	1.9	—	1.9
Total ..	100.0	100.0	100.0

Nearly 59% of the households had income n the range of Rs. 1500-4000.

Employment

Nearly 42% of the persons were gainfully employed. The distribution of the gainfully employed persons was also even; males were 51% and females 49%. 77% workers were engaged in occupations in household enterprises, 23% workers in salaried occupations, out of which 19% workers were also engaged in occupations in household enterprises. 19% workers were working in the capacity of unpaid family enterprise workers. 29% were engaged

in joint enterprises. Of the persons engaged in salaried occupations 55% were engaged in fishery and 24% in agriculture.

64% of the persons engaged in salaried occupations had income less than Rs.1 000and 20% had income in the range of 1500 to Rs. 4000. 48% of the persons engaged in occupations in household enterprises had income in the range Rs. 1500 to Rs.4000. Overall 48% of the persons had income in the range 1500 to Rs.4000.

Economic status

The gainfully employed persons were further classified as earners and earning dependents: earner being one who earns sufficient to maintain oneself and earning dependent being one who earns but not sufficient to maintain oneself. 20% of the total persons were earners and 23% were earning-dependents whereas 57% were non-earning dependents.

Capital assets

Capital assets were owned either proprietory or in partnership. Some households possessed hull, engine and gears proprietory or in partnership; yet some possessed gears without possessing boat or engines, the practice in such cases being to operate the fishery in group and an additional share of the catch is given to the owner of the boat. Table 12 gives the distribution of households by fishery assets.

TABLE 12. *Percentage distribution of the households by fishery assets.*

Fishery	*Percentage* Possessing Assets		Without possessing assets	Total
	hull	engine		
Major gears	22.7	16.7	17 6	57.0
Minor gears	—	--	13.9	13.9
No gears	—	—	29.1	29.1

A total of 57% households possessed major gears (bagnet and gillnet fishery). Out of which 18% did not possess boat or engine. Nearly 14% possessed minor gears such as *Nedhi, Gholwa, Pag*, (cast net), etc. 29% of the households did not possess gears.

Consumer expenditure

Information on consumer expenditure of the household was collected for a period of 30 days proceeding the date of enquiry. The data relates to household consumption for non-productive domestic purposes. 71.36% of the expenditure was on food items and 28.64% on non-food items.

Co-operatives

76% of the households have membership in the co-operative societies. That only 43% of the households purchase requisites from co-operatives showed that large number of co-operatives had not taken to supply of requisites to the members. Only 19% of the households supply fish for sale to the co-operatives against availing of credit.

Indebtedness

A household having an outstanding amount of loan on 1-7-68, was treated as an indebted household. For this purpose short term loans and advances were excluded. Outstanding loans were classified as for fishery and other purposes.

Indebtedness in the fishermen community was widespread. 65% of the households were indebted. The average indebtedness was Rs. 2212 per household.

It appears that in 7% of the cases the loan taken was used for purposes other than for which it was taken, the source of loan being Government and Co-operatives. In about 37% cases the source of loan was private money lenders, friends and relatives, taken for the fishery enterprise purposes. Most of these loans had a high rate of interest, above 10%.

Housing

Twenty-nine percent of the households had pucca houses. 39% semi-pucca houses and 32% thatched houses. 63% of the houses had separate kitchens. Only 16% of the houses had electricity. Of the 216 households, 214 used open space for toilet purposes and only one had a septic tank. Wells formed the source of drinking water for 215 houses.

APPENDIX - I

List of villages according to classes by number of households in the village.

Class-I with No. of households above 200		Class-II with No. of households between 101 and 200		Class-III with No. of households below 101	
Sr. No.	Name	Sr. No.	Name	Sr. No.	Name
1.	Dahanu	1.	Zai	1.	Bordi
2.	Popbran (including Dandi)	2.	Veror	2.	Gholwad
3.	Nawapur	3.	Chincheni	3.	Chikhali
4.	Murbe	4.	Ghiwali	4.	Narpad
5.	Satpati	5.	Madrai	5.	Dahanuaga
6.	Datiware	6.	Kelwa	6.	Darha
7.	Arnala (including fort)	7.	Usarni	7.	Tarapore
8.	Bassein	8.	Edwan	8.	Karbode
9.	Naigaon	9.	Kore	9.	Ucheholi
10.	Uttan	10.	Kochiwade	10.	Aleaedi
		11.	Kalamb	11.	Kharekuran
		12.	Dongri-Chowk	12.	Shirgaon
				13.	Tembi
				14.	Kelwa Mahim
				* 15.	Kelwa Dadar
				16.	Rangaon
				17.	Chendand-Koliwada
				18.	Ballunpada
				19.	Dunge
				* 20.	Kasheli

* No household was selected from these villages.

PRESENT STATUS OF THE FISHING INDUSTRY OF GOA

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INTRODUCTION

In the economy of the Union Territory of Goa, Daman and Diu, the fishing industry occupies a position of honour as it offers vast employment to quite a sizeable population of this territory. Fish is a staple food for Goans who by and large are fish eaters, their percentage being about 90% of the population. It has a continental shelf of 5180 sq. km adjoining a coastline of 104 km. The productivity of these waters is greatly stimulated by the regular discharge of fertile material into coastal waters by seven rivers. Consequently, the blooms of plankton produced in the inshore waters sustain lucrative fisheries for pelagic fishes

The Territory was excluded from the fishery development programmes during the First and Second Five-Year Plans as it was under foreign rule. In 1957, four mechanised boats were introduced in this region. The major fishing activity was by indigenous crafts consisting of dugout canoes with outriggers. Beach seines (Rampani), gill nets and stake nets were the main fishing gears in use. The level of annual fish production at the time of liberation of Goa was of the order of 10,000 tonnes. Up to this time only pelagic resource was exploited in a limited area up to 4 to 5 km from shore along the coast by the above mentioned traditional gears. There were no fish-handling and preservation facilities.

It was only after the liberation that fisheries development activities in an organised manner were taken up in this area by the Department of Fisheries which was created on 2nd January, 1963. As basic data for planning the development of fisheries for this zone were not available, a comprehensive survey of fisheries resources and the small-scale fishing industry was conducted. Based on this information, various schemes were drawn up during the Third Five-Year Plan. Schemes like expansion of the exploratory fishing activities, mechanisation of fishing crafts grant of financial assistance, providing landing and berthing facilities for various types of fishing vessels, training of fisher youth, creation of ice factories and cold storage facilities, collection of fishery statistics and expansion of fisheries research were implemented and, as a result, considerable progress has been made in the fisheries sector during the last 15 years. The main objectives of the fisheries development in this territory have been to increase fish production and to better the socio-economic status of the fishermen community who are the main pillars of the fishing industry. Up to the end of Fourth Five Year Plan, the development of fishing industry has been more or less individual-based or of the level of a cottage industry. However, with the commencement of the Fifth Five Year Plan it has assumed an industrial outlook, playing a major role in earning substantial foreign exchange, producing more nutritious food for its people, generating better self employment opportunities, etc.

MARINE FISHERIES

From a humble beginning of four mechanised boats in 1962, Goa has increased its fishing fleet to over 360 by 1977 and its fish production to almost four folds, from 10,000 tonnes to over 40,000 tonnes. This achievement has been, possible due to the increase in the fishing activities undertaken by the small fishermen and introduction of modern fishing techniques such as purse-seining and trolling lines. Goa has not only given a lead to the rest of the country in introducing purse-seining at first at departmental level but has also passed on the technique to the fishing community for commercial operations.. Today there are nearly 46 purse-seine vessels operating in Goa waters. Following this success, the adjoining state of Karnataka has taken up purse-seining and introduced almost 80 vessels in its waters last year. Goa has now a fishing fleet of 360 mech-

anised boats and over 4000 non-mechanised boats, which use trawl net, purse-seine, trolling lines, gill nets, shore seines, stake nets, cast nets and barrier nets. The mechanised vessels can be, by and large, classified as small to medium type (mostly 43 to 45' OAL) powered with engines in the range of 30 to 87 H. P.

Mechanisation of fishing crafts was started in Goa in 1963. To assist this programme a Fishermen Training Centre was started where fisher youths are trained in maintenance and repair of marine diesel engines, fabrication and operation of modern fishing gears and working knowledge of navigation. The trainees are given practical training in operation of various types of fishing gear on departmental vessels. So far this Training Centre has trained nearly 300 candidates. Each trainee during the period of training is given a stipened of Rs. 100 and a sea allowance of Rs. 15 per month. For advanced training in different trade courses like engine drivers, shore mechanics etc., the department deputes trainees to various national institutes in different parts of the country, and so far about 30 persons have been trained in such courses. A scheme to provide financial assistance to subsidise the costly raw material like nylon, monofilament, cotton twine etc., was started in 1963. These schemes like mechanised fishing, training, and subsidy on fishery requisites along with fishery survey for location of fishing grounds have helped greatly in increasing the marine fish production in this territory. So far the department has financed 168 marine diesel engines, 69 hulls and 14 trawl winches and 10,000 fishermen have been helped for purchase of fishery requisites.

The advantages of mechanised fishing over traditional fishing have been well accepted by local fishermen and they have realised that instead of waiting for the fish to come to the shore to be caught by traditional gear it is more advantageous to go out and catch fish in offshore waters. This also helps in reducing concentration of vessels in limited area thereby reducing competition among units. The Department has introduced suitable purse seine cum trawlers (14.2 meters) which have better range of operation and sea endurance of 2 to 3 days. These vessels are fitted with 120 h. p. engines and the design has been duly approved by the Mercantile Marine Department.

Repair facilities

In order to provide better repair facilities to avoid loss of fishing days by the mechanised boats, the department has already constructed a slipway. Facilities for service station are being provided close to slipway.

Ice plants and cold storage

In the early sixties, Goa had practically no cold storage facilities specially for fish. Ice production was of the order of 10 tonnes per day in whole of Goa and the plants with individual capacity of 2 tonnes were located away from coast and ice was mainly used for other purposes. At the end of 1977 the number of ice plants in the territory stood at over 20 with per-day production of over 200 tonnes. Ten cold storages have been established both in private and public sector with an aggregate storage capacity of nearly 400 tonnes. It is a known fact that fish production is uneven during the year being maximum from September to January, lean from February to May and scarce from June to August. In order to make available fish throughout the year, the department has undertaken from 1966, to provide facilities like fresh storage, plate freezer and processing halls to private enterpreneurs on rental basis to avoid capital investment by smaller parties and such facilities are being fully utilised. The department has set up cold storages at Panaji, Ganacona and Diu and it is proposed to develop similar facilities at Daman and at 3 or 4 more centres in Goa. At present, the department has 200 tonnes frozen storage space, 75 tonnes fresh storage, 4 processing halls, one plate freezer and 4 ice plants. It is only after making these facilities available in 1966, that export of prawns and fish for the first time started from Goa.

Processing units and exports

In order to make available fish in scarce season the department took up freezing of fish in peak season and selling the same during monsoon period on experimental basis. In Goa people do not prefer iced fish and as such there was need to create demand for such frozen goods. Fishes like pomfret, mackerel, sardine, ghol, Rane, butter fish and seer fish which have a shelf life of 4 to 6 months have good demand. Now the department is trying to take up freezing

on a larger scale and supply the same to actual consumer through departmental stalls.

INLAND FISHERIES

For the first time, culture of freshwater varieties like major carps was started by the department from the year 1964. Goa being a coastal area the demand for the fresh water fish is less. However, due to the effort of the department, many private parties have now taken up culture of carp in their tanks and demand for the fish seed is also increasing. Goa has taken up two major irrigation projects at Selaulim and Anjune which are expected to be completed by 1980. This will bring in a large area under fresh water fish culture. Keeping in view the requirement of fish seed for these reservoirs, the department is setting up a fresh water fish seed farm at Mayem lake, where induced breeding of carp will be taken up.

BRACKISHWATER FISH CULTURE

Goa has good scope for development of brackishwater fish culture along the banks of the seven rivers. The rivers taversing the region are Trikol Chapora, Mandovi, Zuari, Sal, Talpona and Galgibag which have tidal influence ranging from 30 to 52 km inland from seashore. There are low laying fields on the banks of these rivers which remain submerged during the high tide and are marshy in nature. The extent of such areas is approximately 4000 hectares which can be gainfully utilised for prawn and fish culture. In order to undertake experimental work on the quick growing brackishwater varieties, the department has set up a Brackishwater fish farm at Ela Dhauji in Old Goa on the bank of River Mandovi. The total area of this farm is 17 acres. This has in all eleven tanks having a total water area of 4 hectares. This farm where culture is being done of tiger prawn white prawn, milk fish, pearl spot and mullet, is working very well. Already a yield of 1200 kg of fish per hectare has been achieved under polyculture experiments. Monoculture of prawns is also being practised and results achieved are very encouraging. In order to bring 4000 hectares of fallow khazan land under fish culture, the department has formulated a scheme to give financial assistance to prospective fish culturists for construction of tanks and sluice gates and for desilting. This will help to increase prawn production and also fish production during monsoon period. After seeing the results of the departmental fish farm, many small farmers are showing interest in taking up fish culture in their marshy fallow lands which till now had remained completely unproductive.

CO-OPERATIVE SOCIETIES

In the Union Territory of Goa, Daman and Diu as many as 10 primary co-operative societies were registered and some of thess were functioning well. However, most of these societies ran into trouble after working for some years mainly due to their limited borrowing capacity and their working capital being blocked in construction of fishing boats for the society or in giving fishery requisites to members on loan. The recovery position being poor most of them became non-functional. However, in order to revive these societies, the department with the help of the Co-operative Department, established a Fisheries Federation with an integrated fisheries project for which funds were obtained from the Agricultural Refinance Corporation and other financing agencies. The Federation was registered in 1971 and started functioning from March 1974 with the following main objectives : 1) to increase fish production by means of introducing mechanised fishing crafts and modern methods of fishing; 2) to undertake storage, distribution and marketing of its members' catches at reasonable rates; 3) to supply fishery and allied requisites as well as credit facilities to fishermen specially during off season to save them from the clutches of money lenders; 4) to strengthen the primary fishery co-operative by providing them enhanced borrowing facilities at lesser rate of interest and minimum procedural formalities to help its members and boost the fishing industry of this region; 5) to set up net making plants, service station, chain of cold storages, distribution transport system and making available to actual consumer his most relished item of diet at prices within his means; and 6) to raise the socio-economic status of fishing community by providing them necessary social facilities and training in latest fishing techniques.

No doubt the Federation has helped the fishermen in acquiring vessels, both trawlers and purse seiner-cum-trawlers, and has also advanced short-term loans for various other purposes

like purchase of fishery requisities repair facilities etc. But its peformance on the marketing side has been far from satisfactory. The Federation has opened a fair price fish stall. It has set up a 5 tonne ice plant at Panaji with fresh storage facilities it is installing a diesel pump at jetty for supply of diesel to its members. In return it will be possible for the Federation to take the fish catches of these boats (excluding prawns) for local cosumption. It has to develop its own transport facilities so that fish could be collected, preserved, transported and supplied to actual consumers at reasonable rates. The Federation has yet to make its mark in this field.

ROLE OF SMALL-SCALE FISHERIES IN KARNATAKA AND ITS IMPACT ON RURAL ECONOMY

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Karnataka Government have been actively considering for the past few years, how to bring in the traditional fishing sector under modernisation to improve their professional prospects and productive capacity so as to achive better socio-economic prosperity to the community leading to the development of coastal rural sector. It was also the consideration of the Government how to replace the hard manual labour of the fishermen in the sea as well as to reduce their exposure to risks at sea with mechanised methods that would improve the catching power and extend the area of operation as well as speed up trips to and fro the ground A silent transitional change of the traditional sector into modernisation together with convincingly demonstrative economic results by the change was aimed to be achieved slowly but steadily. A direct transformation from age old practices was not desired. Instead, a policy of expanding mechanisation into new fields and introducing mechanisation into the traditional sector first at demonstrational level were thought of. Accordingly, purse-seining was introduced in 1975-76 in the state which proved to be a great success. This necessitated recruitment from traditional sector to mechanised sector in considerable numbers. Government incentives were also offered for groups of traditional fishermen who came forward to lanuch purse-seining, to the extent of Rs 600,000 per unit as subsidy and soft loans. About 50 purse seine units are expected to be operating under this scheme by the end of 1978-79, employing more than 1,000 active traditional fishermen. By the end of 1978-79, Karnataka would have a total of about 200 purse seine units operating in her waters which would be directly employing more than 40,00 active fishermen. Most of these fishermen have to come naturally from the traditional sector.

In addition to this, motorisation of canoes for mechanising gill netting is being introduced for the first time in the state. To start with, 10 kerosene-operated inboard and 13 petrol-operated outboard motors have been procured by the department for this purpose. It is expected that this scheme would become popular among the traditional fishermen soon and would catch up to cover a large number of traditional units. This scheme is expected to benefit at least 6000 active fishermen in the state. The state has already 1500 mechanised fishing vessels employing about 7500 active fishermen. The total number of active fishermen in the fishing sector of the state today is 23,000. On completion of these mechanisation programmes the state would be having only about 4000 to 5000 fishermen left over in the traditional sector and their main operational area would possibly be the river mouths and backwaters. A considerable number among these would be engaged in subsistence fishing. This is inevitable under the Indian conditions. The state expects to develop subsidiary coastal fishery activities such as mariculture and large scale seed collection that would provide additional avocation for these fishermen to improve their earnings. When these programmes are completed, the traditional marine fishermen of Karnataka would be a comparatively elevated sect, socio-economically.

FISHERIES DEVELOPMENTAL BACKGROUND

Fisheries development in Karnataka could be intensified in a planned and orderly way only from the second year of the country's second Five-Year Plan when an independent Fisheries Department with its Directorate at Bangalore was established in 1957-58. The state's coast stretches over a distance of 300 km embracing a continental shelf extending up to 25000, sq.km. The three fishing sectors of the state are the traditional fishing, mechanised trawl fishing, and the recently developed purse-seining sector. Before starting purse-seining, the traditional sector was the major fishing force contributing up to 75% of the total marine fish landings in the state. But from last year mechanised sector has taken over as the leading contributor to the total landings. The marine fish catch of the state during the year (1977-78 was 126,726 tonnes (Table) valued at Rs. 137.27 million at boat side price. It was constituted by 61,988 tonnes from the traditional fishing sector, 34,187 tonnes from the coastal trawl fishing sector and 30,551 tonnes from the purse seining sector. *The year 1977-78 has thus witnessed a historic change in the pattern of fish landings in the state by the mechanised fishing sector overtaking the traditional sector in fish landings for the first time in the country*, the share of each sector being 51% and 49% respectively against 40% and 60% respectively in the previous year. The current trend of landings by the purse-seiners suggests that the total marine landings in the state would cross 1.5 lakh tonnes during 1978-79 and that the percentage of landings by the traditional sector would further be reduced.

FISHERY RESOURCES

Karnataka coast, popularly known as the "mackerel coast" of India, abounds in pelagic resources. The state's marine fish landings every year have been influenced by the wide fluctuations in the pelagic fishery which is dominated by the mackerel and oil sardine. These two species together have been forming up to 70% of the total landings in the state. The prawn fishery contributes another 7-10% to the total. Cat-fish, shark, ribbon-fish, silverbelly, pomfret, seer fish, sciaenids, soles and *Lactarius* are other groups landed on this coast. Only about 20% of the continental shelf area is being exploited The State Government, however, has been making earnest efforts to persuade the fishermen to diversify fishing methods and to explore new grounds to cover more fishable areas. It is estimated that an additional one lakh tonnes each of mackerel and oil sardine could be produced in the state from the base level catch of 1977-78. The west coast fishery resources of mackerel and oil sardine have been estimated at 3 lakh tonnes and 4 lakh tonnes respectively by the FAO/UNDP Pelagic Fishery Project at Cochin. It is also reported that the concentration of shoals of these species has been relatively denser in the Goa-Mangalore area, particularly off Malpe in Karnataka, beyond the 30 metre depth line. Through mechanisation of gill netting and long lining the present production of food fishes could be doubled. Midwater trawling, the introduction of which is being planned, is expected to add substantial quantity to the total landings of the state.

TABLE 1. Marine fish production in Karnataka during the Fifth Plan period

Species	Quantity in tonnes 1974-75	1975-76	1976-77	1977-78
Mackerel	3,760	16,372	7,667	36,205
Oil sardine	36,500	43,541	18,148	33,491
Cat fish	2,052	2,400	1,998	3,034
Shark	1,544	827	904	2,309
Ribbon-fish	570	61	624	1,783
Silverbelly	2,287	582	934	1,348
Pomfret	340	662	352	1,039
Seer fish	2,276	1,211	1,237	947
Sciaenids	995	864	744	639
Lactarius	356	197	264	473
Prawns	6,977	6,606	5,520	9,093
Others	14,970	15,103	243,93	36,365
Total	72,627	88,426	62,785	126,726

FISHING CRAFTS

Mechanisation and modernisation on the fishing front in the state have made good progress. Starting from two small mechanised boats two decades ago, today the state has a fishing fleet of 1650 mechanised vessels including 100 purseseiners of 43½ ft and 45 ft size and 1550 trawlers of 30 ft, 32ft and 36 ft size engaged in the coastal prawn fishery. The investment for the purseseine fleet in the state from 1975-76 to 1978-79 would be Rs. 8 crores.

On the traditional sector, it is estimated that the state has 8000 indigenous dugout and plank built canoes, which are engaged partly in the traditional coastal fishing and partly in fishing in the river mouths and backwaters. The recent trends on the fishing side indicate a professional shift to more promising mechanised sector. However, the indigenous fishing methods are still a strong force. Motorisation of country canoes by outboard as well as inboard engines has already been initiated in the state to develop the columnar fishery by gill netting and the like. Large-scale motorisation of country canoes has been planned under the proposed Integrated Fisheries Project at Tadri under foreign collaboration.

TRADITIONAL FISHING GEAR

About a dozen major gears are in regular use in the state, of which the giant shore seine "rampany" is a speciality of the state. There are about 140 rampanies engaged in catching pelagic fishes, mainly mackerel and oil sardine, contributing to about 70% of the total traditional catch.

Rampany (large shore-seine): The net is so big that 60–80 people are required to operate one unit. It can encircle any big shoal but within a range of about 3 km from the coast. Tonnes of mackerel or sardine are caught in one successful operation. The net is operated throughout the coast except Ullal.

Kairampany (Small shore-seine): The method and area of operation are the same as in the case of rampany. But the net is small and is operated by about 30 fishermen.

Kantha Bale (drift net) : A variety of food fishes are caught by it. The net is used throughout the state within an operational range of about 5-7 km from the coast.

Patte Bale (Encircling gill net): This is also used through the coast, mainly in Dakshina Kannada. Its range of operation is within 5 km from the coast.

Chala Bale (Small-meshed drift net) : Used throughout the state, mainly in Dakshina Kannada. It operates up to a range of 4-5 km from the coast.

Maari Bale (Bag net) : This net is designed to catch mainly the cat fish and hence it is also called "cat-fish bag net". Sciaenids and other fishes are also caught. The net is operated by two canoes holding the two wings of the net which ends in a bag. Operational range is within 7 km from the coast.

Kettu Bale (Bottom-set gill net): Mainly used in Dakshina Kannada in Ullal, Mangalore, Kulai, Kaup, Malpe and Gangolli. The net is set at night and hauled in the early morning. During monsoon the net is used for fishing in river mouth.

Odu Bale (Drift net for night fishing): It is largely used in Ullal, Mangalore, Kulai, Hejmady, Kaup, Malpe, Gangolli and also in Karwar, Keni, Murdeswar, Bhatkal in Uttara Kannada.

Bessu Bale (Cast net) : Used throughout the coast in all sesons. During August, a lot of prawns, chiefly *Metapenaeus dobsoni* and *Penaeus indicus* also sole and silverbellies, are caught.

Bepu (Long line) : Used throughout the coast, mainly in Ullal, Mangalore, Malpe and Gangolli. It is operated in the night to a range up to 10 km from the coast.

Iliyuva Bale (River trawl nets): It is operated by two fishermen and is used only around Mangalore.

Sthira Bale (Stake net): Operated by fixing the funnel shaped net to stakes against high tide. It is used in Uttara Kannada and is prevalent in Agnashini backwater areas.

In addition to the above, hand picking of clams, mussels and oysters is of considerable importance on the traditional sector employing about 300-350 fishermen in the state. Clams from a major sustenance fishery on the coastal belt especially during monsoon months.

INFRASTRUCTURE

Berthing and landing facilities

Along the 300 km coast of the state there are more than 100 traditional fish landing centres catering to the needs of about 8000 country crafts. For the mechanised sector there

are 19 river-mouth ports provided with wooden or concrete jetties and many of them have auction halls. These ports and most of the landing centres are well connected with fishery approach roads. Besides these, the Karwar fishing harbour provides berthing and landing facilities for larger vessels. The all-weather Malpe fishing harbour which is under construction would accommodate 21 deep-sea trawlers of above 23 metre size and 46 purse-seiners of above 14 metre size. The Honavar fishing harbour which is nearing completion would accommodate 20 purse-seiners of above 14 metre size. Both these harbour projects together would produce an additional catch of about 50,000 tonnes of fish annually.

PRESERVATION, PROCESSING, EXPORT AND MARKETING

Starting with one ice plant of 5 tons/day, one freezing plant of 5 tons/day, one cold storage of 60 tons and one frozen storage of 80 tons at Mangalore in the early fifties, today the state has 78 ice plants with a total capacity of 781 tons/day, 27 freezing plants with a combined capacity of 117.5 tons/day, 32 cold storages with 796 tons storage besides 2361 tons of frozen storage capacity. In addition, there are 3 modern fish meal plants and 12 canning plants besides a number of fish oil extraction units. Freezing industry in the state took its present level of development from the middle of the sixties and there are about 50 registered exporters in the state. The commissioning of a major commercial harbour at New Mangalore in Dakshina Kannada during 1974-75 has given a further fillip to the expansion of the fish freezing industry in the state. The freezing capacity can be generally expressed as one freezing plant for every 11 km coast or one tonne capacity of freezing per day for every 2.5 km length of the coast in the state. The annual export from the state has reached Rs. 12 crores from a finished product of about 5000 tons per year.

In the earlier days the state had a flourishing fisheries by-products trade in oil extraction and guano manufacture which still forms important local cottage industry besides fish curing. In 1966-67, there were 101 fish oil and guano production centres on the Dakshina Kannada coast alone.

Marketing of fish to the advantage of the fishermen and at their choice was made possible by the construction of 77 fishery approach roads at an approximate cost of Rs. 32 lakhs by the department, connecting fish landing centres with motorable roads to markets and highways, in addition to the adequate availability of ice and cold storage facilities. Fish from Karnataka Coast now reaches markets hundreds of Kilometres away at Bombay, Madras, Kerala, Bangalore and Goa in iced condition. The Fisheries Corporation of the state has been doing yeoman service in supplying fish to important consuming centres in the state in frozen condition through a "Cold Chain" from the production centres on the coast to the consumer points in the interior. The general trend of fish marketing in the state is represented by the disposal of catch during the year 1977-78, which is as follows:

fresh	.. 53%
curing	.. 28%
freezing	.. 7%
reduction to meal and oil	.. 4%
canning	.. 0.5%
manure	.. 3%
miscellaneous	.. 4.5%

BOAT BUILDING AND GEAR FABRICATION

To import boat building technology and to construct mechanised boats for distribution among groups of fishermen on their completion of training in the Fishermen Training Centres, two boat building yards at Mangalore and Karwar were established in the later part of the Second Five Year Plan. The local builders soon picked up the modern technology of boat building and started construction of mechanised boats from the beginning of the sixties in the state. At present there are 29 boat building yards in the private and co-operative sector with a capacity to build boats up to 45 ft size at present.

