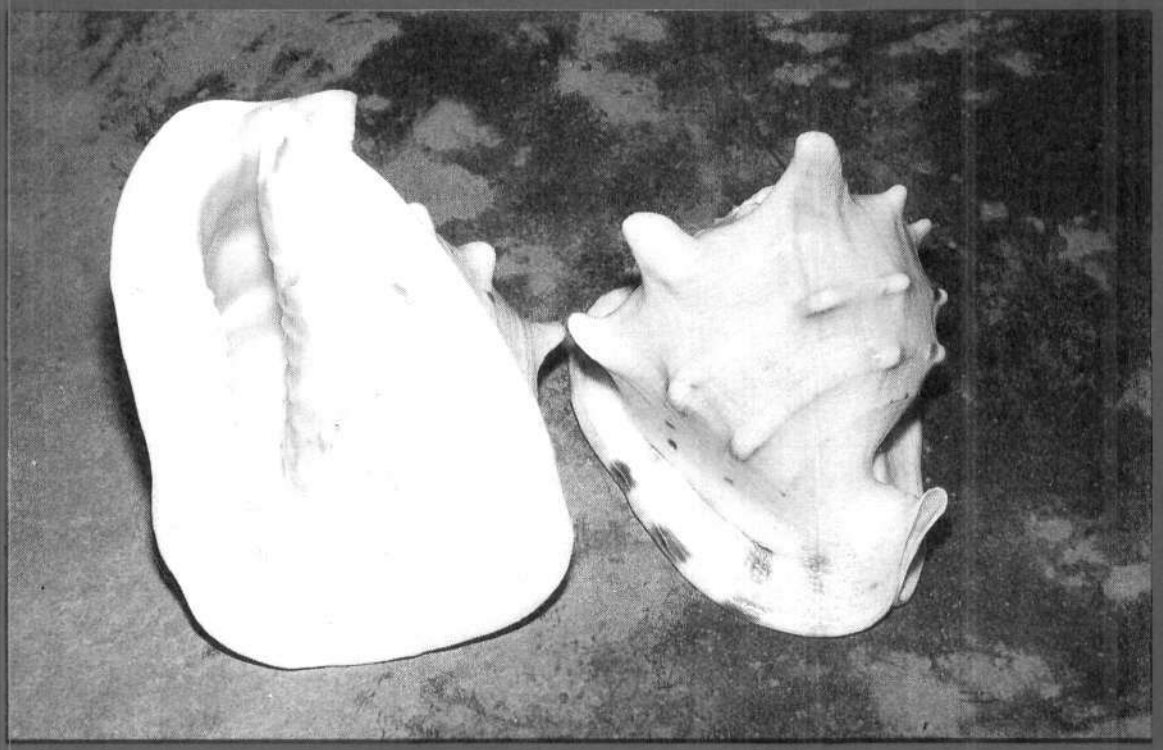
ISSN 0254-380 X

समुद्री मात्स्यिकी सूचना सेवा
MARINE FISHERIES INFORMATION SERVICE

No. 160 April, May, June 1999



तकनीकी एवं विस्तार अंकावली
TECHNICAL AND EXTENSION SERIES

केन्द्रीय समुद्री मात्स्यिकी अनुसंधान संस्थान कोचिन, भारत
CENTRAL MARINE FISHERIES RESEARCH INSTITUTE COCHIN, INDIA

भारतीय कृषि अनुसंधान परिषद
INDIAN COUNCIL OF AGRICULTURAL RESEARCH

समुद्री मात्स्यिकी सूचना सेवा: समुद्री मात्स्यिकी पर आधारित अनुसंधान परिणामों को आयोजकों, मत्स्य उद्योगों और मत्स्य पालकों के बीच प्रसार करना और तकनोलजी का प्रयोगशाला से श्रमशाला तक हस्तांतरित करना इस तकनीकी और विस्तार अंकावली का लक्ष्य है।

The Marine Fisheries Information Service : Technical and Extension Series envisages dissemination of information on marine fishery resources based on research results to the planners, industry and fish farmers, and transfer of technology from laboratory to field.

Abbreviation - *Mar. Fish. Infor. Serv., T & E Ser.*, No. 160 : April, May, June 1999

CONTENTS अंतर्वस्तु

Front cover photo : *Cassis cornuta* (Horned helmet) — the largest and heaviest ornamental shell of the family cassidae found abundant in the Gulf of Mannar, southern India.

मुख आवरण चित्र : दक्षिण भारत की मान्नार खाडी में प्रचुर मात्रा में दिखाये पडने वाला *कासिस कोरनूटा* का आलंकारिक कवच—यह फामिली कासिडे में सब से बडा और भारी है।

Back cover photo : The seed of green mussel *Perna viridis* collected from the natural habitats along the sea shore are being seggregated sizewise and cleaned for seeding on ropes for culture purpose in the estuarine environment at Kasaragod in northern Kerala.

पृष्ठ आवरण चित्र : उत्तर केरल के कासरगोड ज्वारनदमुख में रस्सियों में रोपण केलिए प्राकृतिक आवासों से संग्रहित हरित शंबु *पेरना विरिडिस* आयाम के अनुसार अलग करके साफ करते है ।

समुद्री मात्स्यिकी सूचना सेवाः समुद्री मात्स्यिकी पर आधारित अनुसंधान परिणामों को आयोजकों, मत्स्य उद्योगों और मत्स्य पालकों के बीच प्रसार करना और तकनोलजी का प्रयोगशाला से श्रमशाला तक हस्तांतरित करना इस तकनीकी और विस्तार अंकावली का लक्ष्य है।

The Marine Fisheries Information Service : Technical and Extension Series envisages dissemination of information on marine fishery resources based on research results to the planners, industry and fish farmers, and transfer of technology from laboratory to field.

Abbreviation - *Mar. Fish. Infor. Serv., T & E Ser.*, No. 160 : April, May, June 1999

CONTENTS अंतर्वस्तु

Front cover photo : *Cassis cornuta* (Horned helmet) — the largest and heaviest ornamental shell of the family cassidae found abundant in the Gulf of Mannar, southern India.

मुख आवरण चित्र : दक्षिण भारत की मान्नार खाडी में प्रचुर मात्रा में दिखाये पडने वाला *कासिस कोरनूटा* का आलंकारिक कवच—यह फामिली कासिडे में सब से बडा और भारी है।

Back cover photo : The seed of green mussel *Perna viridis* collected from the natural habitats along the sea shore are being seggregated sizewise and cleaned for seeding on ropes for culture purpose in the estuarine environment at Kasaragod in northern Kerala.

पृष्ठ आवरण चित्र : उत्तर केरल के कासरगोड ज्वारनदमुख में रस्सियों में रोपण केलिए प्राकृतिक आवासों से संग्रहित हरित शंबु *पेरना विरिडिस* आयाम के अनुसार अलग करके साफ करते है ।

903 MARINE FISHERIES IN KERALA

T. M. Yohannan, P. N. Radhakrishnan Nair, N. G. K. Pillai and P. L. Ammini

Central Marine Fisheries Research Institute, Cochin — 682 014, India

Introduction

The 1980s was an important period in the development of marine fisheries in Kerala. In the first half of this period rapid motorisation of the indigenous crafts with outboard engines made the traditional sector more efficient. Outboard engines became an integral part of the indigenous fisheries and the fishers could extend their activities to more distant and deeper waters. Slowly they started discarding their old dugouts and going for plank-built boats with transformed stern to fix their outboard engines conveniently. In the latter half of the 1980 s a new gear called ringseine became very popular in exploiting the pelagic resources and replaced the boatseines to a very great extent. Huge size of the new net (450 to 900 m long) and large number of crew (30 to 40) needed for its operation necessitated larger boats and more outboard engines. . Thus the large plank-built 'kettuvallam' became the common craft to which 3 outboard engines were fitted. The smaller plank-built boats used in the operation of boatseines and gillnets, were coated with fiberglass. During the peak ringseine fishing period these boats are being used as carrier boats to land the catch from ringseines so that the fishing can continue for a longer duration. Now even the 'kettuvallam' is being made of marine plywood coated with fiberglass. Thus a new sector called motorised sector was added to the existing mechanised sector and the remaining being non-mechanised indigenous sector. The motorised sector grew rapidly and in 1988 it became the most important sector yielding the maximum catch.

In 1988 a partial ban on trawling during the monsoon was introduced along the coast of Kerala through a Government Order. Thereafter, the ban was enforced every year at varying intervals during the southwest monsoon period. This was based on the recommendations of the expert committee appointed by the Government of Kerala to study the fisheries of the state and to suggest resource management measures for reviving the marine fisheries which was suffering a set back during the 1968-80 period. The ban was recommended for the southwest monsoon in order to protect the sprawners and the new recruits, on the ground that most of the commercially important fish species have their peak spawning and recruitment along the Kerala coast during this period. It was also aimed to protect the interests of the traditional fishermen.

In the meantime, infrastructural facilities like the fisheries harbour helped the fishers to land their catches safely even during the rough monsoon season. This resulted in an increased fishing activity during the monsoon which greatly improved the catches of pelagic resources. With the increased export market for cephalopods, in addition to prawns, there was an intensification of trawling by increasing the size of the crafts, extending the fishing area and the fishing time. These developments resulted in an increase in the annual average catch.

Data base

Data collected by the Fisheries Resources Assessment Division of the Central Marine Fisheries Research Institute (CMFRI), Cochin on the fisheries of Kerala during the period from 1980 to 1996 form the basis of this study. By 1988 the ringseines got established in exploiting the pelagic resources. Partial ban on trawling during the monsoon was initiated and an upward trend in the marine fish catch was also observed in the same year. Hence, 1988 is taken as an year of transition in the marine fisheries of Kerala and the fishery for the years before 1988 was compared to that during the years therafter to study the changing characteristics of the fishery.

Characteristics of the growth of marine fisheries in Kerala

Fig. 1 representing the annual marine fish catch in Kerala from 1980-'96, shows two distinct periods. The first period is from 1980- '87 with annual average catch of 3,33,577 tonnes and the second from 1989-'96 with an annual average catch of 5,85,224 tonnes. With a catch of 4,70,000 tonnes, 1988 stands as a year of transition. The increase from the former period was 2,51,648 tonnes which is 75.40 % of growth.

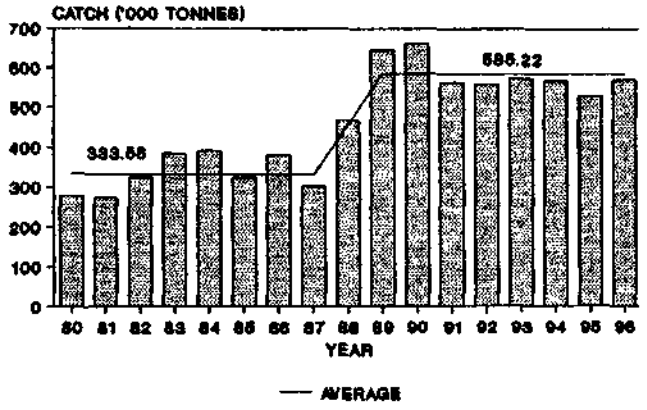


Fig. 1. Total marine fish catch in Kerala (1980-'96).

Fig. 2 gives the changing prominence of the different sectors of the fishery. The traditional sector dominated the fishery till 1983 and thereafter it declined with the fast development of the motorised sector. In 1985 , the traditional sector contributed only 24 % of the fish catch in the state when the contribution by the motorised sector was 43 % and the mechanised sector 33 %. In 1989 the contribution by the motorised sector increased to 63 % and the traditional sector declined to 5 %, but the mechanised sector maintained its contribution at 32 %. In 1994 the contribution by the mechanised sector increased to 57 %., pushing down the contribution by the motorised sector to the second place at 39 %. The traditional sector suffered further decline. In 1996 the motorised, mechanised and the traditional sectors contributed 51, 44 and 5 %, respectively.

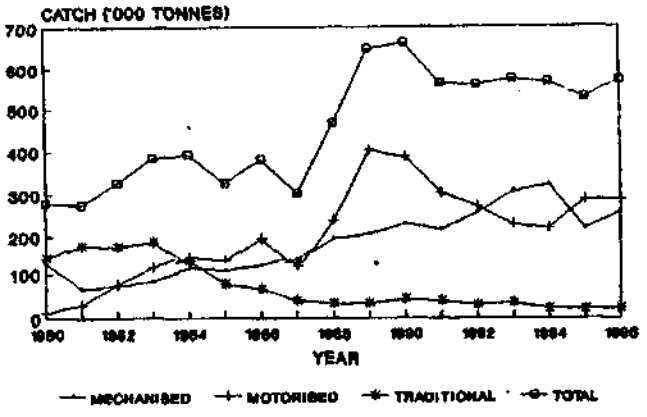


Fig. 2. Catch in different fisheries sectors.

The effort, catch and the catch per unit effort of the individual gear in the different sectors during 1993 - '96 are given in Table 1. It can be seen that the mechanised sector was dominated by trawl nets which contributed 97.40 % of the catch in this sector. The peak catch per unit effort was realised by purseseines. Purseseines are operated only at Cochin whereas trawl nets are operated all along the coast except in the Trivandrum District. With 71.10 % of the total catch in the motorised sector, ringseine is the most important gear with the maximum catch per unit effort in the motorised sector.

TABLE 1. *Effort, catch and catch per effort in different fisheries sectors in Kerala (average for 1993 - '96)*

Gear	Effort (nos)	%	Catch (tonnes)	%	C/E (kg)
MECHANISED SECTOR					
Trawl net	6,13,085	97.88	2,77,291	97.36	452.29
Gill net	6,776	1.08	876	0.31	129.28
Purse seine	3,124	0.50	5744	2.02	1,828.86
Hooks & line	3,349	0.53	898	0.32	268.27
Total	6,26,333	100.00	2,84,809	100.00	
MOTORISED SECTOR					
Ringseine	2,28,607	18.92	1,75,964	71.10	769.72
Gillnet	5,67,381	46.96	34,713	14.03	61.18
Trawl					
(Minitrawl)	1,40,188	11.63	10,164	4.11	72.35
Boatseine	39,669	3.28	13,590	5.49	342.59
Hooks & line	1,76,114	14.58	11,325	4.58	64.31
Disco net	55,975	4.63	1,734	0.70	30.97
Total	12,08,34	100.00	2,47,490	100.00	
TRADITIONAL SECTOR					
Gillnet	5,17,674	56.33	10,054	39.66	19.00
Shoreseine	55,529	6.04	7,725	30.47	139.00

Hooks & line	3,02,449	32.91	3,515	13.87	12.00
Boat-seine	27,821	3.03	3,256	12.84	117.00
Others	15,420	1.68	800	3.16	51.88
Total	9,18,893	100.00	25,350	100.00	

Table 2 gives the growth of the marine fisheries in Kerala rom 1985 - 87 period to 1993-'96 period. The average annual increase in catch was 2,20,024 tonnes. 74.9 % of this increase was made by ringseines, 64.5 % by trawls. 5.9 % by motorised gillnets and 0.2 % by purse seines when the catches of motorised boatseines registered a decline of 31.2 %, the mechanised gillnet 3.5 % and the other gear 10.8 %. Only ringseines and trawls had an improved catch per unit effort whereas all other gear suffered a decline in catch per effort.

TABLE 2. *Increase in the total average annual catch from 1985-'87 period to* 1993-'96 period and *the percentage contribution by the important gear*

Gear	Increase no. of operations	Increase in catch (t)	Percentage contribution to total increase	Increase in catch per effort (kg)
Ring seine	1,78,483	1,64,832	74.92	356.78
Trawl	1,16,174	1,41,936	64.51	195.82
OB gilnet	2,70,303	12879	5.85	-9.05
Purse seine	398	4,95	0.22	-96.71
Mech. gillnet	-56,584	-7,708	-3.50	-3.18
OB boatseine	-1,77,565	-68,695	-31.22	-59.70
Others	--	-23,716	-10.78	--
Total		2,20,024	100.00	

Fig. 3 gives the growth of trawl fisheries during 1986-'96. A steady increase in catch was observed from 1986 to 1994 followed by a minor decline. The peak effort was in 1988 with the lowest catch per effort. Subsequently there was a decline in effort and an increase in catch per effort. The second peak in effort was in 1994 with a decline in catch per effort. The relation between the relative growth in effort and catch per effort from 1986 to 1996 is shown in Fig.4. There is a clear trend of decrease in relative growth in catch per effort with the relative growth of effort.

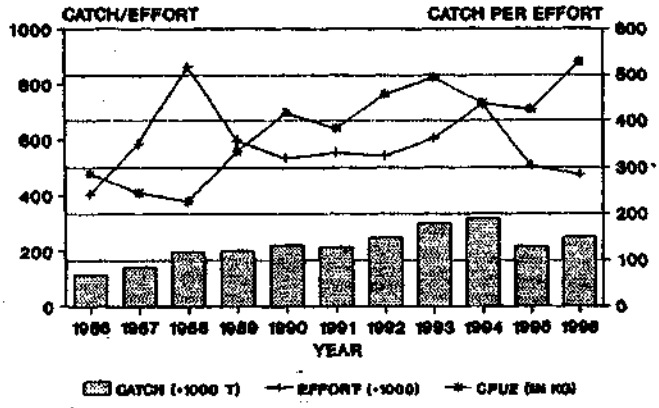


Fig. 3. Trawl; fishery in Kerala export, catch and cpue.

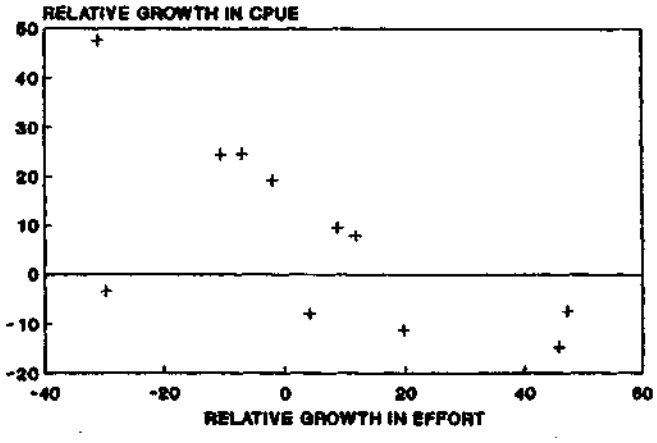


Fig. 4. Relation between effort and cpue trawl (Kerala 1986-'96).

Similar analysis of the ringseine fishery is shown in Fig. 5. A sharp increase in effort and catch of ringseines after 1998 is evident. But the fishery could not maintain the catch level. It steadily declined till 1994 followed by a minor improvement. This fishery attained its

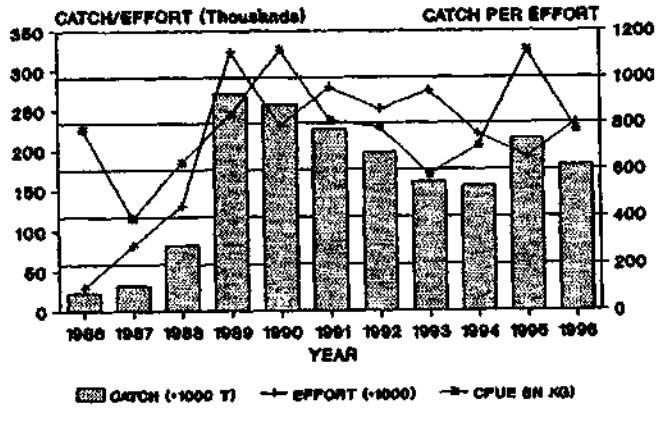


Fig. 5. Ring seine fishery in Kerala effort, catch and cpue.

full strength and efficiency by 1989. Hence, the relation between the relative growth of effort and catch per effort was studied only for the period from 1989 to 1996. Fig. 6 shows the inverse relation between these two characteristics more clearly than in the trawl fishery.

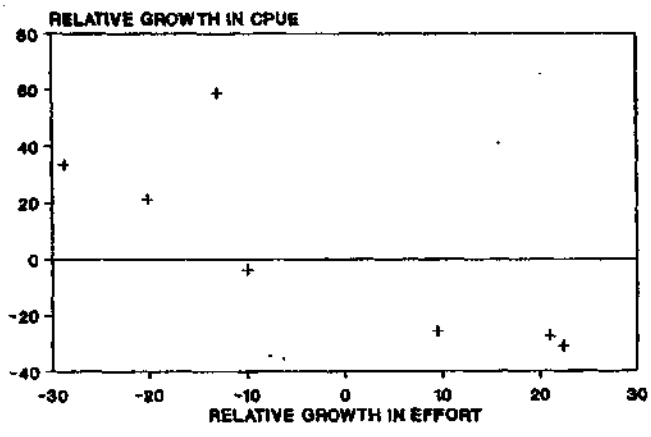


Fig. 6. Relation between export and cpue ringseine (Kerala 1989-'96).

The annual catch trends in the marine fisheries of Kerala are set by these two gear. The growth of the average catch after 1988 is influenced by the ringseines and trawl. The increase in effort by both these gear was found to result in a reduction in their catch per effort.

Table 1 shows that the trawl fishery is the most important in terms of effort and catch, followed by ringseine. Though the effort in gill net fishery is much higher than in the ringseine fishery the catch and catch per effort are not comparable to the trawl and ringseine fishery. Fig. 7 shows the relative growth in catch, effort and catch per effort of major gear from 1985-'88 period to 1993-96 period. Maximum increase in effort and catch is observed in ringseine fishery. But its increase in cpue is second to that of trawl fishery in which the growth in effort was the least. The growth was poor in the purse seine and motorised gillnet fishery with a decline in catch per effort. Mechanised gillnet and motorised boatseine fisheries declined. The boatseine fishery declined on the onslaught of ringseine fishery because they were competing for the same resources.

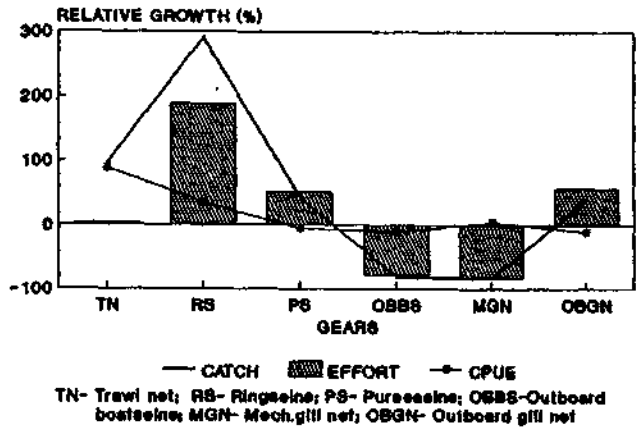


Fig. 7. Variations in effort, catch and cpue Kerala (1985-'88 to 1993-'96).

