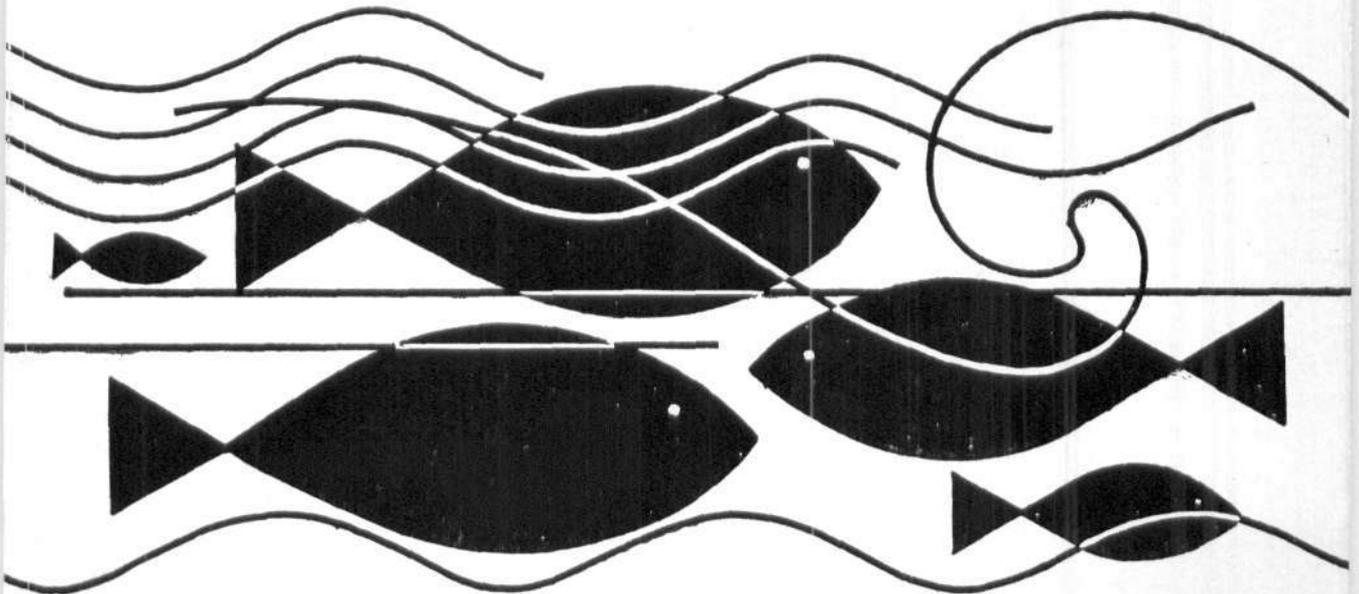


Central Marine Fisheries Research Institute
40
YEARS
1947-1987

Number 35

an
appraisal
of the
marine fisheries
of
kerala



Issued in connection with the 40th Anniversary Celebrations of

Central Marine Fisheries Research Institute

P. B. No. 2704, E. R. G. Road, Cochin 682 031, India

Indian Council of Agricultural Research

September 16-18, 1987

AN APPRAISAL OF THE MARINE FISHERIES IN KERALA

T. JACOB, V. RAJENDRAN, P. K. MAHADEVAN PILLAI,
JOSEPH ANDREWS AND U. K. SATYAVAN

CMFRI Special Publication
Number 35



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Limited Circulation

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Published by

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Central Marine Fisheries

Research Institute

P. B. 2704

E. R. G. Road

Cochin-682 031

India

Cover drawing by Shri K. K. Sankaran
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PREFACE

The Central Marine Fisheries Research Institute, Cochin, is the premier organisation in the country conducting research in marine fisheries leading to rational exploitation, management, development and conservation of living marine resources. The Institute, ever since its early days of inception, has been collecting data on the catch and effort along with the biological information on the exploited marine fisheries resources of the country, through a stratified multistage random-sampling method. In addition to making use for biological studies, including assessment of stocks conducted by the Institute, these data have been processed and utilised to furnish estimates of annual marine fish production in different states over the past 38 years.

With the changed objectives and functions of the institute in recent times, greater emphasis has been laid on the assessment of stocks for better management of the exploited stocks and to indicate the possible sources of additional production in the context of modern technological innovations in fishing practices in both traditional and mechanised sectors.

With continued increase in fishing effort and intense exploitation of certain resources in different areas of the seas around India a need now arose to examine critically the present status of the exploited stocks, the fishing intensity, the number of boats and different types of gears, infrastructural facilities for handling, storage, transportation and marketing of the catches, the status of the underexploited resources and the availability of additional resources beyond the presently exploited areas of each maritime state for providing necessary technical advice to the respective Governments to manage and conserve the resources.

It is with this in view that the data relating to each maritime state for the period 1975-84 are consolidated and processed and presented as a separate special publication. This number gives the appraisal of the marine fisheries of Kerala state, highlighting the status of the exploited resources and the catch prospects. Some suggestions for management measures are also discussed.

I thank Shri. T. Jacob, Shri. V. Rajendran, Shri. P. K. Mahadevan Pillai, Shri. Joseph Andrews and Shri. U. K. Satyavan for the concerted efforts taken in bringing out this publication. S/Shri. K. Ramachandran Nair, K. C. Yohannan, R. Bhaskaran Achari, S. B. Chandran-gathan, Jacob Jerald Joel, P. Karunakaran Nair, M. Babu Philip, T. G. Vijayarwarrier, T. Girijavallabhan, A. A. Thankappan, C. K. Krishnan, K. Thulasidas. K. Soman, S. Siddalingaih, N. Palaniswamy, T. Krishnankutty and V. S. Gopal collected the catch data and other details, which form the base for the report. Shri. M. G. Dayanandan and Shri. C. R. Shanmughavelu ably supervised the field work. The earnest effort put in by all of them is very much appreciated.

I thank Dr. K. Alagarwami, Joint Director, and Mrs. K. Srinath, Scientist, for going through the manuscript and giving valuable suggestions.

P. S. B. R. James,
Director.

AN APPRAISAL OF THE MARINE FISHERIES IN KERALA

T. Jacob, V. Rajendran, P. K. Mahadevan Pillai,
Joseph Andrews and U. K. Satyavan

INTRODUCTION

Kerala, the southwestern part of the peninsular India, has a narrow stretch of land with a long surf-beaten coast on the western side and a lush green mountain range on the eastern side. The coastline is 590 km long, which is almost one-tenth of the Indian coastline. Marine fishing, using artisanal tackles like boat-seines, shore-seines and chinese dip nets, is an age-old tradition of the state. Mechanisation was started in late fifties by the Indo-Norwegian Project, at first in the Quilon area. The early sixties too saw an important technological development, namely the shift from cotton to nylon nets. By mid-sixties, individual entrepreneurs entered the scene, paving way for a fast development of trawl fishery in the coastal waters. Commercial purse-seining started during late seventies, and the process of large-scale motorisation of country crafts began in early eighties.

The state has two major fishery harbours, one at cochin and the other at Sakthikulangara. About 220 landing centres, some of them equipped for mechanised boats to land, are located along the coast. The landing centres are well connected by motorable roads. Ice plants, cold storages, boat-building/repairing yards and other infrastructure facilities are also developed in various centres.

Kerala occupies the foremost position in marine fish production in India, accounting for almost a quarter of the total landings of 1.6 million

tonnes. But, in the course of the last 3 decades, marine fish production in Kerala has only increased from 1.96 lakh tonnes (average of 1950 and 1951) to 3.90 lakh tonnes (average of 1983 and 1984), about doubling production while, at the all-India level, production has trebled.

This disparity in increase of production between Kerala and the all-India level is obviously due to marine fishing activities having been already near-saturated in Kerala and the development having been taken place only during the last one-and-half decades in many other states. This is more evident in the fact that the fish production in general in Kerala during the last two decades was more or less stagnant with only slight spurts now and then when there was a leap in production in many other states. In fact, this has been a matter of concern to the planners and developmental agencies engaged in finding out ways and means for augmenting production. Therefore, it is felt that a publication giving an appraisal of marine fisheries in Kerala for a ten year period of 1975 to 1984, for which comparatively more detailed data are available, would be useful.

The publication covers information on the means of production, exploited marine fishery resources and the effort expended. Maximum catch prospects and how the fishing units are to be allocated are discussed and some programmes suggested. Some of the important publications related to the study are also listed in the following Bibliography.

BIBLIOGRAPHY

- ANON, 1951. *Proc. Natn. Inst. Sci. India*, 17B (1)
- ANON, 1951. *Handbook on Indian Fisheries* (Govt. of India, Ministry of Agriculture).
- ANON, 1958. Progress of marine fisheries research. Fisheries of the west coast of india. CMFRI, India.
- ANON, 1973. *Proc. Symp. Living Resources of the Seas Around India*. Special Publication, CMFRI.
- ANON, 1981. Monsoon fishery and mudbanks of Kerala coast. *Bull-Cent. Mar. Fish. Res. Inst.*, 30A.
- ANTONY RAJA, B. T. 1969. The Indian Oil Sardine. *Bull. Cent. Mar. Fish. Res. Inst.*, 16.
- BALAN, V. 1962. Some observations on the shoaling behaviour of the oil sardine *Sardinella longiceps*. *Indian J. Fish.*, 8 (1) : 207-221.
- BALAN, V. 1973. Purse seine and boat seine (Thanguvala) fishery for the oil sardine off Cochin 1968-1971. *Indian J. Fish.* 20 (1) : 70-77.
- BALAN, V. 1980. Changes among traditional fishing grounds in Kerala. *Sea-food Export Journal* 12 (6) : 9-14.
- BALAN, V. 1978. The sailfish fishery off Calicut during 1974-75 and 1975-76. *Indian J. Fish.*, 25 (1 & 2) : 67-76.
- BALAN, V. 1984. The Indian oil sardine fishery : A review. *Mar. Fish. infor. Serv. T & E Ser.*, 60 : 1-10.
- BANERJI, S. K. and D. CHAKRABORTY, 1970. A preliminary appraisal of the prawn fishery of Kerala. *Indian J. Fish* 17 (1 & 2) : 13-20.
- BHIMACHAR, B. S., S. K. BANERJI and G. VANKATARAMAN, 1957. A study of the variability in the fish catches taken by successive hauls in the inshore waters off Calicut. *Indian J. Fish.*, 4 (1) : 1-19.

- CMFRI 1967. The Central Marine Fisheries Research Institute. *Souvenir, 20th Anniversary.*
- CMFRI 1969. Marine Fish Production in India. *Bull, Cent. Mar. Fish. Res. Inst.*, 13 :
- CMFRI, 1979. Trends in total marine fish production in India. *Mar. Fish. Infor. Serv. T & E Ser.* 9: 7-22.
- CMFRI, 1979. Synopsis of marine fishery of India 1978. *Ibid* , 10.
- CMFRI, 1980. Trends in total marine fish production in India, 1979. *Mar. Fish. Infor. Serv. T & E Ser* 22: 1-19.
- CMFRI, 1981, All India Census of Fishermen, Craft & Gear 1980. *Mar. Fish. Infor. Serv. T & E Ser.* 30.
- CMFRI, 1981. Trends in total marine fish production in India for the year 1980. *Ibid.*, 32: 1-6.
- GEORGE, M. J., S. K. BANERJI and K. H. MOHAMED, 1968. Size distribution and movement of the commercial prawns of the southwest coast of India. *Seafood Exporter*, 3 (1):143-149.
- GEORGE, M. J., SUSEELAN, M. M. THOMAS and N. S. KURUP. 1980. A case of over fishing: Depletion of shrimp resources along Neendakara coast, Kerala, *Mar. Fish. Infor Serv. T & E Ser.* 18 : 1-8.
- GEORGE, M. J., C. SUSEELAN and K. BALAN. 1981. By-catch of shrimp fishery in India. *Mar. Fish. Infor. Serv. T & E Ser.*, 28: 1-13.
- GEORGE, M. J., C. SUSEELAN, M. M. THOMAS, N. S. KURUP, K. N. RAJAN V. S. KAKATI, K. N. GOPALAKRISHNAN, K. CHELLAPPAN, K. K. BALASUBRAMANIAN and C. NALINI 1983. Monsoon prawn fishery of Neendakara coast, Kerala—A critical study. *Mar Fish. Infor. Serv. T. & E. Ser.*, 53: 1-8.
- GEORGE P. C., B. T. ANTONY RAJA and K. C. GEORGE 1977 Fishery Resources of the Indian Economic Zone. *I. F. P. Silver Jubilee Souvenir.*

- JACOB, T., K. ALAGARAJA, S. K. DHARMAAJA, K. K. P. PANIKKAR, G. BALAKRISHNAN, U. K. SATYAVAN, V. BALAN and K. V. N. RAO 1982. Impact of traditional fishery with special reference to oil sardine in Kerala during 1980-81. *Mar. Fish. Infor. Serv. T & E Ser.*, 40: 8-11.
- JACOB, T., G. VENKATARAMAN, K. ALAGARAJA and S. K. DHARMAAJA 1982. Manpower and fishing equipments available and exploited fishery resources in the coastal waters of India. *Proc. Symp. Harvest and Post harvest Technology of Fish.* Society of Fish Technologists, Cochin. 31-36.
- JACOB, T., K. ALAGARAJA and K. N. KURUP 1983. Marine fishery statistics in India— Present Status. *Mar. Fish. Infor. Serv. T. & E. Ser.*, 46: 6-11.
- JAMES, P. S. B. R. 1972. Distribution pattern of marine fishery resources of India. *Biologica*, 5.
- KURUP, N. SURENDRANATHA and P. VEDAVYASA RAO 1975. Population characteristics and exploitation of the important marine prawns of Ambalapuzha, Kerala. *Indian J. Fish.* 21 (1) (1974): 183-209.
- KURUP, N. S. 1979. The mud bank prawn fishery of Kerala—Declining trend. *Mar. Fish. Infor. Serv. T & E Ser.*, 9: 1-5.
- KUTHALINGAM, M. D. K. 1979, Results of the experimental trawling off Vizhinjam in the Arabian Sea. *Seafood Export. Journal* 8: 15-19.
- LUTHER, G. 1979. Anchovy fishery of the southwest coast of India with notes on characteristics of the resources. *Indian J. Fish.* 26 (1 & 2): 23-39.
- LUTHER, G., P. N. RADHAKRISHNAN NAIR, G. GOPAKUMAR and K. PRABHAKARAN NAIR 1982. The present status of small-scale traditional fishery at Vizhinjam. *Mar. Fish. Infor. serv. T & E Ser.* 38: 1-16.
- MURTY, A. V. S. and M. S. EDELMAN 1968. On the relation between the intensity of the southwest monsoon and the oil sardine fishery of India. *Indian J. Fish.* 13 (1 & 2): 142-149.
- NAIR, P. V. R., V. K. PILLAI, A. G. PONNIAH and D. VINCENT 1981. Fish mortality from ammonia pollution. *Proc. Seminar on status of environmental studies in India.* March 1981.