A modern net making factory had been established at Tungabhadra in Bellary district. The factory has machinery for knotless webbing, knotted webbing and for twisting. The annual production is estimated at 15 tonnes of netting. Nets from this factory are very popular among fishermen and orders are received from many other states also.

SOCIO-ECONOMICS

There are 151 fishing hamlets dotted along the coast of the state. Many of these villages are connected by the fishery approach roads to the highways and markets. These road communication facilities speeded up extension of electric services to many landing centres and fishing villages. The marine fishermen population in the state as estimated in 1978 is 1,40, 750 with a proportion of adult male to female at 37 : 40. The active adult fishermen engaged in fishing is estimated at 22,500. While many fishermen own mechanised boats and traditional crafts individually or jointly; many others are working on a catch share system or on mutually agreed other remunerative basis. In Karnataka, a family of 7 can generally be considered as having at least two active fishermen on the fishing side and another two, as part time or full time, engaged in other trades connected with fish marketing, net making and repairs, fish processing and curing and other auxiliary works like fish transportation etc. On the marketing side, fisherwomen play an important role in Karnataka. As per a census of 1972, there were 13,500 fishermen (both sexes) in fish marketing, 5,700 in net making and repairs, 2,000 in fish processing and curing and 5,500 in all other types of fisheries works. Therefore, the source of income of a fishermen family in Karnataka is not from fishing alone. However, the income of an active fisherman from fishing is a major indicator of the family income. The annual gross income per active fisherman from fishing for the past 5 years is given in Table 2. (estimated figures).

TABLE 2. *Annual gross income per fisherman of Karnataka.*

Year	Fish landings (tonnes)	Value in Rupees	No. of active fishermen	Yearly gross income per active fisherman (Rupees)
1973—74	76, 542	1039, 95,306	20, 443	5, 087
1974—75	72, 627	582, 54, 169	20, 709	2, 813
1975—76	88, 427	966, 41, 038	21, 369	4, 522
1976—77	62, 785	810 74, 977	21, 811	3, 717
1977—78	126, 726	1372, 72, 554	22, 411	6, 125

Fishermen in Karnataka as a community, are an enlightened sect having among them many highly educated men, successful entrepreneurs, eminent politicians, executives and administrators. Professionally, Karnataka fishermen are second to none. The general educational standard among fishermen is comparatively high. A random survey conducted in 1974-75 among 483 fishermen from 32 fishing villages of the Dakhina Kannada District had revealed that education up to high school standard was common and only about 10% of the persons did not have any education at all. There are three fishermen journals in the district, namely, *Mogaveera*, *Matsya Loka* and *Meenugara*, published by the fisherfolk projecting their voice in the state. In addition, there is an "All Karnataka Fishermen Federation" to take care of the fishermen's interest in the state.

Development plants

The main marine fisheries development plants proposed under the VI Five-Year Plan are given in Table 3.

SUBSIDY AND LOANS

For traditional fishing one third of the cost of nylon and 25% of the cost of outboard motor are granted as subsidy. For mechanised fishing 25% of the cost of engine limited to a maximum of Rs. 20,000 in individual case, 25% of the cost of purse-seine net to the maximum of Rs.20,000 are granted as subsidies. Besides, managerial cost of Cooperative Societies at 100% in the first year, 75% in the 2nd year, 50% in the 3rd year and 25% in the 4th year is given as subsidy from the Government.

TABLE 3. *Fisheries schemes in Karnataka during VI Plan period.*

Scheme	Outlay (Rs. lakhs	Physical target
Assistance to traditional fishing	33.50	Assistance for outboard motors, 30 mini purseseines 300 gill net units and nylon net covering 2000 fishermen
Mechanisation of fishing craft	59.50	Subsidy to 210 marine diesel engines and 110 purse seine nets
Deep-sea fishing (subsidy to above 20 metre vessel)	20.00	Subsidy to 13 vessels
Corporation	45.00	As share capital
Mariculture	51.00	75 hectare of farm to be constructed and 50 tonnes of prawns to be produced
Maintenance of harbour & berthing facilities	10.00	19 fishery ports to be maintained
Construction of fishery roads	15.00	45 km of road to be laid
Research, training and extension	72.47	(both for marine and inland
Assistance to Cooperatives	18.85	(both for marine and inland)
Infrastructure facilities to coastal villages	17.00	25% of the state's share
Indo-Danish Project	35.00	(State's initial share)

FISHERIES COOPERATIVES

There are 58 primary Cooperative Societies and two Cooperative Fish Marketing Federations in the marine sector covering about 75-80% of the active fishermen. Three of the Fishermen Cooperative Societies have taken up commercial curing of fish with improved methods under the *N. C. D. C. assistance totalling* Rs. 2.88 lakhs. A Cooperative Society, exclusively for fisherwomen has been organised at Malpe for the first time in the state. Financial assistance from the Government in the form of loan and share capital to cooperative institutions in the state rose from Rs. 14.57 lakhs during 1967-72 to Rs.69.18 lakhs during 1972-77. It may be interesting to note that the first fishermen cooperative society was started at Mangalore almost 60 years ago.

FISHERIES CORPORATION

Karnataka Fisheries Development Corporation was set up on 1-1-1971 at Mangalore to handle development of commercial fisheries in the state. The important commercial activities taken up by the Corporation are as follows:

1. Commercial fishing with deep-sea trawlers.
2. Ice production and sale of ice.
3. Fish processing (freezing and export).
4. Freezing of fish and prawns and internal marketing through a "Cold Chain" established for it connecting the production centres to the consumer points in the internal towns through about 19 retail centres.

5. Lending of space for freezing and storage to private processors on rental basis.
6. Maintenance of a chain of ice plants, chill storage, freezing plants and frozen storages.

The Corporation is running 5 major fish freezing plants with a combined capacity of 48 tonnes/day with a frozen storage capacity of 850 tonnes. It has a total ice production capacity of 72 tonnes per day with a chill storage capacity of 197 tonnes.

EDUCATION AND TRAINING

Fishing villages, being far flung in the remote coastal area, insufficiently or in some cases hardly connected to nearby towns and developed areas in the earlier days, would have remained neglected educationally, socially and professionally but for the departmental efforts started decades ago in starting fishery schools up to high school standard in the interior coastal area and fishermen training centres to impart modern fishing skill. The 53 schools (primary, middle and high schools) built and run by the department along the coastal area played a pivotal role in improving the socio-economic and educational levels of the fishermen in the state. The schools, after having achieved the purpose of providing educational facilities in the interior coastal area, have been transferred to the Education Department in 1975-76. To improve the professional competency in modern fishing, 4 Fishermen Training Centres were established during the end of the Second Five-Year Plan in the two coastal districts of the state. In addition, the fishermen boys are sent for training at the Central Institute of fisheries Nautical and Engineering Training at Cochin and Madras regularly in various special courses. About 2900 fishermen have already been trained in mechanised fishing in the state and about 150 in the Central Institutions.

HOUSING AND REHABILITATION

Fishermen who do not have their own houses are being rehabilitated under schemes started from 1966-67. House sites were alloted to fishermen under other Government schemes such as the Janatha Housing Scheme, Rural Housing Scheme and under the 20-point programme. About 300 houses and 1750 house sites were alloted to fishermen in the two coastal districts alone.

COASTAL INFRASTRUCTURE SCHEMES

Under the Centrally Sponsored Scheme for providing infrastructural facilities to fishermen villages, Shiroor in Dakshina Kannada and Alvekodi in Uttara Kannada were selected for improvements at a total cost of Rs. 2.96 million. This scheme will provide facilities like ice plants, water supply, fish drying units, community halls, roads etc.

CREDIT FACILITIES AND MECHANISM OF OPERATION

To stimulate fisheries development, the department encourages the private sector and commercial banks to invest in the fishery industry. The banking institutions in the state, mostly on advice from the department, have been responsible for more than 60% of the total fishery investment in the state. On the fishing side, the banks, contribution in providing loans has been very significant up to 65-75% of the total investment with an initial repayment period of about 60 instalments at an interest rate of 12½%. The bank gets the loan refinanced by the A.R.D.C. In other cases the interest may go up to 14-16%. During the 3 years ending with 1978-79, the total investment on purse-seine fleet alone in the state is estimated at Rs. 8 crores. This huge investment in one sector alone was made possible by the financing institutions like the banks and the Karnataka State Financing Corporation. The latter charges interest at 0% only.

CONFLICTS BETWEEN TRADITIONAL FISHERMEN AND THE MECHANISED SECTOR

The fishermen of Karnataka are capable of great tolerance and adaptability to changing situations as they generally believe in modernisation for achieving socio-economic betterment: In addition to this, the traditional fishermen of the state have always been showing qualities of resilience and accommodative spirit to mechanisation. Perhaps there might have been ripples of resentment towards mechanisation but they were only temporary and local. The approach of the department in taking care of both the sectors

is also a contributing factor for the comparatively peaceful and amicable atmosphere prevailing on the Karnataka Coast.

LEGISLATION

No fishery legislation has so far been promulgated in Karnataka. However, a Fishery Act is being formulated for better managment of fisheries and its development in the state.

MARICULTURE

The state has 4000 hectares of cultivable brackishwater area. The mariculture unit started at Karwar has conducted brackishwater culture experiments mainly to study the commercial possibilities. The harvest consisted of 30% *P. indicus*, 30% *M. dobsoni*, 10% *P. monodon*, 20% mullet and 10% miscellaneous fishes. To aid mariculture research, a Centrally sponsored scheme with an outlay of Rs 14.63 lakhs has been sanctioned.

STATUS OF TRADITIONAL FISHERIES IN KERALA

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The physical geography of Kerala State. with about 590 km of sea coast on the west and the mountain ranges on the east interspersed with a net-work of 44 river systems is certainly one of the chief reasons for fish becoming an important source of food for the people of the State. Fishing in the high seas is an age-old avocation that has been carried out by certain communities who have from time immemorial lived along the coastline of Kerala. The traditional fishermen have been socially and economically very marginal, undertaking fishing primarily for subsistence. Over the years they have perfected several techniques of fishing, and developed craft and gear suited for their local conditions.

CRAFTS

Dugout canoes

The dugout canoes as the name implies, are made by scooping out the wood from a single log of mango or jungle jack. The keel portion is left thicker than the sides. Often it is not possible to get the total symmetrical shape from the log and the 'patches' have to be panelled with planks of teak wood rivetted on to the main body with nails. The dugouts are of three sizes; the large ones of over 10 metre length are called *odam* or *vanchi*, the medium sized ones called *thonies* measure about 9 meters, and the *beputhoni* which is about 8 metre long is the smallest type. The width and depth of the three types of dugout range from 0.7 m to 1 m and 0.8 m to 0.9 m respectively and their displacement ranges 2 to 5 tonnes. The *odams* carry a crew of 7 to 11 fishermen and the *thonies* from 3 to 6. The larger dugouts are used in pairs for operating boat-seines and the smaller ones used singly with gill-nets, drift nets or the hook and line sets. None of them are provided with rudders and steering is effected by means of a big paddle which is used for propulsion as well as control. Sails; either square or triangular, are used by some. Dugout canoes are used during the fine wheather months from October to May.

Plank-built canoes

These canoes are made by building a body of wooden planks with or without ribs on the inside. The wooden planks are seamed together with coir rope and the craft is made water tight by applying a layer of pitch on the inside. They are of two sizes, both called *vallams*, one about 11-12 m long 1.0-1.5 m wide and 0.8 m deep. Their displacement varies between 3 and 5 tonnes. The larger ones are capable of carrying 9 to 11 persons and the smaller ones 3 to 6. The canoes also have no rudders and use paddles. Sails are used only occasionally. The larger ones can be used immediately after the monsoon in August when the waves are still high and the

sea turbulent. The smaller ones can be used only in the calmer seas from October to April. From the plank canoes gill nets, drift nets and hook and line sets are operated. They are used also in the operation of shore-seines.

Catamarans

The word is derived from the Tamil *'Kattumaram'* which aptly describes the nature of the craft. It is basically a crude raft made by tying 3 to 5 logs of soft wood together securely at the two ends with coir ropes. If more than 3 logs are used, then the rope is tied around the ends with a cross piece cut in the shape of stumped bull's horns. Catamarans are also of two broad sizes, the larger ones of dimensions 7.5 to 8.5 m long and 0.8 m wide and the smaller ones 4 to 5 m long and 0.6 m wide. The larger ones can carry 3 to 4 persons and the smaller ones not more than two. The catamaran is by far the most rudimentary craft used by any group of traditional fishermen the world over. For all its disadvantages, from the point of its inability to provide even the bare minimum protection to its occupants from the waves and the wind, it is the only craft that is unsinkable and that can be launched from any point on the coast, at any season of the year. Once across the surf it proves an excellent and fast sailing craft. It is light and uses a triangular shaped sail, the base of which is attached to a bamboo pole which is often longer than the craft itself. The catamaran is propelled with split bamboo oars of 2 m length. Catamarans can be used in pairs to operate boat seins or individually to operate gill nets, drift nets and hook and line sets.

Unfortunately systematic collection and publication of data on the number of these crafts is scanty and what is available is rather unreliable. Over the period 1957-1973 we have four sources that give an estimation of these crafts at five points of time. These estimates are shown in Table 1.

TABLE 1. *Estimated number of traditional fishing crafts in Kerala*

Year	Source	Catamarans	Canoes plank-built	Dugouts	Total
1957—58	1	8280	3173	8774	20,227
1961—62	2	n a	n a	n a	20,227
		Big and small boats			
1966	3	6056	12476	8964	27,496 *
1972	3	9719	11010	9865	30,594 *
1973	4	3708	4720	16672	25,100

n a—Not available; * includes craft used for inland fishing.

Sources:

1. Census of Fishermen's Assets and Liabilities, Department of Fisheries, Administration Report 57-58.
2. Census of Fishermen and fishing craft for All-India Maritime States CMFRI, Bulletin, No-13, July, 69.
3. Kerala State Livestock Census Reports, 1966 and 1972.
4. Govt. of Kerala, Development Department, Integrated Fisheries Development Project for Kerala, 1975.

GEAR

The types of fishing gear used in marine fishing in Kerala by the traditional fishermen are quite numerous. There are basically three types of nets, shore seines, boat seines and gill nets and several types of hook and line set. In the case of nets, the qualifying nouns indicate broadly the nature of the net.

Shore seines

These nets are usually bag-shaped with coir-wings of extensive lengths of over 1500 metres. One end of one of the wings remains on the shore. A plank-built canoe moves out across the surf paying out that wing until the bag-shapped net is reached. Thereafter the net is also put out and the canoe returns to the shore paying out the second wing and brings its extremity to another point on the shore. In this process the canoe makes a V-shaped course from one point on the shore to the other point which would be about 100 to 200 metres apart depening on the size of the seine. The two ends of the seine are simultaneously and gradually pulled in by two parties, each of 15 to 20 fishermen. Shore seines are used all along the coast of Kerala mainly during the calmer seasons between November and March/April and it is the pelagic, shoaling fishes (oil sardine, mackerel, anchovies etc.) that are caught in it.

Boat seines

These are conical, bell-shaped or bag-shaped nets, fabricated from cotton or nylon yarn. Sometimes wings are used. On the cotton nets wings made of coir, and in the case of nylon nets wings made of monofilament plastic are used. The open end of the boat seines normally have larger meshes which decrease in size towards the closed end. The boat seine is operated using two canoes or catamarans which pull at either end of the wings thus keeping the mouth of the net open and hence making the fish swim into the narrower end. Sometimes scaring devices made of wood or coconut leaf are used to beat the water or the side of the boats to drive the fish into the nets. Boat seines are also normally used to fish for pelagic and mid-water shoaling species. They are used all over Kerala during the seasons when the above mentioned types of fishes are available in the inshore waters. At least 5 persons are required to operate a boat seine and this number can increase to as many as 25 depending on the type of craft used, the size of the seine and the nature of the fish to be caught.

Gill nets

These are single wall nets which may be of the 'set' or the 'drift' type. The set-type gill nets may be used from a stationary craft (anchored in the fishing area) and can be either surface or bottom set nets. The drift-type of all gill nets are attached to the side of a catamaram or canoe and the craft and net drift along with the current. Fish are gilled in the net when they swim into it. Gill nets may be made of cotton or nylon yarn. It is the position (surface or bottom-this is manipulated by attaching or removing the weights fixed to rhe lower end of the net) and the mesh size which will determine the type of fish caught in it. Gill nets are also used all along Kerala's coast. They can be operated by as few as 2 persons on a catamaran, or as many as 12 on a canoe, depending on the length and weight of the net.

Hook and Line

The hook and line units are generally used for fishing in deeper waters. The fish has to be baited by live or artificial bait attached to the hooks. The line is weighed down either with iron weights or stones. It is the weights which will determine the position which the line will take in the water. Consequently it is the size of the hooks which are attached to the line and the depth to which the line sinks that will determine the nature and size of fish caught. After the line is laid the craft may either remain anchored or drift with the current. The end of the line in the fishermen's hand is egntly jerked to attract fish to the bait. Once a fish bites at the bait, the line is drawn in, the fish removed and the process repeated. Fishing with the hook and line is not undertaken by many fishermen. The greater depths to which they have to go, the longer time that is taken and the very strenuous nature of this kind of fishing are the major constraints. The more daring and adventurous of the traditional fishermen, notably the catamaran fishermen of the south, are experts in this type of fishing. Normally it is undertaken when the fishing in the

inshore waters is not lucrative or when fish is scarce in this region.

The statistics relating to fishing gear have been collected by the Department of Fisheries in 1957-58 and by the livestock Census of 1966 and 1972 (Table 2). The former related only to the marine fisheries sector and are much more reliable. The latter include both the marine and inland sectors and the wide variations exhibited, along with the total non-enumeration of hooks and line sets make the data very questionable.

TABLE 2. *Fishing gear tackle in Kerala State*

Type of gear/tackle	1957-58[1]	1966[2]	1972[2]
Shore seine	4,501	6,617	8,224
Boat seine	21,281	2,909	—
Gill net	—	—	35,919
Drift net	35,778	—	—
Drift and gill nets	—	30,907	—
Drag nets	—	—	19,988
Trawl Nets	—	7,555	16,500
Cast nets	—	99,271	11,273
Scoop nets	—	18,246	—
Spawn collecting nets	—	—	977
Fixed & Stationary nets	—	1,918	—
Traps	—	—	—
Hook & Line sets	16,312	—	—
Bag & Purse nets	—	12,484	—
Others	—	17,416	23,554
Total	77,872	197,323	116,435

Sources:- 1. Census of Fishermen's Assets and Liabilities–Department of Fisheries Admn. Report, 1957-58.

2. Kerala Livestock Census 1966, 1972 (includes inland fishing gear and tackles).

FRESH AND BRACKISHWATER FISHERIES

The fresh and brackishwater resources of the State comprise of rivers, canals, tanks, ponds, reservoirs, brackishwater lakes, backwaters and the adjoining low fields, canals, ponds, mangrove swamps and estuaries. The estimated extents of these water areas in the State are given in Table 3.

TABLE 3 *Inland water resources of Kerala*

Type of water area	Estimated area (ha)
Rivers	85,000
Tanks and ponds	3,300
Reservoirs	24,137
Brackish water lakes	97,100
Backwaters including mangrove swamps	2,02,300
Estuaries	40,300
	4,52,137

About 24,400 fishermen living in 167 fishing villages, are engaged in inland and brackishwater fishing activities. The coastal fishery engages 99,000 fishermen. Both capture and culture fisheries contribute to the fisheries of the fresh as well as the brackish waters. The currently exploited fish production from these waters is of the order of 21,000 tonnes, 80% of which is being realised from the estuaries and brackish waters.

Capture fisheries

The capture fishery is carried out by a variety of fixed as well as free gears. Among the fixed gears, the important ones are the stake nets Chinese dip nets and filter nets. Free gears are the gill nets, cast nets, drag nets, *Pachil Chengadom* and hook and lines. Medium and small dugout canoes are the principal crafts employed for fishing. No reliable statistics of the number of gears in operation at present in the estuaries and backwaters of Kerala are available. Table 4 furnishes the number of different types of gears licensed by the Department of Fisheries during 1975-76.

TABLE 4. *Details of nets licensed by the Department Fisheries during 1975-76*

District	Chinese nets	Stake nets	Free nets
Trivandrum	1	7	234
Quilon	88	873	406
Alleppey	282	1508	2335
Kottayam	90	869	560
Idukki	—	—	—
Ernakulam	1082	3116	682
Trichur	42	401	41
Palghat	—	—	—
Malapuram	—	28	—
Kozhikode	—	127	—
Cannanore	—	—	—
Total	1585	6929	4258

The annual fish production from the estuaries and backwaters of Kerala has been found to fluctuate between 14,000 and 17,000 tonnes during the last few years. The major groups supporting the fishery are prawns (60-70%) mullets (11%), pearl spot (10%), cat fishes (9%) and other fishes, such as clupeoids, threadfins, perches and crabs. Among molluscs, clams of the genera *Villorita* and *Meretrix* contribute to the bulk of the fishery.

Among prawns, 4 species of penaeid prawns, namely, *Penaeus indicus, Metapenaeus dobsoni, M. affinis* and *M. monoceros*, and 2 species of palaemonid prawns, *Macrobrachium rosenbergii* and *M. idella* are important from the point of view of commercial fishery. The penaeid prawn fishery is contributed by the juveniles of the above species while the palaemonid fishery by the adults. In the annual prawn catch, *M. dobsoni* contributes to about 79%, *M. monoceros* 11.8% *M. affinis* 2% and *P. indicus* 6.5%. Prawns are caught by the stake nets, gill nets, drag nets, Chinese dip nets, cast nets, and *Pachil Chengadom*. The average annual catch of prawns during the last five years has been of the order of 3722 tonnes.

Mullets are the next important group of fish caught from this region. Their average annual catch is estimated at 2136 tonnes. They are mainly caught by the stake nets, gill nets, seine nets and cast nets. The average annual catch of pearl spot and catfishes is 1894 and 1377 tonnes respectively. Most of the fish catch except that of prawn are marketed fresh and utilised for local consumption. However, the surplus catch is salted or semidried. Most of the prawn catch is processed and exported.

Up to the end of the 'sixties, the Pampa river system and the low saline regions of the Vembanak lake were supporting lucrative fishery for the giant fresh water prawn, *M. rosenbergii*. The average annual catch of this prawn during that period was of the order of about 400 tonnes. However, the increasing fishing pressure particularly for the juveniles, and the suspected effect of pesticides used for paddy and leached out into the river system adversely effected the resources relegating the fishing into an insignificant proportion. There is an urgent need to revive the fishing through appropriate measures. Besides prawns and fishes, a large quantity of live clams at an estimated rate of 88,000 t are also taken from this region.

Culture fisheries

Brackishwater fish culture is practised on a commercial scale at present only in central Kerala. This is an age-old avocation carried out in the lowlying fields adjoining the backwaters. The practice entails cultivation of a special variety of paddy called 'Pokkali' during the monsoon months when almost fresh water conditions obtain in the fields. After the harvest of paddy in September/ October, the fields are prepared for prawn culture by strengthening the bunds and fixing the sluice gates. Incoming tidal currents which bring in young ones of prawns and fishes as well as other organisms are let into the fields through the sluice gates. The prawn and fish fry thus trapped in the fields are grown for a period of about 2 months. Escape of the trapped seed during the ebb tides is preventsd by placing a bamboo screen in the mouths of the sluice gates. Fishing is carried out during seven to eight days on either side of the full moon and new moon periods by fixing a filter net to the sluice during the ebb-tide. Besides the seasonal fields' the practice is also carried out in the perennial fields throughout the year.

Table 5 gives the details of the licences issued by the Department of Fisheries, area utilised and the amount realised for prawn/fish culture in the paddy fields during 1975-76.

TABLE 5. *Details of prawn filtration from paddy fields during 1975-76*

District	No. of issued	Area (ha)	Amount Collected Rs.
Alleppey	52	352. 67	4223. 25
Kottayam	15	167. 43	2183. 75
Ernakulam	894	4000. 00	50569. 72
Trichur	160	590. 80	7518. 65
Total:	1121	5110. 90	64495.37

The average production of paddy from these fields has been found to be 1510 kg/ha and that of prawns (*M. dobsoni* 53.3%, *P. indicus* 42.5%, *M. monoceros* 3.5% and *P. monodon* 0.7%) 903 kg/ha. The average total income from paddy as well as prawns amounted to Rs. 4278 per ha during 1969-72, the share of prawns alone being Rs. 2996 per ha. The average, maintenance and operational expenditure was estimated at Rs. 2847. The yield of prawns from the perennial fields is of the order of 806.5 kg/ha.

SMALL-SCALE MARINE FISHERIES OF TAMILNADU

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INTRODUCTION

There is no precise definition of "small-scale fisheries". In the cast of small-scale industries, Rs. 10.0 lakhs investment is the ceiling. "Traditional Fisheries" will certainly be deemed to be part of small-scale fisheries. Possibly fishing with boats of size upto 43½ ft. will also belong to small-scale fisheries. But the F.A.O. reports on small-scale fisheries refer only to improvements in traditional craft and heir "motorization" but not mechanization.

MARINE FISHERY RESOURCES OF TAMILNADU

This State has a coastline of 1000 km with a continental shelf area of 41,500 km. The inshore area (20 m depth) is 16,000 km. The Wadge Bank, off the south west coast is 13,500 sq. km in area and has a potential of 25,000 tonnes of fishes of high quality. With the declaration of Exclusive Economic Zone in 1976, the exclusive fishing area of India is about 2 million sq. km or 40% of its land area and 16% of the Exclusive Economic Zone lies off the coast of Tamil Nadu. This zone in India may support 4.5 million tonnes of fish. In Tamilnadu there are 3.9 lakh fishermen living in over 300 hamlets. Fishing is the principal occupation, generating income in coastal rural areas and providing employment.

The potential catch of the shelf region of Tamilnadu is estimated to be 8,79,920 t (Chodamani, 1972). Information on the offshore pelagic and demersal resources is inadequate. The major exploited group of fishes are the sardines, anchovies, mackerel and sharks among the pelagic group, and sciaenids perches and silverbellies among the demersal.

It has been estimated that the pelagic resources in the Gulf of Mannar is 5 lakh tonnes consisting of anchovies, sardines, etc. The demersal fishes such as silver bellies perches and sciaenids and the cephalopods constitute over 2.85 lakh tonnes. In the inshore area of the lower east coast, the potential is 4.8 lakh tonnes consisting of whitebaits, ribbon fish, silver bellies and sardines. The offshore waters can provide 2 lakh tonnes constituted by perches, whitebait, deep-sea lobsters and prawns. The Exclusive Economic Zone off Tamilnadu would support 5.3 lakh tonnes of fish, of which the region upto 200 m would support 3.53 lakh tonnes.

The above data indicate that the potential for fishing in the inshore and offshore areas off Tamilnadu is appreciable. The survey carried out by the Indo-Norwegian Project in the Gulf of Manner points to the availability in good quantities of redsnappers, 'Kalava', horse mackerel and sharks between 24-32 fathoms. Shoals of sardines and mackerel also occur in this zone. Large quantities of deep-sea lobsters and prawns

are available between 150 to 300 fathoms (Krishnamoorthy, 1972).