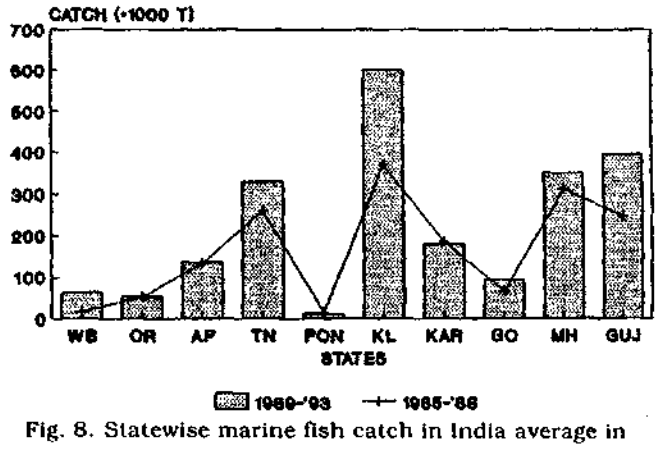


Fig. 8. Statewise marine fish catch in India average in tonnes.

Comparison with all India marine fish catch

During 1989-'93 the annual average marine fish catch in Kerala was 6,02,012 tonnes which was 25.34 % of the total marine fish catch in India (Fig. 8). The increase in the annual average catch from 1985-'88 to 1989-

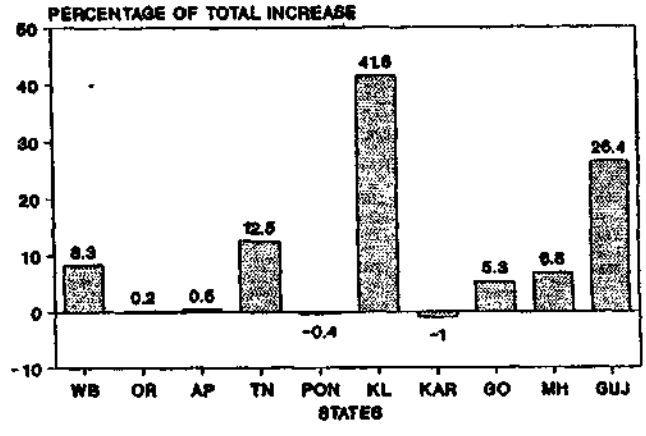


Fig. 9. Statewise increase in total catch 1985 '88 to 1989-'93

'93 period is shown in Fig. 9. Kerala contributed 41.6 % of the increase followed by Gujarat (26.4 %), Tamil Nadu (12.5 %), West Bengal (8.3%), Maharashtra (6.8 %), Goa (5.3 %), Andhra Pradesh (0.5 %) and Orissa (0.2 %). The catches from Karnataka and Pondicherry showed a minor decline. Kerala tops in the average fish catch per kilometer of coastline (Fig. 10) and per area of the continental self (Fig. 11). Thus the coastal waters of Kerala are the most productive around the Indian coast and intensively exploited, and the increase in exploitation with time is much faster. The decline in the catch of Karnataka the nearby state along the same coastline, has to be considered against this background. Such increase in the intensity of exploitation can destroy the natural refuges of the fish stocks in space and time resulting in damaging their renewability. As Kerala leads the development of marine fisheries in India the state has the responsibility to initiate conservation and management of the resources seriously.

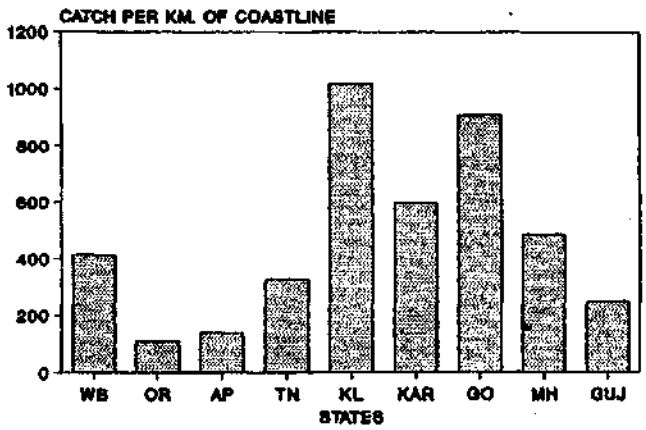


Fig. 10. Catch per km. of coastline in tonnes trawl (Kerala 1986-'96).

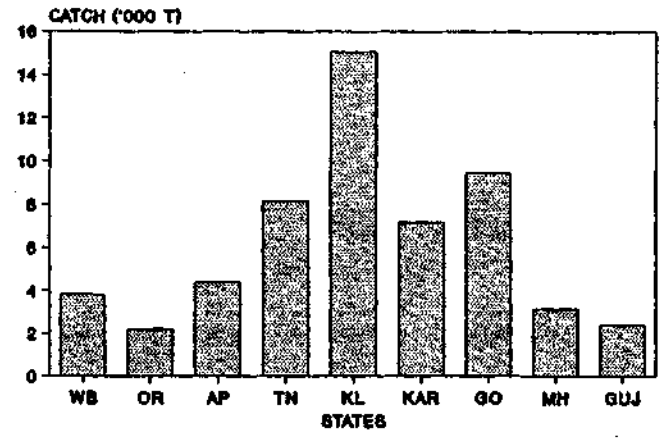


Fig. 11. Catch per 1000 sq.km continental shelf average in tonnes (1986-'93).

Changing fishery resources

Table 3a to 3e give the annual average catch of different varieties of fish during 1985-'88 and 1993-'96. The relative growth in the total fish catch from the former period was 50.8 %. 51.7 % of the total increase was contributed by pelagic fishes, 17.8 % by demersal finfishes, 13.5 % by molluscs, 9.4 % by crustaceans and 7.5 % by miscellaneous groups. The catch variations are depicted in Fig. 12. The maximum increase and decline

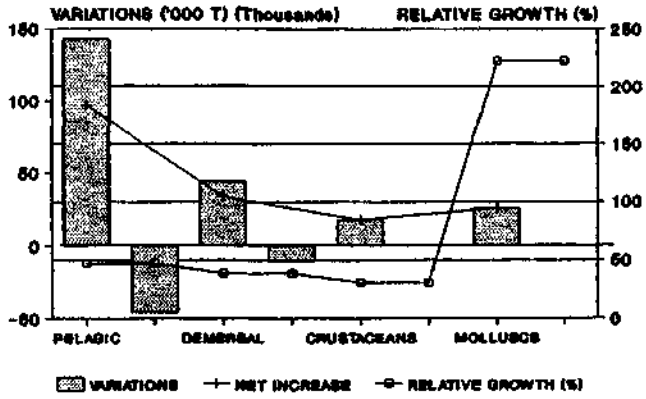


Fig. 12. Groupwise catch change Kerala (1985-'88 & 1993-'96).

in catch of different varieties of fishes were experienced by the pelagic fishery with maximum net increase, followed by demersal finfishes. Catches of molluscs did not show any decline. Among crustaceans there was a minor decline only in the catch of non-penaeid prawns. The maximum relative growth was registered in the molluscan fisheries due to sharp increase in the catch of cephalopods with the increased export demand. The minimum relative growth was registered in the crustacean fisheries in spite of the export demand.

TABLE 3a. *Growth in the average landing (tonnes)*

PELAGIC FISHES

Name of fish	1993-'96	1985-'88	Difference	Rel. growth %	% of total growth
Indian mackerel	83,189	23,495	59,694	254.1	31.7
Scads	56,120	16,492	39,628	240.3	21.1
Lesser sardines	28,477	8,201	20,276	247.2	10.8
Stolephorus	39,290	31,495	7,795	24.7	4.1
Other clupeids	11,988	6,991	4,997	71.5	2.7
Horse mackerel	5,203	1,816	3,387	186.5	1.8
Thryssa	5,655	3,364	2,291	68.1	1.2
Barracudas	3,510	1,257	2,253	179.2	1.2
Auxis spp.	4,565	3,791	774	20.4	0.4
Half beaks & full beaks	1,476	810	666	82.2	0.4
Wolf herring	1,370	716	654	91.3	0.3
S. commerson	5,879	5,340	539	10.1	0.3
E. affinis	7,388	7,212	176	2.4	0.1
Other shads	130	17	113	664.7	0.1
other tunnies	806	747	59	7.9	0.0
Mullets	520	486	34	7.0	0.0
Hilsa shads	38	15	23	153.3	0.0
Flying fishes	7	2	5	250.0	0.0
Thrissina	0	1	0	1	0.0
Billfishes	167	167	0	0.0	0.0
Acanthocybium spp.	0	0	0	0	0.0
Leather jackets	342	344	-2	-0.6	0.00
Coilia	0	3	-3	-100.0	0.0
T. tonggol	117	200	-83	-41.5	0.00
K. pelamis	1	92	-91	-98.9	0.0
S. gutiatus	186	1,824	-1,638	-89.8	-0.9
Other carangids	6,545	19,914	-3,369	-16.9	-1.8
Ribbon fishes	9,122	15,317	-6,195	-40.4	-3.3
Oil sardine	1,519	56,266	-34,747	-61.8	-18.5
Total	3,03,610	2,06,369	97,237	47.1	51.7

Table 3a further indicates that the resource that contribute maximum (31.75 %) to the growth of fish catch from 1985-'88 period to 1993- 96 period was the Indian mackerel. Fig.13 shows the annual catch of Indian mackerel in Kerala

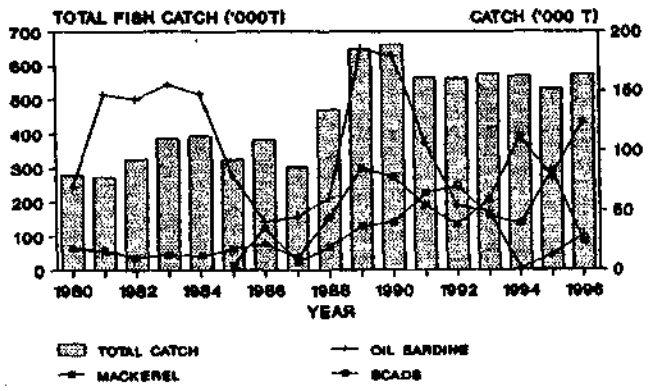


Fig. 13. Total fish of Kerala against the catch of come species.

from 1980-'96. The increase in the catch of mackerel is almost concomitant with the increase in the total fish catch, but at a higher rate and with sharper fluctuations. 73 % of the mackerel catch in Kerala is contributed by the ringseine fishery which has been maintaining the prominence since 1989.

In contrast, the oil sardine fishery which was the mainstay of the pelagic fisheries of Kerala sharply declined after 1990. Its decline from the annual average catch during 1985-'88 to 1993-'96 was 61.8 % (Fig. 13). The earliest success of the ringseine fishery was in netting this resource abundantly in 1989 and '90 along with mackerel. In 1989 this resource gave a record catch of 1.9 lakh tonnes which decline to 1,554 tonnes in 1994 (a decline of 99.2 %). The collapse of this very important resource after 1990 put a break in the fast growth of ringseine fishery. Fig. 5 shows almost a steady decline in the catch and effort in the ring seine fishery.

Another important resource which contributed substantially (21.1 %) to the increase in the pelagic fisheries is the scads (Table 3a). This resource showed its pontential in 1986. After poor catches in 1987 the yield increased steadily till 1992 and started to fluctuate thereafter (Fig.13).

In the demersal fisheries (Table 3b) the catch variations were not as strong as in the pelagic fisheries. The maximum increase was in the catch of threadfin breams accouting for 8.06 % of the increase in total fish catch. This was

followed by perches, soles, lizard fishes and croakers. The maximum relative increase was observed in the catch of Chinese pomfret and eel.

TABLE 3b. *Growth in the average landings (tonnes)*

DEMERSAL FINFISHES

Name of fish	1993-'96	1985-'88	Difference	Rel. growth %	% of total growth
Threadfin breams	42,854	27,702	15,152	54.7	8.1
Other perches	13,640	5,776	7,864	136.1	4.2
Soles	17,653	10,835	6,818	62.9	3.6
Lizard fishes	12,826	7,820	5,006	64.0	2.7
Croakers	13,790	9,506	4,284	45.1	2.3
Rock cods	3,833	665	3,168	476.4	1.7
Silver pomfret	913	453	460	101.5	0.2
Chinese pomfret	405	22	383	740.9	0.2
Rays	1,546	1,329	217	16.3	0.1
Halibut	235	95	140	147.4	0.1
Eels	141	9	132	466.7	0.1
Black pomfret	1,256	1,145	111	9.7	0.1
Pigface breams	342	244	98	40.2	0.1
Skates	102	18	84	466.7	0.0
Flounders	112	52	60	115.4	0.0
Threadfins	71	80	-9	-11.4	0.0
Big jawed jumper	868	980	-112	-11.4	-0.1
Snappers	202	387	-185	-47.8	-0.1
Silverbellies	4,900	5,486	-586	-10.7	-0.3
Sharks	3,162	4,464	-1,302	-29.2	-0.7
Goatfishes	1,015	2,708	-1,693	-62.5	-0.9
Catfishes	468	7,096	-6,628	-93.4	-3.5
Total	20,333	86,868	33,462	38.5	17.8

TABLE 3c. *Growth in the average landings (tonnes)*

MOLLUSCS

Name of fish	1993-'96	1985-'88	Difference	Rel. growth %	% of total growth
Cephalopods	36,295	11,490	24,805	215.9	13.2
Gastropods	746	0	746	-	0.4
Total	37,041	11,490	25,551	222.4	13.6

Conspicuous decline was observed in the catch of catfishes. The rate of decline is estimated as 93.4 %.

The cephalopod fishery (Table 3c) experience a major intensification with relative growth of 215.8 % in the catch of 1993-'96 period from 1985-'88 period. As in the case of scads this resource also exhibited its potential in 1986, declined in 1987 and started its steady and fast development (Fig. 14).

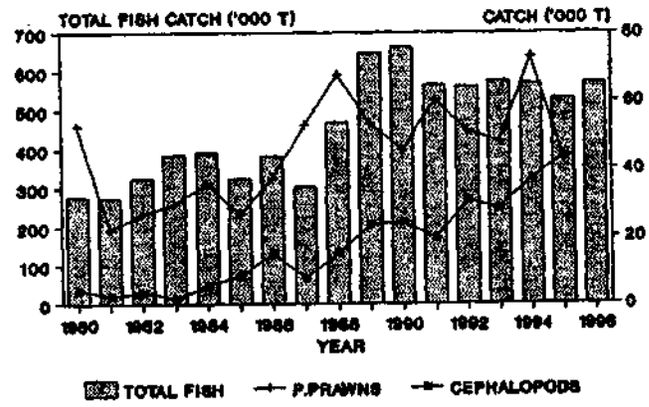


Fig. 14. Total fish catch of Kerala against the catch of some species.

The crustaceans showed a relative growth of 30.5 % from 1985-'88 to 1993-'96 (Table 3d). The penaeid prawn catch increased by 18% during the period.

TABLE 3d. *Growth in the average landings (tonnes)*

CRUSTACEANS

Name of fish	1993-'96	1985-'88	Difference	Rel. gowth %	% of total growth
Penaeid prawns	54,361	46,059	8,302	18.0	4.4
Stomatopods	16,916	9,923	6,993	70.5	3.7
Crabs	4,140	1,771	2,369	133.8	1.3
Lobsters	193	99	94	94.9	0.0
Non-penaeid prawns	139	182	-43	-23.6	0.0
Total	75,749	58,034	17,715	30.5	9.4

TABLE 3e *Growth in the average landings (tonnes)*

MISCELLANEOUS AND TOTAL CATCH OF FISH

Name of fish	1993-'96	1985-'88	Difference	Rel. growth %	% of total growth
Dolphin & porpoise	6	0	6	-	0.0
Seacow	0	0	0	-	0.0
Miscellaneous	21,400	7,345	14,055	191.4	7.5
Total	21,400	7,345	14,061	191.4	7.5
All varieties	5,58,133	3,70,105	1,88,026	50.8	100.0

The crab also showed maximum relative growth. Only the nonpenaeid prawn landings registered a relative decline by 23. 8 %. The prawn fishery though improved steadily from 1985 to1988 fluctuated afterwards. But the general trend is that of improvement. The difference in the average catch of certain important groups during 1986-'88 and 1993-'96 along with percentage growth is given in Fig. 15.

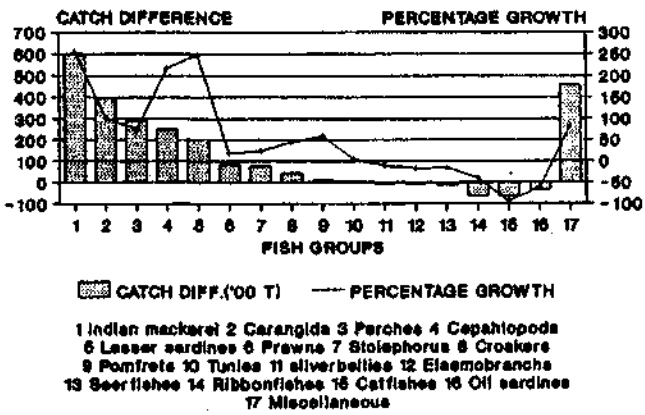


Fig. 15. Kerala-difference in average catch 1985'88 to 1993-'96.

Causes of growth

As stated earlier the average annual catch of the marine fish from Kerala in 1980-'87 increased by 75.4 % during 1989-'96 period. The transitional period was 1988. Two important events of this transitional period are worth mentioning.

1. Growth of ringseine fishery and
2. Commencement of ban on trawling for varying periods during the monsoon to protect the resources and the interests of the traditional fishermen.

Table 2 gives an indication of the growth of the fisheries by different gear. A comparison is made between the average annual situation in 1985-'87 (being the pre-ringseine and pre-ban period) and 1993-'96 (being the ringseine. ban period). The increase in the total fish catch from former period to the latter was 2,20,024 tonnes. The ringseine with an increase of 1,78,483 operations, 1,64,832 tonnes of catch and 356.8 kg of catch per effort contributed 74.9 % of this increase. Ringseine is a surface gear. This increase in the catch is offset by the decline of catch in other surface gear reducing the effective total increase in catch by surface gear to 78,087 which is only 35.5 % of the total increase. But the increase in the catch by trawl amounts 64.5 % of the total increase in the fish catch. Hence a major share of the average increase in catch was made by trawls. Similarly the increase in the catch per unit effort of trawls also can be considered as the maximum. But the relative increase in effort was less in the trawl when compared to all the other gear together. The effort of motorised gillnets increased most with a decline in the catch per effort. The question is whether monsoon ban on trawling was the reason for such an improvement in trawl catches. There is no method of verifying this as the fishery underwent a series of changes during this period apart from introduction of trawl ban-increase in the efficiency of trawlers, duration of fishing and range of exploited area. However, when the trawl fishery alone is considered the low relative increase in effort and significant increase in its catch and C/E (Fig.7) indicates that the introduction of trawl ban during monsoon has also played a key role in the enhancement of production. Moreover the penaeid prawn catches have improved and started fluctuating sharply and the cephalopod fishery has expanded. However, an uncontrolled

development of a fishery is always dangerous because continuous exploitation of the resources would violate their natural refuges in space and time and refuse them the opportunity to multiply and grow. On that ground the present duration of ban on trawling during the monsoon has to be considered as insufficient.

Analysis given in Figs. 4 and 6 indicates that the further growth of the ringseine and trawl operations will result in a reduction of catch per effort. These fisheries are the backbones of the marine fisheries in Kerala. We have perhaps reached a state of supersaturation of fishing effort in these sectors.

Gearwise variations

Table 4 gives the changes in the catch of different fish varieties in the major gear. In the trawl catches there was an average increase of 1,58,455 tonnes of fish in 1993-'95 when compared to 1985-'87 indicating a relative growth of 1,334 %. The increase in effort was only 35.3 %. Major varieties that contributed to this growth were cephalopods, scads, threadfin breams and penaeid prawns. A decline in the catch of catfishes, mullets and nonpenaeid prawns was observed. Table 5 shows the changes in catch per effort of these fishes. The cpue of penaeid prawns showed a slight decline, so also the cpue of silverbellies, non-penaeid prawns, threadfins, mullets, catfishes, etc. But cpue of most of the other species showed an increase with a total average relative increase of 72.5 %.

The average catch in the ringseine fishery increased by 1,30,650 tonnes which is 288.3 % of relative growth with 186.5 % increase in effort. (Table 4). Catch of Indian mackerel, scads, whitebaits and lesser sardines contributed to the bulk of the increase. Major decline was in the catch of other carangids, catfishes and oil sardine. The catch per unit effort of oil sardine and other carangids showed a decline. However, the total cpue showed a relative growth of 35.6 %.

It was the motorised boatseine fishery which declined considerably. The relative growth in catch was -84.3 % with a decline of 83.1 % in effort. All varieties of fishes except Indian mackerel, mullets, non-penaeid prawns and hilsa shad showed decline. Similarly there was a general decline in catch per effort. Considerable increase was observed in the catch of Indian mackerel and to a certain extent the mullets. The relative decline in the total catch per effort was -6.8 %.

Biological basis of fisheries management

A critical perusal of the fisheries in Kerala reveals that the single species resources are prone to sharper fluctuations than the multispecies fisheries. The fluctuations get more smoothened when we consider the total annual catches. The total fish catch is a product of the total productivity of the area fished. Variations in the total productivity are less pronounced and beyond our control. The decline in one species may help another species to increase due to their ecosystem interactions. But due to selective exploitation, the valuable species generally decrease and worthless species increase.

Most of the fish species that we exploit are short lived. They grow fast, reproduce at the age of one year and do not contribute to the fishery for more than two years. Table 6 gives the most successful spawning periods of some of the fishes we exploit. It can be noticed that a lot of spawning activity takes place in our waters during or immediately prior to monsoon. The spawning activity starts by around February and prolongs upto July.