- NAIR, R. V. 1953. Studies on the revival of the Indian Oil Sardine fishery. *Proc. Indo-Pacific Fish. Coun.*: 115-129.
- NAIR, R. V., S. K. BANERJI, K. VIRABHADRA RAO, G. VENKATARAMAN, K. V. NARAYANA RAO and V. BALAKRISHNAN. 1970. The Indian Mackerel. *Bull. Cent. Mar. Fish. Res. Inst.* 24.
- NOBLE, A. 1979. The Indian mackerel in 1978. *Mar. Fish. Infor. Serv. T & E Ser.* 8: 1-11.
- PANIKKAR, K. K. P. 1980. Coastal rural indebtedness - a case study. *Mar. Fish. Infor. Serv. T & E Ser.*, 18: 8-12.
- PANIKKAR, K. K. P. and K. ALAGARAJA. 1981. Socio-economic status of fishermen community of Calicut area *Mar. Fish. Infor. Serv. T & E Ser.*, 33: 1-v2.
- PANIKKAR, K. K. P. and R. SATHIADHAS. 1984. Fishermen's share in consumer's Rupee-A case study. *Proc. Symp. Harvest and Post-harvest Technology of Fish. Society of Fish Technologists, Cochin.*
- PILLAI, P. K. MAHADEVAN. 1978. A preliminary study on the catfish fishery off Blangad on the southwest coast of India. *Indian J. Fish.* 25 (1 & 2) : 240-243.
- RADHAKRISHNAN, N. 1969 On the pelagic fishery resources off Vizhinjam on the southwest coast of India I, *Proc. Ind. Sci. Cong. Assn.* 56th Session, Bombay 1969. Part III. Also Adv. *Abstr. Contr. Fish. Aquat. Sci. India*, 3 (2) : 147-148.
- RAO, K. V. NARAYANA and M. KUMARAN. 1977. Resources of horse mackerel off the southwest coast of India. *Seafood Export Journal.* 9 (8) : 9-28.
- RAO, K. V. NARAYANA, M. KUMARAN and J. SANKARASUBRAMANIAM. 1977. Resources of ribbonfish and catfish off the southwest coast of India. *Ibid.*, 9 (11) : 9-26.
- SAM BENNET, P. 1967. Some observations on the fishery and biology of *Sardinella fimbriata* (val) at Vizhinjam. *Indian J. Fish.* 14 (1 & 2) : 145-158.
- SATHIADHAS, R. and G. VENKATARAMAN. 1981. Impact of mechanised fishing on the socio-economic conditions of the fishermen of Sakthikulangara-Neendakara, Kerala. *Mar. Fish. Infor. Serv. T & E Ser.*, 29 : 1-18.

- SATHIADHAS, R. and G. VENKATARAMAN. 1983. Indebtedness and utilization of fisheries credit in Sakthikulangara-Neendakara, Kerala: A case study. *Mar. Fish. Infor. Serv. T & E Ser.*, 54 : 1-6.
- SESHAPPA, G and B. S. BHIMACHAR. 1955. Studies on the fishery and biology of the Malabar sole *Cynoglossus semifasciatus* Day. *Indian J. Fish.*, 2 (1) : 180-230.
- SHANMUGAVELU, C. R. and P. K. MAHADEVAN PILLAI. 1980. On the results of exploratory purse-seining between Cochin and Goa. *Indian J. Fish.*, 27 (1 & 2) : 183-192.
- SILAS, E. G., S. K. DHARMARAJA and K. RENGARAJAN. 1976. Exploited marine fishery resources of India - a synoptic survey with comments on potential resources. *Bull. Cent. Mar. Fish. Res. Inst.*, 27.
- SILAS, E. G., M. J. GEORGE and T. JACOB. 1984. A review of the shrimp fishery of India - a scientific basis for the management of resources. *Fishery News Book* England : 83-103.
- SILAS, E. G., T. JACOB, K. ALAGARAJA and K. BALAN, 1986. Exploitation of marine fishery resources and its contribution to Indian economy. *CMFRI Spl. Publ.* 29.
- SILAS, E. G., P. P. PILLAI, A. A. JAYAPRAKASH and M. AYYAPPAN PILLAI. 1984. Focus on small scale fisheries-the drift gillnet fishery off Cochin. 1981 and 1982. *Mar. Fish. Infor Serv. T & E Ser.*, 55 : 1-14.
- THOLASILINGAM, T., G. VENKATARAMAN and K. N. KRISHNA & KARTHA 1964. A study of the fishery and estimation of relative abundance of ground fish off Cochin. *Indian J. Fish* 11A (2): 709-734.

MEANS OF PRODUCTION

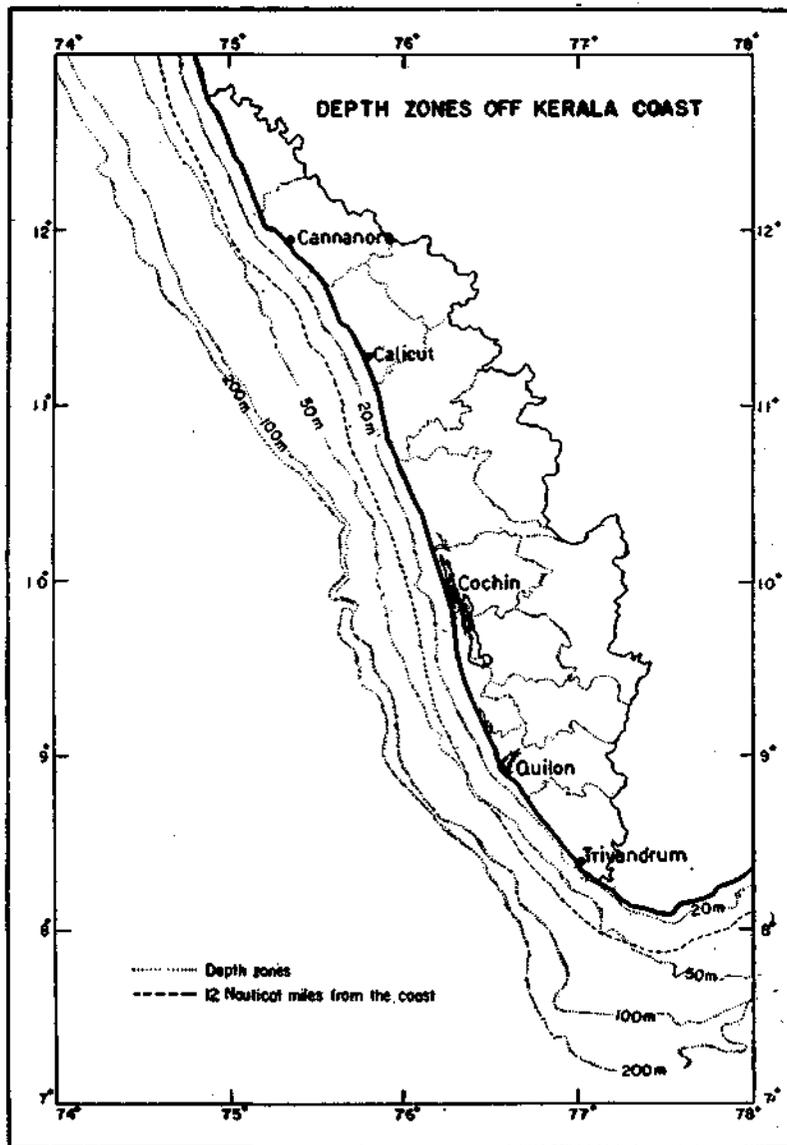
The Central Marine Fisheries Research Institute conducted an all-India census of marine fishermen and craft and gear in 1980. The procedures followed and other details are given in Marine Fisheries Information Service, No. 30, 1981. In Kerala, the census was conducted in the 8 coastal districts, namely, Trivandrum, Quilon, Alleppey, Ernakulam, Trichur, Malappuram, Kozhikode and Cannanore. It may be noted that Cannanore district's figures include also those of Kasargod, because Kasargod was at that time a part of Cannanore district.

Fishing Villages and Landing Centres

Of the 304 fishing villages/hamlets in Kerala, the largest number is in Cannanore district (65) and the least is in Malappuram district (18). There are 222 landing centres in the state (Census, 1980). Apart from the two major fishery harbours, at Cochin and Sakthikulangara, there are a number of centres where mechanised boats land such as Munambam, Azhikkal, Ponnani and Beypore. Trivandrum district has the maximum of landing centres (24%) and Malappuram has the minimum (5%). The highest number of landing centres per. 10 km coastline is in Quilon district (9) and the next is in Trivandrum (7). In the other districts the number varies from 2 to 4.

Fishermen Population

The total fishermen population in the state is about 6.4 lakhs. Adult males and females form 33% each of the total population and children form 34%. The districtwise percentage of total population ranges from 8 in Ernakulam to 21 in Trivandrum. There are about 1 lakh fishermen families in the state. As in the case of population distribution, the number of fishermen households is the lowest in Ernakulam district (8%) and highest in Trivandrum district (27%). In the state as a whole, average size of a fishermen family is 6, ranging from 5 in Trivandrum to 8 in Malappuram.



Education

Those who are literate constitute 23 percent of the total fishermen population in the state. Out of them, 81% are primary standard completed, 16% secondary standard completed and 3% have studied beyond secondary standard.

Fishermen Engaged in Actual Fishing

Twenty percent of the total fishermen population are engaged in actual fishing. Eighty five percent among them are engaged in full-time fishing (with least 90% time spent for fishing) 8% in part-time fishing (30 to 90% time for fishing) and 7% in occasional fishing (less than 30% time for fishing).

Fishing Craft

The estimated total number of mechanised craft in Kerala in 1979-80 was 3038, which comprised 2630 trawlers, 362 gillnetters, 37 (purse-seiners and 9 'other categories'. The number of purse-seiners increased to about 70 by 1982. In the meantime, the process of motorisation had started in Alleppey district and soon spread other parts, between Munambam in the north and Vizhinjam in the south and the number of craft taken to motorization grew to 4000 by end of 1984. Soon motorization picked up also in North Kerala, the total number of mechanized craft in the state growing to about 6000.

There are about 980 mechanised fishing craft owned by fishermen families. Seventy-six percent of this comes under the category of trawlers. Gill netters, which constitute 22%, form the next major category. The maximum number of mechanised craft is recorded in Quilon district (37%), followed by Ernakulam (16%), Cannanore (15%) and Kozhikode (13%). In all the other districts it is less than 7%.

Of the 26,000 non-mechanised craft, catamarans form 44%, dug-out canoes 40% and plank-built boats the rest. Catamarans are found only in Trivandrum (90%) and Quilon districts (10%). Plank-built boats are concentrated more in southern districts, namely, Trivandrum, Quilon and Alleppey, whereas dug-out canoes are comparatively more in northern districts namely, Trichur, Malappuram, Kozhikode and Cannanore.

Fishing Gear

There are about 1,500 trawl nets in the state, owned by fishermen, the bulk of which are found in the districts of Quilon (41%), Cannanore (18%), Ernakulam (16%) and Kozhikode (14%). The total trawl nets in the state are about 4000. The most commonly used gear in all the districts of Kerala is drift/set gillnet. Boat seine is the next important gear found in all the districts. Hooks and lines, traps and scoop nets are mainly concentrated in Trivandrum district. In all the coastal districts of Kerala except

Trivandrum, indigenous fishing operations are mainly carried out either by drift/set gill net or by boat seine. In Trivandrum district, fishing activity is more diversified, with the use of various types of gear such as drift/set gill nets, shore-seines, boat seines, scoop nets and traps. Among the gears given under 'others', cast nets constitute a major portion.

Ice Plants and Cold Storages

As per statistics pertaining to the year 1980, there are five ice and cold storage plants, in the public/co-operative sector in Cannanore district some with freezing facilities. The numbers are four in Kozhikode, two in Malappuram, three in Trichur, three in Ernakulam, three in Alleppey, two in Quilon and two in Trivandrum. The total ice plant capacity is 186 tonnes (in 24 hours), ice storing capacity is 723 tonnes, fresh fish storing capacity is 584 tonnes, freezing capacity is 56 tonnes and frozen-fish storage capacity is 1530 tonnes. In the private sector there are 19 units in Cannanore district, 26 in Kozhikode, 19 in Malappuram, 20 in Trichur, 84 in Ernakulam, 45 in Alleppey, 46 in Quilon and 8 in Trivandrum. (Kerala Fisheries Facts and Figures, Govt. of Kerala, 1980). Full information on the capacity, present status and diversified utilisation of these is however not available.