FISHING CRAFTS

Tamilnadu has 42,000 "traditional" country crafts (34,000 catamarans and 8,000 vallams) and a little over 2000 mechanized boats. These traditional crafts land about 135,000 t of fish (i. e. 60% of total landings of Tamilnadu). Also the bulk of quality fish is landed by the traditional crafts. It is interesting to note that even in a very advanced country like Japan, 50% of fishing crafts are of the "traditional" type. Though mechanisation programme was initiated in 1955 and it was intended to replace the traditional crafts, the results achieved were a mere addition of 2000 mechanised boats in 20 years as against 17,000 of traditional crafts added in 5 years. The traditional crafts operate within a limited range of 20 m depth or 20 km from the shore. Manual winches are used in 9.1 m boats, but 9 8 m boats have power take off and winch. Anchovies, sardines and mackerel require only vessels in the range of small purse-seiners. Since anchorage and harbour facilities are still lacking, small and light mechanized beach-landing crafts (surf boats) have vast scope in Tamilnadu.

PLANS FOR THE DEVELOPMENT OF SMALL-SCALE FISHERIES

The sub-group on Fisheries (Sixth Five-Year Plan) of the Government of India has remarked that "traditional craft could continue to contribute to National economy". Increase in size and range of operation of traditional crafts is warranted. Mechanisation of traditional crafts using inboard and outboard engines of low horse power and deck machinery should be pursued. Introduction of more of small mechanised boats in areas which have remained comparatively unexploited and less number of small vessels where intensive fishing has taken place is suggested. The NCST gave priority for improvement of traditional fishing and mechanisation of coastal fishing. It recommends assistance to mechanised fishing by small boat. The traditional sector is to be given 15% of outlay on marine fisheries.

Mechanisation of catamarans has been suggested and trials were made in Muttom with 18 HP outboard engines which were reported to be successful but uneconomical. 10 HP engine was later preferred. It has been suggested that Tamilnadu should concentrate on small boats capable of being beached and go in for smaller 25' boats with 30 HP engines (Krishnamoorthy, 1972).

During the VI Plan period, it is proposed to motorise 3400 catamarans and 800 vallams with outboard engines. A subsidy of 50% on outboard engines and 25% on nylon nets for these traditional crafts has been recommended. Both the traditional crafts and mechanised boats compete with one another in the narrow inshore belt for prawns, neglecting fin fish, leading to conflicts.

Light weight beach-landing crafts with inboard engines is preferable to catamaran with outboard engine. "Doris" type (20') tried in Tamilnadu will also be useful and must be given extensive trials.

Small F. R.P. (Fibreglass Reinforced Plastic) boats which proved successful in Sri Lanka are also proposed to be introduced in Tamilnadu during the Sixth Plan. These may be supplied to fishermen owning traditional, craft, with a subsidy of 33 1/3%. The boat (mechanised) may cost Rs. 20,000 each.

To assist the traditional crafts and catamarans, tow vessels may be operated. Preservation of timber used for catamarans, supply of sail cloth of improved material, supply of manual winches for having shore seines may also be necessary to assist traditional fisheries.

The objective of improving the operational efficiency of traditional sector will be aided by supply of sophisticated and modern gear to enable them to land more fish. Rs. 20 lakhs has been provided for this in the VI Plan.

DIVERSIFICATION OF FISHING

With the prawn boom in full swing, the entire inshore belt less than 50 m depth and within 20 km from shore, is being swept both by the traditional and mechanised boats, leading to severe competitive fishing and consequent conflicts. Quite possibly the "law of diminishing returns" will soon operate in Tamilnadu coast also, as has happened already in Kerala coast.

The entire fleet of 2000 mechanised boats are fishing only for prawns. The Government's assistance and support for this mechanisation programme has helped a handful of lucky fishermen to become rich while most of them ramain below the poverty line. Even in Kerala, it is said that out of 2000 mechanised boats, hardly 25 are engaged in pelagic fishing (Joseph 1973). In contrast, in Orissa, 200 out of 650 mechanised boats are gillnetters (F. A. O., 1977). The sub-group on Fisheries of Central Planning Commission remarked that "there is an urgent need for diversified fishing activities from small mechanised boats".

The prawn catches of Tamilnadu, have increased from 5300 t in 1966 to 12,000 t in 1975. It is reported that, at best, only an additional 2350 t of prawns can be had from this coast If it is overexploited, the size and total landings will diminish resulting in lower prices and lower profits. The pelagic fishery resources off Tamilnadu estimated at 2.5 lakh tonnes has not been fully exploited. During 1975-76, nearly 30,000 catamarans caught 1.1 lakh tonnes of sardines, mackerel and ribbon fish, using gill nets and drift nets. Canoes numbering about 7000using longlines, drift nets, etc. caught 25,000 t of perches, sharks and rays and cat-fish.

Only by diversification we can fully and judiciously exploit the near shore and offshore fisheries. Trap fishing with 43½' (72. 5 BHP engine) boats will give optimum results. Using the same sized boat Karnataka has achieved great success in purse seining. Purse seining has also been successful in Goa. This is a pointer to other Staties. Smaller sized FRP gillnetters will be very useful. These are available in sizes of 15' and 16' (10 HP outboard motor), 20' (15-20 HP outboard motor) and 38' (mechanised). These are being widely used in Sri Lanka. Gillnetters of 25' and purse-seiner/ gillnetters of 43' size may be used to exploit pelagic resources.

The 36' vessel is considered to be the smallest sized vessel for purse seining for economic operation and the ideal size is from 36' to 57'. A 36' trawler can be converted into a purse seiner. Purse seiners of size 17.5 m or less are used to fish anchovies and sardines. Midwater fishes remain unexploited. Best priced fishes such as seer, pomfret and Indian salmon are in this zone. Midwater trawling for these would be profitable. The Integrated Fisheries Project has recommended midwater trawling for *Anchoviella* using 57' boat (230 HP engine). The sub-group on Fisheries of Central Planning Commission suggested introduction of purse seining and midwater trawling by 36'-45' vessels, and employing more than one type of gear in mechanized boats. Deep-water prawns and lobsters are available on the south-east and south-west coasts and could be fished by large sized vessels such 70' boat (400 BHP).

Longlining and bottom set nets would be used to exploit the sharks, rays and perches and jew fish. In Bangladesh. traditional boats of size 12 to 14 m (15-33 HP) are being used for gill neting (FAO, 1977). In Sri Lanka also, the most important gear is the gill net (FAO, 1977).

ECONOMICS OF VARIOUS TYPES OF CRAFT

The greatest asset of traditional craft is that there is no question of hike in operational expenses at any time since it is based on man-power only. Small-scale fisheries using small boats with inboard or outboard engines have to incur operational expenses, especially on fuel and maintenance.

In Sri Lanka, a 3.5 t boat landed 18.5 t of fish per boat per year. A motirised (outboard) craft landed 7 t/yr/boat. The National Commission on Agriculture has stated that in India a non-mechanised boat lands about 6 t/yr while a mechanised boat lands about 30 t/yr. The profitability of the latter is said to be 14%. Very interesting studies on the economics of different fishing vessels were made by AFC Ltd, Bombay. It was reported that an 82' vessel will incur a loss of Rs. 1,86,000/yr. "Klaus Sunnana", the I. N. P. vessel (19.81 m) was incurring a loss of Rs. 8.19 lakhs/yr. The I.F.P. has recorded that a 43.5' vessel doing purse-seining and trap fishing fetched a net profit of Rs. 1.12 lakhs/yr.

In Tamilnadu, a catamaran lands an average of 5 t/yr and the sailing canoes land 20 t/yr. The mechanised boats catch fish as indicated below (State Planning Commission, 1972):

9.1 m	— 50 t/yr
9.8 m	— 80 t/yr
13.8 m	— 170 t/yr
17.5 m	— 500 t/yr.

For gillnetting, lighter vessels with minimum horsepower alone will be economical (Balasubramanyan, 1972). By investing Rs. 1.2 lakhs in a 9.1 m boat, a net profit of Rs. 25,000 per year can be had (Choodamani, 1973).

The economics of F.R.P. boats has been worked out in detail by Unni (1978). According to him the profitability of small FRP boat of sizes 15', 16, and 20' is 37.3%, 36.3% and 42.2% respectively, for an investment of Rs. 41,950, Rs. 47,500 and Rs 58, 950 respectively (including engine and gear). Gokhale (1978) made a detailed analysis of the operation of boats and pointed out that the larger imported vessels were less efficient and less economical than the smaller indigenous mechanised boats. For example, the Polish vessel, "Muraena" brought a catch of 0.3 kg/HP/hr while the all-India average was 0.8 kg/HP/hr. He stated that for the cost of one 400 HP imported trawler we can have 10 numbers of indigenous / mechanised boats getting twice the catch of the former. He added that the big imported trawler gives direct employment to only 10 persons (indirect nil) whereas the 10 indigenous boats would provide direct employment to 60 persons and indirect employment to 90 persons (including in the boat building yard). The return per unit investment of nonpowered boats is twice that of the powered boats and generates almost seven times direct employment than mechanised boat.

FINANCING SMALL-SCALE FISHERIES

The principal objectives of financial assistance in developing countries are related to welfare of fishermen, improving their economic conditions and nutritional levels.

Although finance is easily available for large vessels (imported) from local and external agencies, very little assistance has been forthcoming for artisanal fishermen. Some nationalised Banks have now ventured to finance the small-scale fisheries upto 75%. The N.C.S.T. (1973) has also recommended assistance to traditional fisheries.

Credit assistance should be provided in the following fields: 1) introduction of improved fishing vessels, 2) improved transportation of fish, 3) establishment of shore facilities, processing complexes, etc, 4) improved marketing and 5) elimination of debts.

In the Sixth Five-Year Plan, the Government of Tamilnadu will be assisting the traditional fishermen in a big way. Banks must also assist the programmes massively by liberal loans to motorise the traditional craft. Instead of giving huge loans to a few big boat operators, a large number of small boat operators may be assisted to improve the economy of persons on the borderline of poverty.

The Agriculture Refinance Development Corporation refinanced the loans for two Cooperative Federation for buying and operating boats. The National Cooperative Development Corporation is very eager to assist any fish production programme through cooperative organisations. Primary Cooperative Societies and Federations may, therefore, avail themselves of this source of finance and pass on the benefit to their members. These Cooperatives can operate fleets for fishing. Differential rate of interest for artisanal fisheries will help to lift this segment from the bottom of economic ladder. The SIPCOT has shown interest in financing projects for the manufacture of marine engines, freezing plant, fleet operation, etc.

PRESERVATION OF THE CATCH

In small-scale fisheries facilities for preserving the catch on board are lacking. Small insulated boxes are proposed to be supplied to catamarans and 'vallams' and in the VI Plan, a provision of Rs. 10,00 lakhs has been made for this. In the small F.R.P. boats to be issued the insulated box will be fitted in the boat itself. A total number of 1300 country crafts and 2000 F.R.P. boats will be given such boxes. The main thrust in the coastal fishing sector should be to improve the handling, storage and utilisation aspects of catch.

Ice Plants are needed at strategic points to provide ice to the traditional and small mechanised crafts. Since small ice plants are not economical, supply of ice through mobile insulated ice vans to important fishing centres

may be considered, especiallv to assist small-scale fisheries.

SERVICE SCHEMES

Housing

So far over 6500 houses have been provided for the fishermen of the State. Another 1500 houses are under construction. An annual allotment of Rs. 100 lakhs is being made to house the marine fishermen in stages.

Roads

So far about 47 villages have been provided with link roads. In the VI Plan, Rs. 200 lakhs have been allotted to provide roads needed for the rapid transport of fish from landing centres to the hinderland.

Cuidelights

These navigational aids are essential and during the current Plan period 15 fishing centres will be provided with such guidelights.

SMALL-SCALE MARINE FISHERIES AND RURAL DEVELOPMENT

Small-scale marine fisheries (artisanal or traditional fisheries) is essentially based in sub-rural areas called fishing "Kuppams" (hamleis). Generation of employment and income is therefore mainly at rhe rural level. Fish production is the means to generate further employment in processing, marketing, transport, etc. Even now fishermen are engaged in marketing in some from or the other (auctioning or vending). Additional income could be had by making all the fishing requisities, mainly nets, and the fisherwomen are adepts at it. The bye-catches (trash fish) could also be processed in the village itself to be made into fish meal which could be used to raise the village poultry units. It has been shown that appropriate technology is available for this as well as for making animal feeds by ensilaging fish or fish wastes.

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PRESENT STATUS OF SMALL-SCALE FISHERIES IN PONDICHERRY

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The Union Territory of Pondicherry, comprises four maritime regions viz., Pondicherry, Karikal, Mahe and Yenam, covering a coast line of about 45 km with 675 sq.km of inshore waters. The marine fisheries were not exploited properly before the territory became a part of the Indian Union even though fish is readily consumed by the people. The annual fish production was estimated at 900 tonnes before the transfer of these regions to the Indian Union.

DEVELOPMENT PROGRAMMES DURING THE PLAN PERIOD

The Department of Fisheries was newly created in the Union Territory of Pondicherry in November, 1954. The office of the Director of Fisheries was established in November 1955 with a strength of one Gazetted Officer as Director of Fisheries and one Inspector of Fisheries in each region of the Union Territory. With the help of the technical staff of the Fisheries Department, necessary data on fishery resources were collected, and the Five Year Plan development schemes were formulated to increase fish production and to improve the socio-economic conditions of the fishermen.

During the last year of the First Five-Year Plan a sum of Rs. 30,000 was spent on organisational matters and development of marine and inland fisheries. In the Second Plan, schemes costing Rs. 5.31 lakhs were implemented and the fishermen were supplied with 500 kg of synthetic fish net twine at subsidised cost. In order to enable the fishermen to cure the fish under hygienic conditions, a departmental fish curing yard was established at Mahe and salt was supplied to them at 20% subsidised cost. The department hired out 2 motor vans for quick transport of fresh fish from landing centres to marketing places at reasonable hire charges. The fish production had increased to 4500 tonnes at the end of Second Plan period by implementing the above schemes successfully. During the Third Plan, the scope of the schemes was widened and more quantity of synthetic nylon twine was distributed at subsidised cost to replace the cotton and hemp nets. Ice plant-cum-cold storage units were established in marketing centres to preserve the surplus catches and unsold fish to prevent spoilage and more vehicles were hired for the transport of fresh fish. A total amount of Rs. 15.24 lakhs was spent during the Third Five-Year Plan period and, as a result, the fish production increased to 9,000 tonnes.

During the succeeding three Annual Plans, from 1966 to 1969, the various developmental schemes initiated in the previous Plans were implemented successfully at a total cost of Rs. 19.29 lakhs. The Fourth-Five Year Plan schemes were formulated with a total outlay of Rs. 85.00 lakhs to augment fish production from 9000 tonnes to 15000 tonnes by imparting training to fishermen in modern methods of mechanised fishing, supply of modern fishing gear, affording loans at low interest through Fishermen Co-operative Societies for the purchase of essential fishery requisites and provision of facilities for landing of fish, storage, marketing, curing, quick transport etc. In order to preserve the surplus catches, a two-ton ice plant and five-ton cold storage unit were installed in Pondicherry and a one-ton ice plant and two-ton cold storage unit at Karaikal. Credit facilities at nominal rate of interest were afforded and essential fishery requisites were also supplied at subsidised rate through 25 primary Fishermen Co-operative Societies and one Fishermen Co-operative Federation set up for the benefit of fishermen community.

The funds allotted for development schemes from the inception of Fisheries Department till data are furnished below:

Year	Funds allotted (Rs. in lakhs)	Year	Funds allotted (Rs. in lakhs)
1955-1960-61	5.42	1970-71	22.35
1961-62	1.05	1971-72	18.45
1962-63	1.18	1972-73	24.55
1963-64	3.02	1973-74	17.81
1964-65	1.90	1974-75	25.06
1965-66	7.01	1975-76	44.20
1966-67	6.35	1976-77	37.38
1967-68	6.00	1977-78	33.00
1968-69	6.93	1978-79	30.00
1969-70	13.40		

FISHERY RESOURCES

All the four maritime regions of Pondicherry cover a coastline of about 45 km with 675 sq.km of inshore waters which offer immense scope for the development of marine fisheries. The continental shelf area is 1424.70 sq.km Average distance to the continental shelf margin is 25 km. The inshore water area is about 569.80 sq.km at Pondicherry, 841.95 sq.km at Karaikal and 12.95 sq. km at Mahe. The Union Territory of Pondicherry has a sizable fishermen population of 29,000 scattered over 27 marine fishing villages. There are more than about 2353 indigenous fishing crafts (catamaran) and 218 country boats with about 10,000 fishing gears. The peak fishing season starts from January and ends in June and the varieties of fish caught during various seasons are given below:

Jan: Ribbon-fish, horse-mackerel,*Lactarius*, seer fish, jew-fish and prawns

Feb: Mullets, ribbon-fish, sabre-fish horse-mackerel, white-bait.

Mar: White-bait, sardines, ribbon-fish horse-mackerel, jew fish.

Apr: Sardines, white-bait, *Lactarius*, pomfret, jew fish.

May: Sardines, white-bait, pomfret, jew-fish, flying fish.

Jun: Flying fish, pomfret, horse-mackerel, mullets, jew-fish.

Jul: Sardines, ribbon-fish, mackerel, mullets, *Lactarius*, prawns.

Aug: Jew-fish, mullets, horse-mackerel, shark, sabre-fish, flying fish.

Sep: Shark, jew-fish, sardines, anchovies, silverbellies, prawns.

Oct: Ribbon-fish,jew-fish, mullets, prawns, white bait, *Lactarius*.

Nov: Sabre-fish, mullets, prawns, jew-fish, *Lactarius*.

Dec: Silverbellies, cat-fish, mullets, *Lactarius*, prawns.

Fish production in the Union Territory during the last four years is given below:

Fish production (1000 tonnes)

Year	Marine	Inland
1974—75	21.7	0.6
1975—76	13.3	0.5
1976—77	12.1	0.4
1977—78	11.2	0.6

CRAFT AND GEAR

The fishing crafts and gears of Pondicherry are mainly of indigenous nature designed to suit local conditions. In the East Coast the sea is rough and the surf breaks haavily upon the coast throughout the year. The crafts used are chiefly the non-rigid 'Catamarans' and 'Masula Boats'. Nets and other implements have been so designed as to capture particular varieties of fish. As brief description of crafts and gear used in this region is given below:

Catamaran: It is the most porminent fishing craft of this region. The catamaran is a keelless craft formed by lashing together 3 to 7 or 8 logs. The logs are cut square on one edge and curved into a rough cone at the other. The conical end rises slightly above the general level of the craft and forms the stern of the catamaran. The catamaran logs are purchased from private merchants and Fisheries Co-operative Societies who import logs, previously from Sri Lanka and now from Kerala. Mostly *Melia dubia* and *Albizzia* logs are used for the catamaran and the cost of each set varies from Rs. 500 to 2000. There are various sub types. Special mention may be made of 'Kola Maram' or 'flying fish catamaran' used in this coast to go 30 to 35 kilometres from the shore for catching flying fish exclusively during June to August. It consists of 7 logs with an accessory one lashed from the starboard and costs about Rs. 2500.

Masula boats: This boat is employed for fishing with shore seines. This is non-rigid boat constructed with "Ayini" (*Artocarpus hirsuta*) planks without ribs or frames so as to stand the severe knocking of the surf. The planks are sewn together with coir rope and the inter spaces between the planks are filled up with dry

straw. The cost of the masula boat ranges from Rs. 3500 to 5000.

Odam: It is a large-sized dugout canoe measuring about 9.75 m long, 0.91 m wide and 0.76 m deep. It is made by scooping out large trunk. The keel portion is left thicker than the sides.

Thonies: It is a comparatively smaller dugout canoe measuring about 7.31 m long, 0.91 m broad and 0.45 m deep. It is chiefly used for conducting drift and gill net operations.

Nava boat: It is predominantly used in and around Yanam area. It is also built of wooden planks with strong ribs. It is about 7.62 m to 10.6 m in length. It has mast and sail for propulsion. It is employed in sea fishing for operating gill nets.

Shoe dhoni: It is popular in Yanam area. It is made of teak wood and is about 5.4 m to 6.7 m in length. It has got the shape of a shoe and used for operating gill nets and entangling—nets.

Gear

Though the indigenous fishing implements are of various types, they can be conveniently classified under some broad groups. The nets are mostly made of cotton and hemp and long lines used for sea fishing are made of cotton. The nets are fabricated by hand and are commonly preserved by treating them with the bark decoction or by starching. Some important types of nets under each group are briefly described below:

Bag nets and boat seines: "Thuri valai" (Vella valai) is a primitive trawl net operated from two cstamarans in waters 4-6 fathoms deep. Demersal fish like cat-fish, rays and soles are caught. The mesh of net is usually 12.7 mm near cod end and 63.5 mm in the wings.

"Edavalai" is a shallow bag net with a wide rectangular mouth having meshes of size of 63.5 mm near the mouth. It is used along with lures called "Kambi" consisting of strings of cocount leaves attached to a rope and moored in the sea. The net is operated in 6-8 fathoms and pelagic fish like pomfrets, sardines and mackerel are caught.

Shore seine: "Peria valai" contains a bag like cod and with two short wings (halves) of about 18.3 m length and 10.6 to 13.71 m breadth and two long wings 700 m in length. The net is shot near the surf-beaten shore from a boat in about 1-2 fathoms. Shoaling fish like sardines mackerel, anchovies, cat—fish, *Caranx* and prawns are caught.

Drift nets and *gill nets.* These are wall-like nets either made of hemp or cotton and now-a-days of synthetic twine of various sizes and meshes. The material, mesh and size of nets differ according to the type of fish caught. Generally wooden floats (now replaced by synthetic floats) and some sinkers are attached to the foot rope of the net. Drift nets are generally intended to catch big varieties of fish and are therefore made of strong material with large mesh. Gill nets are generally made of comparatively smaller meshes. The cost of the above nets ranges from Rs. 1500 to 2500 per piece depending upon the size, material used for webbing etc. The local names of these types of nets are as follows: Vala valai, Thadachivalai' Kavala valai and Pachu valai or Irugavalai.

Long lines: Long line consists of a special from of set line made of twisted cotton yarn. They are sufficiently longer in length and provided at regular intervals with thinner branch lines called snoods to which innumerable hooks are attached. The long line is made to suspend horizontally in mid water or at required depth by attaching the line to vertical supporting ropes with anchored buoys. The line is periodically hauled up to collect fish.

Hand lines are mostly made of nylon monofilament. It consists of a simple vertical line to which lead or iron weight is attached for throwing the line. To each line is attached two or more hooks by means of snoods. A fishermen will operate 2 or 3 hand lines at a time. Small sharks, perches and other miscellaneous fish are caught.

The traditional crafts and gear are generally operated at a distance of 2 to 8 km from the shore. In the flying fish fishery the range extends up to 35 to 45 km.

Fishing without gear: In Pondicherry and Karaikal regions, Sunnambar estuary and

Ariankuppam estuary have abundant bivalve shells called as "Matti". They are collected by hand picking and the shells are processed in kilns for manufacturing lime which is used for white washing. The fishery right for the shells are vested with the respective Commune Panchayats.

INFRASTRUCTURE

Berthing facilities

Under the Centrally sponsored scheme "Improvements to minor fishing harbours", landing and brething facilities for the mechanised boats are made available. A fish landing jetty for Karaikal region was constructed prior to the IV Plan and another fish landing jetty was constructed at Mahe during 1971-72. About 15 to 30 numbers of 30' boats can be anchored safely along the above mentioned jetties. At present no landing facilities are available in Pondicherry and all the fish are landed in the sea adjacent to the fishing villages. The catches are brought to the shore by catamarans.

Preservation and processing

Most of the catches are sold afresh. Excess fish is preserved only when the catches cannot be disposed off. This excess may work out to one-fifth of the total carches. The ice plant-cum-cold storage plant at Pondicherry was constructed at a total cost of Rs. 1.78 lakhs in the year 1967. Ice is sold to the fish merchants at subsidised rates. Another ice plant-cum-cold storage unit is functioning in Karaikal.

There is only one fish curing yard at Mahe. Pure salt is distributed to the fishermen for curing at the fish - curing yard at Mahe at subsidised rate. The fishermen cure the fish in their respective villages and the cured fish is transported to interior markets by lorries, fish vans and by carts.

Marketing

Fish is auctioned with or without the help of fish auctioners who take a commission for their services. The distribution of most of the fresh fish to interior villages is done by cyclists and to the big markets by fish vans.

Boat building

Private parties have established boat building yards, one at Kanniakoil in Pondicherry region with the financial assistance of PIPDIC another at Karaikal. Since there is no Government yard-boats for the Fisheries Department are also constructed in the private yards.

SOCIO-ECONOMICS

There are 16 marine fishing villages along the coast of Pondicherry: 10 at Karaikal and one each at Mahe and Yanam. The details of the villages are furnished below: *Pondicherry*—Kanagachettikulam, Periakalapet, Chinnakalapet, Pillaichavadikuppam, Solaithandavankuppam, Vaithikuppam, Kuruchikuppam, Vambakeerapalayam, Thuppirayapet, Veerampattinam, Chinna Veerampattinam, Pudukuppam, Nallavadu, Panni, thittu, Narambai and Moorthikuppam-Pudukuppam; *Karaikal*—Mandapatheer, Kalikuppam, Akkampettai, Keelakasakudi medu, Kottucherry-medu, Killinjalmed, Karaikalmedu, Karukkalacherry, T.R. Pattinam and Keelavanjoor; *Mahe*—Mahe; *Yanam*-Guerimpeta.

Some of the above mentioned fishing villages are not connected by approach roads.

There are about 14,333 fishermen living in Pondicherry region, 6,565 at Karaikal, 924 at Yanam and 3515 at Mahe. Of them, about 7425 fishermen are engaged in full time fishing, about 2927 on part-time basis and 560 in occasional fishing.

Unlike in other regions of Pondicherry, Mahe which lies in the west coast is having a separate system of ownership of the craft and employment of fishermen. The major craft used is big "odam", which 8 fishermen per boat to operate large seine nets. Here the system is catch-share basis. The boat owner receives 36% of the catch as his share and the rest is divided equally among the sixteen employed for operating the nets. Of late fishing units procured through bank assistance are jointly owned by fishermen who share the catches equally.

In Pondicherry region, the fishermen get 50% share of the catches, and the other 50% goes to the owner of the net and catamaran. Among the fishing villages of Pondicherry and

Karaikal, a portion of the catch is set apart for the common — good fund of the villages. The amount is utilised for the benefit of the fishermen during non-fishing season, festival, distress etc. The average daily income of the fishermen ranges from Rs.5 to 10.

The socio-economic conditions of the fishermen remain vastly to be improved. Generally the thrift mentality is found lacking among the fishermen and they spend whatever they earn on the same day.

DEVELOPMENT PLANS

The Department of Fisheries of Pondicherry has taken up several schemes for the development of fisheries in the region and for the uplift of the socio-economic conditions of the fishermen community.

Fish seed farm

The object of the scheme is to set up fish seed farms, induced breeding centres etc. to meet the reguirement of quality fish seed. One farm each at Pondicherry and Karaikal and 2 at Yanam are functioning.

During 1977-78, steps have been taken to set up an induced breeding centre at Karaikal and to complete the pending works of Bahour and Oussoudou lake nurseries. During 1977-78, four lakhs of fish seed were obtained. During 1978-79, an amount of Rs. 2.45 lakhs has been earmarked in the budget for the development of these centres.

Mechanisation of fishing boats

So far 184 boats have been distributed to fishermen. Owing to certain circumstances, the second phase of the ARDC scheme could not be taken up for implementation. It is proposed to procure mechanised boats for distribution to Mahe and Yanam regions the areas which are not covered the ARDC scheme. Under the above circumstances, the targets proposed under the scheme could not be achieved. However, the funds earmarked were utilised for the completion of 10 boat hulls.