TABLE 4., *Change in the fishery of major gear in Kerala between periods 1985-'87 and 1993-'95 (Average catch in tonnes)*

I. Trawl fishery

Name of species	1985-'87	1993-'95	Relative growth	
			In catch	In %
Cephalopods	6,169	33,521	27,352	443.38
Scads	1,277	20,672	19,395	1,518.79
Threadfin breams	27,833	42,695	14,862	53.40
Penaeid prawns	31,972	42,787	10,815	33.83
Other perches	2,605	9,807	7,202	276.47
Lizard fishes	5,827	12,772	6,945	119.19
Stolephorus	2,402	9,219	6,817	283.81
Stomatopods	9,156	15,527	6,371	69.58

Ribbon fishes	2,238	8,570	6,332	282.93
Soles	7,073	13,040	5,967	84.36
Other carangids	3,156	8,035	4,879	154.59
Croakers	4,846	8,783	3,937	81.24
Indian mackerel	215	4,151	3,936	1,830.70
Rockcods	53	3,250	3,197	6,032.08
Barracudas	389	2,819	2,430	624.68
Crabs	1,406	3,805	2,399	170.63
Thryssa sp.	768	2,922	2,154	280.47
Horse mackerel	9	1,878	1,869	20,766.67
Sharks	405	2,113	1,708	421.73
Other clupeids	298	1,594	1,296	434.90
Half beaks & Full beaks	2	890	888	44,400.00
Wolf herring	143	927	784	548.25
Gastropods	0	744	744	-
Goat fishes	284	982	698	245.77
Rays	743	1351	608	81.83
S.commersoni	15	619	604	4,026.67
Silver pomfret	127	592	465	366.14
Chinese pomfret	2	273	271	13,550.00
Black pomfret	62	331	269	433.87
Halibut	35	225	190	542.86
Silverbellies	2,792	2,944	152	5.44
Lobsters	35	150	115	328.57
Leather-jackets	0	109	109	-
S. guttatus	3	92	89	2,966.67
Skates	3	91	88	2,933.33
Other sardines	31	106	75	241.94
Eels	5	68	63	1,260.00
Flounders	65	109	44	67.69
Snappers	0	36	36	-
E.affinis	1	7	6	600.00
Pig-face breams	0	6	6	-
Flying fishes	1	7	6	600.00
Hilsa shad	1	4	3	300.00
Other tunnies	1	4	3	300.00
Auxis spp.	1	4	3	300.00
Other shads	12	3	-9	-75.00
Non-penaeid prawns	13	2	-11	-84.62
Threadfins	53	32	-21	-39.62
Big-jawed jumper	445	401	-44	-9.89
Oil sardine	92	11	-81	-88.04
Mullets	188	25	-163	-86.70
Catfishes	1,113	202	-911	-81.85
Miscellaneous	4,454	17,361	12,907	289.78
All Fish	1,18,819	2,77,274	1,58,455	133.36
Effort (units)	4,53,085	6,13,085	1,60,000	35.31

II. Outboard boatseine fishery

Name of species	1985-'87	1993-'95	Relative growth	
			In catch	In %
Indian mackerel	2,564	3,148	584	22.78
Mullets	58	310	252	434.48
Non-penaeid prawns	43	67	24	55.81
Hilsa shad	0	6	6	-
Halibut	0	0	0	-
Auxis spp.	1	0	-1	-100.00
Lizard fishes	3	3	0	0.00
Goatfishes	3	0	-3	-100.00
S.guttatus	4	0	-4	-100.00
Rays	13	8	-5	-38.46
Wolf herring	5	0	-5	-100.00
Crabs	7	1	-6	-85.71
Bill fishes	7	0	-7	-100.00
S.commersoni	11	3	-8	-72.73
Threadfin breams	8	0	-8	-100.00
Catfishes	12	3	-9	-75.00
Black pomfrets	76	59	-17	-22.37
Sharks	22	1	-21	-95.45
Barracudas	65	44	-21	-32.31
Stomatopods	44	0	-44	-100.00
Silver pomfrets	70	26	-44	-62.86
Unicorn cod	46	0	-46	-100.00
Half beaks & Full beaks	98	45	-53	-54.08
Big-jawed jumper	272	63	-209	-76.84
Horse mackerel	317	0	-317	-100.00
Other sardines	1,788	1408	-380	-21.25
Cephalopods	453	29	-424	-93.60
E.affinis	474	0	-474	-100.00
Thryssa sp.	931	414	-517	-55.53
Leather-jackets	600	43	-557	-92.83
Soles	567	7	-560	-98.77

Other perches	1601	540	-1061	-66.27
Silverbellies	1,413	151	-1262	-89.31
Other clupeids	2,897	1,572	-1325	-45.74
Ribbon fishes	2,156	128	-2028	-94.06
Croakers	3,593	1,142	-2451	68.22
Penaeid prawns	4,162	145	-4017	-96.52
Scads	7,790	980	-6810	-87.42
Other carangids	8,343	358	-7985	-95.71
Stolephorus	13,263	1,592	-11671	-88.00
Oil sardine	32,191	1,144	-31047	-96.45
Miscellaneous	312	107	-205	-65.71
All Fish	86,284	13,590	-72694	-84.25
Effort (units)	2,34,678	39,669	-195009	-83.10

III. Ringseine fishery

Name of species	1985-'87	1993-'95	Relative growth	
			In catch	In %
Indian mackerel	8,194	60,712	52,518	640.93
Scads	3,549	30,807	27,258	768.05
Stolephorus	3,250	22,409	19,159	589.51
Other sardines	2,702	20,480	17,778	657.96
Penaeid prawns	1,263	5,971	4,708	372.76
Other clupeids	1,610	5,777	4,167	258.82
Croakers	246	2,047	1,801	732.11
Other perches	695	2,397	1,702	244.89
Auxis spp.	0	1,404	1,404	-
Thryssa sp.	298	1,265	967	324.50
Silverbellies	75	797	722	962.67
Black pomfrets	174	579	405	232.76
E. affinis	168	417	249	148.21
Soles	27	220	193	714.81
Chinese pomfret	0	120	120	-1
S. commersoni	76	145	69	90.79
Mullets	70	138	68	97.14
Big-jawed jumper	11	77	66	600.00
Ribbon fishes	2	52	50	2,500.00
Barracudas	6	45	39	650.00
Cephalopods	2	38	36	1,800.00
Rays	1	27	26	2,600.00
Elasmobranchs	0	21	21	-
Sharks	1	15	14	1,400.00
Bill fishes	0	14	14	-
Wolf herring	3	12	9	300.00
Clupeids	0	7	7	-
Rockcods	0	5	5	-
S. guttatus	8	10	2	25.00
Threadfin breams	0	2	2	-
Threadfins	0	2	2	-
Skates	0	1	1	-
Seer fishes	0	1	1	-
Other shads	11	11	0	0.00
Silver pomfrets	89	65	-24	-26.97
Oil sardine	16,228	16,151	-77	-0.47
Leather-jackets	169	63	-106	-62.72
Half beaks & Full beaks	267	124	-143	-53.56
Catfishes	574	9	-565	-98.43
Horse mackerel	1,558	430	-1128	-72.40
Other carangids	3,768	2,477	-1291	-34.26
Miscellaneous	220	619	399	181.36
All Fish	45,314	1,75,964	1,30,650	288.32
Effort (units)	79,800	2,28,607	1,48,807	186.47

TABLE 5. *Change in catch per effort (kg) of major gear in Kerala between the periods 1985-'87 and 1993-'95*

I. Trawl fishery

Name of species	1985-'87	1993-'95	Relative growth	
			In catch	In %
Cephalopods	13.61	54.68	41.07	301.76
Scads	2.82	33.72	30.90	1,095.74
Threadfin breams	61.43	69.64	8.21	13.36
Penaeid prawns	70.57	69.79	-0.78	-1.11
Other perches	5.75	16.00	10.25	178.26
Lizard fishes	12.86	20.83	7.97	61.98
Stolephorus	5.30	15.04	9.74	183.00
Stomatopods	20.21	25.33	5.12	25.33
Ribbon fishes	4.94	13.98	9.04	183.00
Soles	15.61	21.27	5.66	36.26

Other carangids	6.96	13.11	6.15	88.36
Croakers	10.70	14.33	3.63	33.93
Indian Mackerel	0.47	6.77	6.30	1,340.43
Rockcods	0.12	5.30	5.18	4,316.67
Barracudas	0.86	4.60	3.74	434.88
Crabs	3.10	6.21	3.11	100.32
Thryssa sp.	1.70	4.77	3.07	180.59
Horse mackerel	0.02	3.06	3.04	15,200.00
Sharks	0.89	3.45	2.56	287.64
Other clupeids	0.66	2.60	1.94	293.94
Half beaks & full beaks	0.00	1.45	1.45	-
Wolf herring	0.32	1.51	1.19	371.88
Gastropods	0.00	1.21	1.21	-
Goat fishes	0.63	1.60	0.97	153.97
Rays	1.64	2.20	0.56	34.15
S.commersoni	0.03	1.01	0.98	3,266.67
Silver pomfret	0.28	0.97	0.69	246.43
Chinese pomfret	0.01	0.45	0.44	4,400.00
Black pomfret	0.14	0.54	0.40	285.71
Halibut	0.08	0.37	0.29	362.50
Silverbellies	6.16	4.80	-1.36	-22.08
Lobsters	0.08	0.25	0.17	212.50
Leather-jackets	0.00	0.18	0.18	-
S. guttatus	0.01	0.15	0.14	1,400.00
Skates	0.01	0.15	0.14	1,400.00
Other sardines	0.07	0.17	0.10	142.86
Eels	0.01	0.11	0.10	1,000.00
Flounders	0.14	0.18	0.04	28.57
Snappers	0.00	0.06	0.06	-
E.affinis	0.00	0.01	0.01	-
Pig-face breams	0.00	0.01	0.01	-
Flying fishes	0.00	0.01	0.01	-
Hilsa shad	0.00	0.01	0.01	-
Other tunnies	0.00	0.01	0.01	-
Auxis spp.	0.00	0.01	0.01	-1
Other shads	0.03	0.00	-0.03	-100.00
Non-penaeid prawns	0.03	0.00	-0.03	-100.00
Thredfins	0.12	0.05	-0.07	-58.33
Big-jawed jumper	0.98	0.65	-0.33	-33.67
Oil sardine	0.20	0.02	-0.18	-90.00
Mullets	0.41	0.04	-0.37	-90.24
Catfishes	2.46	0.33	-2.13	-86.59
Miscellaneous	9.83	28.32	18.49	188.10
All Fish	262.24	452.26	190.02	72.46
Effort (units)	4,53,085	6,13,085	1,60,000	35.31

II Outboard boatseine fishery

Name of species	1985-'87	1993-'95	Relative growth	
			In catch	In %
Indian mackerel	10.92	79.35	68.43	626.65
Mullets	0.25	7.81	7.56	3,024.00
Non-penaeid prawns	0.18	1.68	1.50	833.33
Hilsa shad	0.00	0.14	0.14	-
Halibut	0.00	0.00	0.00	-
Auxis spp.	0.00	0.00	0.00	-
Lizard fishes	0.01	0.07	0.06	600.00
Goatfishes	0.01	0.00	-0.01	-100.00
S.guttatus	0.02	0.00	-0.02	-100.00
Rays	0.05	0.20	0.15	300.00
Wolf herring	0.02	0.00	-0.02	-100.00
Crabs	0.03	0.03	0.00	0.00
Bill fishes	0.03	0.00	-0.03	-100.00
S.commersoni	0.05	0.08	0.03	60.00
Threadfin breams	0.03	0.00	-0.03	-100.00
Catfishes	0.05	0.08	0.03	60.00
Black pomfrets	0.32	1.50	1.18	368.75
Sharks	0.09	0.02	-0.07	-77.78
Barracudas	0.28	1.10	0.82	292.86
Stomatopods	0.19	0.00	-0.19	-100.00
Silver pomfrets	0.30	0.66	0.36	120.00
Unicorn cod	0.19	0.00	-0.19	-100.00
Half beak & full beaks	0. 42	1.13	0.71	169.05
Big-jawed jumper	1.16	1.59	0.43	37.07
Horse mackerel	1.35	0.00	-1.35	-100.00
Other sardines	7.62	35.50	27.88	365.88
Cephalopods	1.93	0.73	-1.20	-62.18
E.affinis	2.02	0.00	-2.02	-100.00

Thryssa sp	3.97	10.44	6.47	162.97
Leather-jackets	2.56	1.09	-1.47	-57.42
Soles	2.41	0.18	-2.23	-92.53
Other perches	6.82	13.62	27.28	22.28
Silverbellies	12.34	3.80	-2.22	-36.88
Other clupeids	12.34	13.62	27.28	221.07
Ribbon fishes	9.19	3.22	-5.97	-64.96
Croakers	15.31	28.80	13.49	88.11
Penaeid prawns	17.74	3.65	-14.09	-79.43
Scads	33.19	24.71	-8.48	-25.55
Other carangids	35.55	9.02	-26.53	-74.63
Stolephorus	56.51	40.12	-16.39	-29.00
Oil sardine	137.17	28.83	-108.34	-78.98
Miscellaneous	1.33	2.71	1.38	103.76
All Fish	367.67	342.59	-25.08	-6.82
Effort (units)	23,468	39,669	-195009	-83.10

III. Ringseine fishery

Name of species	1985-'87	1993-'95	Relative growth in catch	Relative growth in %
Indian mackerel	103	266	163	158.25
Scads	44	135	91	206.82
Stolephorus	41	98	57	139.02
Other sardines	34	90	56	164.71
Penaeid prawns	16	26	10	62.50
Other clupeids	20	25	5	25.00
Croakers	3	9	6	200.00
Other perches	9	10	1	11.11
Auxis spp.	0	6	6	-
Thryssa spp	4	6	2	50.00
Silverbellies	1	3	2	200.00
Black pomfrets	2	3	1	50.00
E. affinis	2	2	0	0.00
Soles	0	1	1	-
Chinese pomfret	0	1	1	-
S. commersoni	1	1	0	0.00
Mullets	1	1	0	0.00
Big-jawed jumper	0	0	0	-
Ribbon fishes	0	0	0	-
Barracudas	0	0	0	-
Cephalopods	0	0	0	-
Rays	0	0	0	-
Elasmobranchs	0	0	0	-
Sharks	0	0	0	-
Bill fishes	0	0	0	-
Wolf herring	0	0	0	-
Clupeids	0	0	0	-
Rockcods	0	0	0	-
S. guttatus	0	0	0	-
Threadfin breams	0	0	0	-
Threadfins	0	0	0	-
Skates	0	0	0	-
Seer fishes	0	0	0	-
Other shads	0	0	0	-
Silver pomfrets	0	0	0	-1
Oil sardine	203	71	-132	-65.02
Leather-jackets	2	0	-2	-100.00
Half beaks & full beaks	3	1	-2	-66.67
Catfishes	7	0	-7	-100.00
Horse mackerel	20	2	-18	-90.00
Other carangids	47	11	-36	-76.60
Miscellaneous	3	3	0	0.00
All Fish	567.84	769.72	201.88	35.55
Effort (units)	79,800	2,28,607	1,48,807	186.47

TABLE 6. *Intensive spawning period of major pelagic fishes along the Kerala coast*

	Fishes	Spawning period
1.	*Sardinella longiceps*	May to July
2.	*S. gibbosa*	March to May
3.	*S. albella*	April to June
4.	*S. fimbriata*	May to June
5.	*Dussumieria* spp.	April to July
6.	*Stolephorus devisi*	January to March
7.	*S. bataviensis*	January to March
8.	*Euthynnus affinis*	May to July
9.	*Auxis thazard*	May to july
10.	*Rastrelliger kanagurta*	May to July
11.	*Trichiurus lepturus*	April to June
12.	*Decapterus russelli*	April to June
13.	*Megalaspis cordyla*	May to August

There is a phenomenon termed as "bet-hedging" by Lambert and Ware. Some fishes release batches of eggs over an extensive area during a protracted spawning period which is adaptive in situation where prey availability is unpredictable and the risk of total recruitment failure is avoided by many independent spawning bouts. This phenomenon is prevalent in Indian waters. Indian mackerel starts spawning by February and reaches a peak by May-July. Spawning is observed even in November but peak recruitment is confined to the products of spawning in May-July. This is due to the repetitive phenomenon called "upwelling" in our coastal waters. The process of upwelling starts by around March, reaches a peak by August/September and starts sinking by October/November. The upwelled water rich in nutrients causes plankton bloom in the coastal waters. The nutrients brought in by the river inflow during the monsoon also intensify the bloom. This plankton bloom is favourable to the successful survival of the planktonic larvae of the fishes reducing their death due to starvation especially during their critical stage in development and helps better recruitment. Hence, the spawning activity during the upwelling period becomes most successful. The spawning during May-July is very crucial to recruitment. During the pre-outboard and pre-ringseine period the fishing activity using the traditional units was very little in the monsoon period because of the unfavourable weather conditions and lack of safe landing facilities. With the introduction of powerful outboard engines and better landing facilities like fishing harbours, the fishing activity during the monsoon has become easier resulting in increased exploitation of spawners and early juveniles of many fish species. The length frequency distribution of mackerel and oil sardine in Kerala along with their mean length during 1993-'94 in respect of mackerel and during 1985-'88 and 1993-'96 in respect of oil sardine are given in Figs. 16 and 17. Figs. 18 and 19 give the mean length and mean weight of mackerel and oil sardine. Juveniles of Indian mackerel of size below 155 mm and weight below 35 g are exploited abundantly during the period from July to September. In

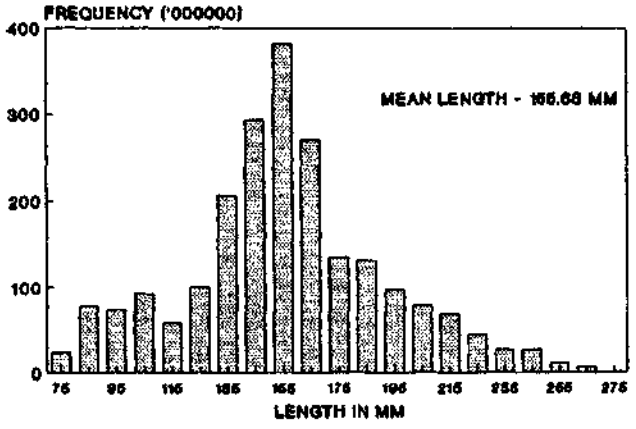


Fig. 16. Indian Mackerel - Kerala (1993-'94) length frequency distribution.

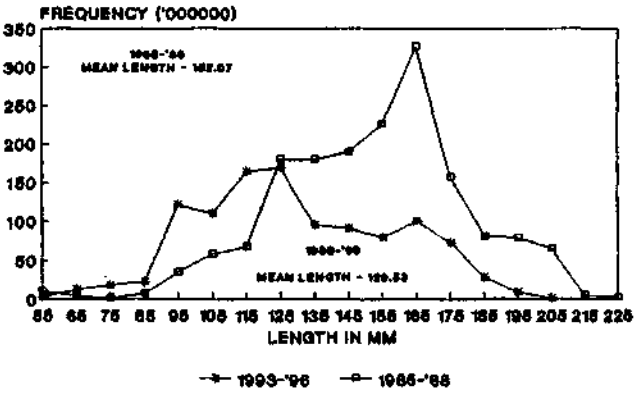


Fig. 17. Oil sardine - Kerala length frequency distribution (1986 - '88 & 1993-'96).

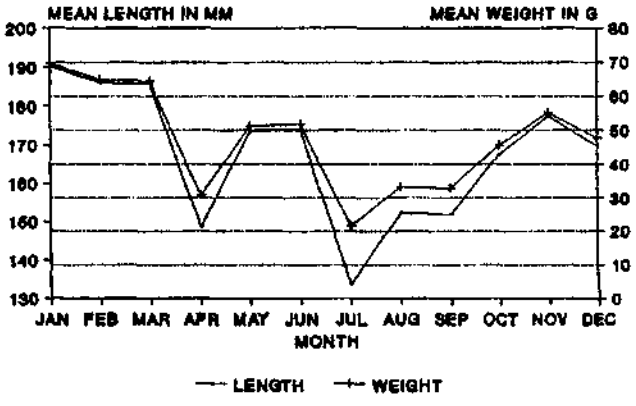


Fig. 18. Monthly mean length and weight Indian mackerel (1993-'96).

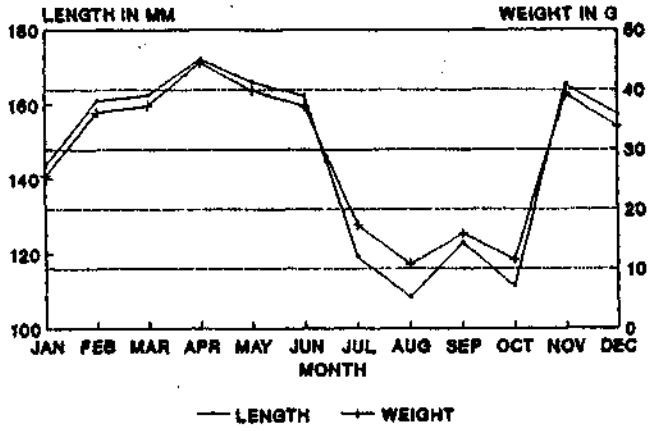


Fig. 19. Monthly mean length and weight oil sardine (1993-'96).

the case of oil sardine juveniles of length below 120 mm and weight below 15g are exploited during the period from July to October. Table 7 gives the monthly catch details of oil sardine and mackerel in different districts of the state. On an average, from 1993 to 1996 almost 50.3 % of the catch of mackerel was landed during July-September. Oil sardine catch during the period of low mean length (July-October) comes to 50 %. These are the rates at which early juveniles of most of the pelagic fishes are being exploited. As a result the fish stocks decline very fast. This growth overfishing is the result of uncontrolled development in the fishery due to intensified ringseine operations during monsoon season.

If growth overfishing is the problem caused by monsoon fisheries, the exploitation during the premonsoon period is on the spawning stocks. As the peak spawning is in May-July, exploitation during April-July is on the spawning stocks. The intensity of this kind of fishery is more towards the southern districts of Kerala (Trivandrum to Alleppey). From Table 7 it can be assumed that the new recruits of mackerel enter the fishery in full strength in September and that of oil sardine in October when they are of age less than 4 months and 5 months respectively.