As per the 1980 figures there are 25 canning factories in Kerala, some of them not functioning owing to various reasons.

Boat Building/Repairing Yards

In the public sector there are two boat building yards, one in Sakthikulangara and the other in Beypore. In the private sector there are 14 yards in Quilon district, 4 in Alleppey, 13 in Ernakulam and 5 in Kozhikode districts. The yards undertake repairing work also.

EXPLOITED MARINE FISHERY RESOURCES

Sampling Design Followed for Estimation of Landings

Fish landings may take place all along the coast in all seasons during day and night. In such a situation the collection of statistics is a formidable task, because of the cost, operational difficulties and non-sampling errors of a continuous survey of all the landing centres becoming very high in magnitude. A scientifically planned sampling design is the only feasible answer, by which the landings of the large number of non-mechanised and mechanised craft can be estimated. The historical background and details of the design are given in Marine Fisheries Information Service, No. 46 (1983).

Total Fish Landings

The present annual marine fish landings in Kerala are estimated at 3.9 lakh tonnes (the average of 1983 and 1984), which account for almost one-fourth of the all-India landings. There was a gradual increase in the catches, during the period 1955-64, from 1.1 lakh tonnes (in 1955) to 3.5 lakh tonnes (in 1960). The fishery fluctuated between 3.3 lakh tonnes and 4.5 lakh tonnes during 1965-1979. The landings were again very low in 1980, descending to 2.8 lakh tonnes. Since then, there has been a gradual increase, the figures reaching 3.9 lakhs in 1984.

An increasing trend in prawn landings started in 1964, with the introduction of commercial trawling by the then Indo-Norwegian Project. The spurt in 1982 may be attributed to the motorisation of country crafts. The annual purse-seine catches during 1980 to 1984 were of the order of only 16,000 tonnes and did not make any noticeable change in total production.

Landings of Pelagic and Demersal Groups and Individual Species

The total landings can be divided into two major groups, namely the pelagic and demersal. The pelagic group comprises fishes such as oil sardine, lesser sardines, *chirocentrus*, hilsa shad, other shads, *stolephorus*, *Thryssa*, *Setipinna*, *Coilia*, other clupeoids, bombayduck, half-beaks, full-beaks, flyingfish, ribbonfish, carangids, mackerel, seer fish, tunas barracudas and mullets. The demersal group comprises fishes such as elasmobranchs,

eels, catfishes, lizard fishes, perches, red mullets, polynemids, sciaenids, silverbellies, lactarius, pomfrets, soles, prawns, lobsters and cephalopods.

TABLE 1. *Groupwise and total fish landings in Kerala in different Years (in tonnes).*

	Pelagic	Demersal	Total
1975	216276	204560	420836
1976	248114	82933	331047
1977	221860	123177	345037
1978	262774	110565	373339
1979	228272	102237	330509
1980	146713	132830	279543
1981	202868	71527	274395
1982	225426	100369	325795
1983	274212	111605	385817
1984	253023	140448	393471

Annual pelagic fish landings are estimated at 2.64 lakh tonnes (average of 1983 and 1984) and the demersal 1.26 lakh tonnes, the former accounting for 68% and the latter 32%. It is also seen that demersal fin fishes accounted for about 21%, crustaceans 10% and molluscs 1%. Considering the trend for the decade, it is seen that, two-third of the landings were of pelagic group of fishes. However, in 1980, when the pelagic catches were very low (oil sardine showed an all time low figure) and in 1975, when the demersal catches were very high (prawns showed an all time high figure), this condition was reversed.

THE TRENDS IN PRODUCTION OF IMPORTANT GROUPS

Oil sardine : The oil sardine, *Sardinella longiceps*, a pelagic shoaling fish, forms the most important fish in terms of quantity. The coastal area between Quilon in Kerala and Ratnagiri in Maharashtra is the rich traditional region for oil sardine.

The annual catches of oil sardine in Kerala are estimated at 1.5 lakh tonnes (average of 1983 and 1984), which is 38% of the total catches in Kerala. In 1975, about 97,000 tonnes of oil sardine were landed and

thereafter the figures remained steady around 1.2 lakh tonnes till 1979. In 1980 it went down to an all-time low figure of about 70,000 tonnes. This dip, at first attributed to the emergence of purse seiners which were operating in and around Cochin since 1979, was later shown, by a special study made by the Scientists of CMFRI, to be due to lack of availability rather than impact of purse seiners, which, unlike in Karnataka, is negligible in Kerala. In 1981, with purse-seiners still in operation, the total sardine landings rose to 1.5 lakh tonnes and almost stabilised at that level. If the previous decade (1965-1974) is considered, it is seen that oil sardine catches had reached the peak value of 2.5 lakh tonnes in 1968. In fact, from 1965 to 1971, except for one year the catches were maintained at about 2.0 lakh tonnes. However, from 1972 onwards the catches reduced to almost half with a slow recovery after 1980. But it never reached the pre-1972 figures.

Kerala accounted for 78% of the total oil sardine landed in the country. The all-India trend of landings over the years was similar to that observed in Kerala.

Mackerel : The Indian mackerel, *Rastrelliger kanagurta*, is mostly found on the west coast between Cape Comorin and Ratnagiri and to some extent in Tamil Nadu, Andhra Pradesh and Orissa. The annual landings in Kerala is about 12,200 tonnes (average of 1983 and 1984), accounting for about 3.1% of the total production. An increasing trend has been noticed from 1975 (about 15,000 tonnes) to 1978 (25,900 tonnes) and thereafter a declining trend was observed. Neither the advent of purse-seining nor the motorisation of country crafts helped in increasing the total catches of mackerel.

There has been wide fluctuations in the landings of mackerel in Kerala in the pre-1975 period, with the maximum catch of almost 1 lakh tonnes in 1971.

Thirty-three percent of the mackerel landings in India are accounted for by Kerala. The trend over the years of the all-India figures was similar to that of Kerala.

Penaeid prawns : India is one of the leading countries of the world harvesting and exporting prawns. Over half a lakh tonnes of prawns are exported annually from this country, earning over 400 crores of rupees in foreign exchange. Among prawns, the penaeid group has a better demand in foreign markets and is the major component of prawn landings in Kerala.

The annual prawn production in Kerala is estimated at 32,600 tonnes (average of 1983 and 1984). The fishing is mostly supported by *Metapenaeus dobsoni*, *Penaeus indicus* and *Parapenaeopsis stylifera*. The production in 1975 was about 77,000 tonnes. It decreased to 30,000 tonnes in 1979, showed a spurt in 1980 (52,600 tonnes), then a dip (22,300 tonnes) in 1981 and a marginal increase thereafter.

The maximum catch of penaeid prawns was recorded in 1973, the figure being 84,770 tonnes. Higher catch was recorded also in 1974 (60,000 tonnes) and in 1975 (77,000 tonnes). But the catches never reached that level anytime afterwards.

The State accounted for 26% of the penaeid prawns landed in India. The all-India catches over the years showed a trend similar to that of Kerala.

Whitebaits : *Coilia*, *Setipinna*, *Stolephorous*, *Thrissina* and *Thryssa* mostly constitute the anchovy fishery of India. *Stolephorous* spp. (commonly called white baits) is the most important among them. In Kerala they account for almost 97% of the anchovy catches. The annual catches of whitebaits have been estimated at 48,000 tonnes (average of 1983 and 1984). The figures from 1975 to 1984 indicate almost a downward trend till 1981 and an upward trend from about 4,300 tonnes in 1981 to 42,000 in 1984. The fishery over the last three decades have been highly fluctuating with the maximum of 55,000 tonnes in 1983.

58% of the total all-India landings of whitebaits in 1984 were accounted for by Kerala.

Catfishes : *Tachysurus tenuispinis*; *T. thalassinus*, *T. serratus* and *T. dussumieri* are the major species of catfishes caught in Kerala. The annual catch of catfish is estimated at 13,500 tonnes (average of 1983 and 1984). Considering the period 1975 to 1984, catfish landings were maximum in 1975, the estimate being 33,000 tonnes. It declined thereafter with the catches varying around 11,000 tonnes. The trend over the last three decades shows that the fishery was fluctuating. The catches were less than 10,000 tonnes till 1969, but thereafter, except for two years, it was much above 10,000 tonnes with the peak in 1974 (33500 tonnes). About 23% of the all-India catches of catfishes are accounted for by Kerala.

Perches : Threadfin breams, rock cods and snappers are the major groups coming under perches. The annual catch of perches is estimated at 18,400 tonnes (average of 1983 and 1984). The maximum catch during the decade was registered in 1984 the figure being 26,880 tonnes. The trend during the last three decades shows that the catches were mostly less than 3,000 tonnes prior to 1970. Thereafter the landings were on a higher plane. The catches were even above 20,000 in 1974, 1978, 1979 and 1984.

The perch landings in Kerala form about 29% of the total all-India landings.

Carangids : The landings of the carangid group of fishes, comprising mostly *Caranx* spp, have been estimated to be about 15,100 tonnes (average of 1983 and 1984) accounting for almost 4% of the total Kerala fish landings. To the all-India landings of carangids, the contribution of Kerala works out to 27%. The catch figure was generally over 10,000 tonnes in six of the ten years 1975-84, the maximum catch being in 1983 (16500 tonnes). Prior to 1972 the catches were mostly less than 8,000 tonnes.

Croakers : An average annual landing of about 7,900 tonnes (average of 1983 and 1984) have been observed of the group croakers, which comprise a number of species. This is about 2% of the total fish landings of Kerala and 8% of the all-India catches of croakers. In 1975 the catches were of the order of 16,800 tonnes, which was the highest for the decade 1975-84 and which generally showed a declining trend, minimum being 3,100 tonnes in 1981. During the period prior to 1975 (1956 to 1974) the catches were around 5,000 tonnes except in 1973 and 1974, when the catches reached the figure of 10,000 tonnes.

Soles : About 15,400 tonnes (average 1983 and 1984) of soles were landed in Kerala, forming about 4% of the state's total landings and 48% of the total landings of soles in India. The catches were about 6,900 tonnes in 1975, they declined till 1981 and almost doubled afterwards, the maximum catches being 17,700 tonnes in 1984. If the data from 1956 onwards are examined the fishery is seen to be highly fluctuating with a minimum of 2,700 tonnes in 1957 and a maximum of 16,200 tonnes in 1962.

Seer Fishes : The fishery, constituted mainly by three species, namely *Scomberomorus commerson*, *S. guttatus* and *S. lineolatus*, is quite important qualitatively. The catches are estimated at 6,600 tonnes (average of 1983 and 1984), forming only about 2% of the catches of Kerala. However, it

contributed 18% to the total seer fishes caught in India. During the last one decade the catches have been varying around 5000 tonnes annually. The catches were generally less than 2,000 tonnes during the period 1956 to 1973 but rose to more than double in 1974 and maintained that level thereafter.

Tunnies : The tunas though are an oceanic resource, some important species like *Auxis thazard*, *A. rochei*, *Sarda orientalis*, *E. affinis* and *T. tonggol* are coastal. The landings of these in Kerala are estimated at 6,000 tonnes (average of 1983 and 1984), forming only about 2% of the total fish landings of Kerala, but about 32% of the total tuna landings of the country. During the last one decade the catches were mostly stable, but in 1979 it reached the highest figure, namely 15,400 tonnes. If the past two decades are considered, the catches are less than 2,500 tonnes prior to 1971.

Elasmobranchs : Sharks, skates and rays form this group, whose catches are estimated at 8,000 tonnes (average of 1983 and 1984), accounting for 2% of the total landings of Kerala. It formed 13% of the total elasmobranch catches at the all-India level. In 1975 the catches were 10,000 tonnes, which is the highest for the decade 1975-84 with the minimum at 4,900 in 1981. During the previous 2 decades, the fishery was fluctuating between 3,000 and 10,000 tonnes without any apparent trend.

Ribbonfishes : The catches of ribbonfishes are estimated at 3800 tonnes (average of 1983 and 1984), forming about 1% of the total fish landings of Kerala. It contributed about 8 per cent to the total ribbonfish catches of India. During the decade 1975-84, the years 1978 and 1979 were very favourable, as production reached almost 25,000 tonnes. During the previous two decades the fishery was highly fluctuating with maximum catches of 30,000 tonnes recorded in 1974. In some of the years the catches were even less than 1000 tonnes.

Cephalopods : The catches of cephalopods are estimated at 3,600 tonnes (average of 1983 and 1984), constituting mostly by squids and cuttlefishes which are of considerable importance from the export point of view. This forms about 1% of the total landings of Kerala. About 18% of the cephalopod catches in India are accounted for by Kerala.

The catches were more or less steady during the last one decade. Prior to 1974, the catches had been less than 1,000 tonnes, but doubled in 1974, and reached a maximum of 6,500 tonnes in 1978. The fluctuations continued, but on a higher level, also during the period 1975 to 1984.

Pomfrets : About 1,800 tonnes (average of 1983 and 1984) of pomfrets were landed, constituting mostly by the black and silver pomfrets and forming about 3% of the all-India pomfret catches. During the last one decade, the catches were more or less steady with spurts in 1977 (3,700 tonnes) and 1982 (4,200 tonnes).

District-wise landings

Maximum fish landings, of about 93,000 tonnes (average of 1980 to 1984) were observed in Quilon district, accounting for 28% of the total landings of the state. Trivandrum comes next with a catch of 48,000 tonnes (accounting for 14%), followed by Ernakulam 38,900 tonnes (12%) Alleppey 37,800 tonnes (11%), Cannanore 36,400 tonnes (11%) Kozhikode 28,400 tonnes (9%), Malappuram 26,100 tonnes (8%) and Trichur 23,300 tonnes (7%).