During 1978-79, it is proposed to revive the procurement of 35 mechanised boats with institutional finance from ARDC, Bombay and financial assistance from State Bank of India, Pondicherry. The second phase of ARDC Scheme will be restricted to the extend of 9 mechanised boats already procured during 1976-77. It is also proposed to revive the scheme of procurement of mechanised boats through the department. One patrol-cum-rescue boat will be procured and an amount of Rs. 10.75 lakhs has been earmarked for the purpose.

Service-cum-maintenance units

The scheme aims to provide repair and servicing facilities to mechanised fishing boats and to supply spares by setting up Service-cum-Maintenance Units. Such units are at present working in Pondicherry, Karaikal and Mahe regions. Construction of building for the Mahe unit has been taken up and an amount of Rs. 0.959 lakh has been spent.

Transport facilities

The department is at present maintaing 8 fish vans to provide transport facilities for carrying fish from landing centres to the interior markets.

Improvements to fish markets

With the object of providing hygienic fish markets, 75% subsidy and 25% loan are granted to local bodies for improving/remodelling the existing fish markets. So far 4 markets were constructed under the scheme. During 1977-78 an amount of Rs. 2.77 lakhs has been spent for the construction of 6 markets.

Ice plant-cum-cold storage

During the year 1977-78, steps have been taken to construct one more ice plant at Yanam in addition to the existing ones at Pondicherry and Karaikkal. An amount of Rs. 0.40 lakh have been spent for the construction of the building. During the year 1978-79, the Yanam unit will be completed. Steps will be taken to set up one more unit at Mahe. A sum of Rs.2.00 lakhs has been provided for this purpose.

Inshore Fishing Survey Station

The Inshore Fishing Survey Station is conducting survey off the coast of pondicherry. During 1977-78, an amount of Rs. 1.41 lakhs

has been spent for the procurement of survey equipments and maintenance of boats. During 1978-79, the survey work will be extended to other regions. An outlay of Rs. 1.50 lakhs has been made under this scheme.

Training of fishermen and fisheries personnel

So far 300 fishermen have been trained under this scheme. During 1977-78, 14 fishermen were trained in advanced methods of fishing in the Fisheries Training Centres at Kakinada, Cuddalore and Nagapattinam. In addition, the 6 in-service personnel of this department have been deputed for various short term refresher courses. During 1978-79 steps have been taken to send 10 candidates each to Central Institute of Fisheries Nautical Engineering and Training at Cochin and Madras to undergo training in Engine Driver and Fishing Second-hand courses. Rs. 1.00 lakh has been provided under this scheme.

Assistance to Fishermen Co-operative Societies

There are at present 32 Fishermen Co-operative Societies, an Apex Federation and a Marketing Union functioning in this Union Territory for the betterment of fishermen community. During 1977-78 an amount of Rs. 0.75 lakh has been granted in the form of loan and subsidy. Besides the above, Rs.0.25 lakh has been granted as share capital contribution. During, the year 1978-79, it is proposed to continue the scheme with an outlay of Rs. 4.50 lakhs.

Supply of Fishery Requisites

In view of high cost of fishery requisities, assistance is given to fishermen in the form of 20% subsidy. During the year 1977-78, fishery requisites worth Rs. 1.25 lakhs were purchased and distributed to fishermen through Fishermen Co-operative Societies by the Karaikal Fishermen Co-operative Marketing Union and Pondicherry State Fishermen Co-operative Federation. The scheme will be continued with an outlay of Rs. 0.25 lakh on the same lines during the year 1978-79.

Housing for Fishermen

The scheme aims at providing housing facilities to fishermen by granting 25% loan and 75% subsidy at the rate of Rs. 3,700 to each beneficiary. So far 675 houses have been constructed under the scheme. During the year 1977-78, the Pondicherry State Housing Board has taken up the construction of a fishermen colony consisting of 55 houses at Moorthikuppam-Pudukuppam. Construction of 60 houses at Karaikal, 15 at Mahe and 10 at Yanam were taken up by the respective blocks. During 1978-79, the scheme will be continued with a total outlay of Rs. 3.02 lakhs. It is proposed to construct 205 houses under this scheme.

Development of infrastructural facilities in coastal fishing villages

The object of the scheme is to provide essential infrastructural facilities in Periaveerampattinam and Chinnaveerampattinam fishing villages as approved by Government of India. The scheme was taken up for implementation in April 1978 and action has been taken to provide approach roads, water supply, community building, flake ice plant, children's park, fish curing yard, etc. During 1977-78, the construction of a community building was taken up. During 1978-79, all the intrastructural facilities will be provided at a cost of Rs. 2.96 lakhs.

Fishing harbour

The Department of Fisheries has taken steps for the establishment of a fishing harbour at Pondicherry and deepening of the river mouth of Mahe under the Centrally Sponsored Scheme "Improvement to Minor Fishing Harbours".

Under the assistance of the Marine Products Export Development Authority, Cochin, a fish landing platform is constructed at a cost of Rs. 40,000 in Karaikal.

During 1977-78, the survey team from Pre-investment Survey of Fishery Harbour, Bangalore, visited Pondicherry and conducted survey. The survey report is awited to approach the Government of India for necessary action to set up a fishing harbour at Pondicherry. Likewise, the Government of India has been addressed by this Administration to accord sanction for incurring expenditure of Rs. 0.80 lakh for conducting geophysical survey in Mahe river by National Institute of Oceanography, Panaji, Goa. Government of India approval is still awaited.

Aid/Assistance

Whenever the fishermen are affected by cyclone relief measures are taken by the Department and loan and subsidy are granted to compensate loss of catamarans and net during cyclone. A scheme has been formulated to grant aid up to Rs. 5000 for the loss of life, fishery requisites etc.

Education

Generally the fishermen population in Pondicherry is below the mark in the field of education. Lower Primary, Upper Primary and Middle Schools are functioning in almost all the villages. Preparatory Schools are also functioning in some villages for giving nursery education for children of age group 3 to 5. Facilities of High School education and College Education are also available to them in the nearby towns.

Nutrition

Fishes are distributed free of cost to the pre-school children through Balwadies and to expectant mothers through "Mathar Sanghams", under the Applied Nutrition Programme implemented by Block Agencies.

Extension

Extension activities are being implemented through Block Agencies. The Audio-visual Unit is regularly screening on the latest development in fisheries. Information gathered by the Inshore Fishing Survey Station is conveyed to the fishermen through pamphlets and leaflets.

CONFLICTS BETWEEN TRADITIONAL AND MECHANISED FISHING SECTORS

Clashes have occurred between the mechanised fishing boat operators and country craft fishermen since the inception of the mechanised programmes. These disputes are noticed in Vaithikuppam and Pudukuppam during prawn fishing season. The main objections raised by the traditional fishermen are that they are being deprived of catches of prawn and other fish from the coastal areas enjoyed by them in the past due to competition by more efficient mechanised boats and that their nets are also frequently damaged by the trawling operation of the mechanised boats. With a view to ensuring that both the mechanised fishing boat operators and traditional fishermen go about fishing without infringing on each other's rights, the Government has introduced a new clause in the rules framed for governing the allotment of mechanised fishing boats under the hire-purchase system which stipulates that the mechanised fishing boats shall not operate within a distance of three miles from the shore where traditional fishing crafts generally operate. This three-mile limit has been well recognised by both the group of fishermen. An agreement on the following lines has been reached between the two groups by the intervention of the Government.

1. Mechanised boat owners should operate their boats at 7 fathoms depth or more between 6 A. M. and 6 P. M.

2. The mechanised boats should display the first two letters denoting the name of the village and the boat number conspicuously on the boat.

3. Mechanised boats should pay the compensation as decided by the respective village panchayat in case of any damages caused to catamaran or nets by them during the course of fishing.

4. The compensation amount should be paid within three days of the decision taken.

5. There should not be any objections for the anchorage and fish landing of the boats in any of the fishing village of the Union Territory of Pondicherry State.

6. The mechanised boats and catamarans should not be utilised for any purpose other than fishing.

7. A penalty of Rs.500 levied by panchayatdar after enquiry should be paid by the mechanised boat owner if he violates the agreement and conducted fishing below 7 fathoms depth from the shore.

8. The mechanised boats and catamarans should take their boat for fishing 90° east from the anchorage point in the sea upto 7 fathoms and beyond.

9. A clause may be inserted in the rules framed for governing allotment of mechanised fish-

ing boats under the hire purchase system and also a condition in the hire purchase agreement executed by the fishing boat hirers to the effect that the mechanised boats should not operate within 7 fathoms depth from the shore.

10. Conciliation Committees should be constituted in each region *viz.*, Pondicherry, Karaikal, Mahe and Yanam. The conciliation Committees shall be represented by five representatives from each group of fishermen with the Deputy Director of Fisheries/Inspector of Fisheries concerned as the chairman of the Committee. The Committee will rush to the spots wherever clashes occur and settle the disputes then and there and decide the compensation to be paid by the mechanised boat operators to catamaran/country craft fishermen towards loss of nets etc.

11. The Police Department, Pondicherry shall arrange for coastal patrolling and police pickets in all marine fishing villages of this Union Territory to avoid clashes and keep a vigilant watch to ensure that the mechanised boats keep to their side of fishing area. The State Police Department shall intervene whenever there is a clash on the high seas or in the fishing villages and treat the matter purely as a law and order problem.

12. An act may be passed to make the 7 fathom limit as a statutory one so as to ensure that the mechanised fishing boats operate only in 7 fathoms depth from the shore.

PRESENT STATUS OF SMALL-SCALE (TRADITIONAL) MARINE FISHERIES IN ANDHRA PRADESH

P. P. WILLIAMS
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INTRODUCTION

Andhra Pradesh is the fifth largest state of India, which was constituted in 1956 by merger of 9 districts of the bifurcated state of Hyderabad with 11 districts of Andhra State. It has 8 coastal districts with a total coastline of 982 km and a continental shelf extending upto 32-43 km on an average, covering an area of 32,000 sq. miles besides a net work of rivers aggregating to 4160 km. (325 sq. miles in area), and 60 reservoirs and 40,000 tanks (5 lakh acreas in area) offering scope for development of capture and culture fisheries.

There are 2,37,470 coastal fishermen distributed in 408 villages in the coastline earning their livelihood by exploiting the inshore waters. total number of 24,000 craft and 65,000 tackle of various types are operated in traditional fishing which contributes about 70% of the total marine fish landings. In view of the latest techniques adopted in catching prawns by bottom-set gill nets, the traditional fisheries has also been playing a considerable role in the export trade.

In spite of the important role played by the traditional fisheries sector, the socio-economic situation of the fishermen residing in the coastal fishing villages is poor due to several factors such as lack of feeder roads, chain of ice plants, provision of Institutional finance for purchase of inputs, regulated markets, etc. This sector suffers also partly due to the conservative approach of the traditional fishermen. Further, while the estimated potential of marine fisheries is 4 lakh tonnes, the existing marine production is about 1 lakh tonnes. There is thus a wide gap providing an opportunity for further exploitation of inshore waters. This would be possible to a large extent by developing traditional fishing. There is therefore, considerable scope for improving the status of the fishermen by undertaking extension work on a large scale by introducing and demonstrating diversification of fishing gear, improvements in processing of fish and provision of feeder roads, drinking water, housing and medical facilities.

THE AVERAGE FISHERMAN

The fisher folk of Andhra Pradesh can be classified broadly into inland and marine fisher-

men. While for inland fishermen fishing is only a subsidiary occupation, the fishermen living in coastal fishing villages depend totally on fishing for their livelihood. The coastal fishermen generally live in clusters of huts made of palmyrah or coconut leaves or 'dubbu' or 'jammu' grass. The huts are generally round in shape and put up in a disorganised way and ill-ventilated. The entire family lives in a hut which serves all purposes such as cooking, storing, eating and sleeping. Tribal leadership is still in vogue in fishermen community. The 'pettandars' or leaders in each village generally control the life in the whole fishing village with customary rights and powers vested in them. Their presence will be witnessed during the religious functions and social meetings. Due to unhygienic conditions prevailing, occurrence of epidemics is common which is attributed by the fishermen to the displeasure of God or Goddesses for which sacrifice will be offered by them.

Most of the coastal fishing villages are not connected to the main arteries of communication and are even deprived of electricity and drinking water facilities. Lack of communications has placed the fishermen in a disadvantageous position in regard to selling of their catches. However laying of feeder roads and provision of electricity and water facilities figure now under various developmental programmes and it is hoped that this major handicap will be removed in course of time.

FISHERY RESOURCES AND FISH PRODUCTION

The number of marine fishing villages, coastline and fishermen population are given in Table 1.

TABLE 1. *Coastline, number of fishing villages and fishermen population in the coastal districts of Andhra Pradesh*

District	Coastline (km)	Fishing villages	Fishermen population	Active fishermen
Srikakulam	192	109	57,187	13,972
Visakhapatnam	160	74	54,259	15,998
East Godavari	174	72	39,315	11,657
West Godavari	32	9	8,040	1,160
Krishna	80	29	14,696	4,413
Guntur	42	16	19,552	5,493
Prakasam	102	45	22,102	6,182
Nellore	200	54	22,319	5,717
Total	982	408	2,37,470	64,592

The fishing activity in the State is influenced to some extent by the south-west monsoon from June to September and the north-east monsoon from October to December. But unlike the West Coast, the south-west monsoon manifests in the from of a few cyclonic spells lasting for about 3 to 4 days only. Though cyclonic weather renders marine fishing impossible for about 40 to 50 days in a year, fishing is not stopped for long stretches in any part of the year.

The dominant marine fishery of the State is pelagic constituted by ribbon-fish, seer fish and other clupeids. The demersal fisheries consist of elasmobranchs, cat fishes, sciaeniads, *Leiognathus*, *Gazza* and perches. The major fishing season is January to April. The data on exploratory fishing reveal that in the matter of potential yield of demersal fishery wealth, the upper east coast has a stock of 4.26 tonnes per sq.km. The potential yield of the State is estimated at 4,06,800 tonnes.

The total fish production of Andhra Pradesh during the period from 1974 to 1977 is given in Table 2.

TABLE 2. *Fish production in Andhra Pradesh (Figures in tonnes)*

Marine fisheries	1974	1975	1976	1977
a. Traditional fisheries	1,49,289	1,45,972	1,18,953	73 805
b. Mechanised craft	9,529	9,666	12,368	26,951
Total	1,58,818	1,55,638	1,31,321	1,00,756
Inland fisheries	99,733	94,943	1,04,339	1,19,013
Grand total	2,58,551	2,50,581	2,35,660	2,19,769

The catch composition (percentage) of marine fish landings in 1977 in the State is given in Table 3.

TABLE 3. *Catch composition of marine fish landings in 1977.*

S. No.	Name of fish	Percentage
1.	Elasmobranchs	6.4%
2.	Eels	0.4
3.	Cat-fishes	5.6
4.	*Chirocentrus*	1.2
5.	a. Lesser Sardines	10.9
	b. Other Hilsa	1.6
	c. *Anchoviella*	8.9
	d. *Thrissocles*	1.4
	e. Other Clupeids	2.3
6.	a. *Harpodon nehereus*	0.9
	b. *Saurida & Saurus*	0.9
7.	*Hemirhamphus & Belone*	0.1
8.	Flying fish	0.1
9.	Perches	2.7
10.	Red Mullets	0.3
11.	Polynemids	0.7
12.	Sciaeniads	10.1
13.	Ribbon fish	8.5
14.	a. *Caranx*	3.9
	b. *Chorinemus*	0.6
	c. Other carangids	0.1
	d. *Coryphaena*	0.1
15.	a. *Leiognathus*	5.9
16.	*Lactarius*	1.1
17.	Pomfret	2.5
18.	Mackerel	1.0
19.	Seer fish	3.2
20.	Tunnies	0.4
21.	*Sphyraena*	0.1
22.	*Mugil*	0.2
23.	Soles	0.7
24.	a. Penaeid prawns	4.7
	b. Non-penaeid prawns	6.5
	c. Crabs and other crustaceans	0.7
25.	Cephalopods	0.4
26.	Msicellaneous	4.9

FISHING CRAFT AND GEAR

The traditional small-scale fishing fleet on the coast is given in Table 4. (Source: Departmental Census, 1977).

TABLE 4. *Strength of fishing fleet engaged in Small-scale fisheries*

Craft	*No.*
Nava	1,165
Catamarans	18,132
Kakinada type boat	4,184
Big sail boats	109
Small sail boats	672
Total	24,262

Gear	*No.*
Shore seine	1,471
Bottom gill nets	6,480
Nylon gill nets	16,676
Drag nets	5,729
Gill nets	18,543
Drift nets	1,187
Bag nets	159
Hooks & lines	2,587
Boat seine	1,481
Others	11,265
	65,578

A brief description of indigenous craft and gear employed in Andhra Pradesh is given below:

Catamarans: It is a keelless craft of about 21 to 24 feet in length and constructed with a wood of *Albizzia stipulata* (Royya wood). In view of the shortage of this particular suitable wood, the fishermen are constrained to use the wood of other trees. It consists of 2 main logs and 2 side logs. All these logs are cut into boat shape and tied together with rope. Two mango planks are tied on either side of the craft to give a perfect boat shape. It costs Rs. 1,000 to Rs. 3,000 depending on the size.

Stitched boat: This is also a keelless boat. It is constructed with planks, stitched together with palmyrah leaf fibre, keeping a continuous rope in between the seams. This gives the boat sufficient elasticity to compensate for lack of strength and in view of its lightness it can cross the surf and land on the beach. It has a mast and sail. The length of the boat is 25' to 30' and breadth ranges from 4'6" to 8'6" depending upon its use for gill net fishing or boat seine operation respectively. The cost varies from Rs. 2,000 to Rs. 6,000.

Kakinada nava: A keelless boat of about 35' in length (2 to 3 tonnes capacity) made of teak-wood and carvel built. It costs about Rs. 4,000 to Rs. 8,000 and is used for drift net, set net, stake net and shore seine fishing.

The traditional tackle mostly used in this area are shore seine, boat seine, gill nets fabricated with nylon yarn and cotton yarn. The material used and fish caught by these tackle are given in Table 5.

TABLE 5. *Particulars of marine fishing nets*

Gear	Material used	Season of operation	Fish caught
Boat seine	Cotton	September to April	Jew fish *Lactarius*, pomfret, prawns, etc.
Shore seine	Cotton 20 count	November to Febuary	Prawns, jew fish, cat-fish, ribbon-fish etc.
Gill nets	Nylon yarn	Throughout the year except in bad weather	Prawns, pomfrets, seer, *Hilsa*, sardines.
Cotton gill net	Cotton yarn	Throughout the year	*Hilsa*, sardines, seer, pomfret etc.

LANDING AND BERTHING FACILITIES

There are 253 fish landing centres along the coast of Andhra Pradesh and most of them do not have any shore facilities. Smaller fishing craft like catamarans, small navas and stitched boats manoeuvre through the surf and land on the open beach. The big navas and mechanised boats conduct fishing at place where no landing is possible and their catch is transferred to catamarans and brought to shore for disposal. Where rivers and streams enter the sea, boats operating in the inshore waters, enter the river mouth and land the fish on the banks. While smaller crafts do not have much difficulty in negotiating the bar, larger boats (Navas) have to wait for the high tide before entering into the river mouth.

At present Visakapatnam and Kakinada are the only two fishing harbours in the State suitable for use by mechanised fishing vessels. Visakapatnam is India's fifth largest commercial port on the east coast between Paradeep (Orissa) on the north and Madras (Tamilnadu) on the south. Plans were drawn up to construct a fishing harbour in two stages; with stage-I to handle 150 numbers of 10 metre fishing vessels and 15 numbers 23 metre trawlers, and stage II to handle 250 numbers of 10 metre mechanised fishing vessels and 30 trawlers. The work on the first stage was started in 1974. The

Government of India has approved the second stage harbour at Visakapatnam at a cost of Rs. 630.50 lakhs with World Bank assistance.

The present Kakinada fishing harbour is about 6 km from the sea on the Commercial Canal which extends to the centre of Kakinada city. The entrance to the Commercial Canal is sheltered by a large natural breakwater known as Godavari point which almost encircles Kakinada Bay. The present fishing harbour is located on the southern Commercial Canal in a densely populated area close to the heart of the city and it can accommodate about 75 numbers of 10 metre mechanised fishing vessels. Since the mechanised vessels operating regularly from this centre has increas d to 300 there is congestion resulting in traffic hazards in Commercial Canal. Realising the importance of Kakinada as a major fishing centre and also the technical and economic feasibility, proposals for expansion of the fishing harbour were sent to the World Bank which has cleared the project (stage-II) costing Rs. 460.00 lakhs.

At present there are no fishing harbours south of Kakinada suitable for regular use by mechanised fishing vessels. As a result of construction of 3 groynes with indigenous materials at Nizampatnam the bar showed signs of stabilisation and about 115 seiling vessels which go for fishing voyages of 4-5 days duration are using the existing facilities. In addition, 25 numbers of 9-metre fishing vessels are also being operated from here taking advantage of the bar conditions. The World Bank has also cleared a Project costing Rs. 77.00 lakhs for construction of fishing harbour at Nizampatnam which will provide additional landing and berthing facilities for 60 mechanised boats and 60 non-mechanised boats.

The Government of India recently sanctioned construction of fishing harbour at Bhavanapadu which, when completed, would provide landing and berthing facilities for 200 mechanised boats.

TRAINING AND RESEARCH

Fisheries Training Institute, Kakinada: This was established by the State Government in the year 1958. Fishermen having 5 years of sea-going experience and possessing a minimum educational qualification of 7th standard are admitted in the Institute for training in fishing methods, gear technology, elementary principles of navigation, operation and maintenance of internal combustion engines. The duration of the course is 12 months. Seventy-five candidates representing mostly coastal districts, are recruited for each batch and each candidate is given a stipend of Rs. 75 per month. So far the Institute has trained 733 fishermen who are qualified to drive small mechanised fishing vessels. The trained candidates are being given preference in allotment of mechanised boats.

Prawn Breeding Unit, Kakinada (I.C.A.R Unit): This Unit is working on the possibilities of prawn breeding in confined waters so that prawn culture can be taken up on extensive scale.

Central Institute is of Fisheries Technology, Kakinada Unit: This a Central Institute working on evolving suitable gear designs for this region.

Brackishwater Fish Farm of C.I F.E. at Kakinada: This is working as a unit of Central Institute of Fisheries Education and is being made use of both for training of the Institute's candidates and for development of new techniques in brackishwater fish farming.

Brackishwater Fish Farm of A.P., Agricultural University at Kakinada: This was established in the year 1976. It is a State scheme partly financed by I.C.A.R. and has been transferred to the Agricultural University

Cetral Marine Fisheries Research Institute, Waltair and Kakinada Research Centres: These centres are engaged in several aspects of marine fisheries research along the Andhra coast. The centres also carry out researches on mariculture.

Exploratory Fisheries Project, Vizag Base: This is a Central organisation conducting experimental fishing in the offshore waters along Vizag coast.

Department of Marine Sciences, Waltair: A separate department was started for marine sciences in the Andhra Unniversity. The Department has a unit of Oceanography.

ANDHRA PRADESH FISHERIES CORPORATION

The Andhra Pradesh Fisheries Corporation which was established in 1974 under the Companies Act (1958), with headquarters at Kakinada, intially took over the physical assets i. e., Boat Building Yard, Ice Plants and Cold Storages, a Canning Plant and trawlers from the Department of Fisheries. A brief account of the Andhra Pradesh Fisheries Corporation's main activities is given below:

Boat Building Yard, Kakinada: The yard has a designed capacity to build 60 boats per year in the 10 to 12 m size range. There are 233 workers employed in the yard. Since its transfer to the Corporation, 229 boats have been constructed till the end of August, 1978.

Freezing Plant, Visakhapatnam: The plant which went into production in 1976 has a capacity to freeze 4 tonnes of shrimps per day and a storage capacity of 50 tonnes. The Corporation exported about 508.75 tonnes of frozen shrimp valued at Rs. 219.65 lakhs to Japan and the U. S. A. till the end of June, 1978. A second freezing plant of the same capacity is being established at Kakinada.

Ice Plants: Ice Plants are run by the Corporation in Visakhapatnam (20 t), Nellore (10 t), Padala (5 t) and Hyderabad (2 t) and a new plant of 10 tonnes per day at Kakinada is nearly completed.

Cannery, Kakinada: The cannery has an installed capacity to produce 1000 numbers of 4-lb cans per shift.

Fishing Gear Unit, Kakinada: The unit was established in February, 1975 with the main object of creating employment opportunities for fisherwomen. It is employing 30-80 people for manufacturing gill nets and trawl nets.

Fishing Operations Unit: The fleet consists of 18 trawlers in the size range of 9-13 metres in length and two Mexican trawlers. These vessels are operating from Kakinada and Visakhapatnam.

Marketing: The Corporation operates retail fish stalls in Hyderabad, Vijayawada, Eluru and Guntur where mainly marine fish is marketed.

Diesel oil out-lets, Visakhapatnam and Kakinada: These out-lets were opend to supply diesel oil, lubrication oil, grease, etc. required for day-to-day running of mechanised boats at reasonable rates.

FISHERIES CO-OPERATIVES

Andhra Pradesh has 1182 Fishermen Cooperative Societies out of which 656 are in the coastal districts, the details of which are given in Table 6.

TABLE 6. *Details of Fishermen Cooperative Societies in Andhra Pradesh*

	Societies	Members	Share Capital
	(Nos)	(Nos)	(Rupees)
Fishermen Coop. Societies	647	71,877	8,17,680
Primary Fishermen Marketing Coop. Societies	5	3,572	57,041
District Fishermen Marketing Coop. Societies	2	89	1,14,525
Central Fishermen Coop. Societies	2	576	7,59,475
Total	656	76,114	17,48,721

The formation of Cooperative Societies in the Fisheries Sector started even prior to Independence with a view to making the members (fishermen) eligible for obtaining subsidies on cotton and nylon yarn. Now the Government have issued orders giving preferential treatment to Fishermen Cooperative Societies in the matter of lease of water resources.

In the year 1960, a Central Society for Andhra region known as Andhra Fishermen

Central Cooperative Society Ltd with headquarters at Kakinada was registered. The area of this Central Society covers all the Districts of Coastal Andhra and Rayalaseema. The membership of the society is as follows:

Government	:	1
Primary Fishermen Cooperative Societies	:	252
Associated members	:	284

The business of the Society is distribution of cotton and nylon yarn and other fishery requisites to coastal fishermen. It is also implementing mechanisation schemes with 45 mechanised boats with the assistance of A. R. D. C. A Deputy Director of Fisheries is the Managing Director and the District Collector, Kakinada is the Chairman of the Society.

At the District level the Assistant Directors of Fisheries act as ex-officio Deputy Registrars; at Zonal level the Deputy Directors of Fisheries act as ex-officio Joint Registrars and at the State level the Director of Fisheries act as ex-officio Registrar of Cooperative Societies.

HANDLING AND DISTRIBUTION

Majority of the traditional fishing crafts do not carry ice on fishing trips as they generally go for one-day trips. Save big trawlers, the mechanised fishing vessels (upto 12 metres) too conduct daily fishing. It is not customary for indigenous boats to take ice for their daily trips. As prawn is fetching a high price now due to the high demand from the exporters, a few boats are taking ice on board to ensure better quality of prawns. In certain places like Nizampatnam, Guntur district, where fishermen go out in country boats (Kothapalem Nava) for voyage fishing with gill nets for 5 to 6 days, salt is taken for curing the fish on board the vessels.