TABLE 7. *Month-wise and district-wise mackerel catch (t) in Kerala (Average for 1993-'96)*

Months	TVM	QLN	ALP	EKM	TCR	MAL	CLT	KNR	KSD	Total	Percentage Numbers
Jan.	215.75	329.25	136.75	287.00	37.00	687.00	758.75	59.50	3.75	2,514.75	1.36
Feb.	187,25	310.00	68.50	128.00	23.25	64.25	108.50	97.00	5.50	992.25	0.58
Mar.	803.25	268.50	89.50	197.25	46.50	123.25	302.00	171.25	13.50	2,015.00	1.18
Apr.	446.50	827.25	199.50	469.75	7.75	330.25	272.00	203.50	65.25	2,821.75	3.47
May.	1,561.25	1,444.50	448.00	1,154.25	388.00	67.50	213.50	29.00	147.75	5,453.75	4.01
Jun.	50.25	211.00	1,088.00	813.50	1,150.00	228.75	2,005.50	468.5	1,630.25	7,645.7	5.56
Jul.	148.00	72.50	2,078.25	311.75	1,690.00	172.25	6,124.50	515.00	865.00	11,977.25	21.07
Aug.	126.50	672.00	4,530.00	1,223.00	348.50	855.2	3,524.2	844.00	235.25	5,491.75	17.62
Sep.	244.00	820.00	7,300.00	4,761.25	2,269.25	223.25	3,196.25	1,452.50	710.25	20,976.75	24.08
Oct.	240.50	636.50	5,029.25	3,385.75	1,753.50	1,754.75	1,900.75	936.25	1,591.00	17,228.25	14.23
Nov.	791.75	362.75	777.50	808.00	634.75	714.50	370.75	244.00	42.75	4,746.75	3.24
Dec.	281.00	375.75	1,146.50	658.25	29.00	423.00	1,419.50	183.00	28.50	4,544.50	3.59
Total	5,096.00	6,330.00	22,891.75	14,197.75	11,510.50	5,644.00	20,196.25	5,203.50	5,338.75	96,408.50	100.00
%	5.29	6.57	23.74	14.73	11.94	5.85	20.95	5.40	5.54	100.00	

TVM : Trivandrum, QLN : Quilon, ALP : Alleppey, EKM : Ernakulam, TCR : Trichur, Mal : Malappuram, CLT : Calicut, KNR : Kannur, KSD : Kasaragod

TABLE 8. *Month-wise and district-wise oil sardine catch (t) in Kerala (average for 1993-'96)*

Months	TVM	QLN	ALP	EKM	TCR	MAL	CLT	KNR	KSD	Total	Percentage Numbers
Jan.	1.50	123.25	424.00	80.25	449.25	0.00	122.50	21.50	7.50	1,229.75	4.02
Feb.	0.25	384.25	201.25	88.00	25.25	0.00	383.25	104.25	0.00	1,186.50	2.74
Mar.	26.00	426.75	0.00	90.00	32.75	0.00	50.25	19.75	0.50	646.00	1.44
Apr.	10.50	2,837.75	285.50	5.50	0.00	0.00	0.00	0.00	0.00	3,139.25	5.88
May.	33.00	7.75	0.00	9.25	0.00	0.00	0.00	0.00	0.00	50.00	0.10
Jun.	4.25	30.75	55.25	11.50	0.00	0.00	0.00	47.50	0.00	149.25	0.33
Jul.	0.00	4.50	335.25	333.50	744.00	0.00	453.00	0.00	0.00	1,870.25	10.88
Aug.	3.50	8.75	62.00	17.75	361.00	0.00	59.75	182.00	0.25	695.00	5.41
Sep.	49.25	257.25	201.25	830.75	340.75	19.75	2,791.50	556.50	224.25	5,271.25	27.72
Oct.	25.75	325.00	961.50	118.25	800.25	692.50	1,014.00	55.25	44.00	4,036.50	29.02
Nov.	134.50	699.25	648.50	160.25	409.00	284.75	109.00	543.25	4.75	2,993.25	6.36
Dec.	3.75	1,430.50	210.75	101.25	40.50	0.00	358.75	228.75	98.50	2,472.75	6.09
Total	292.25	6,535.75	3,385.25	1,846.25	3,202.75	997.00	5,342.00	1,758.75	379.75	23,739.75	100.00
%	1.23	27.53	14.26	7.78	13.49	4.20	22.50	7.41	1.60	100.00	

Present scenario

During 1993-'96 out of an average catch of 5.5 lakh tonnes of fish landed in Kerala, 48.4 % was contributed by mechanised trawls, 30.8 % by large seines (purseseine and ringseine), 4.1 % by boatseines, 9.2 % by gill nets, 3.8 % by hooks & line and the remaining 1.9 % by other gear (Table 9). Trawl fishery dominates in Kollam, Ernakulam and Kozhikode districts. In other districts the motorised crafts land maximum catch (Table 10). The minitrawl landing is maximum in Alleppey. The contribution by the non-mechanised fishery is of importance only in Thiruvanantha- puram district where neither the trawls nor the ringseines are operated. Even here, the non-mechanised fishery is on the decline with the spreading of motorisation. Fig. 20 shows the monthly average total catch along with the catches of ringseines and trawls. Peak catches are made in August. This is mainly due to the increase in the catches of trawl and ring seines. The poor catch during June is perhaps due to the non-operation of trawls during banperiod.

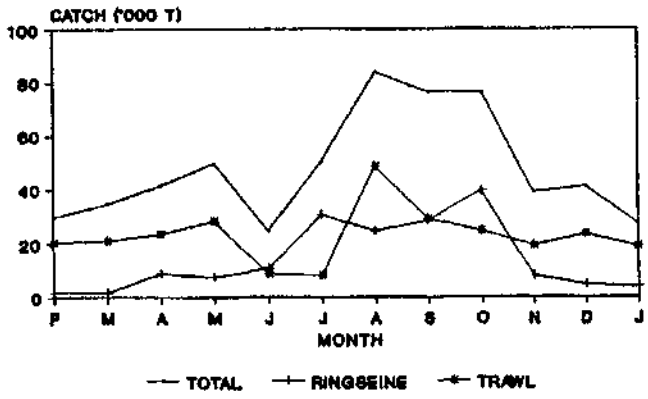


Fig. 20. Monthly catch in *Kerala* average 1993-'96.

Subsequently the ringseine catch increased to a first peak in July. Fig. 21 shows that the peak catches of ringseine are made during monsoon and subsequently there

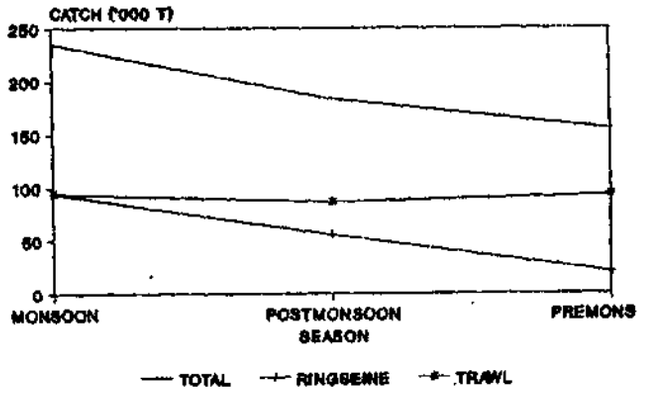


Fig. 21. Seasonwise catch in Kerala average 1993-'96.

was a steep decline in its catches. Due to lifting of the thermocline with upwelling the surface mixed layer during monsoon is v very narrow where the new recruits of the pelagic fishes get locked and become highly vulnerable to the pelagic ear. Besides the incursion of the poorly oxygenated bottom water of the entire shelf during this period push most of the demersal fish stocks to the surface (Banse, 1959). Hence, intensive exploitation by ringseines during monsoon is on the new recruits resulting in early stocks decline. However, in the trawl fishery this trend of fast decline in catches after monsoon is not observed.

TABLE 9. *Average gearwise catch (1993 -'96) in tonnes in coastal districts of Kerala*

Gear	TVM	QLN	ALP	EKM	TCR	MAL	CLT	KSD	Total	Percentage
MTN	0	1,00,899	1,831	58,993	3,124	12.38	82,717	7,032	2,66,632	48.4
OBRN	0	15,367	4,90,35	18,250	22,168	10,975	38,401	7,766	1,61,959	29.4
OBDGN	13,265	15,083	994	279	2,085	664	3,470	607	36,444	6.6
OBBS	4,135	0	0	9,331	4,835	7	25	0	18,332	3.3
OBHL	8,673	5,970	341	123	74	2	538	48	15,766	2.9
NBDGN	6,264	2,573	80	731	655	265	440	27	11,033	2.0
OBTN	0	3	6,036	28	679	133	3,196	13	10085	1.8
NMSS	6,096	1,631	23	4	0	18	1	25	7,797	1.4
PS	0	0	0	7488	0	0	0	0	7,488	1.4
NMBS	4,002	0	117	11	88	6	82	0	4,305	0.8
NMHL	3,140	648	0	49	0	0	174	0	4,010	0.7
OBDN	510	0	0	0	0	1,167	0	0	1,677	0.3
OBDIS	345	62	2	0	3	832	380	0	1,623	0.3
MDGN	0	1	0	1,535	30	6	16	0	1,587	0.3
MHL	0	10	0	891	0	0	14	0	914	0.2
NMSN	893	0	0	0	0	0	0	0	893	0.2
NMOTRS	28	0	0	36	0	0	5	0	69	0.0
OBOTRS	61	0	0	0	0	0	0	0	61	0.0
NMCN	0	0	0	36	0	0	3	0	39	0.0
NMRN	0	0	0	0	0	0	0	0	0	0.0
NMGN	0	0	0	0	0	0	0	0	0	0.0
	47,410	1,42,244	58,457	97,780	33,738	26,112	1,29457	15,518	5,50714	100.00

TABLE 10. *Districtwise total catch in average*

	Catch (t)		Effort (N)	
Trivandrum				
Mechanised	0.0	0.00	0	0.00
Motorised	26,477.5	56.46	6,56,510	52.13
Non-mechanised	20,422.0	43.54	6,02,864	47.87
Total	46,899.5	100.00	12,59,374	100.00
Quilon				
Mechanised	1,00,909.0	70.94	1,71,849	25.24
Motorised	36,482.5	25.65	3,55,422	52.20
Non-mechanised	4,852.0	3.41	1,53,613	22.56
Total	1,42,243.5	100.00	6,80,883	100.00
Alleppey				
Mechanised	1,831.0	3.13	6,324	2.85
Motorised	56,407.0	96.49	2,08513	93.94
Non-mechanised	219.0	0.37	7,137	3.22
Total	58,457	100.00	2,21973	100.00
Ernakulam				
Mechanised	68,905.5	70.47	1,43,085	50.35
Motorised	28,009.0	28.64	69,517	24.46
Non-mechanised	865	0.89	71,556	25.18
Total	97,780.0	100.00	2,84,158	100.00
Trichur				
Mechanised	3,153.5	9.35	14,829	17.32
Motorised	29,841.0	88.45	55,492	64.82
Non-mechanised	743.0	2.20	15,290	17.86
Total	33,737.5	100.00	85,610	100.00
Malappuram				
Mechanised	12,044.0	46.13	39,729	30.04
Motorised	13,779.0	52.77	77,393	58.51
Non-mechanised	288.5	1.10	15,149	11.45
Total	26,111.5	100.00	1,32,270	100.00
Kozhikode				
Mechanised	82,746.0	63.92	88,938	37.36
Motorised	46,007.5	35.54	1,19,919	50.37
Non-mechanised	703.5	0.54	29,215	12.27
Total	1,29,457.0	100.00	2,38072	100.00
Kannur				
Mechanised	10,014.5	41.42	60,200	44.96
Motorised	13,921.0	57.58	56,865	42.47
Non-mechanised	240.5	0.99	16,843	12.58
Total	24,176.0	100.00	13,3907	100.00
Kasaragod				
Mechanised	5,101.0	34.48	36,354	36.25
Motorised	9,620.5	65.03	57,583	57.41
Non-mechanised	73.0	0.49	6,359	6.34
Total	14,794.5	100.00	1,00,296	100.00

Discussion

The marine fisheries of Kerala is dominated by trawls. Trawl landings are concentrated at Calicut, Ernakulam and Quilon districts due to the availability of harbour facilities. Trawl is contributing to 488.4 to % of the the marine fish catch in Kerala and the catch is composed of more fish varieties than any other gear. The increase in fish catch after 1988 was largely due to the increase in the catch of this gear. There was an increase in the intensity and the area of fishing operation. The ban on trawling during varying periods of monsoon since 1988 also might have had a beneficial effect on the fishery as this provided favourable conditions for spawning and recruitment of fish species during the peak period of these activities.

The ringseine fishery which started in the second half of 1980s intensified in 1988 and the gear contributed substantially to the increase in catch. But the progress in ringseine fishery was partly at the cost of other surface gear like boat seine and gillnets. As the development of this fishery was uncontrolled, the exploitation was more during monsoon season on the early juveniles of pelagic fishes of age less than 5 months; as the intensive spawning and recruitment of major pelagic resources are observed during monsoon. This caused an early decline of the stocks of these species.

The major changes that took place in the fisheries of Kerala during the 1980s are the increased efficiency of exploitation and extended area of operation. Larger trawlers are going to deeper waters and were engaged in stay over fishing. The ringseine units fitted with powerful outboard engines were also exploiting deeper waters. The situation can be detrimental to the fish stocks unless they are provided with certain amount of protection in space and time for rebuilding. The ban on trawling enforced during a limited period in monsoon can be considered as a right step in this direction for the benefit of the demersal fish stocks. But the pelagic fish is still left in an unprotected condition. It is high time certain refuges are provided for the species supporting ringseine fishery also.

In an open access exploitation system as ours, conservation of stocks is beset with a lot of problems. The exploitation cannot be expected to be prudent. The gear are used according to their effectiveness without considering the biological implications or sustainability of fish stocks. The United Nations Convention of the Law of the Sea in 1982 entrusted the responsibility of protecting the fish resources of the Exclusive Economic Zone to the corresponding coastal states by judicious exploitation. Many of the coastal states signatory to this convention have not yet taken up this responsibility earnestly. In India, the Government of Kerala state has issued some orders in this direction but many are with poor enforcement record.

It is difficult to suggest methods of managing the multispecies and multigear fisheries of Kerala. A method of successional fishing can be initiated on an experimental basis. By this method, varieties of gear are used in space and time according to the biological characteristics of the fishes with an aim of protecting their spawning stock and early juveniles. As the successful spawning period of most of the fishes is during May-July, the fishing during this period has to be regulated to protect the spawning stock. During this period all gear other than large meshed (above 80 mm) drift gill nets and hooks and line that exploit larger fishes like seerfishes, tunas, sharks, perches, etc. should be strictly controlled. After July operation of gill nets of mesh size above 40 mm may be ecouraged to catch the post-spawners. This will avoid the exploitation of new recruits from the May-July spawning. If the fishermen prefer seines or purse seines the mesh size has to be regulated to 40 mm. All kinds of gear that are presently used may be allowed to operate during October-March under strict vigil. Trawling (including minitrawling) in the inshore waters should be controlled from May to September to protect spawners, spawning activity and the juveniles of fishes.

Under the present condition of the marine fisheries in Kerala with a long history of uncontrolled development these measures may seem to be extremely rigorous. But the fishery will get adapted to the controls. Reduction in the juvenile fishery can cause a surge in the drift net and hooks and line fishery due to predator-prey relationship. By allowing optimum growth of the new recruits the quality and quantity of the yield can be improved many fold and can sustain the production. Besides this will facilitate the maximum use of the productivity of our waters by taking full advantage of the plankton bloom with upwelling. The food chain of plankton/detritus, plankton feeders/detritus feeders and the carnivores will not get interrupted. Bottom trawling ia a destructive way of fishing. Many countries have banned trawling in their coastal waters. It affects the benthos and the production of meroplankton. However, the amount of yield from trawl fisheries and its economic importance cannot be overlooked. Its operation has to be restricted to areas with a depth more than 35 metres.

Management of the fisheries can be made more effective if the actual fishermen are involved in the decision making. Fishermen cooperatives can be formed which can be vested with the responsibility of protecting the fish-

eries resources they exploit. They can be made aware of the biological and environmental basis for sustainability of fish stocks by constant interactions with the scientific community. Such interactions will be beneficial to the fishermen, fisheries, the fishery scientists and the policy makers. Besides it will make the implementation of the management options smooth and effective.

Fishery management policies are seldom final. We are dealing with a highly dynamic biosphere where upheavals can take place without our knowledge. Hence, any management strategy should be reviewed and corrected from time to time.

Acknowledgment

The authors are thankful to Dr. M. Devaraj, Director, Central Marine Fisheries Research Institute, Cochin for suggesting this study. We are also grateful to Mr. K.N. Kurup, Head, Fisheries Resources Assessment Division, CMFRI for making available the marine fish landing data used in this analysis, also for critically going through the manuscript and making valuable comments.

Table 5. *Change in the fishery of major gear in Kerala between periods 1985-'87 and 1993-'95. (average catch in tonnes).*

I. Trawl fishery

Name of species	1985-'87	1993-'95	Relative growth	
			In catch	In %
Cephalopods	6,169	33,521	27,352	443.38
Scads	1,277	20,672	19,395	1,518.79
Thread fin breams	27,833	42,695	14,862	53.40
Penaeid prawns	31,972	42,787	10,815	33.83
Other perches	2,605	9,807	7,202	276.47
Lizard fishes	5,827	12,772	6,954	119.19
Stolephorus	2,402	9,219	6,817	283.81
Stomatopods	9,156	15,527	6,371	69.58
Ribbon fishes	2,238	8,570	6,332	282.93
Soles	7,073	13,040	5,967	84.36
Other carangids	3,156	8,035	4,879	154.59
Croakers	4,846	8,783	3,937	81.24
Indian mackerel	215	4,151	3,936	1,830.70
Rock cods	53	3,250	3,197	60,32.08
Barracudas	389	2,819	2,430	624.68
Crabs	1,406	3,805	2,399	170.63
Thryssa sp.	768	2922	2154	280.47
Horse mackerel	9	1,878	1,869	20,766.67
Sharks	405	2,113	1,708	421.73
Other clupeids	298	1,594	1,296	434.90
Half beaks & full beaks	2	890	888	44,400.00
Wolf herring	143	927	784	548.25
Gastropods	0	744	744	-1.00
Goat fishes	284	982	698	245.77
Rays	743	13,51	608	81.83
S. commersoni	15	619	604	4,026.67
Silver pomfret	127	592	465	366.14
Chinese pomfret	2	273	271	13,550.00
Black pomfret	62	331	269	433.87
Halibut	35	225	190	542.86
Silverbellies	2,792	2,944	152	5.44
Lobsters	35	150	115	328.57
Leather-jackets	0	109	109	-1.00
S. guttatus	3	92	89	2966.67
Skates	3	91	88	2,933.33
Other sardines	31	106	75	241.94
Eels	5	68	63	1,260.00
Flounders	65	109	44	67.69
Snappers	0	36	36	-1.00
E. affinis	1	7	6	600.00
Pig-face breams	0	6	6	-1.00
Flying fishes	1	7	6	600.00
Hilsa shad	1	4	3	300.00
Other tunnies	1	4	3	300.00
Auxis spp.	1	4	3	300.00
Other shads	12	3	-9	-75.00
Non-penaeid prawns	13	2	-11	-84.62
Threadfins fishes	53	32	-21	-39.62
Big-jawed jumper	445	401	-44	-9.89
Oil sardine	92	11	-81	-88.04
Mullets	188	25	-163	-86.70
Catfishes	1,113	202	-911	-81.85
Miscellaneous	4,454	17,361	12,907	289.78
All fish	1,18819	2,77,274	1,58,455	133.36
Effort (units)	4,53,085	6,13,085	1,60,000	35.31

II. Outboard boatseine fishery

Name of species	1985-'87	1993-'95	Relative growth	
			In catch	In %
Indian mackerel	2,564	3,148	584	22.78
Mullets	58	310	252	434.48
Non-penaeid prawns	43	67	24	55.81
Hilsa shad	0	6	6	-1.00
Halibut	0	0	0	
Auxis spp.	1	0	-1	-100.00
Lizard Fishes	3	3	0	0.00
Goat Fishes	3	0	-3	-100.00
S. guttatus	4	0	-4	-100.00
Rays	13	8	-5	-38.46
Wolf herring	5	0	-5	-100.00
Crabs	7	1	-6	-85.71
Bill fishes	7	0	-7	-100.00
S. commersoni	11	3	-8	-72.73
Threadfin breams	8	0	-8	-100
Catfishes	12	3	-9	-75.00
Black pomfrets	76	59	-17	-22.37
Sharks	22	1	-21	-95.45
Barracudas	65	44	-21	-32.31
Stomatopods	44	0	-44	-100.00
Silver pomfrets	70	26	-44	-62.86
Unicorn cod	46	0	-46	-100.00
Half beaks & full beaks	98	45	-53	-54.08
Big-jawed jumper	272	63	-209	-76.84
Horse mackerel	317	0	-317	-100.00
Other sardines	1,788	1,408	-380	-21.25
Cephalopods	453	29	-424	-93.60
E. affinis	474	0	-474	-100.00
Thryssa	931	414	-517	-55.53
Leather-jackets	600	43	-557	-92.83
Soles	567	7	-560	-98.77
Other perches	1,601	540	-1,061	-66.27
Silverbellies	1,413	151	-1,262	-89.31
Other clupeids	2,897	1,572	-1,325	-45.74
Ribbon fishes	2156	128	-2,028	-94.06
Croakers	3,593	1,142	-2,451	-68.22
Penaeid prawns	4,162	145	-4,017	-96.52
Scads	7,790	980	-6,810	87.42
Other carangids	8,343	358	-7,985	95.71
Stolephorus	13,263	1,592	-11,671	-88.00
Oil sardine	32,191	1,144	-3,10471-	-96.45
Miscellaneous	312	107	-205	-65.71
All fish	86,284	13,590	-72,694	-84.25
Effort (Units)	2,34,678	39,669	-1,95,009	-83.10

III. Ringseine fishery

Name of species	1985-'87	1993-'95	Relative growth	
			In catch	In %
Indian mackerel	8,194	60,712	52,518	640.93
Scads	3,549	30,807	27,258	768.05
Stolephorus	3,250	22,409	19,159	589.51
Other sardines	2,702	20,480	17,778	65.96
Penaeid prawns	1,263	5,971	4,708	372.76
Other clupeids	1,610	577	41,67	258.82
Coakers	246	2,047	1,801	732.11
Other perches	695	2,397	1,702	244.89
Auxis spp.	0	1,404	1,404	-
Thryssa	298	1,265	967	324.50
Silver bellies	75	797	722	962.67
Black pomfrets	174	579	405	232.76
E. affinis	168	417	249	148.21
Soles	27	220	193	714.81
Chinese pomfret	0	120	120	-
S. commersoni	76	145	69	90.79
Mullets	70	138	68	97.14
Big-jawed jumper	11	77	66	600.00
Ribbon fishes	2	52	50	2,500.00
Barracudas	6	45	39	650.00
Cephalopods	2	38	36	1,800.00
Rays	1	27	26	2,600.00
Elasmobranchs	0	21	21	-
Sharks	1	15	14	1,400.00
Bill Fishes	0	14	14	-
Wolf herring	3	12	9	300.00
clupeids	0	7	7	-
Rock cods	0	5	5	-
S. guttatus	8	10	2	25.00
Threadfin breams	0	2	2	-
Threadfin fishes	0	2	2	-
Skates	0	1	1	-

Seer fishes	0	1	1	-
Other shads	11	11	0	0.00
Silver pomfrets	89	65	-24	-26.97
Oil sardine	16,228	16,151	-77	-0.47
Leather jackets	169	63	-106	-62.72
Half beaks & full beaks	267	124	-143	-53.56
Catfishes	574	9	-565	-98.43
Horse mackerel	1,558	430	-1,128	-72.40
Other caerangids	3,768	2,477	-1,291	-34.26
Miscellaneous	220	619	399	181.36
All fish	45314	1,75,964	1,30,650	288.32
Effort (units)	79,800	2,28,607	148,807	186.47

TABLE 5. *Change in catch per effort (kg) of major gear in Kerala between the periods 1985-'87 and 1993-'95*