Increasing trend in catches for the five-year period was seen in Alleppey, Ernakulam, Trichur and Malappuram districts. Other districts showed fluctuations without any appreciable trend.

The average oil sardine catches (1980 to 1984) of Quilon district accounted for 22% of the total catches, followed by Alleppey (17%) Cannanore (15%), Ernakulam (13%), Malappuram (11%), Calicut (11%), Trichur (9%) and Trivandrum (2%).

The average mackerel catch (1980 to 1984) was highest in Trivandrum, accounting for 27%, followed by Ernakulam (24%), Quilon (13%), Calicut (11%), Cannanore (9%), Alleppey (6%), Malappuram (5%) and Trichur (4%).

Quilon district accounted for the maximum catches of penaeid prawns (48%), followed by Cannanore district (15%), Ernakulam (13%), Alleppey (9%), Calicut (7%), Malappuram (5%) and Trichur (3%).

A little over one-third of the catches of whitebaits was accounted for by Trivandrum district. The catches in Alleppey accounted for 21%, followed by Quilon (16%), Malappuram (11%), and Kozhikode and Trichur (7% each).

The maximum catches of catfishes were observed at Quilon, accounting for 40% of the total catfish landings of the state. Ernakulam and the northern districts accounted for about 10% of the catches each, while in Alleppey and Trivandrum the percentage was about 5% each.

Quilon accounted for 66% of the catches of perches followed by Ernakulam (20%) and Trivandrum (10%), the other districts contributing only 4% all together.

Quarterwise Seasonwise Landings

For the purpose of present study, the year has been divided into four periods, namely, monsoon (July to September), post-monsoon (October to December), summer (January to March) and pre-monsoon (April to June).

The average (1980 to 1984) contribution of landings is highest in the post-monsoon period (32%), followed by monsoon (29%), summer (22%) and pre-monsoon (18%).

Oil sardine catches were highest in the post-monsoon period, accounting for 43%. Summer contributed to 31% of the total landings of oil sardine, whereas the pre-monsoon and monsoon contributed about 13% each.

Mackerel landings showed highest figure in the pre-monsoon period (29%), followed by summer and post-monsoon periods (27% each) and lowest in the monsoon period (17%).

A little more than half of the penaeid prawn landings took place during the monsoon. This is because of the heavy landings at Sakthikulangara during monsoon period. Pre-monsoon period accounted for 20% and post-monsoon and summer about 13% each.

Monsoon season accounted for 47% of the catch of whitebaits, followed by post-monsoon (34%), pre-monsoon (15%) and summer (4%).

Catfishes landed in the monsoon and post-monsoon periods accounted for about 31% each, followed by pre-monsoon (27%) and summer (11%).

Almost three-fourths of the landings of perches took place during the monsoon season. Summer accounted for about 11%, pre-monsoon 9% and post-monsoon 6%.

Gearwise Landings

Of the total landings of 1984, 67% were by mechanised boats and 33% by non-mechanised boats. Here mechanised boat landings include

landings from boats using mechanisation for both propulsion and fishing such as trawlers and purse-seiners as well as those from boats using inboard engines for propulsion alone like gill-netters and others fitted with outboard engines.

TABLE 2. *Mechanised and nonmechanised marine fish landings (in tonnes) in Kerala for different years.*

	Mechanised	Non-mechanised	Total
1975	183944	236892	420836
1976	58185	272862	331047
1977	106073	238964	345037
1978	117572	255767	373339
1979	94779	235730	330509
1980	135305	144238	279543
1981	96321	178074	274395
1982	148668	177127	325795
1983	197689	188128	385817
1984	263532	129939	393471

In Kerala the non-mechanised boats contributed over two-thirds of the catches prior to 1980. From 1980 onwards the percentage of mechanised landings gradually increased and consequently non-mechanised landings decreased. In 1983 more than half the catches were accounted for by mechanised boats and in 1984 they accounted for two thirds of the landings. Purse-seiners and country crafts fitted with outboard engines contributed to this change.

In Trivandrum district over the five year period 1980 to 1984 only 1% of the catches were accounted for by mechanised boats. In Quilon district an average of 81% of the catches were accounted for by mechanised boats. There has been an increase from 69% in 1981 to 95% in 1984.

In Alleppey district on an average 79% of the catches came from mechanised sector. Here also there has been a rising trend with 99% accounted for by mechanised units in 1984.

In Ernakulam district the catches by mechanised boats were more or less steady accounting on an average about 92% of the landings for the

period 1980-84. In Trichur district, the mechanised landings increased from 8% in 1981 to 49% in 1984.

Malappuram district showed a general increasing trend in mechanised boat landings from 7% in 1981 to 18% in 1984. The pattern has been same for Kozhikode but more pronounced in Cannanore district, where the mechanised boat landings increased from 14% in 1980 to 79% in 1984.

Trawl : During the five year period 1980 to 1984, an average of 23% (76000 tonnes) of the total catches were accounted for by trawlers, the range being 18 to 38. No clear trend was seen.

Forty-four per cent of the trawl catches were accounted for by penaeid prawns in 1980 which showed a decline to 27% in 1984. But in terms of quantity there has been a slight increase since 1981. 59% of the prawn landings were *P. stylifera*, 26% *M. dobsoni*, 8% *P. indicus* and 3 per cent *M. affinis*.

On an average about 16% of the total trawl catches were perches. Threadfin breams form the major component contributing about 91% to the perches group.

Lizard fish (*Saurida* spp) accounted for 7% of the trawl catches. There was no definite trend for the period 1980 to 1984. 5% of the catches were catfishes and there was a slight decline in catches during the period 1980 to 1984. Croakers also accounted for about 5% of the catches.

Soles accounted for 8% of the trawl catches, stomatopods 7%, cephalopods 3%, silverbellies 2% and carangids and elasmobranchs 1% each.

Quilon had the maximum trawl landings of 61%, followed by Ernakulam (16%), Cannanore (12%) and Calicut (5%). Other districts had catches less than 3% each.

Purse-seine: Commercial purse-seining started by the end of 1979 with a small fleet of 20 purse-seiners. By 1980 the number rose to 70 and more or less remained stationary. Out of the total landings of Kerala, purse-seiners accounted for about 5% (16000 tonnes). No trend has been observed for the period 1980-84.

Oil sardine contributed about three-fourth of the catches of purse-seines. Even though the total landings of oil sardine did not show any pattern, the percentage contribution to total purse-seine catches increased during the period 1980-84.

Mackerel contributed to 18% of the purse-seine catch. Both the landings and the percentage contribution of mackerel to total purse-seine landings showed a decreasing trend over the period 1980-84. Carangids and lesser sardines accounted for about 2% and whitebaits 1%.

99% of the purse-seine catches were landed in Ernakulam district, Cochin Fisheries Harbour accounting for the bulk.

Drift/set gill nets (craft with inboard engine): Three percent of the total catches, estimated at 11,500 tonnes (average of 1980-84), were accounted for by drift/set gill nets. The annual catches declined in 1981 but thereafter showed an increasing trend. Maximum catches were accounted for by elasmobranchs (24%). The percentage contribution of elasmobranchs to total gill net catch for the five years was more or less stable while the actual quantity landed generally increased. Catfishes and seer fishes accounted for about 20% each. Both the groups declined in the beginning of the five-year period and then showed increase.

Pomfrets formed 7% of the catches. There has been a general increase in the catches over the five-year period. Major constituent is black pomfrets (60%).

Tunnies formed 17% of the gillnet catches. There was no pronounced trend over the five years. But the proportion in the gillnet catches decreased over the years.

Carangids and mackerel formed 4% and 3%, respectively, of the total gillnet catches.

Gillnet catches were landed in all the districts. Trichur contributed to 35% of the landings, Ernakulam 26% and Quilon 22%.

Boat-seines (craft fitted with O. B. E.): Motorisation of country craft on commercial basis, started in Kerala by 1981, picked up very fast in the Alleppey region. Total catches were 22,40 tonnes in 1981, which rose to 1,11,900 tonnes in 1984. 29% of the total catches of 1984 in Kerala state was accounted for by the boat-seines operated by motorised craft.

The major catches were oil sardine, which had a three-fold increase from 1981 to 1984. However, the proportion of catches of oil sardines over the years decreased from 99% in 1981 to 65% in 1984, which was mainly due to diversified fishing.

Whitebaits formed about 20% of the catches of motorised boat-seiners in 1984. The catches increased from about 1% in 1981 to 20% in 1984. Silverbellies landings were about 5500 tonnes in 1982 and 1983, but reduced to 400 tonnes in 1984.

Penaeid prawns form an important component, the catches increasing from 62 tonnes in 1982 to 8800 tonnes in 1984. *M. dobsoni* was the major component. Mackerel formed only about 1% of the total catches from motorised boats.

In Quilon the boat-seine landings were of the order of 24,000 tonnes in 1982, which increased to 42,000 tonnes in 1984. In Alleppey district from 22,000 tonnes in 1981 the landings increased to 50,000 tonnes in 1984. In Ernakulam district the landings increased from 590 tonnes in 1981 to 10,000 tonnes in 1984. In other districts boat-seine operated by craft with out-board engines picked up only in 1984.

Drift / set gillnet (craft with O. B. E): The catches from motorised gill netter increased from 470 tonnes in 1981 to 12,900 tonnes in 1984, the latter figure accounting for about 3% of the total catches of Kerala. Oil sardine was the major component. From 430 tonnes in 1981 the catches increased to 11,100 tonnes in 1983 but decreased to 4800 tonnes in 1984.

About 1,500 tonnes of seer fishes were caught in 1984, accounting for about 12% of the total catch by that net. Mackerel formed about 14%, tunas 7%, and catfishes and elasmobranchs 4% each of the total catches by this net in 1984.

Hooks and lines (craft with O. B. E): An increasing trend (from 2700 tonnes in 1982 to 7,800 tonnes in 1984) has been observed in the catches by hooks and lines using craft with O. B. E., accounting for about 2% of the total catches of Kerala in 1984.

The major catch in 1984 was catfishes (31% of the catches by the gear) followed by carangids (24%), elasmobranchs (22%), tunnies and mackerel (5% each) and seer fishes (2%).

It may be also mentioned that catches by hooks and lines using craft with inboard engine showed a sharp decline from 2400 tonnes in 1981 to 3,00 tonnes in 1984.

Hooks and lines landings were mostly in Trivandrum and Quilon districts.

Boat-seine (craft non-mechanised): About 28% of the total catches of Kerala (average of 1980-84) was accounted for by boat-seiners. The catch increased in 1981, but showed a decline over the rest of the period. Oil sardine formed the major component, accounting for 66% of the total non-mechanised boat-seine landings. Here again the catches showed a decline from 1981 to 1984 period.

Ribbonfishes formed the next important component, accounting for about 7% of the catches, soles 4% and croakers 1% with no apparent trend.

About 5,900 tonnes of penaeid prawns were caught in 1980 (7% of the boat-seine catch), which gradually reduced to 1,100 tonnes (1%) in 1984.

Malappuram and Cannanore districts accounted for about 22% each of the boat-seine catches, followed by Calicut (19%), Trichur (15%) and Trivandrum (12%). The other districts, Quilon, Alleppey and Ernakulam, together contributed to only less than 10% of the total boat-seine landings, evidently because the boat-seines in these districts were now mostly operated from craft with O.B.E. and the landings have been reckoned as mechanised landings.

Shore seines (non-mechanised): The average catches (1980 to 1984) by shore-seines accounted for about 4% of the total catches of Kerala. The catches were more or less steady during the period.

Whitebaits formed the major component, accounting for about 35% of the shore-seine catches. 19% of the catches were accounted for by carangids group, 9% each by mackerel and oil sardine and 6% each by lesser sardines and silverbellies. There were fluctuations over the years without any noticeable trend. The districts which mostly contributed to the catches were Trivandrum (81%) and Quilon (18%)

Drift / set gill net (craft non-mechanised): About 14% of the total catches of Kerala (average 1980-84) have been accounted for by drift/set gill nets using non-motorised craft. Over the five-year period, there has not been any trend.

Oil sardine formed the most important species caught, accounting for about 28% of the catch by this net.

Whitebaits and mackerel accounted for 14% each, tunnies and lesser sardines 8% each and carangids 4%. There were fluctuations in the landings but without any trend. Forty percent of the catches by gill netters were

accounted for by Trivandrum district, followed by Quilon (22%), Calicut (11%), Cannanore (9%), Ernakulam (5%) and Alleppey, Trichur and Malappuram (less than 5% each).

Hooks and lines (craft non-mechanised): The average catch by hooks and lines was of the order of 12,000 tonnes (average of 1980 to 1984). There were wide fluctuations in the catch figures.

Carangids formed the major component (23%), followed by catfishes (22%), perches (9%), elasmobranchs (8%), tunnies (5%), and seer fishes (2%).

Hooks and lines catches were mostly in Trivandrum (63%) and Quilon districts (14%). The three northern districts together contributed to about 21% of the catches.

FISH LANDINGS AT THE THREE IMPORTANT CENTRES

Cochin Fisheries Harbour: The total landings at Cochin Fisheries Harbour was estimated at 26,200 tonnes (average 1980 to 84), which was about 8% of the total landings of Kerala. The landings during the five-year did not show any trend. 64% of the catches were of pelagic group and 36% demersal group of fishes. In 1982 the pelagic group declined to 55% and consequently the demersal group increased to 45.

Groupwise, oil sardine landings were highest, accounting for 42% of the total landings at the Harbour followed by penaeid prawns (12%), mackerel and perches (11% each) and tunnies and catfishes (3% each).

Gearwise, the total catches by trawlers at the Fisheries Harbour were estimated to be 8900 tonnes (average of 1980 to 1984) seemingly without any trend. The major groups landed by trawlers were the penaeid prawns, accounting for 35% and perches 31%. Catfishes, lizard fishes, soles and stomatopods accounted for about 4% each.