The fish catches are landed mostly on beaches at different landing centres. There is no system of poo'ing of catches of different landing centres for transport to any wholesale market. Actually the fish, immediately after it is landed, is disposed of to the merchant or their agents waiting at the landing centres either at negotiated rates or in auction.

PROCESSING

About 70% of the fish caught in Andhra Pradesh is either salt-cured or sun-dired and disposed of in weekly shandies. The fish curing methods with salt, especially the proportion of the salt to be used for different varieties of fish, are known to the fishermen community and curing of fish is widely practised in all the fishing villages. The fish processing capacity available in the State is as follows:

		Public Sector	*Private Sector*	*Total*
Ice production	:	50 t/day	88 t/day	138 t/day
Ice & fish storage	:	200 t	63.5 t	263.5 t
Freezing	:	4 t/day	22 t / day	26 t /day
Frozen storage	:			865 t

The frozen prawns are exported from Visakhapatnam Port.

There is one Shark Liver Oil factory in the Cooperative Sector in Kakinada. It is engaged in production of shark liver oil capsules which are distributed to various Government Hospitals in Andhra Pradesh and other organisations. There is no fish meal plant in Andhra Pradesh.

EXPORT

The development of marine exports from the State has gained momentum from the year 1971. Prawns caught in the sea of the State's coast were not being directly exported till October, 1971 from the ports of Andhra Pradesh due to various reasons, the most important of which was that cargo ships with refrigerated holds were not calling at Visakhapatnam Harbour. Of late the exports from the ports of Andhra Pradesh have increased considerably. The exports of frozen prawns by processing firms during the period 1971-77 are given in Table 7.

TABLE 7. *Exports of frozen prawns from Andhra Pradesh.*

Year	Quantity (tonnes)	Value in Rupees (in lakhs)
1971	104.59	23.53
1972	635.02	165.25
1973	708.05	221.41
1974	760.08	250.65
1975	1,355.36	600.30
1976	1,802.19	980.75
1977	1,775.50	885.32

MARKETING

The fishermen operating at different landing centres have iittle or no organisation of their own to protect their interests. They are illiterate, poor and conservative without much of bargaining power for their products. They often play into the hands of money lenders who in most of the cases are middlemen trying to exploit the helpless conditions of the fishermen. At every place where money lenders operate, either they or their agent collect the catches from the fishing units to which they have advanced money to the extent of Rs. 1,000 to Rs. 5,000. Generally these people pay to the fishermen about 25–35 paise less per kg for fish and Rs. 1.00-2.00 less per kg for prawns than the prevailing market rate.

There is normally no question of disposal of all the fish landings of any centre by auction. The traders who purchase the fish regularly from the fishing units financed by them establish procurement centres/godowns from where they arrange the transport of fish. Sometimes there may be many procurement centres at one landing place. From these centres the fish is taken by headloads/cycles/buses/lorries to different places for distribution to consumers. The mode of transport mostly depends on the total quantity available for transport from the landing centre. While the retail merchants who take the fish from landing centres may not pay much attention for use of ice for transport of fish, others, who transport their fish to far off places like Calcutta, Tatanagar, Rurkela, Orissa, Hyderabad, etc. invariably use ice for packing their fish even at the procurement centres.

Nearly 70% of the fish is either salt-cured or sun-dried and is disposed of in dry fish shandies. These shandies operate once in a week, the important shandies being Nagayalanka Pathapadu, Dhowleswaram, Tadepalligudem, Kakinada, etc.

Middleman is not only a money-lender but a business man too and maintains the link between producer and the consumer. The poverty of the fishermen is one of the destabilisers in fishing industry. To maintain himself in the off-season and for making huge investments on inputs required for fishing, the fishermen have to approach a money-lender who, mostly in his own interest, takes the risk of financing the poor fishermen for pursuing his profession. Unlike cooperatives, the middle-men advance money to fishermen not only for inputs but also for his day-to-day needs and transport of fish catch. To ensure that the money invested by him is returned, the middlemen undertakes the responsibility of the sale of fish landed by the loanee, by no doubt undertaking all the difficult tasks involved in transport and sale of the highly perishable product. It may perhaps be said that most of the fishing is financed and maintained by the middlemen although the latter to a great extent compensate the risks by exploiting the fishermen to his advantage.

FISHERIES ADMINISTRATION

The Department of Fisheries is mostly responsible for development of fisheries in the State as also improving the economic conditions of the fishermen. It is an independent department under the control of the Forests and Rural Development Department. At the headquarters, the Director of Fisheries is assisted by an Additional Director of Fisheries, Joint Directors of Fisheries, Deputy Register of Cooperative Societies, Accounts Officer and other officers. Andhra Pradesh is one State where Fishermen Cooperative Societies play a vital role in the development of fisheries and the Director of Fisheries has been vested with the powers of the Register of Cooperative Societies in so far as Fishermen Cooperative Societies are concerned. At the regional level the Director of Fisheries is assisted by six Deputy Directors of Fisheries each one being in-charge of a zone consisting of a few districts. The Deputy Directors of Fisheries supervise and coordinate the activities of the Assistant Directors who are district level officers The Assistant Director is assisted by field

officers such as Inspectors of Fisheries, Research Assistant, Assistant Inspectors of Fisheries, Fieldmen, etc.

CONCLUSIONS

Keeping in view the existing status of small scale fisheries as discussed in the earlier chapters and the scope and need for developing this sector, action on the following aspects is considered necessary for the development of the traditional fisheries.

1. a. Provision of feeder roads connecting the fishing villages to the existing main roads.

   b. Repairs to the feeder roads already laid under various programmes and entrusting their maintenance to the Zilla Parishads.

It is desirable to connect a cluster of fishing villages to each other and connect the main village by a feeder to the existing main road.

2. Provision of houses which can withstand cyclones. They may be specially designed adopting the cheapest and suitable design and subsidies may be granted to the fishermen for owing the houses.

3. Provision of drinking water facilities to each fishing village.

4. The fishing inputs may be supplied through Government agencies so that the fishermen may get the required quantities at any time they need instead of depending on different merchants for the supply of material, who partly exploit the fishermen by charging exhorbitant rates.

5. Extension services may be strengthened by differnet means such as audio-visual pamphlets, personal contacts, etc. for taking advanced techniques developed in different research stations to the fishermen proper.

6. Experimental and demonstration units may be set up for diversification of fishing methods.

7. Provision of training facilities to fishermen.

8. Efforts should be made to provide Institutional finance to the fishermen through Banks on personal securities only. This will help in eliminating middlemen influence on the fishermen community to a considerable extent.

MARINE FISHERIES OF ORISSA

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INTRODUCTION

The coast of Orissa stretches to a length of 480 km with a continental shelf area of 25,000 sq. km. The sea off Orissa is rich in pelagic and demersal fishes. Prior to 1957, the entire marine fish catch was produced by the traditional fishing. However, with the introduction of mechanised fishing vessels and establishment of infrastructural facilities, considerable progress has been made in the marine fisheries sector of the state.

POTENTIAL RESOURCES

The Indian Institute of Foreign Trade estimated an exploitable fish stock of 60,000 tonnes within the 40 fathom depth zone. Beyond this region, the potential resources has not yet been assessed. Nevertheless, it is indicated that about 60,000 tonnes of fishes are available in the offshore waters and deep sea off Orissa. The exploited marine fish production of this State in 1975-76 was of the order of 21,000 t and in 1977-78 it increased to 28,000 tonnes. The exploited fish production thus forms about

23.3 percent of the estimated total annual potential resources of 1,20,000 tonnes.

PRESENT STATUS OF THE MARINE FISHERIES

Fishing crafts

About 6,000 non-mechanised boats operate along the coast of Orissa. They realise about 18,000 tonnes of fishes and contribute to 64% of the total marine fish catch of the state. There are 391 mechanised fishing vessels, consisting of 126 gill netters and 265 wooden trawlers. The catch from the mechanised boats is about 10,000 tonnes which forms about one-third of the total catch. In general, the coastal waters of Orissa remain under-exploited.

Fishing season and the fishery

Orissa coast can be divided into two regions depending on the contour of the coast line and availability of fish. Balasore coast, which is in the north, is very shallow. This coast is predominant in pelagic fisheries such as *Hilsa*, silver and black pomfrets, Indian salmon, seer fish and cat-fish. Small mechanised boats of 30' to 32' length with gill nets of 5,000' length, 30' width having 4 to 5" mesh size are operated in this region. The coast of Cuttack, Puri and Ganjam districts covering the central and southern regions, is relatively deep and is suitable for trawling. Here 32' to 42' long wooden vessels, fibreglass boats and 57' steel vessels are in operation. The catch is mainly composed of prawns, sciaenids, pomfrets and other bottom fishes. These vessels are now operating mainly from Paradeep port covering an area of 800 sq. km up to a depth range of 20 fathoms.

The marine fishing season starts after monsoon and extends up to March. The peak period for the pelagic fishery in the northern region is from August to October; in the central and southern region, October to December is the main season for the demersal fishery. Since the coast is subject to heavy storms and cyclones almost every year, the average fishing days in an year is about 200.

In 1974-75 the marine fish landings were constituted by *Hilsa* (40.32%), pomfrets (7.92%), seer fish (6.04%), cat-fish (23.6%) and sharks and skates (6.68%); other fishes encountered in the catches were sciaenids, perches, and thread-fins. Table 1 gives the species composition of the catch in the gill nets.

TABLE 1. *Catch composition (in percentage) of the landings by gillnetters in Orissa.*

	1975-76	1976-77	1977-78
Hilsa spp.	46.50	25.24	10.63
Pomfret	13.00	30 82	50.00
Seerfish	4.50	8.46	5.86
Cat-fish	13.00	13.51	18.80
Sharks & skates	4.00	4.20	2.30
Sciaenids and perches	19.00	17.77	12.41

The percentage composition of the important varieties of fishes landed by the trawler is given in Table 2.

TABLE 2. *Catch composition (%) of the landings by trawlers*

	1974-75	1975-76	1976-77	1977-78
Prawns large	7.10	1.60	0.73	1.50
,, medium	13.48	6.80	1.78	7.00
,, small	2.40	3.00	4.63	9.70
Pomfrets	2.50	5.30	2.31	2.30
Miscellaneous	74.60	83.80	90.55	79.50

The central and southern regions of the coast, especially the area between Paradeep and Gopalpur, form a good trawling ground for shrimps. Daily, about a tonne of large sized shrimp is landed by the mechanised boats as well as indigenous crafts. Good trawling ground is also found off Devi River mouth up to Konark, and large quantities of exportable shrimps are available in this region.

The mechanised boats operate from six important bases along the coast (Table 3). However, above 66% of these boats are based at Paradeep port. Steel trawlers operating at 15-20 fathom depth region land mainly prawns (13.4% of the catch) sciaenids (28%) pomfrets (10%) and sharks, rays and skates (29.6%).

TABLE 3. *Number of mechanised boats operating from different bases along Orissa coast.*

Base	No of boats operating from the base	
1. Kirtania	10	(Gill netters)
2. Chandipur	107	-do-
3. Dhamra	7	-do-
4. Rushikuliya	2	-do-
5. Paradeep	260	(Trawler)
6. Astrang	5	-do-

Processing and preservation Facilities

Recently 4 ice plants and 2 freezing plants with frozen storage facilities have been established near Paradeep. The Marine Products Export Development Authority have proposed to construct a 200 tonne frozen storage here.

There are 12 processing plants having a total capacity of 57 tonnes. Export of fishery products from the State started in 1969, and during the last 9 years, the quantity of marine products exported has gone up from 4.18 tonnes to 2075.93 tonnes (Table 4).

TABLE 4. *Quantity and value of the fishery products exported from Orissa*

Year	Quantity in tonnes	Value (Rs. lakhs)
1969-70	4.18	—
1970-71	61.56	—
1971-72	179.08	50.72
1972-73	375.51	94.63
1973-74	391.80	116.28
1974-75	823.00	241.49
1975-76	1063.00	450.00
1976-77	2075.93	1137.73
1977-78	1847.90	728.38

Fishing harbour

Berthing and landing facilities are at present available at Chandipur and Dhamra. It is proposed to provide such facilities at Hansua, Rushokulya, Adhwan, Kasafal, Balitutha and Kirtania. Work on fishing harbours at Astrang Paradeep and Gopalpur will be started soon.

Other infrastructure facilities

There are 12 boat building yards in the State with a total construction capacity of 200 boats. There is also a nylon net making plant, and one more plant is proposed to be established soon.

Financing of fishery projects

The Orissa State Finance Corporation is the main financial Institute providing assistance to fisheries projects in the State. This Institute has so far sanctioned an amount of Rs. 4.5 crores mainly for procurement of boats. Other financial Institutions have also sanctioned substantial amounts for acquisition of mechanised boats.

STATUS OF SMALL-SCALE FISHERIES IN THE UNION TERRITORY OF ANDAMAN AND NICOBAR ISLANDS

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INTRODUCTION

The Union Territory of Andaman and Nicobar Islands is a group of about 224 islands lying in the south-eastern part of Bay of Bengal, about 1200 km away from the east coast of mainland of India, between 6° and 14° North latitudes and 92° and 94° East longitudes. Geographically these islands are divided into two main groups *viz.*, the Andaman Group of Islands and the Nicobar Group of Islands, separated by the 10° channel. The total land area of the islands is approximately 8293 sq.km with a coastline of about 2000 km including creeks, islets and estuaries.

Awareness of fishery potential in the seas of Andaman and Nicobar Islands and its proper utilisation through developmental programmes is very recent. Little attention was paid to the availability of these vast resources before. and the year 1949 witnessed the birth of the first Fisheries Research Unit at Port Blair. But the pace of development remained slow.

The regions around the Andaman and Nicobar Islands remained the least studied area for potential fishery resources of the country The Fisheries Research Unit was converted into a Development Unit in 1955 under the direction of a Fisheries Development Officer, who was responsible for initiating and implementing the fisheries developmental activities under the Five Year Plan schemes

Before 1961 the Fisheries Department was under the charge of the Deputy Commissioner and as such implementation of the Fisheries Development Schemes was his direct responsibility through the Fisheries Development Officer. The Fisheries Department was declared as an independent office in 1961 with the Fisheries Development Officer as Head of the Office. The department was again up-graded to the level of Directorate in 1975 and a Director of Fisheries was appointed.

These islands, the natural home of certain primitive tribals, had no traditional fishery in the pre-Plan period in the absence of professional fishermen. The aboriginals catch fish by using bow and arrows and the tribal people of the Nicobar Islands use spear with one or more barbs. Apart from the tribals who are not professionals in the sense that they do not fish for profit, there is no endemic communtity of fishermen in these islands. The Government initiated a fishermen settlement scheme under which fishermen mainly from the southern States of India were brought to the islands. There has also been some voluntary migration of fishermen from Andhra Pradesh.

FISHERIES DEVELOPMENT

No fisheries schemes were drawn or implemented in the First Five-Year Plan. It was only during the Second Plan that 5 fisheries schemes *viz.*, mechanisation of fishing boats, introduction of improved types of fishing gears, expansion of office and laboratory, loans to fishermen and Fishermen Cooperative Societies and establishment of fish curing yard were drawn up and put for implementation.

During the Third Plan period emphasis was laid on settlement of fishermen families, training of fishermen in the various fisheries institutes in the mainland, supply of fishery requisities on subsidy basis, supply of ice and provision of storage facility. During the Fourth Plan, apart from the schemes which were continuing from the earlier Plan, new schemes such as training of department personnel, survey and and development of shell fishing, survey of fishing grounds and organisation of Fishermen Cooperative Societies were taken up.

During the Fifth Plan period a total provision of Rs. 102 lakhs was approved for implementation of 11 schemes as detailed below:

1. Inland Fisheries Development.
2. Survey of Fishing Grounds.

3. Setting up of a Fishermen Training Centre at Port Blair.
4. In-service training to Department personnel.
5. Strengthening of Department of Fisheries.
6. Fisheries Extension Centre at Car Nicobar.
7. Settlement of Fishermen Families.
8. Supply of essential fisheries requisities.
9. Organization of Fishermen Coop. Societies.
10. Mechanised Fishing in Andamans.
11. Settlement of floating fishermen and dependents of fishermen settlers.

Out of the population of 1,15,133 (as per 1971 census) the fishermen population is estimated to be about 980 only out of which about one third are part-time fishermen and two thirds are professional fishermen. They are engaged only in inshore fisheries with small dinghies and canoes and run a subsistence type of fishing. Small gill net, beach seine, anchor nets, cast nets and hooks and lines are used by these fishermen for fishing. Mechanised fishing in these islands is only of recent origin (1976) when the Department of Fisheries acquired 7 numbers of 36 ft fishing boats from mainland.

In April, 1976, a Fisheries Expert Team of Government of India visited these islands to study the possibilities of exploitation of its vast fishery resources The team has recommended setting up of a Tuna Fisheries Project at Campbell Bay in Great Nicobar, the southernmost island, for exploitation of tuna and tuna-like fishes on commercial basis and to undertake various development projects in different parts of these islands. Taking into consideration the various recommendations of the Expert Committee, a new and more scientific orientation has been given to the fisheries development plans. Twenty-one schemes have been formulated for the Sixth Fiva-Year Plan period with a total outlay of about Rs. 36 crores. A Fisheries Development Corporation has been proposed to be set up in these islands for which a project report has already been submitted to the Government of India. A Boat Building yard for Andamans has been proposed for which also the project report has been submitted to the Government of India. Other schemes include introduction of more numbers of medium sized fishing vessels, fitting of outboard engines in non-mechanised boats, supply of equipments for the exploitation of marine fisheries on subsidy basis, introduction of aquaculture, training in fisheries, shark liver oil extraction, processing, storage and msrketing, supply of oil and potable water at fishing centres, survey and research, service station for repairing fishing vessels, settlement of fishermen families and setting up of an aquarium in Port Blair. A reconnaissance survey has been conducted by the Pre-investment Survey of Fishing Harbours, Bangalore in 1977 for setting up of a fishing harbour in Great Nicobar. They have submitted a project report to Government of India and it is under consideration. By the implementation of these schemes it has been estimated that the annual production of fish will go up to 8590 tonnes per annum from the current fish landings of 1500 tonnes.

A small percentage of fishermen are also engaged in catching of prawns and collection of *Beche-de-mer*, oysters, clams, lobsters, crabs, seaweeds and sea shells. Most of the crustaceans caught are consumed locally while seaweeds, *Beche-de-mer* and shells are mainly shipped to mainland.

A landing jetty of 231 m length was constructed with a total cost of Rs. 67.18 lakhs at Phoenix Bay, Port Blair by the Ministry of Agriculture and Irrigation. This jetty is being used for berthing of fishing vessels. Apart from this, a small jetty with anchorage facilities is also available at Port Blair for anchoring the country crafts. Programmes are also under-way for the construction of a building for processing and storage facilities near the jetty.

At present, the fish catches are sold locally in the market through the hawkers, fish merchants/contractors and Fisheries Cooperative Marketing Federation. In the VI Five-Year Plan, it is proposed to organise home marketing and inter-island supply of fish with the procurement of insulated vans and carrier boats with refrigerated holds and installation of fish stalls.

Non-mechanised boats are built locally by a few boat builders and private entrepreneurs. Also there are three boat building yards belonging to Marine and Forest Depariments of these islands. No gear fabrication plant is available. The twine and webbing are purchased from

mainland factories and supplied to fishermen by the Department of Fisheries. Small gill nets, cast nets and other seine nets are fabricated by hand by the local fishermen.

There are about a dozen fishing villages in the islands but are not as organised as on the main land. In line with the programme for giving more encouragement to local inhabitants to come forward for commercialising mechanised fishing each of the two Cooperative Societies formed by the fishermen will be provided with a 36 ft boat under the scheme of subsidy-cum-hire purchase. No individual fishermen own mechanised boats. About 480 fishermen are having country crafts. The income of these fishermen ranges from Rs. 4000 to 5000 per annum. The Department is taking every possible action to settle the floating fishermen in a proper area where the basic amenities will be provided.

Fishing boats are supplied to fishermen and their Cooperative Societies on 70% subsidy-30% loan which would be refunded in 64 instalments during the course of 8 years' time. Fishing equipments are also supplied to fisherman on 60% subsidy. Two hundred fishermen families have been proposed to be settled by giving them house sites and financial assistance, of Rs. 4000 per family out of which 50 per cent is grant and 50 per cent loan. Processing, marketing and repair facilities are being provided under one of the schemes. Emphasis has been laid for giving professional fisheries training in various disciplines to the local qualified youths and fishermen. A Fishermen Training Centre has been established at Port Blair in 1977 with an intake capacity of about 30 trainees. Local youths from the two main groups of Andaman and Nicobar Islands will be trained at this centre. A few are also sent every year to the mainland institutions for fisheries training. Candidates were sent to Lakshadweep for training in tuna pole-and-line fishing. A Fisheries Development Corporation is likely to be set up in Andaman and Nicobar Islands.

Fishing in these island comes under the Fisheries Regulation 1938. Under this Regulation fishing without licence, which is issued by the Department of Fisheries, is an offence. Fishing has been restricted in tribal areas where the oboriginals are residing. Shell fishing grounds are auctioned at present once in two years under the Shell Fishing Regulation for collection and selling of shells of *Turbo* and *Trochus* from the islands to the mainland of India. There also thrives a local shell craft industry based on these shells.

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PRESENT STATUS OF SMALL-SCALE FISHERIES IN LAKSHADWEEP

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Lakshadweep waters, extending over an area of one lakh square kilometres, are rich fishing grounds. The islands, resembling anchored vessels in the midst of the ocean, supports a population of nearly 35,000 people who are traditional sailors and agriculturists. There are no fishermen communities in these islands in the normal meaning of the word. But there used to be traditional fishing with harpoons for seer fish and shark, and dragnet and gillnet fishing in the lagoons for coral fishes. However, pole and line fishing for skipjack has been in vogue since time immemorial in Minicoy island. Pole and line fishing with mechanised boats has now been introduced to all other islands in Lakshadweep with success. Tuna 'mas' (cooked, smoked and dried) has been the main traditional product from these islands followed by sundried sharks, devil rays etc.

Though Lakshadweep waters have immense fisheries wealth, attention for its development could be paid only after the area was formed into a Union Territory in November 1956. Developmental activities under fisheries have been taken up since 1959 and during the course of nearly 20 years substantial progress has been achieved. Fisheries development started with the establishment of a fisheries section in 1959 under a Fisheries Officer assisted by a few Inspectors of Fisheries. This organisation took up demonstration fishing with mechanised boats and modern fishing implements. Training has been given to island fishermen in mechanised processing and preservation of fish, extraction of shark liver oil etc. Fishery requisites were supplied to fishermen at subsidised cost. The first mechanised boat was introduced in the island in 1959. More boats were added during the subsequent years and at present there are 158 mechanised fishing boats of different sizes, including 145 boats issued to fishermen at subsidised cost.

GENERAL DESCRIPTION OF FISHERIES

There are ten inhabited islands in this Union Territory. The main occupation of the people is agriculture. Fishing used to be a subsidiary occupation limited for the daily consumption. But the facilities made available during the last two decades have changed the conditions. People are now concentrating more and more on fishing. While there were only 545 full time fishermen in 1972 the number has increased to about 2800 now. The increase in fishing population is the result of promotional activities taken up by the Department of Fisheries. The location of new fishing grounds, training of fishermen, issue of mechanised fishing boats and fishery requisites gave the incentive. The fishermen working in private boats get half of the catch as their share and this perhaps is the maximum in the country. The normal fishing season is from September to May. During the rest of the period (south-west monsoon) fishing is confined to only lagoons.

The market for processed fish, which is mainly 'mas' is the mainland, particularly Mangalore, Cannore, Calicut and Tuticorin. Shark fin also is available in substantial quantities for disposal on mainland. Canned tuna produced in Minicoy is sold all over the country and is becoming increasingly popular in the export market. Fish other than tuna is mostly consumed locally in the fresh form. This includes octopus which is very popular.

Fishing Methods

The fishing methods in vogue in Lakshadweep are pole and line fishing for tuna, trolling, long lining, shore seining, cast netting, hand lining, harpooning and torch fishing. Of these methods, commercially important are pole and line fishing, long lining and troll lines.

Pole and line fishing

This method is for catching skipjack and other pelagic tuna. It involves chumming with live bait to attract a tuna shoal towards the boat Barbless tuna hook on a bamboo pole operated amidst the shoal catches tuna individually. In good season fishing can be very brisk and in

half an hour up to 1000 fish is caught. This fishing is very popular in all the islands and bulk of the tuna caught in Lakshadweep is by this method.

Long line fishing

Long lines are operated from mechanised boats for column swimming fishes. Bulk of the catch is sharks, followed by yellowfin and Northern Bluefin tuna. It has been found that Lakshadweep area is very rich in shark resources.

Trolling

This involves dragging individual lines with baited hooks behind a boat. More than 50 mechanised boats operate for trolling. The catch is mainly tuna, followed by seer fish, carangids and Rainbow runner.

Harpooning

Harpooning is practised from olden days mainly for sharks, seer and bill fishes. The gear includes steel chisel attached to coconut pole with a long rope. Harpooning is very efficient in case of Devil Ray (Manta) 'hunting', which lasts for about a month soon after the south-west monsoon.

Torch fishing

This is done during dark nights mainly for flying fish which are spiked when attracted towards boats with torches made of coconut leaves.

Hand lining

Single lines with hooks are popular for yellowfin and other tunas from the deep and for rock cods and carangids around submerged reefs.

Shore seining, Cast nets

Fishing with these gears is done in lagoons for coral fishes and is of minor importance only.

ECONOMIC AND SOCIAL CONDITIONS OF FISHERMEN

The main occupation of the inhabitants of Lakshadweep islands is coconut cultivation. It not only serves as the basic means of livelihood of the people but gives self employment to a large section of the people in copra manufacture, production of jaggery and vinegar and manufacture of coir and coir products. The second in importance is fishing. The isolation of the islands, exploitation by the merchants on mainland, lack of surface communication were some of the main reasons for the poor economic conditions of the islands. Inland commodities used to be taken for disposal on mainland in 'Odams' (sailing) and on return journey essential articles like rice etc. used to be brought. The common people were often cheated by the boat owners who in turn were exploited by the merchants on the mainland. This situation changed after these islands were formed into a Union territory. Co-operative Societies came into existence. Trading and marketing were undertaken by these co-operatives and the exploitation by the middlemen was eliminated. Today the economic condition of the fishing folk has improved to a great extent. The transport and communication facilities have opened up better market for their products. The daily income of fishing boat has risen to the level of Rs. 1000 from the nominal income of Rs.5-10 obtained a few years ago.

FISHERIES DEVELOPMENT SCHEMES

Pole and line fishing

One of the most importment achievements in fisheries in Lakshadweep has been the extension of pole and line tuna fishing to the other islands from Minicoy. In Minicoy, pole and line fishing has been in vogue for centuries, but the same was unknown in the other islands. Instructors from Minicoy were employed for teaching the fishermen in other islands. The introduction of mechanised fishing boats for tuna fishing in place of the traditional sailing craft 'masodi' has been another development. Overcoming the the inherent intial opposition, the mechanised fishing boats have become extremely popular in this field. Compared to traditional boats, the fish landings by mechanised boats have been more than three times. The mechanised boats have now replaced the traditional tuna fishing crafts completely. Some of the newly developed tuna fishing centres have pushed Minicoy back in fish catch and number of boats operated.