I. Trawl fishery

Name of species	1985-'87	1993-'95	Relative growth	
			In catch	In %
Cephalopods	13.61	54.68	41.07	301.76
Scads	2.82	33.72	30.90	1,095.74
Thread fin breams	61.43	69.64	8.21	13.36
Penaeid prawns	70.57	69.79	-0.78	-1.11
Other perches	5.75	16.00	10.25	178.26
Lizard Fishes	12.86	20.83	7.97	61.98
Stolephorus	5.30	15.04	9.74	183.77
Stomatopods	20.21	25.33	5.12	25.33
Ribbon fishes	4.94	13.98	9.04	183.00
Soles	15.61	21.27	5.66	36.26
Other carangids	6.96	13.11	6.15	88.36
Croakers	10.70	14.33	3.63	33.93
Indian mackerel	0.47	6.77	6.30	1,340.43
Rock cods	0.12	5.30	5.18	4,316.67
Brracudas	0.86	4.60	3.74	434.88
Crabs	3.10	6.21	3.11	100.32
Thryssa	1.70	4.77	3.07	180.59
Horse mackerel	0.02	3.06	3.04	1,52,00.00
Sharks	0.89	3.45	2.56	287.64
Other clupeids	0.66	2.60	1.94	293.94
Half beaks & full beaks	0.00	1.45	1.45	287.64
Wolf herring	0.32	1.51	1.19	371.88
Gastropods	0.00	1.21	1.21	-1.00
Goat fishes	0.63	1.60	0.97	153.97
Rays	1.64	2.20	0.56	34.15
S. commersoni	0.03	1.01	0.98	3,266.67
Silver pomfret	0.28	0.97	0.69	246.43
Chinese pomfret	0.01	0.45	0.44	4,400.00
Black pomfret	0.14	0.54	0.40	285.71
Halibut	0.08	0.37	0.29	362.50
Silver bellies	6.16	4.80	-1.36	-22.08
Lobsters	0.08	0.25	0.17	212.50
Leather-jackets	0.00	0.18	0.18	-1.00
S. guttatus	0.01	0.15	0.14	1,400.00
Skates	0.01	0.15	0.14	1,400.00
Other sardines	0.07	0.17	0.10	142.86
Eels	0.01	0.11	0.10	1,000.00
Flounders	0.14	0.18	0.04	28.57
Snappers	0.00	0.06	0.06	-1.00
E. affinis	0.00	0.01	0.01	-1.00
Pig-face breams	0.00	0.01	0.01	-1.00
Flying fishes	0.00	0.01	0.01	-1.00
Hilsa shad	0.00	0.01	0.01	-1.00
Other tunnies	0.00	0.01	0.01	-1.00
Auxis spp.	0.00	0.01	0.01	-1.00
Other shads	0.03	0.00	-0.03	-100.00
Non-penaeid prawns	0.03	0.00	-0.03	-100.00
Threadfin fishes	0.12	0.05	-0.07	-58.33
Big-jawed jumper	0.98	0.65	-0.33	-33.67
Oil sardine	0.20	0.02	-0.18	-90.00
Mullets	0.41	0.04	-0.37	-90.24
Catfishes	2.46	0.33	-2.13	-86.59
Miscellaneous	9.83	28.32	18.49	188.10
All fish	262.24	452.26	190.02	72.46
Effort (units)	4,53,085	6,13,085	1,60,000	3,31

II. Outboard boatseine fishery

Name of species	1985-'87	1993-'95	Relative growth	
			In catch	In %
Indian mackerel	10.92	79.35	68.43	626.65
Mullets	0.25	7.81	7.56	3,024.00
Non-penaeid prawns	0.18	1.68	1.50	833.33
Hilsa shad	0.00	0.14	0.14	-1.00
Halibut	0.00	0.00	0.00	-1.00
Auxis spp.	0.00	0.00	0.00	-1.00
Lizard fishes	0.01	0.07	0.06	600.00
Goat fishes	0.01	0.00	-0.01	-100.00

S.guttatus	0.02	0.00	-0.02	-100.00
Rays	0.05	0.20	0.15	300.00
Wolf herring	0.02	0.00	-0.02	-100.00
Crabs	0.03	0.03	0.00	0.00
Bill fishes	0.03	0.00	-3.03	-100.00
S. commersoni	0.05	0.08	0.03	60.00
Threadfin breams	0.03	0.00	-0.03	-100.00
Catfishes	0.05	0.08	0.03	60.00
Black pomfrets	0.32	1.50	1.18	368.75
Sharks	0.09	0.02	-0.07	-77.78
Barracudas	0.28	1.10	0.82	292.86
Stomatopods	0.19	0.00	-0.19	-100.00
Silver pomfrets	0.30	0.66	0.36	120.00
Unicorn cod	0.19	0.00	-0.19	-100.00
Half beaks & full beaks	0.42	1.13	0.71	169.05
Big-jawed jumper	1.16	1.59	0.43	37.07
Horse mackerel	1.35	0.00	-1.35	-100.00
Other sardines	7.62	35.50	27.88	365.88
Cephalopods	1.93	0.73	-1.20	-62.18
E. affinis	2.02	0.00	-2.02	-100.00
Thryssa	3.97	10.44	6.47	162.97
Leather-jackets	2.56	1.09	-1.47	-57.42
Soles	2.41	0.18	-2.23	-92.53
Other perches	6.82	13.61	6.79	99.56
Silverbellies	6.02	3.80	-2.22	-36.88
Other clupeids	12.34	39.62	27.28	221.07
Ribbon fishes	9.19	3.22	-5.97	-64.96
Croakers	15.31	28.80	13.49	88.11
Penaeid prawns	17.74	3.65	-14.09	-79.43
Scads	33.19	24.71	-8.48	-25.55
Other carangids	35.55	9.02	-26.53	-74.63
Stolephorus	56.51	40.12	-16.39	-29.00
Oil sardine	137.17	28.83	-108.34	-78.98
Miscellaneous	1.33	2.71	1.38	103.76
All fish	367.67	342.59	-25.08	-6.82
Effort (units)	2,34,678	39,669	-195,001	-83.10

III. Ringseine fishery

Name of species	1985-'87	1993-'95	Relative growth	
			In catch	In %
Indian mackerel	103	266	163	158.25
Scads	44	135	91	206.82
Stolephorus	41	98	57	139.02
Other sardines	34	90	56	164.71
Penaeid prawns	16	26	10	62.50
Other clupeids	20	25	5	25.00
Croakers	3	9	6	200.00
Other perches	9	10	1	11.11
Auxis spp.	0	6	6	-1
Thryssa	4	6	2	50.00
Silverbellies	1	3	2	200.00
Black pomfrets	2	3	1	50.00
E. affinis	2	2	0	0.00
Soles	0	1	1	-1
Chinese pomfret	0	1	1	-1
S. commersoni	1	1	0	0.00
Mullets	1	1	0	0.00
Big-jawed jumper	0	0	0	-1
Ribbon fishes	0	0	0	-1
Barracudas	0	0	0	-1
Cephalopods	0	0	0	-1
Rays	0	0	0	-1
Elasmobranhs	0	0	0	-1
Sharks	0	0	0	-1
Bill fishes	0	0	0	-1
Wolf herring	0	0	0	-1
Clupeids	0	0	0	-1
Rock cods	0	0	0	-1
S. guttatus	0	0	0	-1
Threadfin breams	0	0	0	-1
Thread	0	0	0	-1
Skates	0	0	0	-1
Seer fishes	0	0	0	-1
Other shads	0	0	0	-1
Silver pomfrets	0	0	0	-1
Oil sardine	203	71	-132	-65.02
Leather-jackets	2	0	-2	-100.00
Half beaks & full beaks	3	1	-2	-66.67
Catfishes	7	0	-7	-100.00
Horse mackerel	20	2	-18	-90.00
Other cearangids	47	11	-36	-76.60
Miscellaneous	3	3	0	0.00
All fish	567.84	769.72	201.88	35.55
Effort (units)	79,800	2,28,607	1,48,807	186.47

904 STATUS OF MARINE FISHERIES IN KERALA WITH REFERENCE TO BAN OF MONSOON TRAWLING

P.L. Ammini

Central Marine Fisheries Research Institute, Cochin — 682 014, India

Kerala has been the forerunner in the adoption of technological innovations in fishing operations. The latter part of the sixities and the early seventies witnessed spectacular spread in the mechanised trawling. Purse seineing was introduced in the latter part of the seventies though did not pick up as in the neighbouring state of Karnataka for some reason or other. However, in the hindsight even this did not make such a conspicuous impact as has been made by the popular motorization of the indigenous craft in the early eighties and the consequent changes brought about in the structure of Kerala fisheries. The ring seine which was introduced in 1986 by its popularity became the main stay of the artisanal fisheries of Kerala in a very short time.

Adoption of these technologies has no doubt, resulted in tangible growth in the marine fish production. But amidst the euphoria there lurks a cold truth of intersectoral competition for the same reason with its economic and social dimension constraining the Governmental agencies to sieve out a solution. Apparently conflicting views were expressed by the artisanal fishers and the trawl operators while the former expressed their apprehension that trawling during monsoon was detrimental to the commercially important pelagic fish stocks which have their nursery in the inshore areas during monsoon, the latter claims that it was not so from the early seventies. A good monsoon trawl fishery for prawns existed in Kerala especially with Quilon and Cochin as the bases of operation. While the artisanal fishers wanted trawling to be banned throughout the monsoon season, according to trawler operators, such measures would tend to the erosion of benefits especially through export of prawns. However, seized of the problem, Kerala Government decided to ban monsoon trawling in the territorial waters of Kerala and has been implementing the ban from 1988 onwards. In view of the divergent views expressed by different sectors, it is felt that it would be a welcome preposition to assess the present status of marine fish production in Kerala vis-a-vis the production before ban was introduced. Attempt made here is only to present the status of production without venturing to highlight any specific issues nor answering any specific questions nor drawing inference on a set of hypotheses.

Apparently there has been unprecedented growth in the marine fish production in Kerala during the last decade which incidentally coincides with the period during which ban on trawling during monsoon has been in vogue. Comparison of the average landings during 1981-'87 and 1988-'97 indicate an increase of 69 % in overall landings in the state and surprisingly two points which deserve consideration are

1. The increase (69 %) has been uniform in pre-monsoon, monsoon and post monsoon periods,
2. The relative intensity of landings during the three seasons remain the same during preban and ban period (26 % during pre-monsoon, 24 % during monsoon and 50 % during post monsoon)

This may apparently indicate that the influence of that factor which contributed to the increase has been uniformly felt in all the seasons. However, a detailed analysis is called for, before drawling a conclusion.

The Table 1 gives the percentage realization of landings of important groups in the three seasons and the relative increase/decrease in the ban period. Indian mackerel which was abysmally low in 1982 and 1983 made a splendid recovery by 1989 and on an average during the ban period registered a growth of 43 % over that during pre- ban period. The level of pro-

duction attained by mackerel during 1989 and subsequent years, though remarkable was not unprecedented. But the landings of carangids which rose by 368 % has been unprecedented and spectacular and may be the one single prominent feature of the ringseine revolution in Kerala fisheries. Though lesser sardines showed an increase of 165 % the production reached a substantia level only in 1995. It may be worth observing that there are resources primarily exploited by traditional (motorised) sector. There has been a matching increase in the landings of prime resources exploited by trawlers as well. It is worth mentioning that during ban period the landings of penaeid prawns has shown a conspicuous increase of 82 %. Besides the prawns, perches and cephalopods made remarkable growth by 143 and 365 % which might be the result of accentuated thrusts on these owing to new market potentials available.

The increase observed in the overall trawl landings is mainly in the post monsoon period when before ban, 34 % of annual landings was realised while during the ban period, it rose to 44 % with a matching reduction from 33 to 21 % during monsoon period. Table 2 gives the percentage contribution of landings of important gear in the three seasons and relative abundance decrease during the ban -period. Trawl landings registered an increase of 160%. This was mostly owing to the selective fishing of cephalopods because of its export potential. Remarkable growth of 601% was noticed in the ringseine landings. It may be stressed that the ringseines were launched in Kerala only just two years prior to the introduction of ban on trawling and they were just beginning to get established in these two years of pre-ban period. Mechanised hooks and line earned 339% increase eventhough their operation during monsoon was comparatively less. 295% increase was observed in the landings of other OB units whose mainstay were minitrawlers, disco vala and hooks and line. Drift/gillnet units registered an increase of about 84 %. Non-mechanised sector showed a decline of about 72 %. Mechanised drift/gillnets (79 %), purseseines (32 %). OB boatseine and non-mechanised (72%) (62 %) declined during the ban period.

Table 3 depicts the seasonwise total landings during 1981- '97 Table 4 a-q give the seasonwise and species wise landings during the respective years from 1981 to ' 97. Table-5ai represent the seasonwise landings in different years by different gear during the pre -ban and ban periods. Table 6 a-l show the seasonwise landings in different years of different groups of fishes during the pre- ban and ban periods.

TABLE 1. *Kerala, season-wise, species composition (%)*

Name of fish	Preban period			Ban period			
	Pre-mon.	Mon.	Post-mon.	Pre-mon.	Mon.	Post-mon.	Increase/Decrease *
Shark	31	13	56	37	18	45	-38
Cat fishes	17	23	60	10	29	61	-76
Oil sardine	31	9	60	32	15	53	-28
Other sardines	37	9	54	17	3	80	165
White baits	15	31	54	22	34	44	39
Perches	16	61	23	24	43	33	143
Croakers	24	32	44	23	31	46	-68
Ribbon fishes	3	60	37	11	15	74	-8
Carangids	22	21	57	14	16	70	368
Mackerel	40	12	48	15	30	55	430
Seer fishes	15	6	79	22	6	72	11
Tuna	31	19	50	32	15	53	119
Penaeid prawns	31	40	29	37	33	30	82
Cephalopods	21	14	65	27	18	55	365
Annual	26	24	50	26	24	50	69

* Average annual landings.

TABLE 2. *Kerala season-wise gear composition (%)*

Name of gear	Preban period			Ban period			
	Pre-mon.	Mon.	Post-mon.	Pre-mon.	Mon.	Post-mon.	Increase/Decrease *
Mec. trawlnet	33	33	34	35	21	44	160
Mec. drift/gillnet	22	21	57	22	30	48	-79
Purse seine	40	4	56	28	1	71	-32
Mec. hooks&line	28	4	68	40	5	55	339
Ob. ringseine	7	36	57	15	30	55	601

Ob. drift/gill net	24	13	63	30	19	51	84
Ob. boatseine	22	29	49	10	46	44	-62
Ob. others	21	7	72	32	13	55	295
Non-mechanised	29	20	51	32	17	51	-72
Annual	26	24	50	26	24	50	

*Average annual landings.

TABLE 3. *Kerala ,season-wise landings during 1981-1997 (tonnes)*

Year	Premon.	Mon.	Postmon.	Total
Pre-ban period				
1981	54,900	52,642	1,75,729	2,83,271
1982	92,381	68,709	1,82,738	3,43,828
1983	1,00,238	71,197	1,99,233	3,70,668
1984	1,12,356	96,108	1,68,166	3,76,630
1985	97,369	88,902	1,50,807	3,37,078
1986	81,571	1,03,263	1,85,445	3,70,279
1987	87,218	97,492	1,18,391	3,03,101
Average	89,433	82,616	1,68,644	3,40,694
Ban period				
1988	93,262	1,17,157	2,82,844	4,93,263
1989	1,30,195	1,36,074	3,71,567	6,37,836
1990	1,96,312	1,36,948	3,40,487	6,73,747
1991	1,81,248	1,29,986	2,49,294	5,60,528
1992	1,42,084	1,27,356	2,87,439	5,56,879
1993	1,71,467	1,57,416	2,46,544	5,75,427
1994	1,47,624	1,74,700	2,42,276	5,64,600
1995	96,489	1,53,814	2,76,353	5,26,656
1996	1,38,496	1,60,395	2,98,238	5,97,129
1997	2,13,597	1,01,309	2,43,694	5,58,600
Average	1,51,077	1,39,516	2,83,874	5,74,467

TABLE 4a. *Kerala ,season-wise, species-wise landings during 1981 (tonnes).*

Name of fish	Premon.	Mon.	Postmon.	Total
Shark	1,535	801	2,864	5,200
Cat fishes	3,357	2,161	3,747	9,265
Oil sardine	16,945	13,461	1,25,311	1,55,717
Other sardines	2,730	322	4,046	7,098
White baits	1,255	910	2,128	4,293
Perches	1,395	4,574	2,991	8,960
Croakers	975	913	1,103	2,991
Robbon fishes	24	4,107	2,903	7,034
Carangids	1,616	496	3,441	5,553
Mackeral	7,865	1,053	6,129	15,047
Seer fishes	431	74	3,129	3,634
Tuna	3,050	556	2,309	5,915
Penaeid prawns	4,316	14,078	3,280	21,674
Cephalopods	163	386	2,182	2,731
Others	9,243	8,750	10,166	28,159
Total	54,900	52,642	1,75,729	2,83,271

TABLE 4b. *Kerala, season-wise, species-wise landings during 1982 (tonnes)*

Name of fish	Premon.	Mon.	Postmon.	Total
Shark	1,178	485	2,709	4,372
Cat fishes	1,644	2,911	5,064	9,619
Oil sardine	42,681	15,310	95,689	1,53,680
Other sardines	2,425	71	5,662	8,158
White baits	7,645	2,208	3,717	13,570
Perches	1,724	7,624	1,343	10,691
Croakers	1,082	1,630	1,142	3,854
Ribbon fishes	38	7,615	3,392	11,045
Carangids	5,833	1,035	7,077	13,945
Mackerel	6,480	739	3,358	10,577
Seer fishes	1,342	144	4,248	5,734
Tuna	3,328	1,129	2,340	6,797
Penaeid prawns	4,787	12,781	14,109	31,677
Cephalopods	522	714	1,976	3,212
Others	11,672	14,313	30,912	56,897
Total	92,381	68,709	1,82,738	3,43,828

TABLE 4c. *Kerala, season-wise species-wise landings during 1983 (tonnes).*

Name of fish	Premon.	Mon.	Postmon.	Total
Shark	1,652	1,171	4,875	7,698
Cat fishes	1,649	2,569	11,672	15,890
Oil sardine	52,636	3,026	86,733	1,42,395
Other sardines	2,424	365	2,112	4,901
White baits	5,996	18,860	31,298	56,154
Perches	2,065	5,509	2,917	10,491
Croakers	1,076	3,100	2,409	6,585

Ribbon fishes	45	200	865	1,110
Carangids	6,738	1,893	6,179	14,810
Mackerel	4,625	2,368	6,317	13,310
Seer fishes	639	314	5,675	6,628
Tuna	1,626	1,734	2,643	6,003
Penaeid prawns	7,023	13,833	4,860	25,716
Cephalopods	323	302	1,135	1,760
Others	11,721	15,953	29,543	57,217
Total	1,00,238	71,197	1,99,233	3,70,668

TABLE 4d. *Kerala, season-wise, species-wise landings during 1984 (tonnes)*

Name of fish	Premon.	Mon.	Postmon.	Total
Shark	3,187	678	2,079	5,944
Cat fishes	2,632	3,046	4,917	10,595
Oil sardine	59,987	12,309	62,609	1,34,905
Other sardines	1,722	1,326	4,448	7,496
White baits	2,399	16,883	21,153	40,435
Perches	3,956	17,867	4,988	26,811
Croakers	2,217	3,706	3,331	9,254
Ribbon fishes	184	5,903	383	6,470
Carangids	5,481	2,042	5,872	13,395
Mackerel	3,878	1,533	6,214	11,625
Seer fishes	816	644	4,546	6,006
Tuna	2,486	1,062	2,503	6,051
Penaeid prawns	7,689	14,572	12,974	35,235
Cephalopods	637	891	4,000	5,528
Others	15,085	13,646	28,149	56,880
Total	1,12,356	96,108	1,68,166	3,76,630

TABLE 4e. *Kerala, season-wise - species-wise landings during 1985 (tonnes)*

Name of fish	Premon.	Mon.	Postmon.	Total
Shark	1,194	360	3,511	5,065
Cat fishes	882	1,233	3,087	5,202
Oil sardine	37,106	9,415	40,854	87,375
Other sardines	1,471	161	1,908	3,540
White baits	3,490	11,342	21,506	36,338
Perches	5,061	18,870	6,859	30,790
Croakers	3,394	2,745	2,295	8,434
Ribbon fishes	97	13,348	11,720	25,165
Carangids	3,717	1,959	7,350	13,026
Mackerel	5,332	2,306	10,518	18,156
Seer fishes	1,269	414	7,145	8,828
Tuna	3,535	1,602	4,596	9,733
Penaeid prawns	9,881	9,968	7,443	27,292
Cephalopods	3,012	1,475	3,717	8,204
Others	17,928	13,704	18,298	49,930
Total	97,369	88,902	1,50,807	3,37,078

TABLE 4f. *Kerala, season-wise - species-wise landings during 1986 (tonnes)*

Name of fish	Premon.	Mon.	Postmon.	Total
Shark	1,021	473	3,085	4,579
Cat fishes	320	903	7,277	8,500
Oil sardine	16,291	59	8,973	25,323
Other sardines	2,751	1,821	4,516	9,088
White baits	4,866	7,964	14,265	27,095
Perches	4,392	29,589	12,777	46,758
Croakers	1,678	1,676	9,648	13,002
Ribbon fishes	635	3,941	7,298	11,874
Carangids	3,048	19,546	49,464	72,058
Mackerel	9,196	1,221	11,815	22,232
Seer fishes	483	307	3,762	4,552
Tuna	570	511	8,395	9,476
Penaeid prawns	11,500	17,575	8,175	37,250
Cephalopods	1,464	1,714	12,271	15,449
Others	23,356	15,963	23,724	63,043
Total	81,571	1,03,263	185,445	3,70,279

TABLE 4g. *Kerala, season-wise species -wise landings during 1987 (in tonnes)*

Name of fish	Premon.	Mon.	Postmon.	Total
Shark	1,487	553	1,171	3,211
Cat fishes	162	2,070	2,359	4,591
Oil sardine	1,712	17,762	25,486	44,960
Other sardines	4,860	554	3,915	9,329
White baits	3,356	2,787	10,605	16,748
Perches	8,032	15,930	6,484	30,446
Croakers	2,233	3,049	2,851	8,133

Ribbon fishes	1,021	11,844	2,390	15,255
Carangids	7,631	5,191	9,702	22,524
Mackerel	2,896	2,795	3,880	9,571
Seer fishes	1,212	649	3,309	5,170
Tuna	2,237	4,029	4,234	10,500
Penaeid prawns	24,887	14,576	13,132	52,595
Cephalopods	2,971	736	3,539	7,246
Others	22,521	14,967	25,334	62,822
Total	87,218	97,492	1,18,391	3,03,101

TABLE 4h. *Kerala, season-wise, species-wise landings during 1988 (tonnes)*

Name of fish	Premon.	Mon.	Postmon.	Total
Shark	1,538	1,667	1,912	5,117
Cat fishes	362	3,609	6,017	9,988
Oil Sardine	2,223	7,948	66,636	76,807
Other sardines	1,195	2,067	9,671	12,933
White baits	5,155	15,065	25,853	46,073
Perches	8,602	16,067	7,163	31,832
Croakers	1,922	1,829	5,196	8,947
Ribbon fishes	2,810	928	5,189	8,927
Carangids	7,229	9,847	31,657	48,733
Mackerel	4,108	13,257	27,260	44,625
Seer fishes	1,694	615	8,063	10,372
Tuna	3,294	3,123	7,127	13,544
Penaeid prawns	19,539	20,346	29,309	69,194
Cephalopods	4,779	2,358	8,049	15,186
Others	28,818	18,431	43,742	90,991
Total	93,268	1,17,157	2,82,844	4,93,269