Seasonwise, 40% of the landings were during the monsoon period, followed by pre-monsoon period (30%), summer (20%) and post-monsoon period (10%).

Total catches by purse-seiners were estimated at 16,100 tonnes (average of 1980 to 1984). There have been fluctuations in the landings

accounted for by Trivandrum district, followed by Quilon (22%), Calicut (11%), Cannanore (9%), Ernakulam (5%) and Alleppey, Trichur and Malappuram (less than 5% each).

Hooks and lines (craft non-mechanised): The average catch by hooks and lines was of the order of 12,000 tonnes (average of 1980 to 1984). There were wide fluctuations in the catch figures.

Carangids formed the major component (23%), followed by catfishes (22%), perches (9%), elasmobranchs (8%), tunnies (5%), and seer fishes (2%).

Hooks and lines catches were mostly in Trivandrum (63%) and Quilon districts (14%). The three northern districts together contributed to about 21% of the catches.

FISH LANDINGS AT THE THREE IMPORTANT CENTRES

Cochin Fisheries Harbour: The total landings at Cochin Fisheries Harbour was estimated at 26,200 tonnes (average 1980 to 84), which was about 8% of the total landings of Kerala. The landings during the five-year did not show any trend. 64% of the catches were of pelagic group and 36% demersal group of fishes. In 1982 the pelagic group declined to 55% and consequently the demersal group increased to 45.

Groupwise, oil sardine landings were highest, accounting for 42% of the total landings at the Harbour followed by penaeid prawns (12%), mackerel and perches (11% each) and tunnies and catfishes (3% each).

Gearwise, the total catches by trawlers at the Fisheries Harbour were estimated to be 8900 tonnes (average of 1980 to 1984) seemingly without any trend. The major groups landed by trawlers were the penaeid prawns, accounting for 35% and perches 31%. Catfishes, lizard fishes, soles and stomatopods accounted for about 4% each.

Seasonwise, 40% of the landings were during the monsoon period, followed by pre-monsoon period (30%), summer (20%) and post-monsoon period (10%).

Total catches by purse-seiners were estimated at 16,100 tonnes (average of 1980 to 1984). There have been fluctuations in the landings

reached 3,700 tonnes in 1984. Elasmobranchs and tunnies formed the major catches, contributing to 26% and 25%, respectively, followed by catfish (18%) seer-fishes (14%) and pomfrets (3%).

The catches at Sakthikulangara were more or less of the same order for the pre-monsoon, monsoon and post-monsoon period (around 800 tonnes). In the summer season landings generally ebbed to very low figures.

Munambam

The landings at Munambam were estimated at about 4,100 tonnes (average of 1980 to 1984). Catches were of the order of 10,000 tonnes in 1980 which reduced to 2400 in 1981 and more or less maintained at that level thereafter.

The annual total catches by trawl net were about 3400 tonnes. A decline was observed in 1981 (2000 tonnes) compared to 1980 (9000 tonnes) and the catches remained about 2,000 tonnes thereafter, followed by croakers and stomatopods (about 13% each), soles (8%) and perches (6%).

Bulk of the catches were landed during the summer period (42%) followed by pre-monsoon (37%), post-monsoon (15%) and monsoon (6%).

Total catches by drift/set gillnet at Munambam were about 560 tonnes. Elasmobranchs formed about 31% of the catches, followed by seerfishes (20%), catfishes and tunnies (18% each) and pomfrets (7%).

Maximum landings were observed during summer (35%), followed by post-monsoon (27%), pre-monsoon (26%) and monsoon (11%).

Landings by Govt. of India Vessels

Figures of species-wise and depth-wise catches by Govt. of India vessels landed in Kerala for the years 1975-84 are given in a separate table in the Appendix. Elasmobranchs, catfishes and perches formed important catches by these vessels. The annual total catches were of the order of about 940 tonnes during the period 1975 to 79 and 500 tonnes during the period 1980 to 1984. Eventhough the effort remained more or less same, the total catches showed a decline over the years.

EFFORT EXPENDED AND CATCH PER UNIT EFFORT

The effort is given in terms of boat-trips, from which effort in terms of fishing hours can be approximately worked out by using assumed conversion factors.

As seen earlier, during the period 1975-1980, the mechanised boat landings showed fluctuations. However, since 1980 the landings showed an increasing trend. The number of trips by mechanised boats also showed a similar pattern. This is mainly due to the introduction of out-board engines in indigenous sector in 1981 and thenceforth its fast growth.

The landings of non-mechanised boats were of the order of 250,000 tonnes during 1975 to 1979. But these declined afterwards and touched almost half by 1984, the average for the period 1980-1984 being of the order of 160,000 tonnes, because, as has been stated, the country crafts started operating with out-board engines and thus remained no longer in the non-mechanised category. However, during the period the motorisation picked up only in the region between Quilon and Ernakulam, and in the other parts the traditional way continued till 1983.

The number of boat trips by mechanised units includes that of trawlers, purse-seiners, drift/set gill-netters (with inboard engines), boats operating hooks and lines (with inboard engine) and out-board engined country craft using boat-seine/gillnets/hooks and lines. Till 1979 the units were mostly trawlers and gill-netters (with inboard engines). In 1979-80 purse-seiners got added to the fleet and in 1981 craft fitted with outboard engines started operating. Effort of non-mechanised units include that of boat-seines, draft/set gill nets, hooks and lines and shore-seines. In order to have a better understanding, the split-up figures would be helpful, and so the estimates for the major gears are detailed below.

Trawl Net

Trawl net catches were maximum in 1975 (177,800 tonnes) and minimum in 1981 (49,300 tonnes) during the decade 1975-84. The average of catches during 1975-79 was 103,000 tonnes but it diminished to 75,900 tonnes during 1980-84. The averages of boat-trips for the corresponding periods were 321,000 and 318,000.

The catch per effort (CPUE) was maximum in 1975 (450 kg) and minimum in 1983 (170 kg). The CPUE for prawns varied from 60 kg in 1981 to 180 kg in 1975. The average CPUE for the years 1975 to 1979 was of the order of 325 whereas it has reduced to 240 kg for the years 1980 to 1984. The corresponding CPUEs for prawns were 120 kg and 85 kg.

The effort put in (average of 1980-1984) was maximum in summer (89,700 boat-days), followed by pre-monsoon, post-monsoon and monsoon. However, the trawl catches were maximum in the monsoon season. The catch per unit effort consequently was the highest during monsoon (490kg), followed by pre-monsoon (210 kg) and post-monsoon and summer (150 kg each). This can be attributed to the fact that there was a good 'Karikkadi' fishery at Sakthikulangara during the monsoon, when activities in other areas were not that high. Even though some of the boats from neighbouring areas also went for fishing in Sakthikulangara waters, it was for short duration, the whole coast getting equally active thereafter.

The prawn catches per boat-trip was of the order of 200 kg in monsoon, where as it was only 60 kg in pre-monsoon and still less in the other two periods.

The CPUE in Cochin Fisheries harbour for the period 1980 to 1984 varied from 160 kg to 280 kg with an average of 200 kg. The range between 1975 to 1979 was 160 to 340 kg with an average of 280 kg. The prawn catches per trawler trip was of the order of 70 kg during the period 1980-1984. The average value was 110 kg for the period 1975-1979.

The CPUE in Sakthikulangara showed wide fluctuations during the decade. The average for the period 1975-79 was 390 kg and for the period 1980-84 it was about 340 kg. The prawn catch per unit effort was of the order of 110 kg during 1980-84. In 1975-79 the average prawn catch rates were around 140 kg.

Purse-seine: Commercial purse-seining in the inshore waters started towards the end of 1979. It picked up initially, but, owing to various reasons, the units remained around 70. The fish caught were by and large landed at the Cochin Fisheries harbour.

The number of boat-trips was about 5,300 in 1980, which increased to 8,870 in 1981 and maintained that level in 1982, while it reduced to about 7000 in 1983 and 1984. Catches were of the order of 17,000 tonnes

in 1980 and 1981 but reduced in 1982 to 11,500 which thereafter increased to almost 21,000 tonnes in 1984. The CPUE declined from 3110 kg in 1980 to 1300 kg in 1982 and then increased to 2900 kg in 1984.

Oil sardine catch per purse-seine trip was the highest in 1984 (2,300 kg) and lowest in 1982 (950 kg). On the other hand, mackerel catch per unit effort was highest in 1980 (820 kg) followed by 1981 (440 kg) and the lowest in 1983 (220 kg). The higher catches of mackerel in 1980 and 1981 were the reason for the higher catch per unit effort during these years.

Seasonwise, the maximum number of operation was in the post-monsoon period, amounting to 2720 trips (average of 1980-1984), followed by early summer (2270), pre-monsoon (1490) and monsoon (890).

The catch per unit effort was about 2,500 kg in the post-monsoon, 2,300 in summer period, 2000 kg in the monsoon period and 1600 kg in the pre-monsoon period. The catch rates of oil sardines and mackerel were similar in trend to their total catches.

Drift / set gill net (operated by boats with inboard engine): During the five-year period 1980-1984, the effort expended by the boats has been slightly increasing from about 68,000 trips to 87,000, with a slight dip in 1981. The catch per unit effort was highest in 1983 (182 kg) and lowest in 1981 (120 kg).

Elasmobranch catch per unit effort ranged from 31 kg in 1981 to 44 kg in 1983. Catfish catches ranged from 18 kg in 1982 to 39 kg in 1983. The catch rate for seerfish ranged from 15 kg in 1981 to 42 kg in 1983, showing wide fluctuations. Tunnies catch per unit effort varied from 22 kg in 1984 to 33 kg in 1980.

Maximum number of operations of the gill-netters was in post-monsoon period, amounting to about 26,900 (average of 1980 to 1984) followed by the summer period (18,100). The operations in the pre-monsoon and monsoon periods were more or less same, amounting to a little less than 15,000.

The catch rates were highest in the post-monsoon period (180 kg) followed by monsoon (170 kg), summer (130 kg) and pre-monsoon (120 kg)

Boat-seine (boats with outboard engines): As stated earlier, commercial-scale motorisation of country crafts began in 1980 and picked up fast in

the area between Quilon and Munambam. The number of boat trips operating boat-seine steadily increased from about 14,000 in 1981 to 312,000 in 1984. Catch also increased but at a slower rate. The CPUE was of the order of 1600 kg in 1981, but reduced to 530 kg in 1982 and still reduced to 360 kg in 1984.

Oil sardine catches per unit effort, which was 1590 kg in 1981, reduced drastically to 440 kg in 1982 and further reduced to 230 kg in 1984. However, the study indicates that the operators have been adopting diversified fishing and, in later years, *Stolephorus*, spp; mackerel and prawn were also caught instead of the almost exclusive oil sardine caught in 1981. During monsoon season in the Alleppey region motorised boats operated sometimes were using boat-seine (choodavala) for catching whitebaits and surfacing prawns.

Post-monsoon period had the maximum catch rate (530 kg), followed by early summer (450 kg). Monsoon and pre-monsoon showed lower figures of about 350 kg each.

Drift / set gill net (by craft with outboard engines): Gillnet operations of country craft fitted with OBE increased from 2,000 boat-trips in 1981 to almost 150, 100 boat-trips in 1984, showing a 75-fold increase. Catches increased only at a slower rate. Two hundred and forty kg of fish were caught per boat-trip in 1981, 200 in 1983, 170 kg in 1982 and only 90 kg in 1984. The steep increase in number of boats with no corresponding increase in catches has contributed to the sharp decline in CPUE.

Catch rates of oil sardines decreased from 220 kg in 1981 to 32 kg in 1984. However, in later years this was somewhat compensated by more catches of mackerel, seer-fishes and tunnies.

The post-monsoon period had the highest catch rate (160 kg) and the summer period the lowest (50 kg). In monsoon and pre-monsoon, the rates were a little more than 100 kg.

Hooks and lines (operated by boats with OBE) : The effort expended increased from 36,000 (in 1982), boat-trips to 87,000 (in 1984), registering a three-fold increase. The catch rates increased from 75 kg in 1982 to 90 kg in 1984.

Catch rate of carangids was about 27 kg, catfishes 26 kg, elasmobranchs 20 kg, and tunnies 4 kg.

Maximum catch rate was seen in monsoon season (120 kg) followed by pre-monsoon (100 kg), post-monsoon (90 kg) and summer (50 kg).

Boat-seine (operated by country-crafts): The effort expended showed a decline from about 489,000 in 1980 to 336,000 in 1984. The maximum catch rate was observed in 1983 (350 kg) and minimum in 1980 (170 kg). The rate did not show any specific trend.

The catch rates for oil sardine varied from 95 kg in 1980 to 211 kg in 1983. Ribbonfishes showed a rate of 23 kg in 1980 but reduced to almost 1 in 1983. Penaeid prawn rates varied from 15 kg in 1983 to 3 kg in 1984. There were fluctuations in the rate in general, without any trend. The post-monsoon period showed the highest catch rates (370 kg), followed by summer (260 kg), monsoon (180 kg) and pre-monsoon (140 kg).

Drift / set gill net (operated by country crafts): The total effort showed a general increasing trend except in 1984, when both the effort and catch declined. The catch per unit effort was 48 kg in 1980 which reduced to 32 kg in 1984.

Oil sardine catch per unit effort showed a decreasing trend over the years 1981 to 1984 (18 kg in 1981 and 7 kg in 1984). The catch rate for tunnies was 9 kg in 1980, which drastically reduced to 3 kg and further reduced to 2 kg later. Mackerel also showed a sharp decline in the catch rate from 10 kg in 1980 to 4 kg in 1984.