Maintenance and repair facilities

In order to provide servicing and repair facilities for the mechanised fishing boats,

workshops have been established in all the 10 inhabited islands, including 4 major workshops in Kavaratti, Agatti, Kadmath and Minicoy.

Demonstration and experimental fishing

To popular fishing with mechanised boats among the islanders, demonstration fishing units were started in different islands. Demonstration fishing combines experimental fishing. These units also give advice to the local fishermen on matters related to fisheries, collect hire charges from boats issued at subsidised cost, issue fishery requisites, salt, oil etc. to the fishermen.

Training

In-vessel training scheme for fishermen was started in the year 1959, paying a stipend of Rs. 30 per month per head. Under this scheme 109 persons have been trained. The training has been institutionalised with the starting of the Fishermen Training Centre at Agatti. This Training Centres gives training to 20 fishermen in a batch and the duration of the course is 10 months. A stipend of Rs.100 is paid per head per month. So far 102 persons have been trained by this centre. Besides the above, 89 candidates have been trained in various training courses on fisheries in different institutions on the mainland.

Boat building yards

To meet the growing demands for mechanised fishing boats in the islands and to provide employment to the locol pepole. two boat building yards have been established. The entire requirements of boats in the Union Territory are met from these yards. These yards are of great importance to the progress in fisheries development in Lakshadweep.

Processing establishments

Processing of fish in the islands was confined to making 'mas' with tuna and sundrying of of other fish. Fish curing using salt was introduced which improved the quality of dried fish. Tuna 'mas' has only a limited market. In order to have a wide market and to enable export it was found necessary to can the tuna and, for this purpose, a Tuna Canning Factory has been established in Minicoy which produces canned tuna of very high quality. An export market has already been established for the product.

Fishery requisites

To make available the essential fishery requisites such as material for gear manufacture, salt for curing, fuel for the boat, and spare parts for the engines, these are stored by the department and issued to the fishermen according to the demand.

Fishermen Co-operatives

Two Fishermen Co-operative Societies are now functioning at Agatti and Minicoy and they are doing fairly well

Harbours

The Island lagoons are protected anchorages for small boats. These lagoons are now deepened for bigger boats. In Minicoy. vessels of about 10 ft draft can enter and anchor safely. Berthing facilities are also being provided in this island. Close to Agatti, natural anchorage is available outside the lagoon on the submerged reef.

Subsidies and loans

When fishing with mechanised boats became popular, a scheme for the issue of boats at subsidised cost was sanctioned by the Government of India. The pattern of assistance followed from time to time is indicated below.

Period	Subsidy%		Loan%	
	Engine	Hull	Engine	Hull
1961-68	100	25	nill	75
1968-70	75	25	25	75
1970-73	50	25	50	75
1972-75 for Minicoy &	50	25	50	75
Agatti for other islands	75	25	25	75
1975-for all islands	50	25	50	75

In the beginning, a subsidy of 50% was allowed on the issue of fishery requisites for fishermen which is now limited to the issue of long line fishing gear with a subsidy of 33 1/3% on the cost. In addition to the above, a subsidy of 15 paise per litre is allowed on diesel oil.

FISH PRODUCTION

The fishing in Lakshadweep is marine only. The islands which are small in size do not have any fresh water lakes or rivers. But almost all the islands have vast and beautiful lake-like lagoons from where coral fishes are caught throughout the year. There has been steady increase in the fish catch as a result of facilities made available. The fish catch which was 575 tonnes in 1960 has increased to about 3000 tonnes by 1975 which is an increase of over 500%. As per the report of the National Commission on Agriculture, based on the data for 1974 the per capita availability of fish in Lakshadweep was 57.81 kg, which is the maximum for any State or Union Territory in the country. Based on the figures for 1975, the per capita availability of fish in this territory was 90.2 kg. The annual species-wise fish production of the territory for five years ending 1977 as per the departmental statistics is given in Table 1.

TABKE 1. *Species-wise fish production (in tonnes) in Lakshadweep from 1973 to 1977.*

Name of species	1972	1974	1975	1976	1977
1. Barracuda	11.5	17.2	17.4	20.8	14.9
2. Carangids	63.1	60.2	60.9	94.2	65.2
3. Coral fish	29.9	40.6	43.2	33.6	51.1
4. Flying fish	42.3	43.0	29.6	41.8	29.9
5. Gar fish	49.8	27.0	29.0	34.1	57.9
6. Goat-fish	37.0	32.8	33.1	58.3	29.1
7. Octopus	20.0	15.8	18.9	39.8	23.3
8. Perches	112.6	132.8	116.7	192.4	154.9
9. Ray	75.8	88.7	159.0	151.8	133.6
10. Rainbow runner	15.9	25.8	25.3	49.0	56.5
11. Sail fish	57.5	58.3	42.9	29.0	24.5
12. Seer fish	77.5	90.9	65.9	85.7	41.4
13. Shark	94.1	163.0	157.3	201.4	161.9
14. Trigger-fish	14.5	6.9	9.0	5.1	7.6
15. Tuna	1021.5	1254.9	1932.0	1921.0	1165.6
16. Miscellaneous	136.6	173.1	165.1	223.4	197.1
TOTAL	1859.6	2231.7	2905.1	2571.4	2214.5

Agatti and Minicoy land maximum of tuna in the Union Territory (Table 2).

TABLE 2. *Tuna catch (in tonnes) in Agatti and Minicoy.*

Year	Agatti	Minicoy	Total tuna catch in all islands
1973	419.1	374.8	1021.5
1974	518.1	334.4	1254.8
1975	717.8	542.2	1932.1
1976	542.2	329.7	1290.9
1977	392.1	420.3	1165.6

Exports

Lakshadweep has entered the foreign market with canned tuna. The tuna canning factory at Minicoy has a production capacity of 2 lakh cans a year. Canned tuna produced in Lakshadweep is exported as well as sold in the home market.

ECONOMICS OF OPERATION OF MECHANISED FISHING BOATS

During 1975–76 a special study of the economics of operation of mechanised boats was carried out. The data on income and expenditure under various heads for 1975-76

were collected and, based on these data, the net income per boat has been worked out (Table 3).

TABLE 3. *Average net income per mechanised boat in Lakshadweep for the 1975-76 fishing season.*

Name of Island	No. of boats considered	Average net income in Rupees
Agatti	11	7,010
Minicoy	13	6,188
Kavaratti	7	3,552
Chetlat	4	18,411
Androth	3	1,308
Kadmat	4	4,130
Ameni	6	2,645
Kiltan	4	6,485
Bitra	3	19,040

The net income when expressed as percentage on capital (both unsubsidised) gives a proper appraisal of the economic viability of mechanised fishing operations (Table 4).

The analysis shows that mechanised fishing is a viable industty in almost all the islands and returns of 15% and more are available even on unsubsidised capital in Agatti, Androth, Bitra, Chetlat, Kiltan and Minicoy.

SCOPE AND POTENTIAL

The Lakshadweep waters comprising an area of about one lakh square kilometres, with the 27 islands and submerged reefs are rich in fishery resources, particularly tuna and shark, as already stated. Of these resources, only a fraction is exploited from the inshore area by using small boats, leaving almost the entire bulk untapped.

TABLE 4. *Percentage of net returns on capital showing the economic viability of mechanised fishing in Lakshadeep.*

Name of Island	Total Capital Rs	Subsidised Capital Rs	Annual net return Rs	Percentage of total capital %	Percentage of subsidised capital %
Agatti	3,69,982	2,23,305	77,104	20.84	34.53
Ameni	1,85,158	92,652	15,972	8.57	17.23
Androth	92,267	52,140	21,920	17.9	32.4
Bitra	87,818	48,239	57,122	65.05	118.40
Chetlat	1,28,408	67,994	73,643	57.35	108.45
Kadmat	1,31,720	62,936	16,518	12.54	26.49
Kavaratti	2,02,837	95,864	24,860	12.26	25.93
Kiltan	1,47,099	62,354	33,762	22.95	55.91
Minicoy	4,41,057	2,62,368	80,421	18.23	30.65

Commercial exploitation of the fisher wealth will be highly beneficial for the country in general and the islands in particular.

The exploitation of the marine resources around the islands is necessary for the improvement of the economic conditions of the inhabitants. The limited land area has been put to use and the income from agriculture has almost reached the optimum. The future economic growth of the island will depend upon how best the marine resources are exploited.

A firm foundation for further development of fisheries has been laid. The next step is towards commercial exploitation of the large tuna resources, for which efforts are being made.

ACKNOWLEDGEMENT

I am thankful to Shri K. Koya, Statistical Assistant of the Directorate of Fisheries for his help in the preparation of this paper.

SMALL-SCALE BOTTOM-SET LONGLINE IN NORTH-WESTERN PHILIPPINES

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ABSTRACT

A small-scale bottom - set longline has been discussed as a fishing gear in which its business operation requires only a small capital and operational expenses and yet it is adaptable and profitable. For economic advancement, it is recommendable to low income group of fishermen living in rural coastal fishing villages.

The possible fishing grounds for operation, manpower requirement per fishing unit, investments needed, net profits and the identification of the technology with reference to its adaptability as to the gears's design, construction and operation have been presented. With the status of the traditional method of fish capture, conclusions and recommendations have been provided to increase the catch up to an a:sumption of about three times.

INTRODUCTION

The Republic of the Philippines is an archipelagic country and has an extensive marine body of waters which is teeming with different kinds of fish and other aquatic resources. In spite of the bounty, still just like many of the developing countries in the Indian Ocean and adjacent seas, the country's fish production lags behind the demand. To meet the problem, the administration formulated strategies in attaining self-sufficiency in fish. Among them is a Blue Revolution Program whereby the low-income group of fishermen in rural coastal fishing villages are trained in accelerated technological and socio-economic developments.

The program is integrated with the Ministry of Social Services Development (MSSD), the Ministry of Local Government and Community Development (MLGCD), and the Banking and financing institutions (e. g. the Central Bank of the Philippines, the Development Bank of the Philippines, the Land Bank of the Philippines the Amanah Bank of Philippines, and the Rural, Banks). The Bureau of Fisheries and Aquatic Resources (BFAR), the Philippine Fishery Office through its Fisheries Technological Services Division, Fisheries Extension Division, Fisheries Training Division and 13 regional offices distributed throughout the country is undertaking training programs on fishing technology among the low-income group of fishermen.

SCOPE OF THE STUDY

At the closing period (November to December) of 1977, the Fisheries Technological Services Division conducted a practical training on the technology of the traditional small-scale bottom-set longline fishing gear's design, construction and operation to 100 out-of-school fisher youth (Kabataing Barangay) in six rural coastal fishing villages (barangays), namely Pilar, Taberna, Bacuit Norte, Bacuit Sur, Pudoc and Payocpoc of the municipality of Bauang, Province of La Union (Northwestern Philippines).

The training site was treated as the study/observation area by the authors. They observed the fishermen trainees and treated them as respondents to interviews.

The fishing ground that was observed and tested for fishing operation is the waters of the coastal Barangays of Bauang, La Union. It is located within the eastern mouth corner of Lingayen Gulf.

The small-scale bottom-set longline is commercially important and is known to have been in use in the country even before World War II; yet there is very little literature available about it. An attempt is made in this paper to identify the gear's design, construction and operation and to present other relevant matters.

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The main objective of this paper is to have the technology transferred to the low-income group of fishermen who is in need of such services, whether it is in the Philippines or elsewhere in developing countries, because the method of fishing is adoptable and profitable for the fishing community.

METHODOLOGY

The active youngsters who had undergone the training program, are experienced fishermen and they readily picked up the rudiments of the training. As to educational attainment, many of them have reached or finished high school. The great majority of them can fluently converse in Filipino language and can speak and write simple English. Observations were made on these trainees, in a very casual or informal way, without making them conscious of it. They were treated as respondents in interviews by a friendly approach. As the trainees were arranging the materials as to the design and construction and operating the gear, keen observations and interviews went on hand in hand. For length measurements during the gear's designing and construction, a bamboo stick of one meter length calibrated into tenths was used. To the extent necessary quick sketches were made for retentive memory Emphasis is made on the interviews on the fishing operations held on a minimum 15 respondents (as samples out of the 100 trainees).

DESCRIPTION OF THE FISHING GEAR

Bottom-set longline is a fishing gear which is made up of an extremely long line with a series of baited hooks on branch lines. It is anchored or in some way attached to the fishing ground which made it not completely free to move with and be carried away by the water current. It is known in the Filipino language as *Kitang*.

Gear design and materials

Main line—It is 1,350 to 1,500 m long, which utilizes 900-1,000 hooks to a box. Synthetic materials like nylon or polyester can be used. Although a continuous multi-filament nylon is available in the market a monofilament nylon has been used for the gear. It has a diameter of 0.8 mm with a 20.45 kg breaking strength.

Branch line—A piece is 50-65 cm long and there are 900-1,000 pieces to a main line A monofilament nylon has been used, with a diameter of 0.45 mm and a breaking strength of 5.45 kg.

Hook—Corresponding to the branch lines, there are 900-1,000 hooks to a main line. Mustad hook No. 556 (generally used to catch sea bream fish) has been used. The diameter is 0.8 mm. Ringed and tinned hook can also be used for the purpose (Figure 1).

Main buoy—One float is attached on each end of the main line; for a unit, two pieces of bamboo internodes 30-45 cm long by 10 cm diameter has been used.

Flag Pole—Both ends of the main line are tied with a flag pole; a unit is 152.0-183.0 cm with pointed end provided with a piece of cloth flag. Commonly, bamboo material has been used; two pieces of 20.30 cm x 2.50 cm. iron rod is fixed (clasped and tied) at the base of the pole.

Lamp holder—Both ends of the main line are provided with a lamp holder. It is made from a one-litre plastic oil can. The can is divided into two equal halves, crosswise. The bottom half intact has been used for holding the lamp.

Buoy line—There are five pieces for the entire main line. They are located at both ends and one for every 300 hooks. This line is made of monofilament nylon of one mm diameter with a breaking strength of 30 Kg. The length is $\frac{1}{4}$-$\frac{1}{2}$ times longer than the water depth.

Intermediary buoy—There are two pieces for the entire main line. The distribution is one for every 300 hooks. Each is provided with a buoy line. A piece of buoy is made up of bamboo internode 30-45 cm long by 10 cm diameter.

Sinker—There are ten pieces for the entire main line. They are located one each at both ends and one for every 100 hooks. At each end, the materials used is $\frac{1}{2}$ kg stone or lead weight (synonymous to anchor in service); but in between them, each sinker is made up of $\frac{1}{4}$ kg stone.

Bait—Generally either roundscad (*galong-gong*) or milkfish (*bangus*) is used. The fish

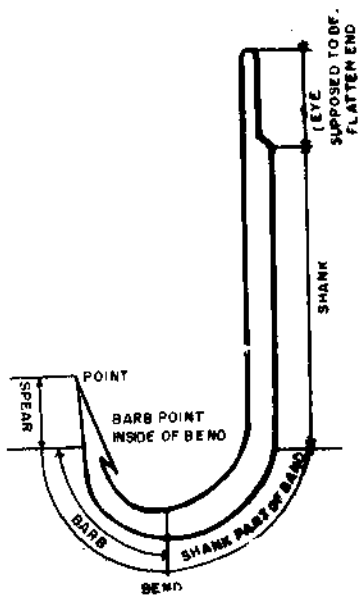

Fig. 1. Parts of a hook

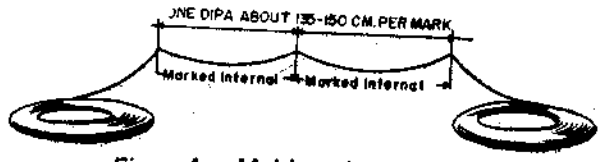

Fig. 4. Making the mainline

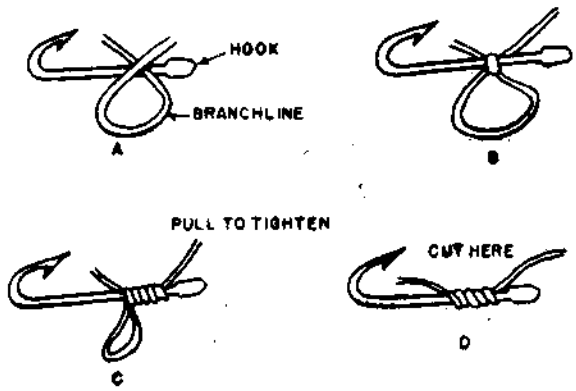

Fig. 5. Tying the hook to the branchline

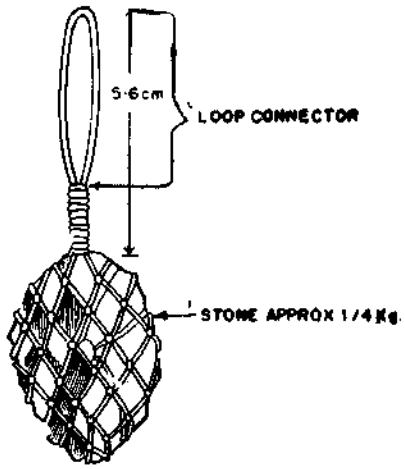

Fig. 2. The stone weight

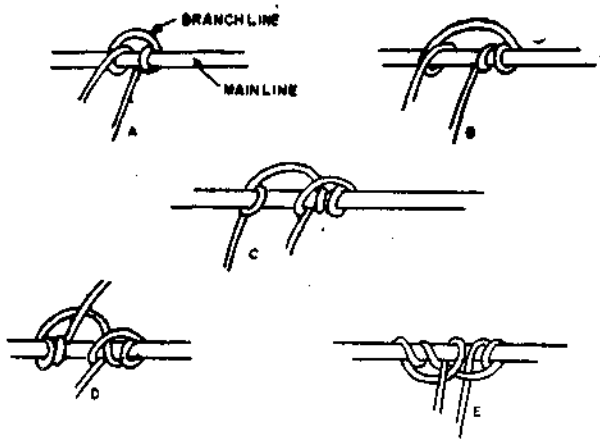

Fig. 6. Attaching the branchline to the mainline

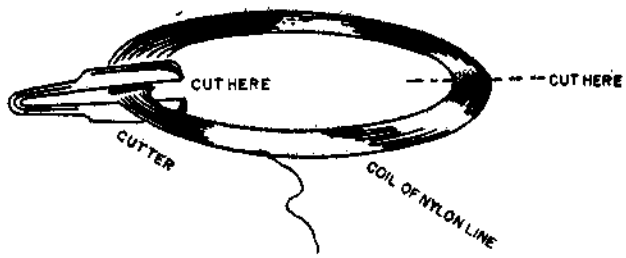

Fig. 3. Cutting the coil for the branchline

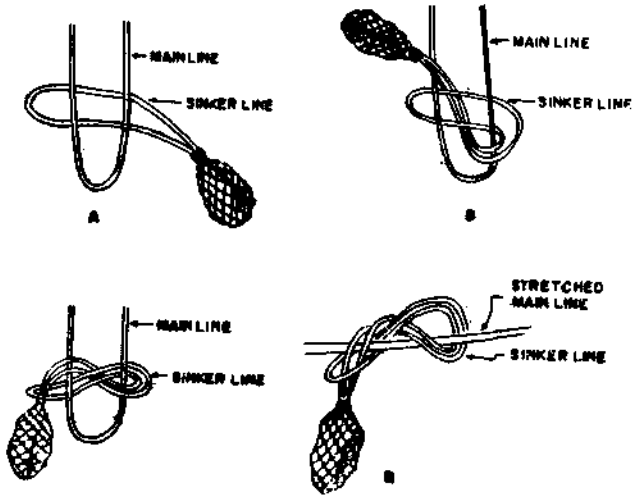

Fig. 7. Attaching the stone weight to the main line

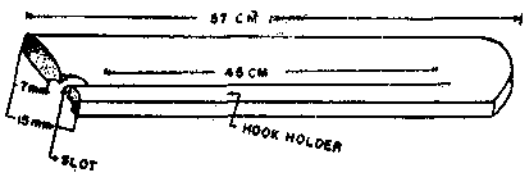

Fig. 8. The hook rack (Serpit-ilocano)

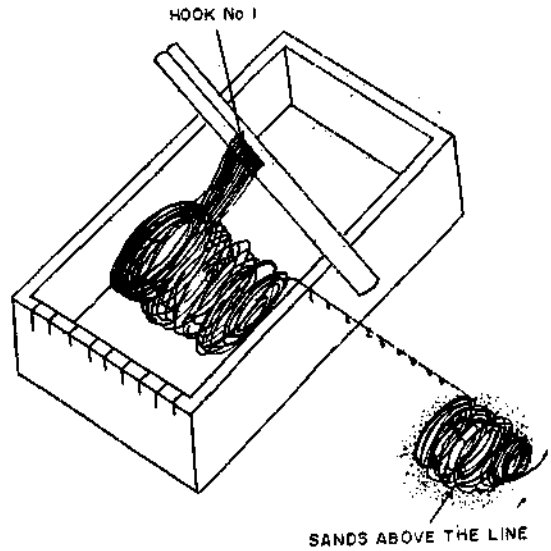

Fig. 9. Arranging the hooks in the hook rack (serpit)

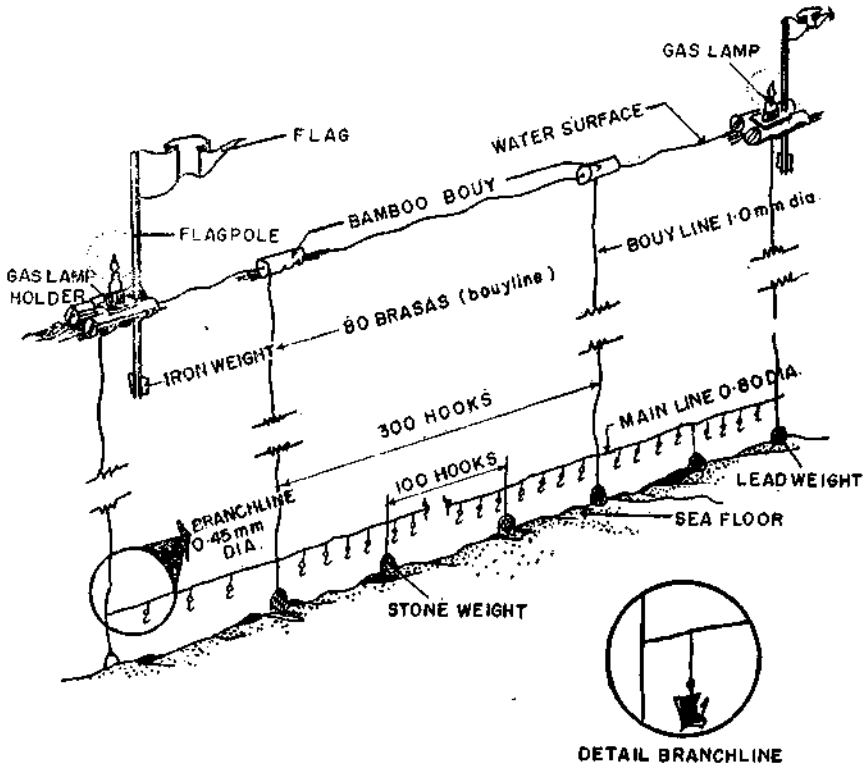

Fig. 10. Parts of a bottom set longline

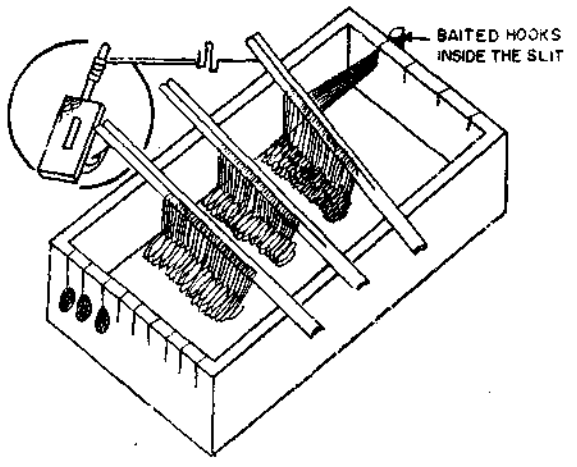

Fig. 11. Baiting the hooks

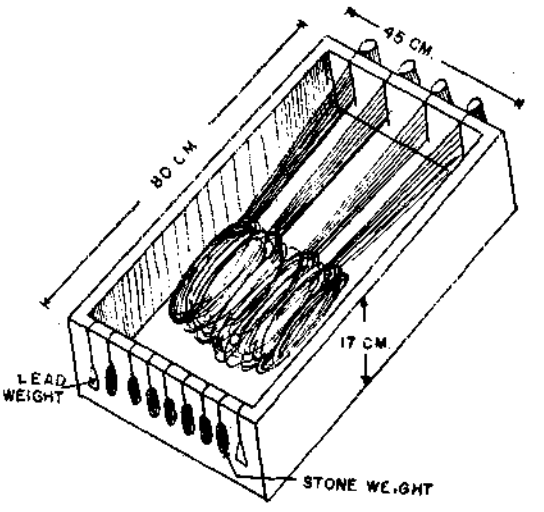

Fig. 12. Longline set of 800-1000 hooks per box with baits ready for operation

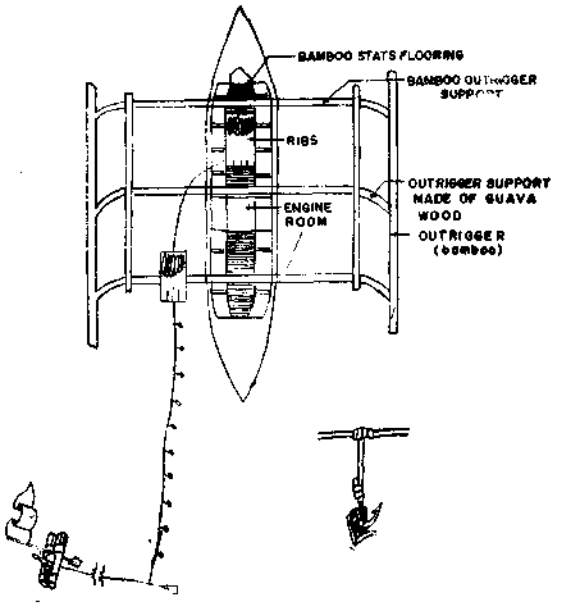

Fig. 13. Paying out the longline

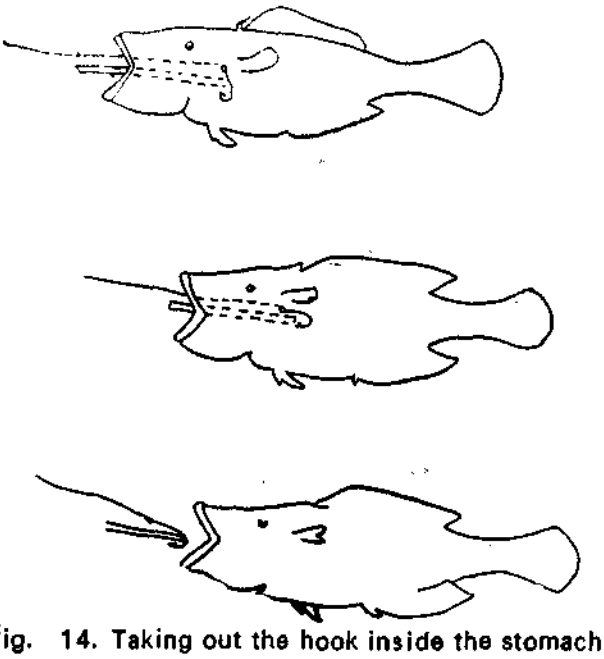

Fig. 14. Taking out the hook inside the stomach.

meat is cut into pieces of ½ cm x 2 cm. It is saturately salted for preservation from spoilage. Preservation of bait is very necessary in case the vessel cannot go out to fish due to inclement weather or for other unavoidable reasons, so that they can still be used for days to come.