TABLE 4i. *Kerala, season-wise, species-wise landings during 1989 (tonnes)*

Name of fish	Premon.	Mon.	Postmon.	Total
Shark	732	337	670	1,739
Cat fishes	500	760	2,688	3,948
Oil sardine	27,523	34,619	1,13,005	1,75,147
Other Sardines	3,000	591	9,460	13,051
White baits	5,520	21,608	17,662	44,790
Perches	11,705	10,690	26,973	49,368
Croakers	1,942	4,984	4,167	11,093
Ribbon fishes	383	339	6,460	7,182
Carangids	6,438	12,094	29,886	48,418
Mackerel	10,370	11,807	63,138	85,315
Seer fishes	1,151	364	6,501	8,016
Tuna	4,214	3,313	14,192	21,719
Penaeid prawns	24,631	16,652	13,076	54,359
Cephalopods	4,854	2,495	16,328	23,677
Others	27,232	15,421	47,361	90,014
Total	1,30,195	1,36,074	3,71,567	637,836

TABLE 4j. *Kerala, season-wise - species-wise landings during 1990 (tonnes)*

Name of fish	Premon.	Mon.	Postmon.	Total
Shark	962	288	1,715	2,965
Cat fishes	290	254	2,317	2,861
Oil sardine	56,652	31,639	90,729	1,79,020
Other sardines	1,833	278	11,956	14,067
White baits	9,100	6,743	11,440	27,283
Perches	18,018	39,115	11,404	68,537
Croakers	2,647	4,200	4,057	10,904
Ribbon fishes	246	92	9,411	9,749
Carangids	13,379	11,551	45,292	70,222
Mackerel	11,117	11,233	59,994	82,344
Seer fishes	1,193	411	3,633	5,237
Tuna	9,863	3,305	20,645	33,813
Penaeid prawns	26,130	8,458	10,015	44,603
Cephalopods	7,406	3,869	14,185	25,460
Others	37,476	15,512	43,694	96,682
Total	1,96,312	1,36,948	3,40,487	6,73,747

TABLE 4k. *Kerala, season- wise - species wise landings during 1991 (tonnes)*

Name of fish	Premon.	Mon.	Postmon.	Total
Shark	603	683	641	1,927
Cat fishes	296	849	588	1,733
Oil sardine	74,626	12,625	17,984	1,05,235
Other sardines	14,007	562	8,316	22,885
White baits	5,440	9,952	30,175	45,567
Perches	5,864	13,150	21,247	40,261

Croakers	2,506	2,562	3,717	8,785
Ribbon fishes	193	580	1,409	2,182
Carangids	8,528	19,820	51,839	80,187
Mackerel	11,383	22,237	16,053	49,673
Seer fishes	981	163	3,842	4,986
Tuna	5,600	1,634	4,631	11,865
Penaeid prawns	15,861	21,913	24,878	62,652
Cephalopods	5,256	2,330	11,835	19,421
Others	30,104	20,926	52,139	1,03,169
Total	1,81,248	1,29,986	2,49,294	5,60,528

TABLE 4l. *Kerala, season-wise - species-wise landings during 1992 (tonnes)*

Name of fish	Premon.	Mon.	Postmon.	Total
Shark	705	489	1,020	2,214
Cat fishes	394	60	458	912
Oil sardine	26,676	6,300	18,068	51,044
Other sardines	1,821	48	14,689	16,558
White baits	7,936	20,848	19,127	47,911
Perches	8,308	23,088	20,608	52,004
Croakers	2,328	2,820	11,017	16,165
Ribbon fishes	101	1,320	4,825	6,246
Carangids	11,899	20,489	52,212	84,600
Mackerel	12,663	10,600	13,831	37,094
Seer fishes	1,356	271	6,926	8,553
Tuna	3,572	1,556	11,245	16,373
Penaeid prawns	19,375	14,411	13,051	46,837
Cephalopods	10,137	3,919	16,887	30,943
Others	34,813	21,137	83,475	1,39,425
Total	1,42,084	1,27,356	2,87,439	5,56,879

TABLE 4 m. *Kerala, season-wise - species-wise landings during 1993 (tonnes).*

Name of fish	Premon.	Mon.	Postmon.	Total
Shark	1,218	427	1,669	3,314
Cat fishes	25	197	414	636
Oil sardine	13,205	5,590	28,455	47,250
Other sardines	3,375	333	19,116	22,824
White baits	23,647	12,729	13,082	49,458
Perches	18,020	43,271	14,202	75,493
Croakers	4,649	3,748	6,000	14,397
Ribbon fishes	1,868	706	5,132	7,706
Carangids	19,979	15,118	36,633	71,730
Mackerel	7,959	24,254	29,680	61,893
Seer fishes	1,979	414	4,538	6,931
Tuna	6,930	1,724	4,440	13,094
Penaeid Prawns	13,228	21,275	15,669	50,172
Cephal opods	9,444	4,152	14,400	27,996
Others	45,941	23,478	53,114	1,22,533
Total	1,71,467	1,57,416	2,46,544	5,75,427

TABLE 4 n. *Kerala, season-wise - species-wise landings during 1994 (tonnes).*

Name of fish	Premon.	Mon.	Postmon.	Total
Shark	1,926	373	1,527	3,826
Cat fishes	81	186	215	482
Oil sardine	302	525	754	1,581
Other sardines	822	219	15,436	16,477
White baits	9,191	15,089	7,354	31,634
Perches	15,913	27,586	16,308	59,807
Croakers	3,090	8,102	6,127	17,319
Ribbon fishes	1,867	1,008	12,239	15,114
Carangids	17,313	21,144	21,475	59,932
Mackerel	9,984	44,977	56,086	1,11,047
Seer fishes	1,521	259	3,455	5,235
Tuna	4,083	1,253	9,086	14,422
Penaeid Prawns	30,697	24,439	16,410	71,546
Cephalopods	12,576	6,942	18,471	37,989
Others	38,258	22,598	57,333	1,18,189
Total	1,47,624	1,74,700	2,42,276	5,64,600

TABLE 4 o. *Kerala, season-wise - species-wise landings during 1995 (tonnes).*

Name of fish	Premon.	Mon.	Postmon.	Total
Shark	1,150	310	916	2,376
Cat fishes	84	94	181	359
Oil sardine	129	60	14,715	14,904
Other sardines	1,245	259	44,503	46,007

White baits	5,905	16,334	14,453	36,692
Perches	11,532	20,491	14,274	46,297
Croakers	3,490	2,637	2,862	8,989
Ribbon fishes	431	716	3,293	4,440
Carangids	13,303	36,292	52,513	1,02,108
Mackerel	7,388	21,648	51,208	80,244
Seer fishes	542	468	4,932	5,942
Tuna	2,980	2,377	6,258	11,615
Penaeid prawns	13,921	21,698	6,220	41,839
Cephalopods	6,577	11,723	24,018	42,318
Others	27,812	18,707	36,007	82,526
Total	96,489	1,53,814	2,76,353	5,26,656

TABLE 4 p. *Kerala, season-wise · species-wise landings during 1996 (tonnes)*

Name of fish	Premon.	Mon.	Postmon.	Total
Shark	1,486	391	2,521	4,398
Cat fishes	94	96	118	308
Oil sardine	1,782	4,661	19,943	26,386
Other sardines	1,782	1,588	3,608	6,978
White baits	6,900	6,971	16,446	30,317
Perches	12,893	27,884	31,507	72,284
Croakers	3,269	4,604	9,752	17,625
Ribbon fishes	703	4,078	17,548	22,329
Carangids	23,829	8,706	32,575	65,110
Mackerel	19,809	48,887	66,422	1,35,118
Seer fishes	2,133	348	2,552	5,033
Tuna	9,040	2,674	6,285	17,999
Penaeid prawns	14,910	19,118	15,669	49,697
Cephalopods	6,895	8,054	18,321	33,270
Others	32,971	22,335	54,971	1,10,277
Total	1,38,496	1,60,395	2,98,238	5,97,129

TABLE 4q. *Kerala, season-wise - species-wise landings during 1997 (tonnes)*

Name of fish	Premon.	Mon.	Postmon.	Total
Shark	1,504	652	1,672	3,828
Cat fishes	13	16	180	209
Oil sardine	45,209	8,698	38,854	92,761
Other sardines	2,329	205	13,855	16,389
White baits	6,850	7,514	12,694	27,058
Perches	20,601	9,688	13,908	44,197
Croakers	3,640	2,868	4,528	11,036
Ribbon fishes	2,573	5,577	10,646	18,796
Carangids	20,363	6,432	21,148	47,943
Mackerel	19,107	18,735	35,877	73,719
Seer fishes	1,272	836	1,869	3,977
Tuna	4,992	4,148	6,545	15,685
Penaeid prawns	22,729	14,559	18,652	55,940
Cephalopods	12,744	5,307	18,638	36,689
Others	49,671	16,074	44,628	1,10,373
Total	2,13,597	1,01,309	2,43,694	5,58,600

TABLE 5a. *Kerala, season-wise, trawl landings during 1982-1997 (tonnes)*

Year	Premon.	Mon.	Postmon.	Total
1982	13,311	21,939	29,243	64,493
1983	20,491	19,476	1,99,909	59,876
1984	25,854	36,995	28,013	90,862
1985	33,091	36,936	28,398	98,425
1986	34,044	47,119	36,857	1,18,020
1987	59,475	36,847	47,696	1,44,018
Average	31,044	33,219	31,686	95,949
1988	70,707	47,759	83,967	2,02,433
1989	67,541	23,627	1,09,459	2,00,627
1990	81,893	59,046	84,300	2,25,239
1991	60,931	41,262	1,12,077	2,14,270
1992	75,887	44,345	1,31,087	2,51,319
1993	1,09,201	73,272	1,16,674	2,99,147
1994	1,19,654	69,394	1,26,502	3,15,550
1995	73,325	56,715	76,793	2,06,833
1996	77,211	57,412	1,26,976	2,61,599
1997	1,22,980	38,777	1,05,804	2,67,561
Average	85,933	51,161	1,07,364	2,44,458

TABLE 5b. *Kerala, season-wise, mec. drift/gillnet landings during 1982-1997 (tonnes)*

Year	Premon.	Mon.	Postmon.	Total
1982	5,837	5,126	7,102	18,065

1983	2,370	5,725	13,519	21,614
1984	3,705	1,960	8,073	13,738
1985	3,448	1,719	10,814	15,981
1986	1,769	1,134	5,985	8,888
1987	364	2,323	2,186	5,373
Average	2,999	2,998	7,946	13,943
1988	1,511	1,737	5,208	8,456
1989	696	1,278	3,345	5,319
1990	1,552	1,154	1,097	3,803
1991	844	552	418	1,814
1992	297	688	840	1,825
1993	354	832	373	1,559
1994	307	372	312	991
1995	90	546	817	1,453
1996	266	565	722	1,553
1997	281	966	588	1,835
Average	620	869	1,372	2,861

TABLE 5c. *Kerala, season-wise, purse seine landings during 1982-1997 (tonnes)*

Year	Premon.	Mon.	Postmon.	Total
1982	4,841	0	6,335	11,176
1983	3,546	1,783	9,415	14,744
1984	6,440	0	1,380	7,820
1985	3,802	0	6,428	10,230
1986	768	0	3,749	4,517
1987	208	0	696	904
Average	3,268	297	4,667	8,232
1988	17	0	1,154	1,171
1989	2,444	0	6,342	8,786
1990	1,939	0	2,487	4,426
1991	2,044	252	1,828	4,124
1992	2,223	0	4,050	6,273
1993	1,384	38	5,417	6,839
1994	1,656	0	4,247	5,903
1995	356	0	4,632	4,988
1996	2,520	0	7,703	10,223
1997	1,157	0	1,696	2,853
Average	1,574	29	3,956	5,559

TABLE 5d. *Kerala, season-wise, mec.hooks & line landings during 1982-1997 (tonnes)*

Year	Premon.	Mon.	Postmon.	Total
1982	27	0	266	293
1983	24	0	235	259
1984	186	0	65	251
1985	11	0	99	110
1986	123	3	336	462
1987	287	92	599	978
Average	110	16	266	392
1988	319	79	332	730
1989	307	46	460	813
1990	4,418	289	3,648	8,355
1991	4	12	422	438
1992	307	139	339	785
1993	27	62	528	617
1994	294	4	457	755
1995	457	15	536	1,008
1996	289	22	1,119	1,430
1997	550	139	1,631	2,320
Average	697	81	947	1,725

TABLE 5e. *Kerala, season-wise, OB boatseine landings during 1982-1997 (tonnes).*

year	Premon.	Mon.	Postmon.	Total
1982	13,712	13,132	38,690	65,534
1983	29,608	12,139	34,267	76,014
1984	17,500	25,234	60,266	1,03,000
1985	26,987	25,091	4,551	56,629
1986	9,910	39,540	63,650	1,13,100
1987	4,665	20,850	22,894	48,409
Average	17,064	22,664	37,386	77,114
1988	3,454	32,791	54,858	91,103
1989	7,218	16,799	24,051	48,068
1990	10,674	12,630	19,251	42,555
1991	3,545	16,099	4,956	24,600
1992	860	12,444	5,574	18,878
1993	1,703	10,899	473	13,075

1994	32	8,669	5,044	13,745
1995	74	9,208	4,669	13,951
1996	133	9,177	314	9,624
1997	404	7,655	11,223	19,282
Average	2,810	13,637	13,041	29,488

TABLE 5f. *Kerala, season-wise, OB ring seine landings during 1986-1997 (tonnes).*

Year	Premon.	Mon.	Postmon.	Total
1986	0	1,104	22,894	23,998
1987	4,056	18,379	7,955	30,390
Average	2,028	9,742	15,424	27,194
1988	1,161	17,470	69,443	88,074
1989	26,316	71,663	1,72,841	2,70,820
1990	51,470	44,050	1,68,198	2,63,718
1991	81,533	60,548	78,672	2,20,753
1992	31,771	62,061	99,690	1,93,522
1993	26,911	58,490	71,161	1,56,562
1994	4,766	82,439	69,036	1,56,241
1995	3,989	69,800	1,41,552	2,15,341
1996	13,033	73,559	98,713	1,85,305
1997	45,761	33,800	77,729	1,57,290
Average	28,671	57,388	1,04,704	1,90,763

TABLE 5g. *Kerala, season-wise OB drift/gillnet landings during 1982-1997 (tonnes)*

Year	Premon.	Mon.	Postmon.	Total
1982	448	1,943	2,087	4,478
1983	815	905	15,417	17,137
1984	6,499	4,066	27,218	37,783
1985	5,699	2,988	12,958	21,645
1986	13,367	1,774	15,728	30,869
1987	4,601	5,868	11,193	21,662
Average	5,238	2,924	14,100	22,262
1988	2,732	3,498	28,377	34,607
1989	7,295	5,595	19,757	32,647
1990	11,087	14,344	25,864	51,295
1991	17,599	10,722	28,074	56,395
1992	14,114	3,936	17,431	35,481
1993	9,010	2,514	16,114	27,638
1994	8,017	3,259	27,719	38,995
1995	10,548	8,742	14,159	33,449
1996	21,050	13,606	17,724	52,380
1997	23,674	10,400	13,266	47,340
Average	12,513	7,662	20,848	41,023

TABLE 5h. *Kerala, season-wise, OB others landings during 1982-1997 (tonnes).*

Years	Premon.	Mon.	Postmon.	Total
1982	1,598	623	299	2,520
1983	2,908	290	2,209	5,407
1984	8,037	3,062	3,561	14,660
1985	3,247	676	46,763	50,686
1986	1,128	1,067	9,766	11,961
1987	2,850	1,370	6,967	11,187
Average	3,295	1,181	11,594	16,070
1988	5,400	5,520	22,827	33,747
1989	5,659	7,894	16,936	30,489
1990	1,159	7	8,632	9,798
1991	17,108	2,026	14,237	33,371
1992	6,110	4,276	8,248	18,634
1993	9,202	828	18,595	28,625
1994	8,186	1,370	12,382	21,938
1995	4,376	2,500	10,879	17,755
1996	16,759	4,361	16,063	37,183
1997	12,820	6,032	21,208	40,060
Average	8,678	3,481	15,001	27,160

TABLE 5i. *Kerala, season-wise, non-mechanised landings during 1982-1997 (tonnes)*

Year	Premon.	Mon.	Postmon.	Total
1982	52,607	25,946	98,716	1,77,269
1983	40,476	30,879	1,04,262	1,75,617
1984	44,135	24,791	39,590	1,08,516
1985	21,084	21,492	40,796	83,372

1986	20,462	11,522	26,480	58,464
1987	10,212	11,763	18,205	40,180
Average	31,496	21,065	54,675	1,07,236
1988	7,961	8,303	16,678	32,942
1989	9,316	8,067	17,385	34,768
1990	14,073	7,308	22,421	43,802
1991	11,820	2,922	25,325	40,067
1992	12,807	4,454	10,961	28,222
1993	15,419	9,252	11,888	36,559
1994	5,828	2,569	11,561	19,958
1995	5,394	4,010	10,737	20,141
1996	7,235	1,693	13,143	22,071
1997	5,970	3,540	10,549	20,059
Average	9,582	5,212	15,065	29,859

TABLE 6a. *Kerala, season-wise, shark landings during 1981-1997 (tonnes)*

Year	Premon.	Mon.	Postmon.	Total
1981	1,535	801	2,864	5,200
1982	1,178	485	2,709	4,372
1983	1,652	1,171	4,875	7,698
1984	3,187	678	2,079	5,944
1985	1,194	360	3,511	5,065
1986	1,021	473	3,085	4,579
1987	1,487	553	1,171	3,211
Average	1,608	646	2,899	5,153
1988	1,538	1,667	1,912	5,117
1989	732	337	670	1,739
1990	962	288	1,715	2,965
1991	603	683	641	1,927
1992	705	489	1,020	2,214
1993	1,218	427	1,669	3,314
1994	1,926	373	1,527	3,826
1995	1,150	310	916	2,376
1996	1,486	391	2,521	4,398
1997	1,504	652	1,672	3,828
Average	1,182	562	1,426	3,170

TABLE 6b. *Kerala, season-wise, catfish landings during 1981-1997 (tonnes)*

Year	Premon.	Mon.	Postmon.	Total
1981	3,357	2,161	3,747	9,265
1982	1,644	2,911	5,064	9,619
1983	1,649	2,569	11,672	15,890
1984	2,632	3,046	4,917	10,595
1985	882	1,233	3,087	5,202
1986	320	903	7,277	8,500
1987	162	2,070	2,359	4,591
Average	1,521	2,127	5,446	9,095
1988	362	3,609	6,017	9,988
1989	500	760	2,688	3,948
1990	290	254	2,317	2,861
1991	296	849	588	1,733
1992	394	60	458	912
1993	25	197	414	636
1994	81	186	215	482
1995	84	94	181	359
1996	94	96	118	308
1997	13	16	180	209
Average	214	612	1,318	2,144

TABLE 6c. *Kerala, season-wise, STOLEPHORUS landings during 1981-1997 (tonnes).*

Year	Premon.	Mon.	Postmon.	Total
1981	1,255	910	2,128	4,293
1982	7,645	2,208	3,717	13,570
1983	5,996	18,860	31,298	56,154
1984	2,399	16,883	21,153	40,435
1985	3,490	11,342	21,506	36,338
1986	4,866	7,964	14,265	27,095
1987	3,356	2,787	10,605	16,748
Average	4,144	8,708	14,953	27,805
1988	5,155	15,065	25,853	46,073
1989	5,520	21,608	17,662	44,790
1990	9,100	6,743	11,440	27,283

1991	5,440	9,952	30,175	45,567
1992	7,936	20,848	19,127	47,911
1993	23,647	12,729	13,082	49,458
1994	9,191	15,089	7,354	31,634
1995	5,905	16,334	14,453	36,692
1996	6,900	6,971	16,446	30,317
1997	6,850	7,514	12,694	27,058
Average	8,564	13,285	16,829	38,678

TABLE 6. Kerala, *season-wise, perches landings during* 1981-1997 (tonnes)

Year	Premon.	Mon.	Postmon.	Total
1981	1,395	4,574	2,991	8,960
1982	1,724	7,624	1,343	10,691
1983	2,065	5,509	2,917	10,491
1984	3,956	17,867	4,988	26,811
1985	5,061	18,870	6,629	30,560
1986	4,392	29,589	12,777	46,758
1987	8,032	15,930	6,484	30,446
Average	3,804	14,280	5,447	23,531
1988	8,602	16,087	7,163	31,852
1989	11,705	10,690	26,973	49,368
1990	18,018	39,115	11,404	68,537
1991	5,864	13,150	21,247	40,261
1992	8,308	23,088	20,608	52,004
1993	18,020	43,271	14,202	75,493
1994	15,913	27,586	16,308	59,807
1995	11,532	20,491	14,274	46,297
1996	12,893	27,884	31,507	72,284
1997	20,601	9,688	13,908	44,197
Average	13,146	23,105	17,759	54,010

TABLE 6e. *Kerala, season-wise, oil sardine landings during 1981-1997 (tonnes).*

Year	Premon.	Mon.	Postmon.	Total
1981	16,945	13,461	1,25,311	1,55,717
1982	42,681	15,310	95,689	1,53,680
1983	52,636	3,026	86,733	1,42,395
1984	59,987	12,309	62,609	1,34,905
1985	37,106	9,415	40,859	87,380
1986	16,291	59	8,973	25,323
1987	1,712	17,762	25,486	44,960
Average	32,480	10,192	63,665	1,06,337
1988	2,223	7,948	66,636	76,807
1989	27,523	34,619	1,13,005	1,75,147
1990	56,652	31,639	90,729	1,79,020
1991	74,626	12,625	17,984	1,05,235
1992	26,876	6,300	18,068	51,044
1993	13,205	5,590	28,455	47,250
1994	302	525	754	1,581
1995	129	60	14,715	14,904
1996	1,782	4,661	19,943	26,386
1997	45,209	8,698	38,854	92,761
Average	24,833	11,267	40,914	77,014

TABLE 6f. *Kerala, season-wise ,other sardines landings during 1981-1997 (tonnes)*

Year	Premon.	Mon.	Postmon.	Total
1981	2,730	322	4,046	7,098
1982	2,425	71	5,662	8,158
1983	2,424	365	2,112	4,901
1984	1,722	1,326	4,448	7,496
1985	1,471	161	1,908	3,540
1986	2,751	1,821	4,516	9,088
1987	4,860	554	3,915	9,329
Average	2,626	660	3,801	7,087
1988	1,195	2,067	9,671	12,933
1989	3,000	59	9,460	12,519
1990	1,833	278	11,956	14,067
1991	14,007	562	8,316	22,885
1992	1,821	48	14,689	16,558
1993	3,375	333	19,116	22,824
1994	822	219	15,436	16,477
1995	1,245	259	44,503	46,007
1996	1,782	1,588	3,608	6,978
1997	2,329	205	13,855	16,389
Average	3,141	562	15,061	18,764