Maximum catch rate was observed in monsoon season (77 kg) followed by post-monsoon (44 kg), pre-monsoon (40 kg) and summer period (32kg).

Hooks and lines (operated by country crafts) : The fishing effort expended was maximum in 1982 (6,24,000 boat-trips). The catch rate was 23 kg in 1980 and increased to 33 kg in 1983 and then reduced to 18 kg in 1984. Catfish catch rate was 6 kg and so also the rate for carangids.

Maximum catch rate was observed in monsoon season (35 kg), followed by post-monsoon (25 kg), pre-monsoon (25 kg) and summer (20kg).

DISCUSSION

Kerala with its long tradition in marine fishing continues to occupy the top position in the All India landings. Today it accounts for about one-fourth (3.9 lakh tonnes) of the country's marine fish landings. But there is also the serious problem of stagnancy, upsetting the plans of developmental agencies. It is here necessary to critically examine the trends in production during the last several years in different perspectives for a proper understanding of the situation. Before going over to the trends it is felt that it would be useful to give a summary of the results of the studies on the production status in relation to various classifications such as species, season and gear and then get back to the past. Mudbank phenomenon, pollution problem and estimates of product value and per capita availability are touched up on before the discussion goes to the maximum catch prospects.

Production Status

As is quite known, oil sardine is by far the most important fish in terms of quantum of landings in Kerala (1.50 lakh tonnes). Even though penaeid prawn production is only about 0.33 lakh tonnes, in terms of value it takes the dominant position. Mackerel is also a traditionally important fishery.

The post-monsoon period contributes to almost one third of the landings, closely followed by monsoon. Whereas oil sardine catches are the highest in post-monsoon period, mackerel catches are highest in pre-monsoon and penaeid prawns in monsoon period.

While catamarans using gillnets or hooks and lines are more prevalent in Trivandrum and Quilon districts, trawlers are mostly operated around Sakthikulangara, Cochin and Ponnani. Purse-seiners land the catches almost exclusively in Cochin Fisheries Harbour. Gill-nets are more or less spread over the coast but with concentrations in Quilon, Ernakulam and Cannanore regions. Motorised country crafts, initially (1980) got introduced in Quilon, Alleppey and Ernakulam region where it picked up very fast, has now taken roots in northern districts as well. Today almost two-thirds of the catches are accounted for by the mechanised sector which covers crafts

using mechanisation for propulsion and fishing as well as for propulsion alone. Motorised country crafts contribute maximum to the total landings. In fact about 30 percent of the catches have been accounted by motorised crafts. Trawlers land about 20 percent of the catches.

More than a quarter of the total catches are landed in Quilon district followed by Trivandrum, Ernakulam, Alleppey and Cannanore districts. While maximum landings of prawns and oil sardines occur in Quilon district, mackerel and white baits are dominant in Trivandrum district.

Trends in Production

A glance at the production statistics through the last three decades shows wide fluctuations. But certain aspects emerge. There has been a general increasing trend up to 1964. In 1965 the catch was 3.4 lakh tonnes and since then the production has been varying between 2.9 lakh tonnes and 4.5 lakh tonnes. Though there has been spurts between 1970 and 1975 and between 1980 and 1984, by and large the production has been stagnant for the last two decades. This may look intriguing because it has happened in spite of the various developmental programmes introduced from time to time. Trawler operations picked up in early sixties. Purse-seiners started commercial fishing in 1979. Motorisation of country crafts got a boost in 1980. Still the fish production remained stagnant with only a few temporary peaks.

A perusal of the composition of the fish landings bring out a distinct phenomenon. The prawn catches have been steadily increasing since mid-fifties till mid-seventies. Prior to 1956, the catch was of the order of 6000 tonnes which rose to 14,000 tonnes by 1959. By mid-sixties it was of the order of 25,000 tonnes which doubled (51,000 tonnes) during 1970-74. However it decreased by 6,000 tonnes during 1975-79 and a further reduction of about 12,000 tonnes was observed during 1980-84 resulting in a lull in the activity since the late seventies. The big leap in prawn landings since 1965 for a period of over one decade had served as a fillip to the fisheries sector as a whole and the trawler operations in particular. Due to increase in catches and the heavy demand for prawns in foreign markets the industry flourished. More and more boats were added. Jetty / harbour and other shore infrastructure and road and transport facilities improved. A large number of persons got employed in fishery allied activities. A number of ancillary industries developed by way of peeling sheds, ice factories and boat building/repairing yards. Additional production of prawns and their exports have significantly contributed to the national

income (C.M.F.R.I. Sp. Bulletin No. 29, 1986). Foreign exchange earnings had a phenomenal growth. Thus even though total production did not show any marked improvement, due to the positive impact of the shrimp fishery, the sector economy prospered.

It may be of interest to know the changes, if any, in the catch trends of other important resources over the last one decade. White bait catches showed a substantial increase especially in 1983 and 1984. Ribbon fish catches on the other hand decreased. While oil sardine and soles increased, mackerel and croakers showed a declining trend. Other important species like perches, lizard fishes, silver bellies, seer fish and tunnies did not show any regular trend. The minor trends observed in some of the species are mostly marred by the wide annual fluctuations. There has not been any appreciable inter-correlation between these species except in the case of ribbon fishes and white baits where a negative correlation ($r = -0.45$) was observed which indicated association of better white bait production with a poor ribbon fish fishery.

Trends in Catch Rates

It is necessary now to examine the trends in effort and catch per unit effort (kg per boat-trip). The trawl landings showed high fluctuations during the last one decade, but around different planes. From about one lakh tonnes caught during 1975-79, it reduced to 0.75 lakh during 1980-84. However, the average number of boat trips remained more or less constant at about 3 lakhs. Consequently the average CPUE which was of the order of 325 kg during 1975-79 reduced to 240 kg. during the period 1980-84. Per boat trip 120 kg of prawn were caught during 1975-79 which reduced to about 85 kg during 1980-84.

The annual purse-seine catches varied from 11,500 tonnes to 21,000 tonnes during the five year period, the CPUE ranging from about one and a half tonnes to three tonnes per purse-seiner trip. Bulk of the catches were accounted by oil sardine. But compared to the total oil sardine landings of the state, the contribution by the purse-seiners was only of the order of 10%. A study on the impact of purse-seining showed that the effect of purse-seining at the present level of exploitation and availability is not tangibly felt on the indigenous fishery of Kerala coast. However any addition to the fleet would have to be done with great caution (MFIS, Vol. 32, 1981).

The catch per boat-trip varied from 120 kg. to 182 kg. for gillnetter operated by crafts with inboard engine, 90 to 240 kg for gillnetters operated with outboard engine and from 32 kg to 48 kg for gill-netters operated by non-motorised country crafts for the five year period 1980 to 1984.

The catch rates for boat-seines operated by craft with outboard engine varied from 360 kg (in 1984) to 1600 kg (in 1981) while those operated by country craft ranged from 170 kg. to 350 kg. In the case of craft with OBE the catch increase during the period 1980 to 1984 was in no way commensurate with the high effort put in with the result the CPUE declined fast as seen from the figures given above.

Mudbank Fishery

Mudbank formation occurs in the south-west coast of India especially along the Kerala coast during the south-west monsoon period with varying intensities over years (CMFRI, 1981, Bulletin No. 31). Mud banks are bodies of calm water along the coast largely due to the existence of fine mud in a state of suspension during the heavy monsoon days. These areas provide safe anchorage to the country craft. On a squally surf-beaten coast these areas facilitate easy launching of country craft which otherwise idle away during the inclement weather.

Various hypotheses on the mud bank formation are discussed in the bulletin referred above. The mud bank fishery is reported from several areas in the state; but the intensity is more felt in the Alleppey region. The fishery is quite important for Kerala as it stimulates fishing activities and generates employment and income to the indigenous boat owners (with or without OBE) in the otherwise lean season.

Water Pollution

The discharge of partially treated or untreated wastes from the factories, sewage and excess chemicals from agricultural operations finding their way into the water bodies are the main factors contributing to the water pollution in Kerala. It has been estimated that more than 5 lakh m³ of industrial effluents are being discharged into the rivers of this state every day (Nair *et al.*, 1981).

In recent years there have been a number of reports about fish mortality due to water pollution in the backwaters around Cochin which included the Periyar river near the industrial area at Eloor and also the Chitrapuzha near Ambalamedu, another industrial suburb of Cochin. A major instance of coastal pollution reported is the one from the Trivandrum coast originating from the titanium factory. The rate of effluent discharge is about 4000 m³/day chiefly containing sulphuric acid, ferrous salts and titanium dioxide and these spread along the coast imparting a reddish brown colour to the sea water extending to a width of 0.3-0.5 km from the shore. Several

studies have already been carried out in this area by scientists which revealed the ecological damage caused by pollution to the fauna and flora of the region.

Value of the Marine Product and its Availability

The value of the marine fish landings (1983) of Kerala at the landing centre price has been estimated at about Rs. 114 crore. About half the total value realised is accounted by prawns (CMFRI Spl. Publ. No. 29, 1986).

The annual per-capita availability of fish in fresh form has been estimated at about 13 kg. This is about 3½ times the availability at the all India level. However there is need to step up production to meet the demand of the comparatively large proportion of fish eating population of the state.

Maximum Catch Prospects in the Inshore Waters and Allocation of Effort

As is well known, assessment of fish stocks in tropical waters poses several problems such as the multispecies multigear character of the fishery and short life span and continuous spawning of prawns and several fishes. The Central Marine Fisheries Research Institute has done considerable work for estimation of stocks of individual resources using the micro analytical models. Estimates based on primary productivity data and those obtained from vessel-based acoustic and other surveys for certain groups of fishes are also available. However, a total picture of the stocks following an integrated approach based on synchronised data covering fishery, biological and environmental aspects is still to emerge. The Institute has plans to collect the requisite data and develop methodologies to suit such an approach.

In the present appraisal a macro-level approach has been followed and the maximum expected annual yield was estimated based on production data on groups of fishes for a ten-year period from 1975-84 and considering the highest catches (Gulland 1969. *Manual of Methods for fish stock Assessment*). These have to be seen in conjunction with the effort expended and trends in catch rates to arrive at conclusions. It is felt that the results would lead to suggestions of short-term nature regarding the fishery.

Following the above approach, the maximum catch prospects from the intensely fished inshore waters of Kerala which can be considered to cover an area upto a depth of about 25 m has been estimated at 4.8 lakh tonnes annually. Apportioning this production to different gears and using the catch rates based on past data the number of craft required to achieve the

production has been worked out. Table below shows the figures of maximum expected annual yield and the craft required in the case of trawls, purse-seines and gill-nets.

Type of unit	Maximum expected yield (tonnes)	No. of units required	No of units operating
Trawler	100,100	1785	2600
Purse-seiner	21,700	65	70
Gill-netter	18,900	610	400

The study showed that the number of trawlers required for exploiting the stocks would be about 1785. About 2600 trawlers have been in operation. The tendency generally is to suggest alternate operating plans for the seemingly extra trawlers. Even to decide which of these trawlers are to be earmarked for alternate plans is a problem. Moreover during the last five years there has not been any addition to the trawler fleet. A number of trawlers now operating are old and would not be maintaining their initial efficiency. Also as mentioned earlier the catch rates have been dwindling from about 325 kg during 1975-79 to 240 kg during 1980-84. Considering these aspects it is apparent that no new trawlers need be added to the small-scale sector.

The number of purse-seiners required worked out at about 65 and about 70 numbers have been operating. As mentioned earlier, a special study has shown that increasing the number of purse-seiners from the current level of exploitation has to be done with great caution. The catch rates have reduced from about 3 tonnes per boat-trip in 1980 to about an average of 2 tonnes for the period 1981-84. Based on these it is felt that no new purse-seiner need be permitted in the small-scale sector.

Gill-netters with in-board engine have been operating mostly in Quilon, Ernakulam and Cannanore coastal areas for the last two decade. The number required worked out to about 610 while about 400 boats have been in operation. The catch rates have not shown any decline for the last five years. Moreover these craft often bring quality fishes. About 210 gill netters could therefore be added. About 70 boats could be introduced in the first year in the Quilon, Ernakulam and Cannanore areas. On the basis of the feed back information the pattern of further increase can be decided.

Estimation of the required number of boats fitted with outboard engines using gill nets, boat seines and hooks and lines for exploitation of

the resources is beset with several problems. Motorisation of country craft in a commercial way started in 1980 in the Alleppey area, which soon spread to Quilon and Ernakulam districts. By 1984 it has picked up in Trivandrum and northern districts as well and it is rapidly growing. In such a fast changing scenario it would not be worthwhile to make any prediction regarding the optimum numbers.

Studies limited to the region covering Quilon to Ernakulam, where some stabilisation is taking place, have shown that increasing the number of craft with outboard engines indiscriminately would not be beneficial as the catch rates have declined fast.

Today there are over 6000 country craft fitted with outboard engines. No doubt motorisation has given a good amount of relief from the hard manual job for the fishermen. However, as mentioned earlier with the increasing numbers, the catch per boat trip is declining and some amount of caution is required to be exercised in adding to their numbers further. Most of these craft operate in nearshore waters. If they can fish farther off in the sea improved catch rates can be expected.

Owing to comparatively high initial investment and maintenance costs and the uncertainties involved there would be still a number of fishermen unable to take to motorisation at least for some time to come. The interests of this group of fishermen need to be protected.

Potential Yield in the Continental Shelf

The continental shelf adjacent to the Kerala coast extends to an area of about 39700 sq km which is half of the shelf area for the south-west coast. The potential yield for the area up to 200m depth has been estimated to be about 8 lakh tonnes (George *et al* 1977). Elasmobranchs, catfishes, perches, carangids, tunas and cephalopods form the major constituents of the shelf fisheries.