CONSTRUCTION OF GEAR

The steps in the construction of the bottom-set longline are as follows:

Construct the main line (Fig 4)

1. Do the measurement with fully streched arms (*dipa*), about 150 cm long.
2. For every measurement, slide both thumb and forefinger of the right hand a little below the wrist and fold the main line.
3. Apply some more pressure to create a sharp mark before releasing the line.

4. Thence grasp the first mark with the left hand, with the right hand proceed to make the next mark.

5. Continue the procedure until the entire line is covered.

Note: It takes an average of half an hour to finish 1,355 m.

Cut the branch line (Fig. 3).

1. Adopt the time-saving procedure of cutting the whole intact coil or bundle of the monofilament nylon into two equal parts.

2. Immediately, produce several pieces of almost equal length branch line.

Tie hook to the branch line (Fig. 5)

1. Fold a piece of branch line to make both ends overlap.

2. Thence lay it flat and parallel on the shank of the hook.

3. On the right side,make one end protrude in order to be held and pulled.

4. With the left hand's thumb and forefinger hold the hook and the branch line, with the right hand make six to seven rounds of the string around the shank of the hook.

5. Thence pull the protruding line, tighten the hitches.

6. Afterwards, cut any extra protrusion in order not to foul the branch lines during operation.

Note: It takes an average of 20 minutesfor a skilled fisherman to finish 100 hooks.

Tie the branch line with the hook to the main line (Fig 6)

1. With a piece of branch line, tie its free end to the corresponding mark on the main line.

2. Use either the double rolling hitch or a combination of a clove hitch and rolling hitch knot tying.

3. Right after the attachment of a branch line, place its hook rack (*serpit*).

4. Follow the same procedure for the rest of the branch lines.

5. In the process, orderly coil the main line inside the box.

Attach the stone weight sinkar to the main line (Fig. 2, 7)

1. Do the attachment with the ratio of one stone weight of 1/4 kg for every 100 hooks interval.

Tie the line of the intermediary buoy to the main line

1. First clip a stainless wire on the main line, then tie the buoy line.

Attach the stone or lead weight anchor at both ends of the main line.

OPERATION OF THE GEAR

The steps in the operation of the bottom-set longline are as follows:

Make the preliminary operation

Assuming that the gear is already made and it has already been operated, then it will be prepared for the next day's operation.

1. Bring the gear with the unconsumed baits to the shore.

2. Take it out of the box and dump it on the ground in a shaded place.

3. To minimize intermingling of the branch lines with one another; pour wet sand on the gear.

4. Then fully rearrange the gear into the *serpit* and rebait it.

Note: To do the job, usually a fisherman works from 8 AM to 3–4 PM (seven to eight hours) until the gear is loaded to *banca*.

Arrange the hooks in the "Serpit" (Fig. 9).

1. Out from the pile, take the first hook with its branch line.

2. Remove unwanted/unconsumed bait.

3. Into the slit of the *serpit*, insert the bend of the hook.

4. Rotate the hook until the shank is perpendicular with the *serpit*.

5. Do the same procedure with the succeeding hooks, until all of them are arranged inside the *serpit*.

Note: With 900 hooks, it takes an average of 30 minutes to do the job.

Bait the hooks (Fig. 11).

1. Holding a piece of bait, thrust a hook ½ mm from one edge of the bait until the hook comes out through the other side.

2. From where it emerged, again thrust the hook to a one-cm distance, until the hook comes out to the opposite side.

3. After baiting the first hook, place it on the first slit on the front edge of the box.

4. Repeat the same procedure in baiting the succeeding hooks until all the slits of the box are filled-up.

5. Finally, resalt the hait again.

Note: In doing the job, the work rate of a fisherman is 13-15 hooks for every minute.

Perform the fishing operation

The average manpower requirement per fishing unit is three fishermen for 2,500-3,000 hooks operated. The average navigating time from the shore base to the fishing ground is one hour and 20 minutes. Boat particulars are: OAL-853.45 cm; width-71.15 cm; depth-38.45 cm; propellor diameter-22.85 cm; rudder-15.25 x 15.25 cm; and dugout width-38.10 cm, depth 12.70 cm.

1. *Do the Shooting Operation*

1.1. Upon reaching the fishing ground, slow down the banca's motor.

1.2. Then place the first box on top of the outrigger support (*batangan*).

1.3. In order not to mingle with the lnes, cast the main line with wet sand.

1.4. One of the fishermen takes the banca's position by cross bearings of terrestial or land objects.

1.5. Simultaneouly, while the position is being fixed attach the tail end of the buoy line to the main line.

1.6. Lower the flag pole to the water.

1.7. Once the flag pole has been upright, place the gas lamp on its holder.

1.8. Lighting the lamp first, release the buoy line.

1.9. Giving the engine an ordinary speed, pay out the main line.

Note: 1) For the operation, it takes an average of 24 minutes to pay out 2,500 hooks.

2) To shoot out the main line, the fisherman who pays out the line is also the one that maneuvers the control for the gasoline and the rudder.

3) Another fisherman takes care of the throwing of the main buoy as called for.

2. *Do the hauling operation*

2.1. Upon releasing the second flag pole into the water, light the gas lamp and immediately make the boat head for the first buoy. The idea of fast operation is to recover the catch ahead of the other cernivorous fish that will devour the catch.

2.2. In hauling, the fisherman at the bow pulls the flag pole and passes it to the third fisherman.

2 3. For the third fisherman, wind the buoy line around the bamboo buoy.

2.4. After hauling the buoy line pull the main line together with the branch lines.

2.5. Then pass the main line to the second fisherman.

2.6. For the second fisherman, remove the catch from the hooks.

2.7. Inside the box, coil the main line together with branch lines and the hooks.

2.8. Should there be any kinks on either the main line or the branch lines, simply cut and do the repair ashore.

Note: 1) For hauling up three boxes, of 2,500 hooks, it takes an average of 1 hour and 45 minutes.

2) With the traditional method, there is only one fishing operation a day, taking an average of two hours and ten minutes.

3) The average catch per fishing operation is 33.5 kg of fish.

4) The average catch per unit of effort is 15.45 kilograms of fish per one hour of fishing operation.

Average percentage catch composition

Sea bream (nemipterids)	73.47%
Sea perch (red bull's eye)	15.11%
Grouper	3.56%
Lizard fish	3.43%
Snapper	2.59%
Pomadasyds	1.81%
Others (e. g. moray etc.)	0.03%
Total	100.00%

Gear Care and Maintenance

1. When not in use, wash the gear with fresh water to remove the solidified salts.

2. The hooks must be especially brushed to remove salt coating and must be oiled in order to prevent them from rust.

3. The gear should be piled inside a clean box and stored inside a room where it is least exposed to the atmosphere, sun and rain to ensure prolonged longivity and tensile strength.

BUSINESS PROSPECTS

The business prospects of bottom-set longline fishing operations are given in Table 1-4.

CONCLUSIONS

The technique is making the fishermen realize that an addition of one or more fishing operations can be attained, if earlier catch can be prevented from getting stale by storing it in a styrofoam iced box.

It is evident that concern for the time element is the prime factor in this fishing; that is why the fishermen simply cut and discard the stuck-up branch line and hook swallowed by the fish caught. The fishermen are always in a hurry to recover the hooked fish, before any carnivorous fish will prey it.

To recover the stuck-up branch line and the hook will need the use of an improvised retrieving device. A simple retrieving device can be improvised from an ordinary piece bamboo stick with a V-shaped end. Its operation is easily done by thrusting it along the branch line to catch the hook. Further inward thrust will snap the hook off. Then the stick together with the trapped hook can be recovered out from the mouth of the fish (Fig. 14)

Collectively, an evaluation of the traditional rigging and operation of the gear exhibited indications that the catch is limited totally to the bottam fish. Innovations can be made to widen the catching capability range of the gear. This can be done if both the bottom (totally demersal) fish and some off-bottom layer (mid-water/semi-pelagic) fish can be caught. The technique is to lift some portion of the line by tying one or more pieces of bamboo internode as intermediary main buoys.

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TABLE 1 *Input investment (Price as of November 1978)*

1. *Capitalization*	*Pesos*
1.1. One dugout banca w/ outrigger, additional planking and pointed	2,000.00
1.2. One engine, 16 Hp, Briggs & Stration w/shafting and propeller	3,500.00
1.3. Three sets of longline (3,000 hooks)	240.00
1.4. Two gas lamps	10.00
1.5. Two paddles	10.00
1.6. One styrofoam box (recommended to maximize operation to 3 times)	50.00
1.7. Miscellaneous	50.00
	5,860.00

2. *Operational Expenses*	
2.1. Gasoline (2 gallons)	14.00
2.2. Baits (roundscad or milkfish, 20 pcs.)	24.00
2.3. Subsistence of fishermen (coffee, cigarettes etc) and salt	7.00
	45.00

Note: If some mid portion of the mainline is to be lifted some distance off bottom, correction of additional capitalization is to be applied for float/s; likewise if an iced box is to be utilized, correction of additional operational expenses is to be applied for supply of ice.

TABLE 2. *Gross Sales (Price as of November 1978).*

1. Case 1, with traditional method making an average catch of 33.5 kilograms of fish selling at 5.00 pesas per kilo	167.50
2. Case 2, an assumption of 5% addition to case 1 if some mid portion of the main line is to be lifited off bottom to widen catching capability range	175.87
3. Case 3, case 2 is to be maximzed to 3 times as assumed with available iced box	527.61

Note: Case 3 is probable in fertile fishing ground.

TABLE 3. *Net Sales/Profit (Price as of November 1978)*

	Pesos	*Pesso*
1. Case 1	167.50	
minus operational expenses	45.00 ...	122.50
2. Case 2	175.87	
minus operational expenses	45.00 ...	130.87
3. Caes 3	527.61	
minus operational expenses	45.00 ...	482.61

Note: It is reiterated that the necessary correction noted in Table 1 is still to be deducted to each case, depending on the situation.

TABLE 4. *Sharing System*

	Pesas
1. Case 2	
1.1. One share for the owner of the banca	20.40
1.2. Two shares for the owner of the fishing gear	40.80
1.3. Three shares for the three fishermen	61.20
2. Case 2	
2.1. One share for the owner of the banca	21.80
2.2. Two shares for the owner of the fishing gear	43.60
2.3. Three shares for the three fishermen	65.40
3. Case 3	
3.1. One share for the owner of the banca	80.40
3.2. Two shares for the owner of the fishing gear	160.80
3.3. Three shares for the three fishermen	122.40

Note: It is reiterated that the necessary correction noted in Table 1 is still to be deducted to each case, depending on the situation.

THE STRATEGY OF ARTISANAL FISHERIES DEVELOPMENT OF INDONESIA

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INTRODUCTION

Marine fisheries potential within Indonesian territorial waters is estimated at 7.2 million tons per year (standing crop), whereby 50% or 3.6 million tons per year, is the maximum sustainable yield.

In terms of area and productivity, fish culture is expected to increase subject to the constraints of area. waters, and technology. In the long run, it is envisaged that fish culture in Indonesia would at least have the same potential as marine fisheries.

According to the National Food Conference held in 1965, an Indonesian needs 55 grams of protein per day to meet minimal nutritional requirements. Of this total, 15 grams would come from animal protein consisting of 10 grams from fish and 5 grams from livestock. Ten grams of fish protein equal 60 grams of fish flesh a day (or 82 grams of whole fish per day), or 29.5 kg of whole fish per year. At the level of production, per capita consumption would be 32.5 kg per year.

At the end of the First Five-Year Development Plan (1 April 1973) per capita consumption of fish was 10.2 kg per year. However, various regions showed varied rates : Sumatera. 15.9 kg, Kalimantan, 38.2 kg, Java 5.5 kg, Sulawesi, 18.9 kg, Nusa Tengara, 6.1 kg, and Maluku/ Irian Jaya, 30.6 kg.

During the Second Five-Year Development Plan (1973-1978), fish production is projected to increase by 4% per year, and would reach 1,589,700 ton by the end of 1978. Comparing this with the growth rate of 2.5% per year during the First Five-Year Development Plan, the production projection during the Second Five-Year Development Plan is relatively high. However, the per capita consumption was still 10.8 kg by the end of 1974.

This account suggests that through nutritional repuirements and fisheries potential are conducive to production increases, production targets should take into account the following factors: per capita income (standard of living), population growth, consumer preferences, and substitutes. In other words, fish is a commodity

which is subject to the law of supply and demand.

Compared with rice, the demand for fish is more elastic, Another characteristic of fish is its perishability. Therefore preserving the quality of fish from harvest to the consumer plays an important role in the production of fish. Without preservation e. g. the use of ice, chill room, cold storages, freezing plants, other processing plants and insulated/refrigerated transportation, fish quality would rapidly deteriorate and result in a loss of volume and value. This is why fishermen/ fish farmers are typically in a disadvantageous position.

In Indonesia, artisanal fisheries contribute 98% of the total fish production. Productivity is low and is of a subsistence nature. It is estimated that the number of fishermen and fish farmers regularly engaged infisheries approximates 1 million, while about the same number are seasonally engaged in fisheries. Current production of fish is 1.3 million tons. Taking into consideration that only one million comprise the primary working force in fisheries, the productivity of fisherman is 1.3 tons per year. Due to the simplicity of fishing gears, most operations are carried out not far from shore. As a result, densely populated areas, like the northern coast of Java and along the Strait of Malacca, demersal/fish resources have been heavily exploited.

SYSTEM APPROACH TO THE DEVELOPMENT OF ARTISANAL FISHERIES

From the brief description noted above, the problem and characteristics of artisanal fisheries can be summarized as follows:

1. Fish is a perishable commodity. Proper handling and the availability of marketing facilities are indispensable for distribution to consumers;
2. The demand for fish is more elastic than that of rice. This means that various factors such as : income per capita, consumer preferences, pnpulation growth, and substitute goods have significantly affected the demand for fish and consequently the production of fish.
3. In Indonesia, approximately 98% of the fish is produced by artisanal fishermen and fish farmers.
4. These operations are carried out by traditional methods, and productivity is low. Therefore, the introduction of a more appropriate technology is required.
5. A subsistence level of existence has been the phenomenon of artisanal fisheries.

In view of these characteristics, an integrated approach appears to be the most appropriate way to solve the problem and improve the standard of living of the artisanal fishermen and fish farmers. An integrated approach would comprise the following two elements :

1. The provision of production, processing marketing means and facilities. These cover/capital, engines, fishing vessels, fishing gear and equipment, chill rooms cold storage, freezing plants, ice making plants, fish fry, fertilizers, pesticides, ditches and canals for fish culture.
2. The creation of infrastructure facilities which are not directly related to production, but constitute a prerequisite for the effctive and efficient utilization of the existing production, processing and marketing of fish. The infrastructure required for artisanal fisheries development can be classified into two categories:
   a. "Physical" infrastructure : fishing ports, break waters, piers, jetties, auction places, water, electricity, bunkering facilities, communication hospitals, schools, and religious services.
   b. "Non-physical" infrastructure: education, training, extension work, research and development, management and administration, security and administration, security and defence.

To improve the living standard of the artisanal fishermen and fish farmers, both production means and infrastructure are required,

simultancously, to obtain the optimal affect. To provide fishermen with fishing vessels, or credit or subsidies are needed. However, if the motorization program is to be successful, research and development (infrastructure) is needed to determine suitable fishing ground, appropriate size of vessels, and effective fishing gear. This is also true as regards fish culture. To embark on a fish culture intensification program, research and development in the application of proper pesticides and fertilizers is necessary.

The results of research and development are transferred to fishermen and fish farmers through education, training and extension work.

Hence, credit extended to fishermen and fish farmers with a view to improving productivity, involves both production means and infrastructure. However to increase the productivity of artisanal fisheries requires other production means and infrastructure: landing places, auction halls, chillrooms, cold storages, marketing facilities, road connection to consumer areas, communications, etc.

On the other hand, to improve the living standard of fishermen and fish farmers, schools, hospitals, clinics, mosques, etc. are required. With more education it can be expected that productivity will improve as the fishermen and fish farmers are more easily oriented to improved technology.

From this brief account, it is clear that there are inter relatioships and interdependencies among the various factors. The development of artisanal fisheries is not merely a matter of fisheries. It is affected, directly or indirectly, by other sectors of the economy and the development of artisanal fisheries will be sucessful if other sectors of the economy are developed hand in hand. This also indicates that the development of artisanal fisheries for the improvement of living standard of fishermen and fishf farmers is not merely the responsibility of one Ministry. It involves many aspects, and needs full support and development by other Ministries. From this point of view the problem of improvement of artisanal fisheries is a system consisting of various subsystoms whereby various Ministries are involved and should coordinate their operations.

THE DEVELOPMENT PROGRAMS FOR ARTISANAL FISHERIES

Since 1969, with the implementation of the First Five-Year Development Plan, the Government of Indonesia has adopted a policy to develop and promote artisanal fisheries through various programs.

A small-holder credit program was initiated by the Directorate General of Fisheries and Rural Credit Bank (Government-owned bank) to provide credit to fishermen and fish farmers in order to improve their productivity. This credit is specially designed to meet the economically weak conditions of fishermen and fish farmers.

This credit is characterized by a low rate of interest, low requirement, low collateral, and simple application procedure The credit is intended for both marine fisheries and fish culture which consist of the following elements:

a. Motorization scheme for the construction of new powered fishing vessels of 5 to 7 gross tons.

b. Fish culture.

— Brackish water pond intensification program, i. e., the utilization of improved techniques (fertilizers, pesticides, proper water management, stocking manipulation, appropriate pond construction) of higher productivity of milkfish and shrimp.

— Brackish water pond extensification program, i. e. the extension of areas to be covered.

— Fresh water pond intensification program, mainly for common carp.

— Fresh water pond intensification program, mainly for fresh water shrimp (*Macrobrachium resenbergii*).

The program to be covered by the small-scale credit scheme is geared to the increase of production of economically important species so that the fishermen and fish farmers would benefit from the highpriced fish.

Another program to promote artisanal fisheries is the construction of coastal fishing ports, financed out of the Government budget.

It was noted above that the small credit scheme is partly used for the construction of motorized fishing vessels of 5 to 7 gross tons. These vessels would operate within 30 miles of the coast. To make the motorization program a success, coastal fishing ports are being constructed. The ports have the following facilities: wharf or jetties for landing, small cold storage and ice plant, workshop, slipway for boat repair, and auction hall. Therefore, it can be said that fishing port construction is intended to provide services to motorized vessels by supplying the related production, processing and marketing facilities.

In coastal areas where heavy concentrations of fishermen are found, the Government is rehabilitating or constructing new break waters, jetties, auction halls and water supplies. With this rehabilitation or new construction, in numerous fishing villages, it is envisaged that production will increase.

To facilititate the distribution of fish from producing areas to consumer areas. the Government has built small chill rooms of 5 to 10 tons capacity at various coastal towns and inland urban markets. These chill rooms are used to keep fish in ice for several days. If the chill room is properly organized, it would contribute to the continuous supply of fresh fish for consumption. The Government has also constructed display cabinets of 100 kg for retail distribution of fish at various market places.

With the assistance of international financial institutions, the Government has also established state-owned firms in some areas which will act as marketing agents for local fishermen for distribution of fresh fish to domestic markets or to foreign markets Thus these Government firms will assist in promoting and stimulating the production of fishermen by ensuring a market outlet and offering reasonable prices.

Another program to promote artisanal fisheries is education, training and extension work. This has been geared to the training of of skippers, master fishermen and engineers for marine fisheries. In several places, training centres have been established, some being assisted by UNDP/FAO. For fish culture, "demonstration ponds" have been introduced to demohstrate more advanced techniques with respect to pond construction, proper utilization of pesticides, fertilizer, additional food, water and stocking management.

The research and development required to develop fishing and pond management techniques in providing assistance to the artisanal fisheries is undertaken by Government fisheries research institutes. The Marine Fisheries Research Institute provides advice on marine fisheries development. This include the design and proper layout of motorized fishing vessels and utilization of the proper gear for specific waters to be fished by artisanal fishermen. The Inland Fisheries Research Institute provides advice on fish pond development, both brackish and fresh water. This includes the physical design of ponds and the utilization of fertilizer and pesticides. The Institute of Fishery Technology provides advice and consultation on fish handling, product development, processing and quality inspection.

To promote artisanal fisheries, fisheries cooperatives are being introduced in order to organize and administer these operations so as to take advantage of economies of scale. Fisheries cooperatives must not only engage in production (fishing and harvest) but also in processing and marketing to earn more income for their members. Thus, fisheries cooperatives deal with: production, the provision of fishing gear and equipment, processing, marketing and credit.

Lastly, to cope with the formidable task of dealing with large numbers of illiterate fishermen and fish farmers, and social pressures resisting introduction of more efficient methods of fishing and culture, there is a need for an effective and efficient administration capable of carrying out the tasks of fisheries development. The improvement of fisheries administration is undertaken through the upgrading of staff and personnel both in the Central and Regional Fisheries Offices.

THE STATUS AND PROBLEMS OF SMALL-SCALE FISHERIES IN THE PHILIPPINES

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INTRODUCTION

Small-scale fisheries is the most important sector in the Philippine fishing industry, not only as to the number of people involved, but also as being the major source in the total production of fish. It is remarkable that this sector, practically without any technological assistance, has managed to increase its production to more than one-half million tons of fish annually. Its productivity measured in catch per man-hour or per man-year is, however, still low and there are good possibilities to increase that productivity, according to a study by NORCONSULT[3].

This paper aims to discuss the present structure of the industry in relation to the programme of the government to develop the small-scale fisheries of the country. The paper also takes note of the government efforts to help elevate the standard of living of the "survival" fishermen and their families in particular and the fishing community in general.

THE RESOURCES

As defined in the Fisheries Decree of 1975, the term coastal Marine Water was changed to Municipal Waters and was broadly redefined to include inland bodies of waters such as tidal flats, streams, rivers and lakes in addition to the marine waters along the 18,000 kilometer coastline of the country to a distance of 4.8 kilometers seaward.

Computation of the area of the marine municipal waters shows a total area of 95,207.51 sq. km. Municipal waters is under the jurisdiction of the local or municipal government concerned.

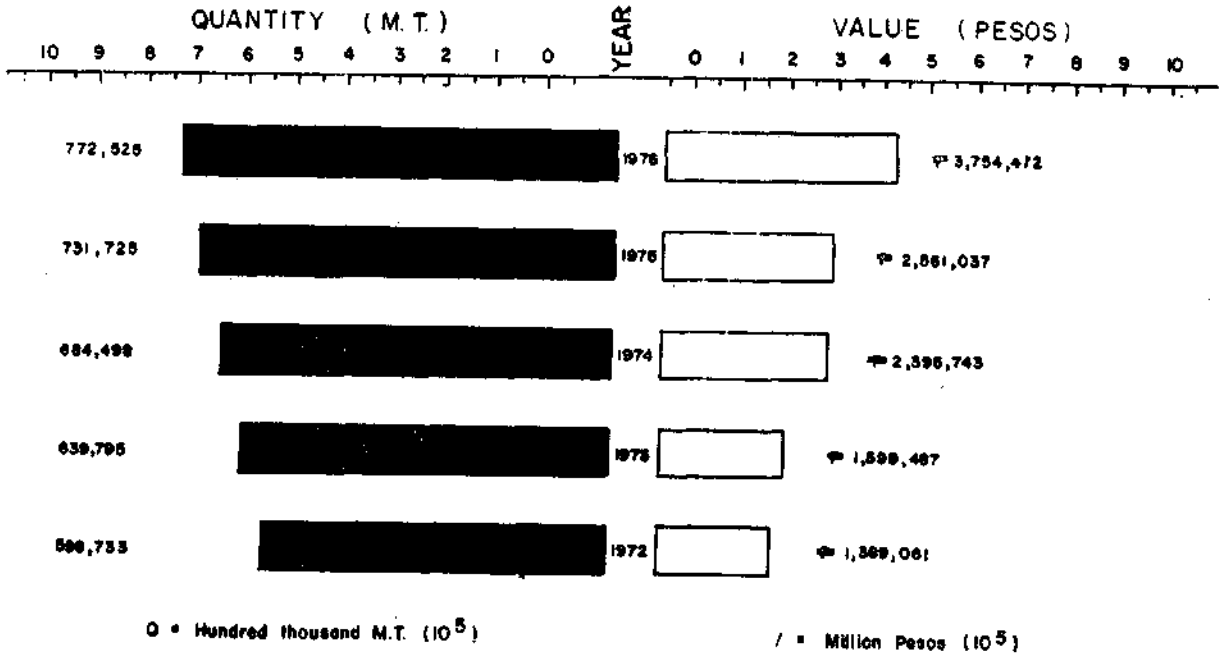

Fig. 1 Status of municipal fisheries production in quantity and value in the Philippines from 1972 to 1976

1 Supervising Fishery Technologist, concurrently Officer-in-Charge, Coastal Fisheries Section.
2 Chief, Fisheries Research Division. 3 Norwegian Consulting Firm

The principal setting of the municipal fisheries lies in the area where invertebrate animals and about 85% to 90% of marine fish species migrate to feed, spawn and hibernate during the cycle of their life. Hence, proper regulatory measures are being implemented to conserve the resources. There are some 2,415 species of fish, of which 65 are of commercial importance which provide the people with half of their protein diet.

Dependent on fish as a source of protein is a great majority of 40 million Filipinos of which an estimated 5 million live in the 6,840 coastal marine barrios throughout the country. Hence the *important role of the municipal fisheries* sector in the economy of the Philippines.

PRODUCTION

The total fish production of the country in 1976 was 1,303,483 m.t. valued at 7,297 million pesos. Out of the total catch, the municipal fisheries contributed 772,525 m.t. or approximately 56% of the total catch.

Figure 1 shows the year-to-year status of municipal fisheries production from 1972 to 1976. It can be noted that there is a substantial increment from 1973 to 1976. In the same figure, the annual fish catch is correspondingly indicated by fish catch valued in pesos.

FISHING BOATS

Fishing boats to be considered under municipal operations are limited to tonnage of 3 gross tons and less. This class of fishing boats is dominated by dugout type bancas which are very narrow, lightly constructed and furnished with outriggers for stability. Originally, the boat was paddled on or sailed with the aid of wind but today more and more fishing bancas are being motorized. Fishing bancas are registered by the Philippine Coast Guard and may be licensed by the Municipal government.

The Bureau of Fisheries and Aquatic Resources Expanded Fisheries Development Programme in 1977 showed a total 243,589 bancas distributed in the 12 regions of the country (Figure 2).