TABLE 6 g. *Kerala, season wise, croakers landings during 1981-1997 (tonnes)*

Year	Premon.	Mon.	Postmon.	Total
1981	975	913	1,103	2,991
1982	1,082	1,630	1,142	3,854
1983	1,076	3,100	2,409	6,585
1984	2,217	3,706	3,331	9,254
1985	3,394	2,745	2,295	8,434
1986	1,678	1,676	9,648	13,002
1987	2,233	3,049	2,851	8,133
Average	1,808	2,403	3,254	7,465
1988	1,922	1,829	5,196	8,947
1989	1,942	4,984	4,167	11,093
1990	2,647	4,200	4,057	10,904
1991	2,506	2,562	3,717	8,785
1992	2,328	2,820	11,017	16,165
1993	4,649	3,748	6,000	14,397
1994	3,090	8,102	6,127	17,319
1995	3,490	2,637	2,862	8,989
1996	3,269	4,604	9,752	17,625
1997	3,640	2,868	4,528	11,036
Average	2,948	3,835	5,742	12,525

TABLE 6h. *Kerala season-wise ribbon fish landings during 1981-1997 (tonnes)*

Year	Premon.	Mon.	Postmon.	Total
1981	24	4,107	2,903	7,034
1982	38	7,615	3,392	11,045
1983	45	200	865	1,110
1984	184	5,903	383	6,470
1985	97	13,348	11,720	25,165
1986	635	3,941	7,298	11,874
1987	1,021	11,844	2,390	15,255
Average	292	6,708	4,136	11,136
1988	2,810	928	5,189	8,927
1989	383	339	6,460	7,182
1990	246	92	9,411	9,749
1991	193	580	1,409	2,182
1992	101	1,320	4,825	6,246
1993	1,868	706	5,132	7,706
1994	1,867	1,008	12,239	15,114
1995	431	716	3,293	4,440
1996	703	4,078	17,548	22,329
1997	2,573	5,577	10,646	18,796
Average	1,118	1,534	7,615	10,267

TABLE 6i. *Kerala, season-wise, mackerel landings during 1981-1997 (tonnes)*

Year	Premon.	Mon.	Postmon.	Total
1981	7,865	1,053	6,129	15,047
1982	6,480	739	3,358	10,577
1983	4,625	2,368	6,317	13,310
1984	3,878	1,533	6,214	11,625
1985	5,332	2,306	10,518	18,156
1986	9,196	1,221	11,815	22,232
1987	2,896	2,795	3,880	9,571
Average	5,753	1,716	6,890	14,359
1988	4,108	13,257	27,260	44,625
1989	10,370	11,807	63,138	85,315
1990	11,117	11,233	59,994	82,344
1991	11,383	22,237	16,053	49,673
1992	12,663	10,600	13,831	37,094
1993	7,959	24,254	29,680	61,893
1994	9,984	44,977	56,086	1,11,047
1995	7,388	21,648	51,208	80,244
1996	19,809	48,887	66,422	1,35,118
1997	19,107	18,735	35,877	73,719
Average	11,389	22,763	41,955	76,107

TABLE 6j. *Kerala, season-wise, carangid landings during 1981-1997 (tonnes)*

Year	Premon.	Mon.	Postmon.	Total
1981	1,616	496	3,441	5,553
1982	5,833	1,035	7,077	13,945
1983	6,738	1,893	6,179	14,810
1984	5,481	2,042	5,872	13,395

1985	3,717	1,959	7,350	13,026
1986	3,048	19,546	49,464	72,058
1987	7,631	5,191	9,702	22,524
Average	4,866	4,595	12,726	22,187
1988	7,229	9,847	31,657	48,733
1989	6,438	12,094	29,886	48,418
1990	13,379	11,551	4,05,291	4,30,221
1991	8,528	19,820	51,839	80,187
1992	11,899	20,489	52,212	84,600
1993	19,979	15,118	36,633	71,730
1994	17,313	21,144	21,475	59,932
1995	13,303	36,292	52,513	1,02,108
1996	23,829	8,706	32,575	65,110
1997	20,363	6,432	21,148	47,943
Average	14,226	16,149	73,523	1,03,898

TABLE 6k. *Kerala, season-wise, prawn landings during 1981-1997 (tonnes)*

Year	Premon.	Mon.	Postmon.	Total
1981	4,316	14,078	3,280	21,674
1982	4,787	12,781	14,109	31,677
1983	7,023	13,833	4,860	25,716
1984	7,689	14,572	12,974	35,235
1985	9,881	9,968	7,443	27,292
1986	11,500	17,575	8,175	37,250
1987	24,887	14,576	13,132	52,595
Average	10,012	13,912	9,139	33,063
1988	19,539	20,346	29,309	69,194
1989	24,631	16,652	13,076	54,359
1990	26,130	8,458	10,015	44,603
1991	15,861	21,913	24,878	62,652
1992	19,375	14,411	13,051	46,837
1993	13,228	21,275	15,669	50,172
1994	30,697	24,439	16,410	71,546
1995	13,921	21,698	6,220	41,839
1996	14,910	19,118	15,669	49,697
1997	22,729	14,559	18,652	55,940
Average	20,102	18,287	16,295	54,684

TABLE 6L. *Kerala, season-wise, cephalopod landings during 1981-1997 (tonnes)*

Year	Premon.	Mon.	Postmon.	Total
1981	163	386	2,182	2,731
1982	522	714	1,976	3,212
1983	323	302	1,135	1,760
1984	637	891	4,000	5,528
1985	3,012	1,475	3,717	8,204
1986	1,464	1,714	12,271	15,449
1987	2,971	736	3,539	7,246
Average	1,299	888	4,117	6,304
1988	4,779	2,358	8,049	15,186
1989	4,854	2,495	16,328	23,677
1990	7,406	3,869	14,185	25,480
1991	5,256	2,330	11,835	19,421
1992	10,137	3,919	16,887	30,943
1993	9,444	4,152	14,400	27,996
1994	12,576	6,942	18,471	37,989
1995	6,577	11,723	24,018	42,318
1996	6,895	8,054	18,321	33,270
1997	12,744	5,307	18,638	36,689
Average	8,067	5,115	16,113	29,295

The author is deeply grateful to Mr. K.N. Kurup, Head, FRA Division, CMFRI, Cochin, for kindly scrutinising the manuscript and offering suggestions for improvement and to Ms. K. Ramani, Technical Assistant for the help rendered.

****

Aquaculture Europe 99 - AquaNor

Trondheim, Norway, August 7-10

The huge technological and developmental achievements for the past 30 years gave way to new hurdles facing the industry today. In view of these challenges, the European Aquaculture Society (EAS) will organise its next conference, **Aquaculture Europe 99 - AquaNor** in Trondheim, Norway, from August 7 to 10. Planning for this major event of the year is now at an advanced stage. The theme **'Toward predictable quality'** has been largely welcomed and large numbers of proposals for oral and poster presentations have been submitted.

The sessions have been designed to deal with all the important topics. On each day, there will be plenary talks followed by three parallel sessions. A three days' session will focus on ***larviculture.*** A renowned trio will chair the session: Yngvar Olsen (Norway), Elin Kjorsvik (Norway) and Patrick Sorgeloos (Belgium). Different aspects of the major theme, larval culture, will be covered on each of the three days, egg quality, rearing technology and larval-bacterial interactions.

A two days' session chaired by Brit Hjeltnes (Norway) and Alain Le Breton (Malta) will focus on ***fish health.*** Jo-Ann Leong (USA) will introduce the first day focusing on the viral diseases and the co-chairman will introduce the second day dealing more particularly with bacterial and parasitic diseases.

Single days sessions will cover the remaining topics, including a session on ***marketing of aquaculture products*** chaired by Patty Clay (UK), a session on the ***quality of adults and the finished products*** chaired by Magny Thomassen (Norway) and Giuseppe Palleschi (Italy), a session on the ***environmental aspects of aquaculture*** chaired by Ian Davies (UK) and Arne Ervik (Norway), and session on ***genetics of farmed aquatic*** species chaired by Trygne Gjedrem (Norway).

To fulfil the needs of all involved in aquaculture, whether as scientists, producers, manufactures, veterinarians, etc. the scientific conference Aquaculture Europe 99 will be held during the days preceding the most important aquaculture trade show in the world, AquaNor 99. The combination of these two milestone events has been made possible thanks to the close collaboration between the European Aquaculture Society and the Nor-Fishing Foundation.

More information on the conference can be obtained from:
European Aquaculture Society, Aquaculture Europe 99 - AquaNor
Slijkensesteenweg 4

B-8400 Oostende, Belgium
Tel : +32 59 323859
Fax : + 32 59 321005
E-mail: eas@unicall.be
or EAS homepage:http://www.easonline.org.

Edited by Dr. K.J. Mathew, Ms. T.S. Naomi, Ms. P.J. Sheela,Ms. E. Sasikala and Ms. P.M.Geetha. Published by Dr. K.J. Mathew on behalf of the Director, Central Marine Fisheries Research Institute, P.B. No. 1603, Tatapuram P.O., Cochin - 682 014, Kerala, India. Printed at Cherrys Printers, Cochin - 682 017.

903 केरल की समुद्री मात्स्यिकी

टी.एम. योहन्नान, पी.एन. राधाकृष्णन नायर, एन.जी.के. पिल्लै और पी.एल. अम्मिणि

केंद्रीय समुद्री मात्स्यिकी अनुसंधान संस्थान, कोचीन – 682 014, भारत

केरल की समुद्री मात्स्यिकी के विकास में 1980 का दशाब्द बहुत महत्वपूर्ण है। इस अवधि के पूर्वार्द्ध में देशी यानों का मोटोरीकरण बहुत तेज़ था जिसके ज़रिए मत्सयन दूरस्थ और गहरी जलक्षेत्र में विस्तृत किया जा सका। इस अवधि के उत्तरार्द्ध में एक नया संभार वलय संपाश वेलापवर्ती संपदाओं के विदोहन केलिए बहुत मशहूर बन गया। इसके प्रचालन केलिए बडे जाल (450 से 900 लंबा), अधिक कार्मिक दल (30 से 40), बडे यानें और अधिकाधिक बाहरी इंजनों की आवश्यकता पडी। इस प्रकार 3 बाहरी इंज़न लगाये गये "केट्टुवल्लम" का प्रचालन शुरू हुआ। इस प्लवक-निर्मित नावों को फाइबर ग्लास से आवृत करके वाहक नावों के रूप में उपयोग करने लगा। इस प्रकार यंत्रीकृत सेक्टरों के साथ मोटोरीकृत सेक्टर भी जोड दिया गया और बाकी अयंत्रीकृत सेक्टर रह गया। 1988 में मोटोरीकृत सेक्टर की तेज़ बढती हो गयी और यह अधिक पकड देनेवाला प्रमुख सेक्टर बन गया।

वर्ष 1988 में मानसून के दौरान आनायन में सरकार आदेश द्वारा एक भागिक रोध लगाया गया था। इसके बाद केरल सरकार द्वारा मात्स्यिकी के अध्ययन और पुनरुत्थान के सुझाव केलिए नियुक्त समिति के सिफारिश के अनुसार हर साल दक्षिण-पश्चिम मानसून के समय इस प्रकार रोध लगाना शुरू किया। यह इसलिए कि केरल तट के अधिकांश वाणिज्यिक दृष्टि से महत्वपूर्ण मछलियों का अंडजनन और अंडों से बाहर जाने का श्रृंगकाल यही अवधि है। परंपरागत मछुआरों की हितों की सुरक्षा भी इसमें निहित है।

मात्स्यिकी पोताश्रय जैसे अवसंरचनात्मक सुविधाएं मानसून के अवसर में भी पकड के अवतरण करने में सहायता दी। इसके फलस्वरूप मानसून के दौरान मत्स्यन क्रियाकलापों में वृद्धि हुई और वेलापवर्ती मछलियों की पकड भी गणनीय मात्रा में बढ गयी। झींगों के अतिरिक्त सेफालोपोडों को भी उच्च निर्यात माँग प्राप्त हुई और क्राफ्टों के आयाम बढाकर, मत्स्यन क्षेत्र और मत्स्यन काल विस्तृत करके आनाय का भी तीव्रीकरण कर दिया गया। इन विकासों के परिणाम में वार्षिक औसत पकड में वृद्धि हुई।

सी एम एफ आर आइ, कोचीन के मात्स्यिकी संपदा निर्धारण प्रभाग द्वारा केरल की 1980-1996 की मात्स्यिकी पर संग्रहीत डाटा इस अध्ययन का आधार है। केरल की समुद्री मात्स्यिकी में वलय संपाशों का प्रस्तुतीकरण, आनायन में भागिक रोध और पकड में वृद्धि वर्ष 1988 की विशेषता है। इसलिए वर्ष 1988 को केरल मात्स्यिकी का परिवर्तन काल माना जा सकता है।

केरल में समुद्री मात्स्यिकी की बढती की विशेषताएं

केरल की 1980-96 तक की वार्षिक मत्स्यन पकड दो विभिन्न अवधि दिखाती है। पहली अवधि 1980-87 तक की अवधि है जब वार्षिक औसत पकड 3,33,577 टन थी और दूसरी 1989-96 तक की अवधि जब पकड 5,85,224 टन थी। 4,70,000 टन पकड के साथ वर्ष 1988 परिवर्तन वर्ष के रूप में खडा है। इस अवधि में वृद्धि 2,51,648 टन थी जो बढती के 75.4% है।

मात्स्यिकी के विभिन्न सेक्टरों का परिवर्तन और एक विशेषता है। वर्ष 1983 तक परंपरागत सेक्टर प्रमुख था जो मोटोरीकृत सेक्टर के ध्रुत विकास के साथ घट गयी। 1985 में परंपरागत सेक्टरों का योगदान केवल 24% था जब कि

मोटोरीकृत सेक्टर का योगदान क्रमशः 43% और 33% था। 1989 में मोटोरीकृत और यंत्रीकृत सेक्टरों द्वारा योगदान 63% तक बढ गया तो परंपरागत सेक्टर द्वारा योगदान केवल 5% था। लेकिन यंत्रीकृत सेक्टर का योगदान 32% रहा । 1994 में यंत्रीकृत सेक्टर मोटोरीकृत सेक्टर (39%), को पीछे हटाकर 57% योगदान दिया। 1996 में मोटोरीकृत, यंत्रीकृत और परंपरागत सेक्टरों का योगदान क्रमशः 51, 44 और 5% था।

यंत्रीकृत सेक्टर में प्रमुख आनाय जाल था जिसके ज़रिए इस सेक्टर के 97.4% पकड प्राप्त हुई थी। प्रति एकक प्रयास पकड में कोष संपाश आगे था। कोष संपाशों का प्रचालन कोचीन में ही सीमित है जबकि तिरुवनन्तपुरम जिला को छोडकर केरल के सभी तटों में आनाय जालों का प्रचालन होता है। कुल पकड के 71.1% के साथ मोटोरीकृत सेक्टर में वलय संपाश प्रमुख संभार है।

केरल के 1985-87 से 1993-96 तक की अवधि की समुद्री मात्स्यिकी की बढती पर भी अध्ययन किया। इस दौरान की पकड में औसत वार्षिक बढती 2,20,024 टन थी। इसमें 74.9% वलय संपाशों के ज़रिए, 64.5% आनायों के ज़रिए, 5.9% मोटोरीकृत गिलजालों के ज़रिए और 0.2% कोषसंपशों के ज़रिए प्राप्त हुई थी। मोटोरीकृत पोत संपाश, यंत्रीकृत गिलजाल और अन्य संभार क्रमशः 31.2, 3.5 और 10.8% की घटती अभिलिखित की। वलय संपाश और आनायों को छोडकर बाकी गिअरों की प्रति प्रयास पकड कम थी।

*आनाय मात्स्यिकी – **1986 – '96***

आनाय मात्स्यिकी में 1986 से 1994 तक की अवधि में नियमित वृद्धि दिखायी पडी। 1988 में प्रयास अधिक और प्रति प्रयास पकड निम्न देखी गयी। प्रयास का दूसरा श्रृंग काल 1994 था जब भी प्रति प्रयास पकड कम थी। इस प्रकार 1986 से 1996 तक की अवधि में प्रयास की बढती के साथ - साथ प्रति प्रयास पकड में आपेक्षिक घट्ती स्पष्ट है।

वलय संपाशों के प्रयास और पकड में वर्ष 1988 के बाद उच्च वृद्धि सुस्पष्ट है। लेकिन पकड स्तर बनाये रखने में यह मात्स्यिकी असफल रहा। वर्ष 1994 तक इस में नियमित घटती हुई, जिसके बाद कुछ प्रगति दीख पडी। लेकिन 1989 तक यह मात्स्यिकी सशक्त हुआ।

केरल की समुद्री मात्स्यिकी के वार्षिक पकड झुकाव उपयुक्त दो संभारों के आधार पर किया गया है। क्योंकि वर्ष 1988 के बाद के औसत पकड वलयसंपाशों और आनायों से प्रभावित है।

प्रयास और पकड की दृष्टि में आनाय मात्स्यिकी वलयसंपाश के आगे है। 1985 - 88 से 1993 - 96 तक की अवधि की प्रमुख संभारों, पकड, प्रयास और प्रति प्रयास पकड की आपेक्षिक बढती देखने पर प्रयास और पकड में अधिकतम बढती वलय संपाश मात्सियकी में देखी जाती है। लेकिन इसमें पकड प्रति एकक प्रयास आनाय मातिस्यकी से कम है, जिसमें प्रयास की वृद्धि निम्नतम है। कोष संपाश, मोटोरीकृत गिल जाल, यंत्रीकृत गिल जाल और मोटोरीकृत पोतसंपाश पीछे हटाई गयी।

अखिल भारतीय समुद्री मात्स्यिकी पकड के साथ तुलना

वर्ष 1989 से 1993 तक की अवधि में केरल की वार्षिक औसत समुद्री मछली पकड 6,02,012 टन थी जो भारत की कुल समुद्री मछली पकड के 25.4% थी। पकड में 41.6 % केरल का योगदान था और दूसरा स्थान 26.4 % के साथ गुजरात ने प्राप्त किया। तट रेखा के प्रति किलोमीटर और महाद्वीप शेल्फ के प्रति क्षेत्र पकड में केरल का स्थान प्रथम है। इस प्रकार भारतीय तटों में अधिक तीक्ष्णता से विदोहित क्षेत्र केरल का तटीय क्षेत्र है। विदोहन में ऐसी तीव्रता प्राकृतिक संपदाओं के नाश केलिए रास्ता खोलेगी। भारत की समुद्री मात्स्यिकी के विकास में केरल का गणनीय स्थान मानकर, संपदाओं के परिरक्षण और प्रबन्धन केलिए आवश्यक कदम उठना इस राज्य की जिम्मेदारी है।

मात्स्यिकी संपदाओं का परिवर्तन

वर्ष 1985 - 88 और 1993 - 96 के दौरान की वार्षिक औसत पकड के मूल्यांकन करने पर पहली अवधि से 50.8% वृद्धि दूसरी अवधि में देखी जाती है। कुल वृद्धि के 51.7% वेलापवर्ती मछलियों का योगदान था। इसके बाद आती है तलमज्जी पख मछलियाँ (17.8 %), मलस्क (13.5 %), कवचप्राणी (9.4 %) और अन्य 7.5 % । इन विभिन्न प्रकार की मछलियों की पकड में अधिकतम वृद्धि और घटती का अनुभव वेलापवर्ती मात्स्यिकी को हुआ था। मलस्क मछलियों की पकड में कोई घटती नहीं हुई। कवचप्राणियों में नॉन- पेनिआइड झींगों की पकड में छोटी सी घटती दीख पडी। अधिकतम आपेक्षिक बढती मलस्क मात्स्यिकी ने रिकार्ड की। सेफालोपोडों की पकड में और इसकी निर्यात माँग में हुई वृद्धि इसका कारण है। निर्यात माँग होने पर भी न्यूनतम आपेक्षिक बढती कवचप्राणियों की थी। यह अध्ययन यह भी व्यक्त करता है कि 1985-88 से 1993-96 की अवधि में अधिकतम योगदान भारतीय बाँगडों का था। केरल की बाँगडे पकड का 73 % वलयसंपाश मात्स्यिकी का योगदान था।

केरल की वेलापवर्ती मात्स्यिकी के मुख्य आधार तारली मात्स्यिकी, वर्ष 1990 के बाद गिर गयी। 1989 - 90 में वलयसंपाशों का विजय बाँगडे के साथ इस संपदा की भारी पकड थी। 1989 में यह संपदा 1.9 लाख टन की रिकार्ड पकड अभिलिखित की तो 1994 में यह घटकर 1554 टन हो गयी। 1990 के बाद इस संपदा की घटती वलयसंपाश की आगे की बढती में भी रोक लगा दी।

वेलापवर्ती मात्स्यिकी की बढती के और एक प्रमुख संपदा है स्काड्स। 1986 में यह अत्यन्त शक्य था। 1987 की कम पकड के बाद क्रमशः बढकर 1992 तक बढती दिखायी और इसके बाद उतार-चढाव दिखाने लगा।

तलमज्जी मात्स्यिकी में पकड की विविधता वेलापवर्ती मात्स्यिकी की जैसी उतना शक्त नहीं थी। अधिकतम वृद्धि थ्रेडफिनब्रीमें की पकड के ज़रिए हुई।

सेफालापोड मात्स्यिकी 1993 - 96 से 1985 - 88 तक की अवधि में तीव्र आपेक्षिक बढती (215.8%) दिखायी थी। स्काड्स संपादा जो 1986 में बहुत शक्त थी, 1987 में घटती और इसके बाद नियमित बढती दिखाई।

कवचप्राणी संपदा 1985 - 88 से 1993 - 96 तक की अवधि में 30.5% की आपेक्षिक वृद्धि दिखायी इस अवधि में पेनिआइड झींगे भी 18% तक बढ गयी थी। कर्कट पकड भी अधिकतम आपेक्षिक बढती दिखायी। झींगा मात्स्यिकी के झुकाव भी बढती की ओर था।

बढती का कारण

आनाय और वलयसंपाश का आगमन पकड की बढती केलिए सहायक निकला। मानसून के दौरान लगाये गये रोक भी एक हद तक उत्पाद बढने का कारण माना जा सकता है। पेनिआइड झीगों की पकड में प्रगति और बाद में उतार-चढाव और सेफालोपोडों की पकड में बढती देखी गई। यद्यपि एक मात्स्यिकी का अनियन्त्रित विकास निरन्तर विदोहन केलिए रास्ता खोलेगा तद्वारा इसके आगे का विकास भी मन्द हो जाएगा। ऐसी स्थिति में मानसून के दौरान आनायन पर लगाये गये रोध अपर्याप्त ही मानना पडेगा।