A number of medium and large trawlers, purse-seiners and gill-netters would have to be employed for tapping the resources. However, the management of the E. E. Z. is vested with the centre. The Government of India is planning to evolve procedures which would help promotion of the capital intensive offshore venture where the state can also participate.

Data Base for Management

Fishery resources are renewable, dynamic and characterised by fluctuations in abundance. There are a number of factors both fishery dependent and fishery independent, contributing to the state of the stock. To assess the stock and to study various other related phenomena it is essential to have a sound information base which should include data on fishery, biological, environmental and economic aspects, suitable for an integrated approach. The coverage is equally important so that the full data become available for making a total assessment of the stocks and related aspects which alone can facilitate objective decision making.

The stock of a resource does not limit itself to any political boundary and the changes in the coastal waters of one state often influence those of another. Once all the states enact legislation to regulate fisheries in their respective jurisdiction, the question of sharing of stocks and other inter-state problems are likely to crop up. Adequate and right type of data covering all the important resources and consequently the entire coastline are essential for arriving at solutions to such problems.

SOME PROPOSED MANAGEMENT MEASURES

The main objective of fishery research is to help in arriving at decisions for development and management of fisheries. It should lead to plans for the rational exploitation of the marine resources. Research should involve studies integrating the several interacting factors contributing to the stock position. Such an approach makes a heavy demand on data. As mentioned earlier CMFRI proposes to give great thrust in this direction in the coming years.

Within the limitations of the present data an appraisal has been made on the current status and trends over the past years. In Kerala, even though the shrimp fishery had made rapid strides during the mid-sixties and seventies, the total fish production has been more or less stagnant during the last two decades. The question asked is whether production can be increased or not. From the analysis of the data it is clear that fish production in the case of conventional species can be increased only marginally if the fishing is confined to the traditional grounds. Hence there is urgent need to extend the area of fishing and diversify the target fishes. The means of production and the quantum of production will have to be regulated. Adequate shore-based facilities and development of a sound internal marketing system would go a long way in promoting the growth of the sector. Innovations have to be gradually propagated without creating socio-economic conflicts. These proposals are to be considered as some of the management measures, in general. However, specific suggestions as arising out of the present appraisal are consolidated below.

i. Considering the number of boats available vis-a-vis the requirement and also the catch rates, there does not seem to be any scope for increasing the present fleet strength of the smaller trawlers and purse-seiners. -

The number of gill-netters with inboard engine can be increased by 210. In the first year 70 boats could be added and the position is to be reviewed every year.

ii. Use of outboard engines for propulsion of country craft has picked up so fast and, as the situation is still fluid, it is difficult to make specific suggestions regarding their number at this stage. However, the experience in the Quilon-Ernakulam belt, where the operations are going on

for about five years, indicate that indiscriminate expansion of motorisation programme may not be desirable as the catch rates are declining and the earnings per boat dwindling fast.

iii. Considering the present spree for motorisation of country craft and its likely repercussions on the strictly artisanal fishery, serious thought is to be given to ensure a coastal fringe zone exclusively for the sector using non-motorised traditional craft.

iv. Resources like anchovies, carangids, ribbonfishes, catfishes and perches have good potential in the 25-50m-depth areas of the southwest coast (*Proc. Seminar on Potential Marine Fishery Resources, 1986, C. M. F. R. I., Cochin*) and the smaller mechanised vessels including gill-netters would be able to exploit the same with advantage.

v. Introduction of medium-sized and larger vessels which can fish in the extended fishing grounds and deeper waters can augment production. Efforts are to be made to exploit the identified potential marine resources in the off-shore waters of Kerala such as oceanic tunas, carangids, perches, squids and deep-sea prawns and lobsters (*Proc. Seminar on Potential Marine Fishery Resources 1986, C. M. F. R. I., Cochin*). Advantage can be taken of the new policy decision of the Government of India on chartering vessels for off-shore fishing.

vi. The increasing discharge of effluents from industrial establishments to the back waters and the sea is posing a serious threat to the fish resource. Intensified efforts should be made to monitor continuously the water quality, and enforce measures to reduce pollution and safeguard the ecosystem from deterioration.

vii. In order to assess and monitor the stocks, to evaluate the fluctuations in the fishery occurring from time to time and to provide guidelines for decision-making, it is essential to maintain a sound information base covering all the targeted resources and the full spectrum of the dependent factors.

APPENDIX

QUARTERWISE AND SPECIESWISE MARINE FISH LANDINGS

Name of fish	1975					1976				
	I	II	III	IV	Total	I	II	III	IV	Total
1. ELASMOBRANCHS	965	2574	2014	4739	10292	2848	1515	979	1966	7308
2. EELS	1	—	1	10	12	4	4	—	2	10
3. CATFISHES	1377	6936	11116	13174	32603	2609	813	4872	4649	12743
4. CLUPEIDS										
a. Wolf-herring	165	30	44	366	605	164	313	4	326	807
b. Oil sardine	41684	15932	12409	27158	97183	29078	19749	9173	65937	123937
c. Other sardines	4124	9656	3882	15990	33652	6006	5152	16696	7651	34306
d. Hilsa shad	10	—	—	—	10	—	—	—	12	12
e. Other shads	—	—	—	—	—	—	—	—	—	—
f. Anchovies										
<i>Stolephorus</i>	823	4898	1480	4231	11432	1104	2270	1331	5282	9987
<i>Thryssa</i>	824	96	611	107	1638	93	2125	333	181	2732
g. Other clupeids	123	194	540	141	998	180	374	86	534	1174
5. BOMBAYDUCK	—	—	—	—	—	—	—	—	—	—
6. LIZARD FISHES	372	4829	6077	16	11294	10	25	45	19	99
7. HALFBEAKS & FULLBEAKS	25	138	39	76	278	32	4	15	90	141
8. FLYING FISHES	—	—	—	—	—	—	1	—	—	1
9. PERCHES	2555	1415	9785	1006	14741	1498	555	393	623	3069
10. GOATFISHES	20	—	—	3	23	2274	47	170	86	2677
11. THREADFINS	7	8	44	46	105	79	12	21	10	122
12. CROAKERS	1174	4231	7687	3719	16811	731	1982	2424	1818	6955

TABLE-1

(IN TONNES) IN KERALA DURING 1975-1979

1977					1978					1979				
I	II	III	IV	Total	I	II	III	IV	Total	I	II	III	IV	Total
885	730	2340	1841	5796	1501	2619	1158	4024	9302	1802	1297	2502	1553	6954
2	—	3	1	6	34	2	1	1	38	1	2	2	5	10
735	2049	4043	1120	7947	983	3637	2859	1845	9125	552	3637	4927	2242	11328
117	58	176	194	547	571	333	94	300	1298	167	483	34	441	1125
22033	20820	17084	57619	117356	19873	7633	16838	75595	119937	27340	10865	25578	53251	116834
7258	5079	3451	4966	20754	1037	2820	1949	5907	11713	1284	2733	1193	10704	15914
1	35	—	—	36	2	85	95	—	182	—	—	—	6	6
—	—	—	14	14	6	—	29	34	69	1	33	2	—	36
668	2072	4116	3249	10105	4427	1024	8319	7433	21203	2148	1529	463	2412	6652
174	139	1204	131	1648	295	121	1241	241	1898	142	292	1218	137	1789
93	154	213	52	512	137	192	579	65	973	52	316	245	61	674
—	—	—	—	—	2	19	—	—	21	1	—	—	—	1
252	458	3252	1207	5169	388	1786	3372	800	6248	112	1012	3628	576	5326
78	142	2	59	281	82	136	1	62	281	125	19	33	80	257
2027	554	11169	371	14121	972	669	22332	1016	24989	1817	549	17409	464	20239
39	2	16	183	240	32	34	96	9	171	126	—	—	1	127
47	13	7	2	69	6	8	19	2	35	25	1	—	3	29
913	1362	5179	4511	11965	2844	2869	6703	829	13045	1427	1403	1310	1097	5237

Name of fish	1975					1976				
	I	II	III	IV	Total	I	II	III	IV	Total
13. RIBBONFISHES	758	2320	11005	1092	15175	480	1419	5328	460	7687
14. CARANGIDS	904	2467	859	3289	7539	1139	1712	4735	3325	10911
15. SILVERBELLIES	763	2098	889	1461	5211	710	991	452	574	2727
16. BIG-JAWED JUMPER	147	297	480	59	983	60	114	126	168	468
17. POMFRETS	85	271	299	526	1181	126	155	192	326	799
18. INDIAN MACKEREL	5642	7731	199	1358	14930	5760	4773	3434	6011	19978
19. SEERFISHES	443	695	552	2375	4065	2049	134	1653	2100	5936
20. TUNNIES	1012	2265	468	2100	5845	6142	3917	916	1905	12880
21. BILL FISHES										
22. BARRACUDAS	54	94	135	113	396	230	90	68	106	494
23. MULLET	—	21	49	4	74	3	2	—	21	26
24. UNICORN COD										
25. FLATFISHES										
a. Soles	1227	1104	2966	1635	6932	595	1034	1163	775	3567
26. CRUSTACEANS										
a. Penaeid prawns	5874	14575	52492	4266	77207	3485	10579	14989	5425	34478
b. Nonpenaeid prawns	308	409	38	—	755	20	20	—	15	65
c. Lobsters	9	6	2	14	31	7	5	2	36	50
d. Crabs	580	137	31	1049	1797	905	357	10	44	1316
e. Stomatopods										
27. MOLLUSCS										
Cephalopods	136	592	1046	1568	3342	305	45	153	369	872
28. MISCELLANEOUS	4333	3382	24983	10993	43696	4254	7184	4535	6851	22824
TOTAL	76524	89421	152202	102689	420836	72980	67472	72998	117597	331047

TABLE-1 (Contd.)

1977					1978					1979				
I	II	III	IV	Total	I	II	III	IV	Total	I	II	III	IV	Total
37	262	6852	289	7440	1153	3418	17984	1652	24207	92	2547	20770	2309	25718
740	1871	12042	1831	16484	1593	782	2904	2342	7621	1307	104	8904	1320	12635
720	1041	5603	344	7708	762	784	1180	314	3040	827	1233	1165	372	3597
20	276	498	29	823	49	260	1157	67	1533	2	141	88	22	253
376	243	2048	1045	3712	684	250	221	459	1614	506	268	608	355	1737
2865	4283	3534	9286	19968	7411	2835	8868	6803	25917	6864	9875	500	1346	18585
545	320	846	1539	3250	578	311	635	1830	3354	1035	174	1513	3553	6275
874	2900	1164	1817	6705	1010	2653	1554	1331	6548	1068	10342	2902	1079	15391
26	79	101	147	353	90	176	240	215	721	135	142	33	167	477
3	17	—	18	38	—	1	—	—	1	30	—	3	6	39
688	800	3147	1143	5778	1410	2664	2698	504	7276	1075	692	2298	422	448
6117	4170	25493	4370	40150	5071	11660	27303	1000	4534	6826	5843	14331	2522	29522
75	59	40	—	174	123	87	184	—	394	16	8	42	9	75
27	7	—	6	40	3	1	28	6	38	16	1	—	9	26
1084	356	2	3179	4621	897	161	151	967	2176	2097	1101	421	226	3846
										—	—	—	3798	3798
411	127	1633	2802	4973	706	155	3821	1834	6516	140	146	799	1891	2976
10093	3743	6069	6349	26254	4485	6099	4389	1850	16823	3354	3264	1111	906	8635
59973	54021	121329	109714	345037	59137	56264	139000	118938	373339	62312	60822	115030	92346	330509

QUARTERWISE AND SPECIESWISE MARINE FISH LANDINGS

Name of fish	1980					1981				
	I	II	III	IV	Total	I	II	III	IV	Total
1. ELASMOBRANCHS	2017	1344	1670	1772	6803					
a. Sharks						1033	621	434	1502	3590
b. Skates						85	1	1	32	119
c. Rays						260	359	398	145	1162
2. EELS	3	—	1	2	6	1	1	—	1	3
3. CATFISHES	1013	5145	5140	2638	13936	1075	3737	2273	2477	9562
4. CLUPEIDS										
a. Wolfherring	478	143	26	355	1002	196	81	23	673	973
b. Oil sardine	23766	14401	5952	25548	69667	19788	9225	29520	88473	146986
c. Other sardines	2642	1586	2147	4642	11017	1657	1736	379	3957	7629
d. Hilsa shad	14	—	—	—	14	1	7	—	—	8
e. Other shads	3	18	—	—	21	—	—	15	—	15
f. Anchovies										
<i>Stolephorus</i>	1606	1174	2123	2869	7772	142	1373	1073	1705	4293
<i>Thryssa</i>	135	939	1013	164	2241	37	22	485	90	634
g. Other clupeids	142	190	223	19	574	126	122	350	346	944
5. BOMBAYDUCK										
6. LIZARDFISHES	558	2112	3317	1093	7080	314	1335	3669	373	5691
7. HALFBEAKS & FULLBEAKS	160	26	2	173	361	81	82	2	400	586
8. FLYINGFISHES	—	—	—	—	—	9	—	—	7	16
9. PERCHES	909	1248	15248	409	17814					
a. Rock cods						703	3	8	20	734
b. Snappers						41	25	2	8	76
c. Pig-face breams						43	6	11	31	91
d. Threadfin breams						184	413	5652	193	6442
e. Other perches						145	265	621	175	1206
10. GOATFISHES	—	—	—	1	1	—	30	2	1	33
11. THREADFINS	—	6	—	2	8	6	28	—	13	47
12. CROAKERS	1877	1659	1978	652	6164	843	756	800	746	3145
13. RIBBONFISHES	48	1175	11577	137	12937	36	579	6178	273	7068
14. CARANGIDS	899	608	1649	1606	4760					
a. Horsemackerel						16	12	20	7	55
b. Scads						441	404	307	536	1688
c. Leather-jackets						10	12	30	266	318
d. Other carangids						725	618	526	1120	2989