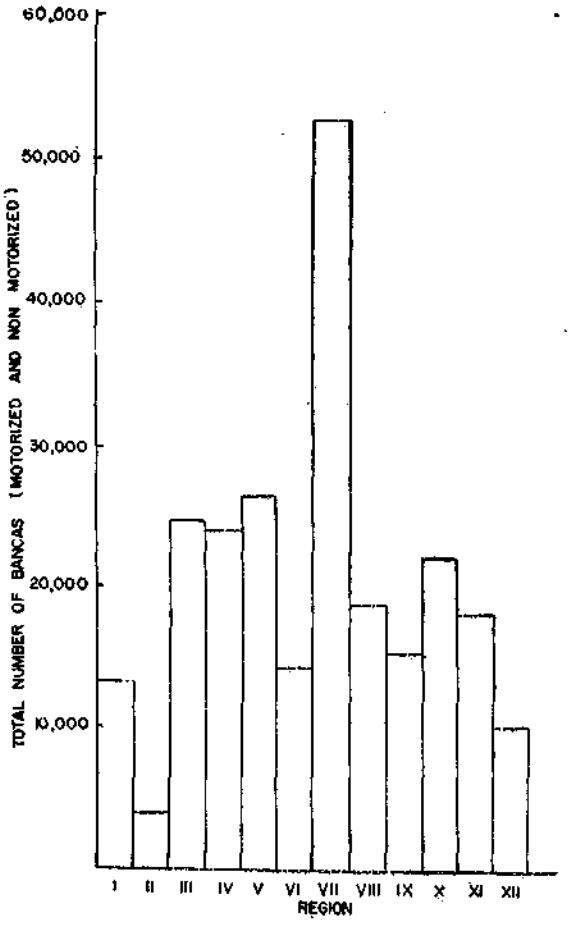

Fig. 2. Distribution of bancas (motorized and non-motorized) in the 12 regions of Philippines.

Figure 3 shows the regional distribution of motorized bancas. Region III has the most number of motorized bancas followed by Region VII. On the other hand, Region II and XII has the least number of motorized bancas.

Figure 4 showing the number of non-motorized bancas indicates that Region VII has the most number of non-motorized bancas, followed by Region V. However, in the total number of bancas, Regions No. VII and V have the most number of bancas with 52,770 and 26,409 units respectively.

FISHING GEAR

The fishing paraphernalia generally used in catching fish in the Philippines are composed of 47 types of fishing gears. Out of this, 35 types are commonly used in medium and small-scale fishing in the marine municipal waters and

freshwater fishing grounds The other types are commonly used in the more developed commercial or large-scale fisheries.

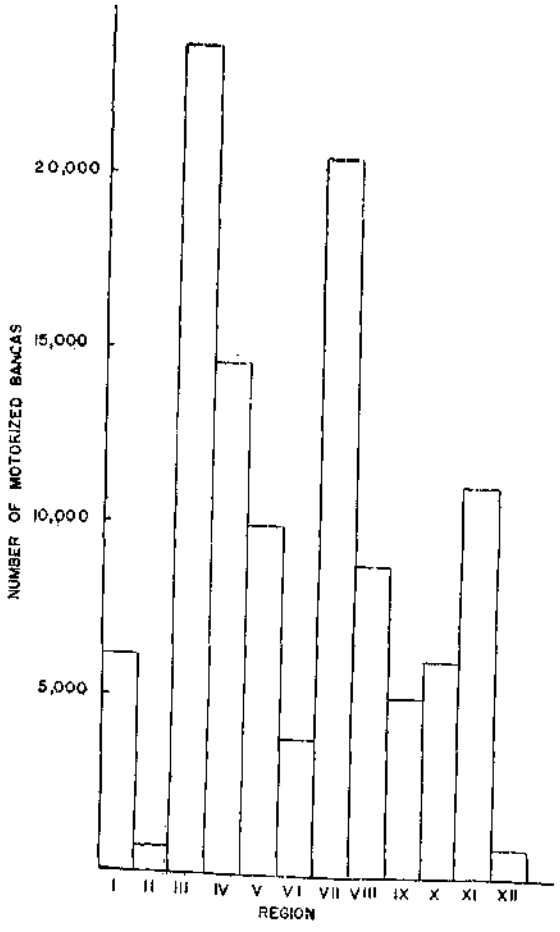

Fig. 3. Regional distribution of motorized bancas n the Philippines.

The Philippines has 41 marine provinces but the distribution of municipal fishing gears varies from one fishing ground to another. The common fishing gear operated by small-scale fishermen with or without the use of banca are as follows: gill net, handlines, pole and line, bottom longline, spear gun, drive-in-net, scissor net, scoop net, cast net, dipnet, beach seine fish corral, round haul seine, filter net, baby trawl, push net, troll line, lift net, jigger, fyke net, fish and crustacean pots, etc.

Except for the stationary type of fishing gears, the movable fishing gears are operated by fishermen either at night or day, but those gears that require light for their operations and for the kind of fish they capture usually are operated during the dark phase of the moon. The time of departure for the fishing ground, the number of fishing hours and the return to their home base are so scheduled as to coincide with the marketing hours of the consumers.

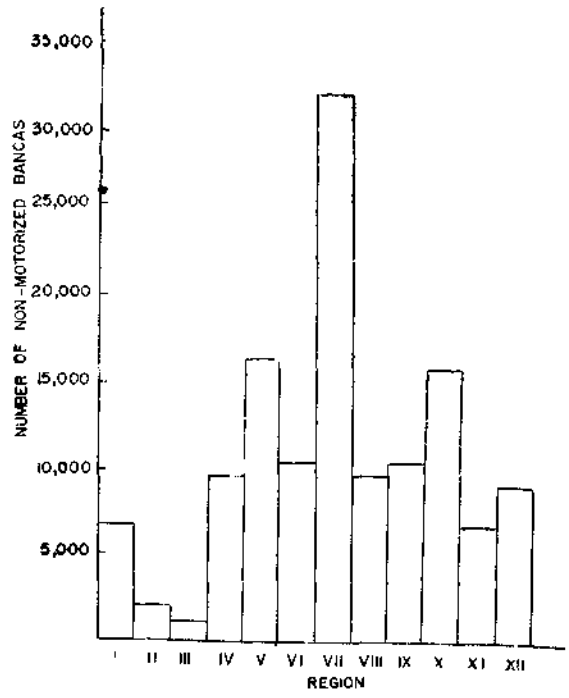

Fig. 4. Regional distribution of non-motorized bancas in the Philippines

THE MANPOWER

The municipal fisheries sector has a big actual and potential manpower compared to the commercial and aquaculture sectors of the fishing industry. This sector employs small-scale fishermen, in addition to the significant number of people who are employed in ancillary activities such as smoking, drying, pickling, salting and transport services. The number of small-scale fishermen alone accounts for nearly 90% of the total work force engaged in marine fisheries.

Figure 5 shows the distribution of the number of small-scale fishermen by regions. It can be noted that Region VII ranks first, followed by Regions IV and V. On the other hand, Region II has the lowest number with 11,792 fishermen followed by Region XII with 12,159. The approximate total number of small-scale fishermen in the Philippines is 500.665 as of 1977.

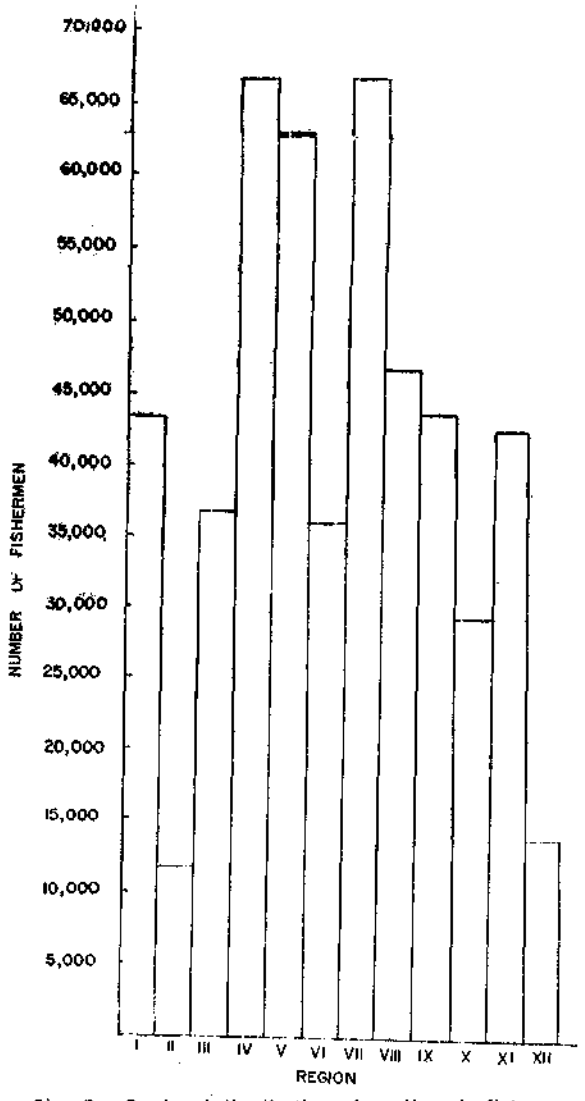

Fig. 5. Regional distribution of small-scale fishermen in the Philippines.

GOVERNMENT PROJECTS ON MUNICIPAL FISHERIES

As envisioned in the Integrated Fisheries Development Plan, the expected production from small fishermen is 814,800 metric tons for 1978 or an incremental production of 35,200 metric tons from 1977 estimates. This increase in production is proposed to be achieved by the implementation of the following plans and programes:

a. *BFAR Municipal Fisheries Projects,* the components of which are:

— Selective outfitting of existing non-motorized boats with motors and gears; and

— Selective adoption of new gears to already motorized boats.

There are indications that certain coastal waters have already surpassed the point of maximum sustainable yield. The BFAR municipal fisheries programme will be implemented in areas which do not exhibit over-fished indications such as in the Moro Gulf, Tawi-tawi, Samar-Leyte area and Aklan.

b. *DAP-FIRM Project:* The DAP-FIRM, through the model fishing concept, will demonstrate new gears, improved boat construction and more efficient fishing methods. The envisioned demonstration effect on continuous fishing areas will upgrade municipal fishing technology. Table 1 shows the barrios selected to be developed as models.

c. *Upgrading of Technology:* The objective of this project is to gradually shift municipal fishing to medium-sized commercial fishing using larger boats and gears. This project is supported by the Fourth Rural Bank Credit from the World Bank which will grant loans of about 300,000 pesos per fisheries project. The World Bank Credit to the DBP also reflects this ternd to bigger-sized boat with the required minimum size of 70 GT.

DEVELOPMENT OF MUNICIPAL FISHERIES TECHNOLOGY

After visualizing the operating characteristics of the subsistence fishermen, from the type of boats and gears used, and their operational activities, the following issues should be taken into consideration for possible research and studies:

a. The possibility of using lightly constructed diesel engines for safe and economic operation;

b. The possibility of shifting sustenance fisheries to medium-scale operation;

c. The possibility of constructing vessels designed to have the following:

— shelter for protection of the fishermen during unfavorable conditions;

— enough space for fishing operation;

— enough space for storage of fish during 2 to 3 days of operation;

— enough space for solid and practical installation of engine and sophistict ed fishing equipment; and

— means of protection of the rudder and propeller shaft for safe landing on beaches:

d. Improvement of fishing gear to enable sustenance fishermen to operate during the day as well as for continuous operation for longer period of time;

e. Norcosult's recommendation on fishing gear methodology:

— operation of two sets of troll-line in a single vessel; and

— promotion of the use of baby trawl in municipal fishing; and

f. Construction of more fishing harbors in fishing areas as needed.

TABLE 1. *Marine pilot barrios project, 1978 (Municipal Fisheries Development.)*

Region	Barrios	Motorization 1 New	Motorization 1 Existing	Extension Total	Extension Workers 2
I	Tubuan, Saul, Pangasinan Dulao,	20	45	65	3
	Aringay, La Union	20	25	45	2
IV	Wawa, Batangas	15	60	75	3
V	Sawanga, Bacon, Sorsogon	20	25	45	2
	Badian, Oas, Albay	25	25	50	2
	Basiad, Sta. Elena, Camarines Norte	20	25	45	2
VI	Malaiba, San Jose, Antique	25	50	75	3
	Sipalay, Negros Occidentai	25	100	125	5
	Atabaywan, Tigbauan, Iloilo	10	40	50	2
VII	Bayawan, Negros Oriental	25	75	100	4
	Pahaytayon, Tubigon, Bohol	15	20	35	1
IX	Sangali, Zamboanga City	50	50	100	4
	Naga-naga, Alicia, Zamboanga del Sur	50	50	100	4
X	Salay, Misamis Oriental	40	50	90	4
	Malimono, Surigao del Norte	15	25	40	1
XI	Piapi, Davao City	30	50	80	3
XII	Bongo Island, Parang, Maguindanao	25	50	75	3
	Tigpuan, Lebak, Sultan Kudarat	25	50	75	3
	Total	480	895	1,345[3]	55

1 Motorization of bancas include rigging and/or improvement of gears.

2 These extension workers are part of the 428 extension workers allocated for the municipal fishing programme.

3 This is part of 2,960 bancas targeted for motorization.

REVIEW OF RECENT PROGRESS ON MUSSEL CULTURE IN THE PHILIPPINES

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ABSTRACT

In recent years, more emphasis was given to develop sea farming particularly green bay mussel *(Mytilus samaraginus)* culture in the Philippines. With the decrease in hectarage in the farming area at Bacoor Bay (part of Manila Bay) due to expansion of Greater Manila through reclamation project at Manila Bay, other areas are being developed. These areas include Samar, Panay and Negros Islands. Mussel farming is not intensive as emphasis is given on the use of available local materials like bamboo and the limitation of finances of mussel farmers.

MUSSEL FARMING AREAS

1. *Bacoor Bay*

Located at the southwestern portion of Manila Bay, Bacoor Bay is the biggest mussel producing area in the Philippines with approximately 1,350 hectares of mussel farm, with an estimated annual production of 33,000 tons of live mussel (Pagcatipunan, 1974). Mussels are also gathered from the wild in other areas of Manila Bay, attached to rocks in brackishwater, old piles of fish corrals, sunken vessels, etc. The prices of mussel range from 3 to 5 pesos per kg. depending on the season and supply.

Farmers utilized bamboo stakes as spat collectors, where mussels grow until harvest, in areas with 2 to 10 meters depth. With the expansion of Greater Manila, sea areas are now being reclaimed including Bacoor Bay where most existing mussel farms may be eliminated. This project which is expected to be completed within five years has already reduced the mussel farming areas into half. Eventually deep areas at Bacoor and shores of the province of Bulacan Pampanga and Bataan can be utilized. These areas are exposed to the Southwest monsoon, the season best suited for mussel farming. Development of other areas for mussel farming is therefore necessary.

2. *Northern Panay Area*

A new mussel producing area is Northern Panay where, previously, fishermen used to gather green mussels from the wild. Mussel farming in this island started in 1974 at Sapian, Capiz by the local government with the help of the Bureau of Fisheries and Aquatic Resources personnel and a U. S. Peace Corps Volunteer. In a venture by a big corporation a production rate of 300 tons of live mussel per hectare per year was attained. Mussel farming easily spread to outlying towns of Capiz. In the province of Aklan, the present culture area is approximately 100 hectares. The method of culture which is widely used is stationary plot made out of

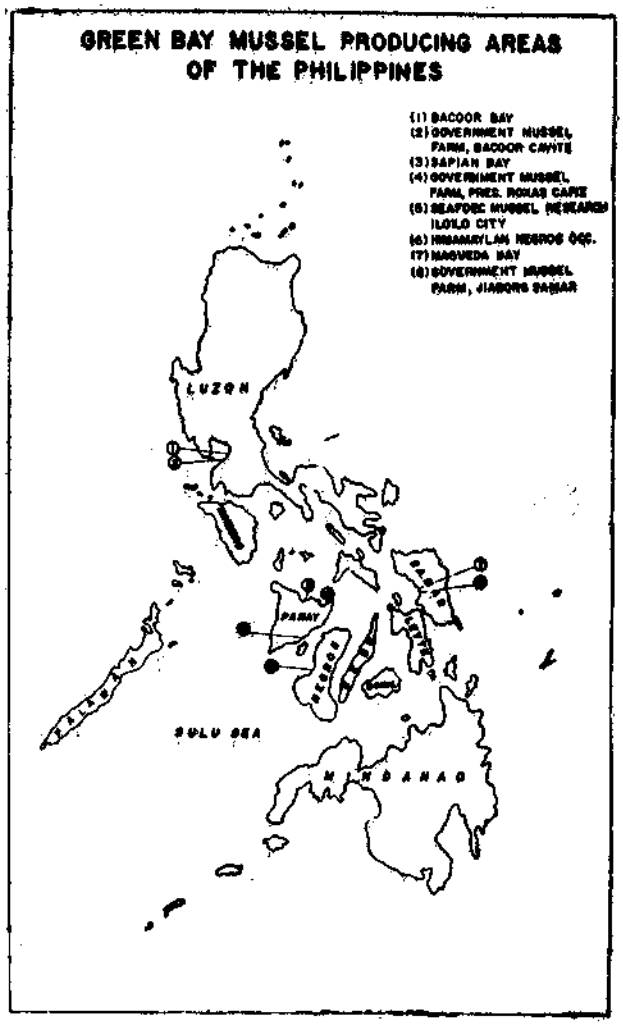

Fig. 1. Mussel productidn centres in the Philippines

bamboos, where synthetic rope nettings, measuring 2 x 5 meters are tied. Production of 50 tons/hectare was attained in this area.

The Northern Panay areas (Capiz and Aklan provinces) have limited scope for expansion. The bays are small and the potential areas are limited to approximately 1,000 hectares. In Sapian Bay, there exists a wide, shallow mud flat which is exposed during low tide and mussel farmers utilize only the deep portion which is the river path. Sitlation due to presence of mussel plots, resulted and changed the course of the river. This condition made these areas shallow and unproductive. There is now a need to develop deeper area further out in the bay.

Mussels, live with shell, used to sell at 1.20 to 1.50 pesos a kilogram in Capiz, but at present it is selling at 0.60 peso due to increased production and few outlets in the island. Some are airshipped to Manila (approximately 250 air miles) but shipment cost is higher than cost of the mussel.

3. *Maqueda Bay*

Maqueda Bay in western Samar is another new mussel farming area. The bay includes Villareal Bay and part of Zumarraga Channel which is approximately 87 sq. natutical miles in area with average depth of 4 meters. All these are potential sites for mussel farming.

Mussels are found in natural beds in the area. They are usually gathered from the wild. Farming was started by a native farmer at Jiabong, Samar. In 1975, the Bureau of Fisheries and Aquatic Resources established a one-hectare demonstration farm in the same town. Now there are new farms including those in Villareal town at the other side of the bay.

The development of mussel farm in the area is quite slow due to the abundance of fish and there is no big demand for mussel. The area developed is less than 20 hectares. With the availability of local materials such as bamboo and the farmers' hesitance to spend more on labor, the only method of mussel culture used is staking. The price of mussel range from 1 to 2 pesos per kilogram.

4. *Negros Occidental*

Himamaylan in Negros Occidental is also a new mussel producing area. The farming method used is the same as that in Capiz. As it is near, the transfer of technology was easier. Negros Occidental, however, has limited area for expansion, with a few hectares for development of mussel farming at the most.

RESEARCH UNDERTAKEN

The South East Asian Fisheries Development Center (SEAFDEC) in Iloilo is undertaking researches on the biology of mussel. The Bureau of Fisheries and Aquatic Resources conducts applied researches at its farms on the various methods of cultivation. There has also been attempts to transport and grow mussel seed and breeders in various areas of the country where green mussel is absent, without much success.

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STATUS OF SMALL-SCALE FISHERIES IN SEYCHELLES

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INTRODUCTION

The Republic of Seychelles is an archipelago of some ninety small islands scattered over the south-western part of the Indian Ocean, roughly between 4°S to 10°S and 46°E to 56°E. Most of the islands are coralline but twenty or so are granitic and lie on a submarine plateau which has an area of 10,800 square nautical miles. Mahe is the largest granitic island and supports 95% of the total population

Although the reefs and coral outcrops of the Mahe Plateau form the main fishing ground, there are various other highly productive grounds which are exploited to a lesser degree by islanders in the vicinity. With the declared 200-mile Exclusice Economic Zone, Seychelles has over 400,000 square miles of water under its jurisdiction but most of it is deep open sea suitable mainly for pelagic fisheries. The total fishable area of the island-associated reefs and banks can be broken down as follows:

Mahe Plateau	10,800	n. miles²
Amirantes Plateau	1,000	,,
Coetivy Island.....	100	,,
Platte Island	100	,,
Providence/Farquhar..... ..	250	,,
Cosmoledo/Aldabra.....	100	,,
Alphonse groud	50	,,
Total	12,400	n. miles²

From this area the portion exploited by the small-scale fishermen (i.e. which is suitable for line and trap fishing) adds up to about 7,000 square nautical miles. It is generally true to say that no traditional fishing takes place beyond the 100-metre isobath.

Seychelles is affected by the twin monsoon system the winds blowing from the south-east from May to October and from the north-west during November to April. Winds are constant during South-East Monsoon, averaging 12 knots and variable during the North-West Monsoon with an average speed of 6 knots.

Because of its geographic location and the nature of its submarine topography, the Seychelles archipelago is influenced by divergences and upwellings which produce favourable fishing conditions.

FISHING VESSELS

According to a 1977 survey the small-scale fishing fleet of Mahe numbered 345 vessels crewed by just over 1,000 men.

(a) The "pirogue" which is a narrow streamlined wooden vessel of semidugout construction; it ranges from 5m to 8m in length and is traditionally painted black. Very few of these exist and are used principally in the beach seine fishery.

(b) The wooden or fiberglass canoes, 5m to 7m long, powered by sails or outboard motors (max. 25 hp). These constitute the largest category (270) and are crewed by 2-3 fishermen who operate either handlines or traps.

(c) The "whaleboats", measuring about 10m in length and built of wood, equipped with inboard diesels (15-35 hp) and sails, and crewed by 6-10 men fishing vertical handg lines or sometimes troll lines. This category comprises only 50 units but land the largest portion by weight of the islands' catch since the crew concentrate on large earangids.

(d) The decked "schooner" ranging from 10m to 14m in length, equipped with 20-50 hp inboard diesels but also provided with sails. These vessels carry insulated ice boxes and stay up to one week at sea with crew of 5-8 men fishing with vertical handlines mainly for snappers and groupers.

In addition, there are three larger vessels (15-20m) which could really constitute the first units of a fifth class. One of these is in ferro-cement.

FISHING TECHNIQUES

Seychellois fishermen employ the following gears and methods:

Handline

Various combinations of line strength (monofilament and braided nylon) and hook size are used, depending on the species and the ground fished. This gear is used in the day time for Carangidae, Lutianidae, Lethrinidae Serranidae, etc., but also at night for Sphyraenidae.

Troll line

This line is 20 m or longer and carries a lured or baited hook. A boat would usually tow ½ lines (multiple-line trolling is practised by one boat only) mainly when steaming to and from the demersal fishing grounds by day. The species caught are predominantly bonitos and small tunas.

Beach seine

This is a polyfilament nylon net which is operated by a handful of fishermen in the few bays where conditions are suitable. Sardines are caught occasionally in seines with 2 cm (stretched) mesh, but more commonly the fishermen use 4 cm mesh seines for catching mackerel (*Rastrelliger kanagurta*).

Gill net

Also of polyfilament nylon, and of various mesh sizes. Large-meshed nets (20 cm) are often used to capture sharks during night time.

Trap

A hexagonal structure made from thin strips of bamboo and containing only one lateral opening. The trap measures about 2 m in width by 0.5 m in height, and the meshes must allow a sphere of 4 cm diameter to go through easily. There are minor variations of style involved and these depend on the depths and species fished. Siganidae constitutes the bulk of the catch from traps.

PRODUCTION AND MARKETING

No accurate statistics of catch are available but the annual production in 1977 was estimated to be around 4,500 metric tons. This was composed mainly of large *Caranx* spp., *Euthynnus affinis*, and *Rastrelliger kanagurta*. In fact, 70% of the 1,400 metric tons sold on Victoria Central Market (the largest market in the country) consisted of pelagic species. Demersal fish made up 27% and the remaining 3% was shark.

Fish is sold directly by the fishermen himself (no middlemen nor cooperatives) either on the beach or in the markets provided for that purpose in the main population centres. Since the total Seychelles population is only 62,000 (1977) the per capita consumption of fish turns out to be extremely high.

A small export trade has developed over the recent years and the amount shipped this year 1978 has exceeded 300 metric tons (Lutianidae, Serranidae).

INFRASTRUCTURE

As yet no fishing port exists in Seychelles. In Victoria, the capital, the fishing boats are able to use a length of quay at the cold commercial port, but elsewhere the boats land on beaches and are then anchored off.

There are three small fishing companies operating but only one of them owns old storage facilities and insulated transport. Government has lately provided a 100-ton cold store and a 5-ton/day blast freezer. Ice production capacity is grossly inadequate at 6 tons per day.

(Value in thousand dinars)
(Quantity in thousand Tons)

MARINE FISH PRODUCTION IN PDR YEMEN FROM 1971 TO 1977

Year	1977		1976		1975		1974		1973		1972		1971	
Kind	Value	Quant.	Value	Quant.	Value	Quant.	Value	Quant.	Value	Quant.	Value	Quant.	Value	Quant.
Lobster	1210.7	0.68	544.9	0.55	609.4	0.70	459.4	0.32	310.8	0.47	362.5	0.38	—	—
Cuttle fish	12613.7	15.53	11173.5	15.25	2062.9	5.80	2512.4	7.11	3011.5	4.52	6628.8	6.98	1669.0	4.56
Harik, yarika (squid)	462.7	2.73	171.2	1.08	22.6	0.14	58.1	0.37	24.0	0.15	—	—	—	—
Sardine (*S. Longiceps)*	1361.3	90.76	1763.9	88.19	1742.8	87.15	1741.6	87.07	1977.9	89.78	1711.8	90.09	1599.7	88.86
King fish (seer fish)	197.3	2.62	218.2	2.35	155.5	1.72	146.6	1.80	113.4	1.44	111.5	1.34	93.8	0.98
Yellow fin tuna	38.0	0.58	414.8	4.42	666.8	8.58	560.4	7.40	477.9	7.38	470.4	7.37	376.3	6.07
Blue fin tuna	163.3	2.11	169.3	2.32	128.8	1.71	92 6	1.19	40.0	0.58	36.1	0.59	32.1	0.46
Tunny like	124.7	1.65	107.6	1.39	82.8	1.13	68.8	0.97	61.4	0.98	62.9	1.07	57.5	0.86
Shark	724.2	9.65	150.2	4.07	106.9	2.52	62.8	0.95	120.4	1.91	110.1	1.77	66.3	0.82
Snapper, red snapper	98.4	1.34	152.2	2.13	108.2	1.55	95.7	1.43	53.4	0.86	44.8	0.89	42.6	1.51
Indian mackerel *(R. Kanagurta)*	668.6	8.93	273.4	10.85	286.1	11.39	287.1	11.42	284.4	11.37	48.2	1.47	61.5	1.37
Anchovy	7.99	5.34	256.3	9.30	279.8	9.99	245.4	9.39	29.5	1.09	103.7	4.53	9.4	0.41
Baiad (King Mackerel/ Jack fish)	—	—	126.1	1.82	160.0	2.14	130.4	1.74	33.2	0.58	34.9	0.61	12.8	0.25
Antak (*N. Japonicus)*	63.7	0.91	32.5	0.49	87.4	1.31	82.4	1.23	83.9	1.26	20.9	0.45	90.9	2.17
Other fish	1380.5	18.53	729.7	12.42	404.2	5.65	763.8	9.94	614.3	10.32	352.2	5.93	328.5	5.78
Fish meal	52.6	0.69	57.4	0.76	51 4	0.68	20.4	0.89	19.3	0.45	—	—	—	—
Frozen fish	23.5	0.10	34.4	0.59	75.3	1.37	3.5	0.05	15.7	0.27	—	—	—	—
Total	19263.1	162.07	16375.6	157.98	7030.9	143.53	7331.4	143.27	7271.0	133.41	10098.8	123.47	4440.4	113.74