विश्लेषण यह सूचना दोती है कि वलय संपाश और अनाय प्रचालनों की और बढ़ती का परिणाम प्रति प्रयास पकड की घटती होगा।

संभारवार विविधता

प्रमुख संभारों में विभिन्न मछलियों का पकड परिवर्तन नीचे दिया जाता है. आनाय पकडों में 1985 - 87 की तुलना

में 1993-95 में 1,58,455 टन की वृद्धि हुई थी। इसमें प्रयास की वृद्धि केवल 35.3% थी। इस वृद्धि केलिए अधिकांश योगदान सेफालोपोड्स, स्काड्स, सूत्रपख ब्रीम और पेनिआइड झीगों का था। शिंगटियाँ, मल्लेट्स और नोनपेनिआइड झींगों की पकड में घटती देखी गयी थी। पेनिआइड झींगे, मुल्लन, नान-पेनिआइड झींगे, सूत्रपखब्रीम, मल्लेट्स, शिंगटियाँ आदि की प्रति एकक पकड प्रयास में कुछ घटती दिखायी पडी। लेकिन अन्य जाति की प्रति एकक प्रयास पकड बढती दिखायी।

वलय संपाश मात्स्यिकी 1,30,650 टन की वृद्धि दिखायी। इस वृद्धि का योगदान भारतीय बाँगडे, स्काड्स, श्वेतबेट्स और लेस्सार सारडीनों का था। अन्य करैंजिड्स, शिंगटियाँ और तारली की पकड कम थी। तारली और अन्य करैंजिडों की प्रति एकक प्रयास पकड भी घटती दिखायी । यद्यपि कुल पकड प्रति एकक प्रयास 35.6% की बढती दिखायी। विचारणीय घटती मोटोरीकृत पोतसंपाश मात्स्यिकी की थी। भारतीय बाँगडे, मल्लेट्स, नॉन-पेनिआइड झींगे और हिल्सा शाड को छोडकर बाकी सभी मछलियों की पकड कम थी। इसके अनुसार प्रति प्रयास पकड भी कम थी। भारतीय बाँगडे की पकड में और कुछ हद तक मल्लटों की पकड में गणनीय वृद्धि देखी गयी थी।

मात्स्यिकी प्रबन्धन का जैविक आधार

केरल की मात्स्यिकी की ऐसी विशेषता है कि बहुजातिय मात्स्यिकी की अपेक्षा एक जाति की संपदाओं में उतार-चढाव अधिक होता है। मछली की कुल पकड मत्स्यन क्षेत्र की कुल उत्पादकता होती है। इस कुल उत्पादकता में विविधता हमारे नियन्त्रण के परे है और इसलिए कम बताया जा सकता है। साधारणतया एक जाति की घटती से दूसरी जाति की बढती हो जाती है। लेकिन मूल्यवान जाति मात्र के विदोहन से इसकी घटती और बेकार जाति की वृद्धि हो जाती है।

हम विदोहित की जानेवाली अधिकांश मछली जाति छोटे जीवनकाल की होती है। ये तेज़ बढकर एक वर्ष की आयु में पुनरुत्पादन करते है और इनका योगदान केवल दो सालों तक रहता है। इनके अंडजनन संबंधित अधिकांश प्रक्रिया मानसून काल के ठीक पहले या मानसून के दौरान होती है। अंडजनन की प्रक्रिया लगभग फरवरी में प्रारंभ करके जुलाई तक जारी रहती है। लाम्बेर्ट और वेयर के "बेट-हेड्जिंग" नामक एक तथ्य है। कुछ मछलियाँ दीर्घकालिक अंडजनन विधि के दौरान विस्तृत क्षेत्र में अंड दलों को छोडते है। जहाँ खाद्य की उपलब्धि अननुमेय है वहाँ यह रीति उचित है। भारत के जलों में यह स्थिति होती भी है। भारतीय बाँगडे की अंडजनन संबंधी प्रक्रिया फरवरी में प्रारंभ होकर मई-जुलाई में परम सीमा प्राप्त करती है। नवंबर में भी अंडजनन होता है। फिर भी श्रृंगकाल मई- जुलाई माना जाता है। इसका कारण प्रायः हमारे तटीय जल क्षेत्रों के "उत्प्रवाह" है। उत्प्रवाह की प्रक्रिया मार्च में प्रारंभ होती है, अगस्त / सितंबर में उच्च सीमा प्राप्त करती है और अक्तूबर/ नवंबर में कम हो जाती है। उत्प्रवहित जल पोषण संपुष्ट है और तटीय जल क्षेत्रों के प्लवकों को पुष्पित करते है। मानसून के दौरान नदियों द्वारा लाये जानेवाले पोषक भी यह फूलन प्रक्रिया को तेज़ बढाता है। यह प्लवक पुंज मछलियों के प्लवकीय डिम्भकों की अतिजीविता और आगे की बढती केलिए अत्यन्त उचित है। अतः उत्प्रवाह के दौरान के अंडजनन सफल हो जाता है। मई - जुलाई के दौरान के डिम्भकों का बढने का अवसर आज विचारणीय है। क्योंकि बाहरी इंजन लगाए पोतों और वलयसंपाशों के आगमन के पहले मानसून के दौरान मत्स्यन कार्य बहुत कम था। लेकिन आज सुशक्त बाहरी इंजनों और मात्स्यकी पोताश्रयों का विकास मानसून के मत्स्यन कार्य को आसान कर दिया है। इसके फलस्वरूप अंडजनकों और किशोरों का अनियंत्रित

विदोहन हो जाता है। जुलाई से सितंवर तक की अवधि में 155 मि मी लंबाई और 35 ग्रा से कम आयाम के भारतीय बाँगडों का विदोहन प्रचुर मात्रा में हो जाता है। इसी प्रकार जुलाई से अक्तूबर तक की अवधि में 120 मि मी से कम लंबाई और 15 ग्रा से कम भार के किशोर तारलियों को पकडे जाते है। वर्ष 1993 से 1996 तक की अवधि के जुलाई-सितंबर काल में लगभग 50.3% कम आयाम के बाँगडों का और इसी अवधि में (जुलाई-अक्तूबर) 50% किशोर तारलियों का विदोहन हुआ था। इसके फलस्वरूप मत्स्य प्रभव की तेज़ घटती हो जाती है। मानसून के दौरान वलयसंपाशों का तीव्र प्रचालन इस अतिमत्स्यन का कारण है।

यदि मानसून मात्स्यिकी अतिमत्स्यन का कारण बन जाता है तो यह कहना है कि मानसून पूर्व विदोहन अंडजनन प्रभव पर होता है। केरल के दक्षिण जिलाओं में इसकी प्रवणता अधिक है।

वर्तमान परिदृश्य

केरल में 1993-96 के दौरान औसत 5.5 टन मछली अवतरण हुआ था जिसमें 48.4% यंत्रीकृत आनायों का, 30.8% बडे पोतों (कोष संपाश और वलय संपाश) का, 4.1% पोत संपाशों का, 9.2% गिल जालों का, 3.8% काँटा डोरों का और बाकी 1.9% अन्य संभारों का योगदान था। कोल्लम, एरणाकुलम और कोषिकोड जिलाओं में आनाय मात्स्यिकी प्रमुख थी। अन्य जिलाओं में अधिकतर पकड मोटोरीकृत क्राफ्टों के ज़रिए प्राप्त हुई थी। आलप्पुषा में छोटे आनाय द्वारा अधिकतम अवतरण हुआ था। अयंत्रीकृत मात्स्यिकी का प्रचालन केवल तिरुवनन्तपुरम जिला में सीमित है जहाँ आनाय और वलयसंपाशों का प्रचालन नहीं होता है। यहाँ भी मोटोरीकरण के प्रचालन वढने के बाद अयंत्रीकृत मात्स्यिकी घटती की ओर है। वलय संपाश और आनायों की माहिक औसत पकड के अनुसार अधिकतम पकड अगस्त में प्राप्त हुई है। जून महीने की निम्नतम पकड का कारण आनाय पर लगाए रोध है। तदनुसार जुलाई में वलयसंपाश पकड में वृद्धि हुई। मानसून की अधिकतम पकड के बाद वलयसंपाश पकड में भारी घटती देखी गयी। उत्प्रवाह के साथ तापप्रवणस्तर ऊपर आ जाने के कारण मानसून के दौरान ऊपरीतल का स्तर संकीर्ण बन जाता है जिसमें छोटी वेलापवर्ती मछलियाँ फंस जाती है और वेलापवर्ती संभारों से आसानी से पकडी जाती है। यही नहीं तलीय जल की प्राणवायु की कमी किशोर तलमज्जी मछलियों को ऊपरीतल में आने की प्रेरणा देती है। अतः मानसून के दौरान वलयसंपाशों का अधिकतर विदोहन छोटी मछलियों का होता है और परिणाम, प्रभव की घटती हो जाती है। यद्यपि आनाय मात्स्यिकी में मानसून के बाद इस प्रकार तेज़ घटती नहीं दिखायी पडती है।

चर्चा

केरल की समुद्री मात्स्यिकी प्रमुखतः आनाय के ज़रिए चलती है। एरणकुलम, कोल्लम और कोषिकोड में पोताश्रय की सुविधा रहने के कारण आनाय अवतरण इन स्थानों में तीव्र है। केरल की समुद्री मछली पकड में 48.4% आनायों का योगदान है और पकड में विभिन्न प्रकार की मछलियाँ प्राप्त होती है। 1988 के बाद मछली पकड में हुई वृद्धि प्रमुखतः इस संभार की पकड में हुई वृद्धि के कारण है। 1988 के बाद मानसून के विविध अवधियों में लगाये गए रोध मछलियों के अंडजनन और तदनुसार विभिन्न मछलियों की जीव संख्या बढने में सहायक निकला।

वलयसंपाश जिसका प्रचालन 1980 के वर्षों में प्रारंभ होकर 1988 में तीव्र बन गया था, पकड की वृद्धि में काफी योगदान किया। लेकिन इसकी प्रगति एक हद तक पोत संपाश और गिल जालों जैसे ऊपरीतल संभारों पर आश्रित थी। इस मात्स्यिकी का विकास अनियन्त्रित हो जाने पर

विदोहन अधिकतः मानसून के दौरान 5 महीने से कम आयु की वेलापवर्ती मछलियों पर रहा और इसका परिणाम रहा इस जाति की शीघ्र घटती।

विदोहन की दक्षता की वृद्धि और विस्तृत क्षेत्रों का प्रचालन 1980 वर्षों के केरल मात्स्यिकी का मुख्य परिवर्तन हैं। बडे बडे आनाय गहरे जलों में दिनों तक मत्स्यन करते थे। सुशक्त बाहरी इंजन लगाए गए वलयसंपाश एकक भी गहरी क्षेत्रों में विदोहन करते थे। ऐसी स्थिति में कुछ सुरक्षा प्रबन्धन के विना मत्स्य प्रभव की स्थिति निर्णायक हो सकता था। मानसून काल के दौरान आनाय पर लगाए गए रोध इस दृष्टि से तलमज्जी मछली प्रभव केलिए कुछ उचित कदम माना जा सकता है। फिर भी वेलापवर्ती मछली आज भी सुरक्षित नहीं है।

हमारे यहाँ प्रचलित विदोहन रीति ऐसी है कि प्रभवों की सुरक्षा करने में कई समस्याओं की सामना करनी पडती है। यहाँ विवेकपूर्ण विदोहन की आशा नहीं की जा सकती है। मत्स्य प्रभव के जैविक तात्पर्य और अतिजीविता देखे बिना प्रभव के अनुसार संभारों का प्रचालन किया जाता है। "युनाइटड नैशन्स कनवेन्शन ऑफ दि लॉ ऑफ दि सी" ने 1982 में अनन्य आर्थिक मेखला में मछली संपादाओं के न्यायिक विदोहन के ज़रिए सुरक्षा की जिम्मेदारी संबन्धित तटवर्ती राज्यों को सौंप दिया। लेकिन इसका ठीक अनुपालन अभी तक नहीं किया गया है। भारत में केरल सरकार ने इस संबंधी कुछ आदेश जारी किया है पर इन में कई, लागू किये बिना रिकार्ड में ही रहते है।

केरल की बहुजातीय और बहु संभार की मात्स्यिकी के प्रबन्धन केलिए सुझाव देना एक कठिन कार्य है। परीक्षण के आधार पर आनुक्रमिक मत्स्यन प्रारंभ किया जा सकता है। इस में मछलियों के जैविक स्वभाव के अनुसार उनके अंडजनकों और मात्स्यिकी में प्रवेशित छोटी मछलियों की सुरक्षा पर ध्यान देकर विभिन्न संभारों का प्रयोग किया जा सकता है। अधिकांश मछलियों के अंडजननकाल मई-जुलाई होने के कारण इस अवधि के मत्स्यन विनियमित करना अनिवार्य है। इसकेलिए इस अवधि के दौरान बडी जालाक्षिवाले ड्रिफ्ट गिल जाल और काँटा डोरों को छोडकर बाकी संभारों को नियन्त्रित करना चाहिए। जुलाई के बाद के प्रचालनों में अंडजननोत्तर मछलियों को लक्ष्य करते हुए 40 मि मी से अधिक जालाक्षिवाले गिल जालों को प्रोत्साहित किया जाना चाहिए। वलय संपाश और कोष संपाशों के प्रयोग करना है तो इसका जलाक्षि आयाम भी 40 मि मी में नियमित करना चाहिए। अक्तूबर-मार्च के दौरान सभी संभारों के प्रचालन केलिए अनुमति कडी निगरानी के साथ दी जाए। मई से सितंबर तक की अवधि में अंडजनकों, अंडजनन प्रक्रिया और किशोर मछलियों की सुरक्षा की दृष्टि से उपतट जल क्षेत्रों में आनायन नियन्त्रित करना चाहिए।

केरल की समुद्री मात्स्यिकी अभी तक अनियन्त्रित प्रचालनों से विकास पा रही थी, अतः उपर्युक्त कदम इसकेलिए कुछ कठिन तो ज़रूर होगा। लेकिन इसके ज़रिए मछलियों को अधिकतम आयाम प्राप्त करने देने से मात्रा और गुणता बढ जाएगी और उत्पादन भी जारी किया जा सकेगा। यही नहीं इसके ज़रिए प्लवक पुंजों के पूर्ण उपयोग करके हमारे जल की उत्पादकता का भी अधिकतम उपयोग किया सकेगा। मत्स्यन में तलीय आनाय की रीति नितलस्थ प्राणियों केलिए हानिकर है। यद्यपि आनाय मात्स्यिकी का आर्थिक महत्व की उपेक्षा नहीं की जा सकती है। इसलिए 35 मी से अधिक गहराई के क्षेत्रों में इसका प्रचालन सीमित करना उचित होगा।

मात्स्यिकी के सफल प्रबन्धन केलिए निर्णय लेते समय मछुआरों का सहभागित्व उचित होगा। मछुआरों द्वारा विदोहित मात्स्यिकी संपदाओं की सुरक्षा निश्चित करने केलिए मुछुए सहकारी संघ का गठन भी किया जा सकता है। वैज्ञानिकों द्वारा उन्हें मात्स्यिकी संपदा की अतिजीविता के जैविक और पारिस्थितिक आधार समझाया जा सकता है। इस

प्रकार के संपर्क प्रबन्धन के नियमित व प्रभावी कार्यान्वयन केलिए भी सहायक होगा।

मात्स्यिकी प्रबन्धन नीति कभी भी अंतिम नहीं हो सकती। यह अत्यन्त गतिशील है कि इसमें परिवर्तन कभी भी आ सकता है। इसलिए प्रबन्धन प्रणालियों का पुनरीक्षण और सुधार समय समय पर करना अनिवार्य है।

****

904 मानसून आनाय के रोक के प्रसंग में केरल की समुद्री मात्स्यिकी

पी. एल. अम्मिणि

केंद्रीय समुद्री मात्स्यिकी अनुसंधान संस्थान, कोचीन

मत्स्यन प्रचालन में नई तकनोलजियाँ अपनाने में केरल सदा आगे रहा है। 1960 के अंतिम और 1970 के प्रारंभिक दशकों में यंत्रीकृत आनायन का गणनीय फैलाव यहाँ हुआ था। कोष सेपाशों का प्रस्तुतीकरण 1970 के दशकों के अंत में हुआ था। पर मोटोरीकरण के समान इसका उतना अधिक प्रभाव भी नहीं हुआ। वर्ष 1986 में प्रस्तुत किये गये वलय संपाश केरल के परंपरागत मात्स्यिकी का मुख्य सहारा बन गया।

इन तकनोलजियों को अपनाने से समुद्री मछली उत्पादन में बढती हुई है। पर विभिन्न मात्स्यिकी सेक्टरों के बीच आर्थिक और सामाजिक समस्याओं को लेकर स्पर्द्धा भी उद्भूत हुई जिसका समाधान सूझाना सरकारी अभिकरणों का काम बन गया। विरोधाभास यह है कि परंपरागत मछुए और आनाय प्रचालकों का विचार परस्पर विरुद्ध है। परंपरागत मछुआरों की राय में मानसून के दौरान होनेवाले आनायन मत्स्यन से वाणिज्यिक मूल्य के वेलापर्वी मछलियों का ह्रास होने की संभावना अधिक है क्योंकि मानसून इनका प्रजनन काल है और यह प्रजनन समुद्र में रहते हुये होता है। आनायक मछुआरों की राय में मानसून काल में सातवें के दशक से लेकर आनाय मत्स्यन करने पर भी पकड में कमी नहीं देखी गई है। केरल में क्वयलॉन और कोचीन में झींगों की अच्छी पकड मिलती हुई देखी है। इसलिए इस अवधि के दौरान मिलनेवाली झींगा पकड का लाभ उठना आनायक मछुए समीचीन मानते है। किसी भी तरह समस्या सुलझाने केलिए सरकार ने केरल के उपतटीय समुद्र में आनायन रोकने का निर्णय लिया और वर्ष 1988 से ये रोक लागू किया गया। विभिन्न सेक्टरों द्वारा प्रकट किये गये विभिन्न विचारों को सामने रखते हुये पकड संबंधी आंकडों के अनुरूप इस प्रश्न का विश्लेषण करने की कोशिश यहाँ किया करती है।

पिछले दशवर्ष में केरल के समुद्री मछली उत्पादन में अभूतपूर्व वृद्धि थी और आकस्मिक वश यह मानसून आनायन में रोक लगाने के समय पर थी। वर्ष 1981-87 और 1988-97 के औसत अवतरण की तुलना करने पर कुल अवतरण में 69% की वृद्धि दिखाई पडती है। इस में ध्यान देने योग्य दो बातें हैं।

1 वृद्धि (69%) मानसून पूर्व, मानसून और मानसूनोत्तर अवधियों में एक समान रही।

2 रोक लगाने के पूर्व और रोक लगायी हुई और बाद की 3 मानसून अवधियों में अवतरण की आपेक्षिक तीव्रता एक ही रही। (26% मानसून पूर्व, 24% मानसून में और 50% मानसूनोत्तर)

यह स्पष्टतः सूचित करता है कि वह तथ्य जिसके ज़रिए वृद्धि हुई, सभी मौसमों में एक समान लगता है। लेकिन निष्कर्ष पर पहुँचने के पहले एक विस्तृत विश्लेषण की आवश्यकता है।

भारतीय बाँगडे जो 1982 और 1983 में बहुत ही कम था 1989 में काफी बढती दिखाई और रोक की अवधि में औसत 43% की वृद्धि अभिलिखित की। 1989 और अनुवर्ती सालों में बाँगडे उत्पादन असाधारण होने पर भी करैंजिड उत्पादन के समान अभूतपूर्व नहीं था। करैंजिड उत्पादन इस अवधि में 368% तक बढ गया था जो वलय संपाश के प्रस्तुतीकरण से हुई क्रांति मानी जा सकती है। यद्यपि लेस्सर सारडीनों के उत्पादन में 165% वृद्धि हुई थी तथापि वर्ष 1995 में ही इसकी पुष्टि की पाई। आनायों द्वारा विदोहित मुख्य संपदाओं के अवतरण में भी समान वृद्धि हुई है। यह विचारणीय बात है कि रोक की अवधि में पेनिआइड झींगे का अवतरण 82% की वृद्धि दिखाई। झींगों के अतिरिक्त पेर्च और सेफालोपोडों में भी क्रमशः 143% और 365% की विचारणीय बढती हुई जिसका कारण शायद नई विपणन क्षमता के संदर्भ में इनकी पकड पर किये गये अधिक प्रयास होगा।

कुल आनाय अवतरण में वृद्धि प्रमुखतः मानसूनोत्तर अवधि में हुई थी। रोक के पहले मानसूनोत्तर अवधि में वार्षिक अवतरण 34% था। रोक की अवधि में यह 44% बन गया। सभी प्रकार के गिअरों पर किए गए अध्ययन ने व्यक्त किया कि रोक की अवधि में आनाय (ट्रॉल) अवतरण में 160% की बढती हुई। यह निर्यात शक्यता के आधार पर मात्र सेफालोपोडों पर किये गए मत्स्यन से हुई होगी। वलयसंपाशों (रिंगसीन) के अवतरण में 601% की अभूतपूर्व वृद्धि देखी गयी। यंत्रीकृत काँटा डोर के प्रचालन मानसून के दौरान कम होते हुए भी 339% की वृद्धि दिखाई। ओ बी एककों, जिनके मुख्य आधार है छोटे आनायक, डिस्को वला और काँटा डोर आदि के ज़रिए 295% की वृद्धि दिखाई। ड्रिफ्ट/गिलजाल एककों ने 84% की वृद्धि अभिलिखित की। अयंत्रीकृत सेक्टर ने 72%, घटती दिखायी। यंत्रीकृत ड्रिफ्ट/गिलजाल (79%), कोष संपाश (32%) और ओबी पोत संपाश (62%) ने रोक की अवधि में घटती दिखायी।

****

GUIDE TO CONTRIBUTORS

The articles intended for publication in the MFIS should be based on actual research findings on long-term or short-term projects of the CMFRI and should be in a language comprehensible to the layman. Elaborate perspectives, material and methods, taxonomy, keys to species and genera, statistical methods and models, elaborate tables, references and such being only useful to specialists, are to be avoided. Field keys that may be of help to fishermen or industry are acceptable. Self-speaking photographs may be profusely included, but histograms should be carefully selected for easy understanding to the non-technical eye. The write-up should not be in the format of a scientific paper. Unlike in journals, suggestions and advices based on tested research results intended for fishing industry, fishery managers and planners can be given in definitive terms. Whereas only cost benefit ratios and indices worked out based on observed costs and values are acceptable in journal, the observed costs and values inspite of their transitionality, are more appropriate for MFIS. Any article intended for MFIS should not exceed 15 pages typed in double space on foolscap paper.

Erratum

MFIS No. 159, back cover, column 2, 5th line from bottom:

The E-mail address may be read as
mdcmfri@md2.vsnl.net.in