TABLE-2

(IN TONNES) IN KERALA DURING 1980-1984

1982					1983					1984				
I	II	III	IV	Total	I	II	III	IV	Total	I	II	III	IV	Total
1225	539	714	1937	4415	1076	1295	1524	3866	7761	1993	1865	981	1430	6269
313	1	16	27	357	21	1	—	12	34	—	—	6	6	12
378	490	233	470	1571	109	232	104	297	742	516	328	328	184	1356
5	4	9	1	19	7	3	—	21	31	8	—	1	10	19
839	2568	2757	3368	9532	1229	1959	3825	8319	15332	2018	3012	4464	2088	11582
286	189	21	564	1060	392	93	85	520	1090	291	147	411	523	1372
45012	18998	28628	50576	143215	61285	20977	6463	66154	154879	56146	26054	14082	50857	147139
1014	1489	4009	876	7388	2114	1299	779	1123	5315	1478	665	1971	1908	6022
4	13	22	—	39	73	—	17	77	167	1	137	25	35	198
523	7475	3555	2044	13597	1060	5532	25063	23387	65042	2119	2222	26186	10978	41505
90	81	736	62	969	78	75	751	268	1172	174	140	952	124	1390
133	313	423	2226	3095	361	619	3913	1844	6727	353	755	2899	1343	5350
271	2354	2577	278	5480	257	1560	3100	509	5456	373	2029	2248	1627	6277
189	124	6	686	1005	238	19	3	223	483	106	16	9	184	315
—	1	—	—	1	—	—	—	—	—	3	—	—	—	3
238	10	27	10	285	264	16	24	80	384	455	1	8	19	483
315	4	11	7	337	27	6	1	58	92	151	—	—	2	153
67	27	8	12	114	34	—	11	58	101	29	—	—	14	43
637	868	7391	258	9152	466	525	5610	664	7265	1052	2087	16277	1023	20439
490	182	278	341	1291	554	605	538	377	2074	1568	742	2934	520	5764
5	10	162	67	244	134	16	1	1	152	40	23	1	11	75
85	14	2	17	118	98	44	4	30	176	180	232	36	5	453
458	984	1730	409	3581	728	944	3180	1259	6111	2048	1739	3367	2532	9686
15	1281	9210	528	11034	27	42	871	172	1112	42	2457	3672	293	6464
154	510	234	23	921	48	1	15	334	398	24	66	13	85	188
311	611	413	741	2076	943	973	2106	1199	5221	694	1290	1321	2394	5699
309	40	47	138	534	163	62	176	86	487	59	70	62	34	225
2669	2679	628	3184	9160	3354	4023	739	2308	10424	2031	2336	1523	1670	7560

Name of fish	1980					1981				
	II	III	IV	Total	I	II	III	IV	Total	
15. SILVERBELLIES	908	590	2459	191	4148	405	904	1162	355	2826
16. BIG-JAWED JUMPER	84	127	618	32	861	9	331	410	129	879
17. POMFRETS	82	230	119	476	907					
a. Black pomfret						208	100	193	113	614
b. Sliver pomfret						25	31	16	677	749
c. Chinese pomfret						1		9		10
18. INDIAN MACKEREL	3852	6074	2203	6345	18474	6938	3530	3666	2066	16200
19. SEERFISHES	1112	571	359	1721	3763					
a. <i>S. commersoni</i>						448	145	201	786	1580
b. <i>S. guttatus</i>						17	71	15	1641	1744
c. <i>S. lineolatus</i>						—	—	—	6	6
d. <i>Acanthocybium</i> Sp.						—	—	—	—	—
20. TUNNIES	1111	8479	329	692	10611					
a. <i>E. affinis</i>						331	2188	349	1208	4076
b. <i>Auxis</i> spp.						32	596	234	262	1124
c. <i>K. pelamis</i>						—	—	—	—	—
d. <i>T. tonggol</i>						—	—	20	2	22
e. Other tunnies						115	126	28	18	287
21. BILLFISHES						9	22	13	85	129
22. BARRACUDAS	41	135	33	121	330	152	221	84	355	812
23. MULLET	20	31	20	80	151	11	31	4	74	120
24. UNICORN COD										
25. FLATFISHES										
a. Halibut						27	36	57	38	158
b. Flounders										
c. Soles	899	1099	1757	639	4394	971	1435	1637	833	4876
26. CRUSTACEANS										
a. Penaeid prawns	4839	12391	33494	1909	52633	3269	4216	12753	2030	22268
b. Nonpenaeid prawns	29	442	1256	15	1742	58	47	55	—	160
c. Lobsters	9	1	7	1	18	1	8	—	41	50
d. Crabs	79	217	6	24	326	32	70	21	45	168
e. Stomatopods	1653	2890	—	2417	6960	788	1047	77	918	2830
27. CEPHALOPODS										
a. Cephalopods	836	228	1561	1619	4244	69	123	617	1567	2376
28. MISCELLANEOUS	1774	3245	1587	1197	7803	701	2146	753	651	4251
TOTAL	53598	68522	97872	59551	279543	42495	39277	75153	117470	274395

TABLE-2 (Contd).

1982					1983					1984				
I	II	III	IV	Total	I	II	III	IV	Total	I	II	III	IV	Total
703	654	6629	744	8730	1066	706	5790	1942	9504	747	703	2195	266	3911
65	193	1224	127	1609	296	31	445	327	1099	150	247	1163	85	1645
130	163	157	1494	1944	97	198	254	426	975	27	84	204	392	707
146	1	475	1666	2288	319	30	54	501	904	151	38	159	336	684
6	—	5	2	13	2	—	1	115	118	14	—	53	155	222
3626	4092	1285	1814	10717	2079	3005	3529	4070	12683	2104	3492	1932	4218	11746
1031	287	499	1804	3621	711	153	1362	2228	4444	280	274	750	1881	3185
526	74	147	1211	1958	428	65	343	1641	2477	429	224	669	1654	2976
—	38	—	—	38	—	1	1	22	24	9	—	4	—	13
					—	—	—	54	54	—	—	—	—	—
1490	1561	1309	905	5265	639	1066	834	1265	3804	696	1609	591	1299	4195
354	722	303	99	1478	285	113	330	106	834	352	621	139	285	1397
1	49	—	—	50	—	—	—	2	2	1	—	—	4	5
42	—	1	—	43	6	—	3	1	10	2	6	1	25	34
20	229	46	80	445	—	15	940	145	1100	63	42	146	286	537
22	38	10	183	253	38	15	15	27	95	61	67	65	127	320
243	229	73	111	656	131	255	288	464	1138	98	210	500	301	1109
8	15	—	10	33	7	19	79	11	116	8	2	56	8	69
65	37	38	41	181	—	34	7	119	160	44	2	10	3	59
					6	31	—	8	45	2	—	—	—	2
659	991	6638	3134	11422	1397	1431	4509	5781	13118	1843	1653	10348	3901	17745
2811	4553	14348	4986	26708	8391	5704	13691	1968	29754	4737	7046	12459	11287	35529
40	25	—	—	65	8	1	96	—	105	73	460	205	—	738
10	4	51	29	94	26	2	6	34	68	14	4	15	20	53
82	104	15	146	347	106	174	138	56	474	201	144	18	106	469
796	818	785	1624	4023	2133	1580	23	2605	6341	4199	1038	9	1845	7091
595	487	1037	1417	3536	265	183	506	776	1730	812	883	1561	2766	5422
3501	2204	965	3018	9688	1991	2027	1020	1377	6415	2223	2017	1768	1559	7567
72907	59497	99888	93503	325795	95555	57790	93157	139315	385817	92792	69179	118797	112703	393471

TABLE - 3

**DISTRICTWISE FIGURES OF MARINE FISHING VILLAGES AND
FISHERMEN POPULATION - KERALA, 1980**

Sl. No.	Items	D I S T R I C T S								Total
		Trivandrum	Quilon	Alleppey	Ernakulam	Trichur	Malappuram	Kozhikode	Cannanore	
1.	Coast-line (km)	78	37	82	46	54	70	71	152	590
2.	No. of fishing villages/hamlets	54	29	39	20	22	18	57	65	304
3.	No. of landing centres	54	33	34	13	19	12	24	33	222*
4.	No. of fishermen households	26519	12381	15648	7648	8295	8321	11884	9148	99894
5.	Fishermen population									
	Male	43348	27615	33026	16931	19655	19888	26320	23325	210609
	Female	41737	25662	33105	17098	20421	22366	26157	23307	209853
	Children	46502	25836	31257	15030	20356	28650	26957	24822	219410
	Total	132087	79113	97388	49059	60432	70904	79434	71455	639872
6.	Educational status									
	Primary	23566	19056	19170	14633	13845	5435	13154	10964	119823
	Secondary	2009	3611	9410	3174	1099	345	1133	2733	23514*
	Above secondary	900	1258	1181	415	397	44	364	758	5317
	Total	26475	23925	29761	18222	15341	5824	14651	14455	148654
7.	No. of fishermen engaged in actual fishing									
	Full time	20882	12115	19365	7768	10186	12944	16005	12705	111970
	Part time	5115	875	904	1862	720	425	435	681	11017
	Occasional	3116	982	872	586	700	577	609	672	8114
	Total	29113	13972	21141	10216	11606	13946	17049	14058	131101

* The number is 238 as per latest information.

TABLE - 5

LANDINGS OF GOVT. OF INDIA VESSELS IN KERALA (IN TONNES) DURING 1975-84

Species	1975			1976			1977			1978			1979		
	Below 40 m	Above 40 m	Total	Below 40 m	Above 40 m	Total	Below 40 m	Above 40 m	Total	Below 40 m	Above 40 m	Total	Below 40 m	Above 40 m	Total
Elasmobranchs	58	39	97	22	16	38	51	7	58	13	67	80	21	36	57
Catfishes	42	27	69	39	28	67	135	15	150	9	76	85	50	49	99
Perches	11	8	19	64	46	110	61	7	68	8	53	61	38	55	93
Prawns	6	2	8	—	—	—	—	—	—	—	3	3	—	1	1
Cephalopods	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Others	307	205	512	270	199	469	998	47	1046	464	223	687	699	35	734
Total	424	281	705	395	289	684	1315	76	1391	494	422	916	808	176	984
Effort (hrs)	3137	2091	5228	3239	1983	5222	4381	983	5364	1345	2993	4338	2063	1252	3315

Species	1980			1981			1982			1983			1984		
	Below 40 m	Above 40 m	Total	Below 40 m	Above 40 m	Total	Below 40 m	Above 40 m	Total	Below 40 m	Above 40 m	Total	Below 40 m	Above 40 m	Total
Elasmobranchs	29	21	50	23	16	39	32	54	86	40	30	70	23	25	48
Catfishes	88	65	153	79	44	123	21	14	35	99	73	172	57	43	100
Perches	3	5	8	4	5	9	22	17	39	22	29	51	7	5	12
Prawns	—	—	—	—	—	—	—	1	1	1	1	2	—	—	—
Cephalopods	1	1	2	1	1	2	10	7	17	5	3	8	7	5	12
Others	179	130	309	66	178	244	162	88	250	143	91	234	240	166	406
Total	300	222	522	173	244	417	247	181	428	310	227	537	334	244	578
Effort (hrs)	3296	2020	5316	1446	2359	3805	2292	1405	3697	3398	2080	5478	2081	1277	3358

TABLE - 6

DISTRICTWISE QUARTERWISE TOTAL CATCH*
(IN TONNES) IN KERALA, 1980 - 1984

Years	1980					1981					1982		
	Districts	I	II	III	IV	Total	I	II	III	IV	Total	I	II
Trivandrum	3376	21194	17478	7638	49886	3868	7801	8856	8626	29151	7106	17379	16868
Quilon	7031	23373	63454	11161	105019	4603	14330	17475	10387	46795	20227	23602	29390
Alleppey	7575	5957	4747	8027	24306	6037	2639	5407	24044	38127	5473	1079	16511
Ernakulam	12207	9813	3325	12518	37863	8313	6797	7668	11414	34192	10274	7313	10488
Trichur	3376	2181	1298	5470	12325	5264	489	7758	6248	19759	7106	3818	4215
Malappuram	5781	1462	818	3346	11407	1967	791	2128	5349	10235	2845	882	1124
Kozhikode	10832	2284	3035	6838	22989	10101	4541	4799	13739	33180	6310	1376	11072
Cannanore	3174	2190	3595	6467	15426	2261	1782	20944	37552	62539	13506	3981	10250
Total	53352	68454	97750	59465	279021	42414	39170	75035	117359	273978	72847	59430	99718

Years	1982 contd.		1983				1984					
	Districts	IV	Total	I	II	III	IV	Total	I	II	III	IV
Trivandrum	12817	53970	10912	16881	15798	16004	59595	7367	11826	18836	9428	47457
Quilon	19137	92356	37180	17635	33238	19427	107480	19968	23837	37850	29774	111429
Alleppey	11013	34076	4893	951	13490	17920	37254	3226	7060	15880	28796	54962
Ernakulam	7528	35603	6850	8441	11156	10918	37365	16132	8671	12632	11916	49351
Trichur	9387	24526	7154	662	4040	21445	33301	7555	2420	7593	8607	26175
Malappuram	5290	10141	2076	3301	8399	36426	50202	15938	9554	12488	10566	48546
Kozhikode	12691	31449	9493	2327	4926	13400	30146	10185	2914	5886	5035	24020
Cannanore	15509	43246	16914	7349	2003	3673	29939	12313	2801	7462	8377	30953
Total	93372	325367	95472	57547	93050	139213	385282	92684	69083	118627	112499	392893

* excluding offshore catches