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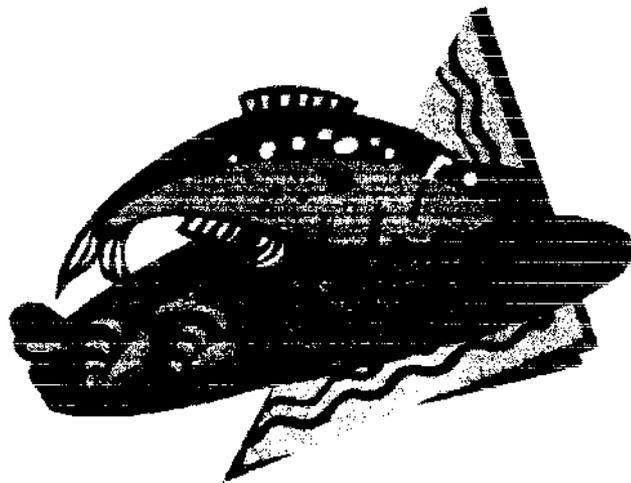
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PRODUCTION PATTERN IN THE MARINE FISHERIES OF KERALA

BY

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**CENTRAL MARINE FISHERIES RESEARCH INSTITUTE,
COCHIN, KERALA**

1999

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1. INTRODUCTION

The state of Kerala is a narrow strip of lush green land bounded on the east by high hills interspersed with rivers and on the west by the Arabian Sea. It is situated in the southwest corner of the Indian Peninsula between $8^{\circ} 18'$ and $12^{\circ} 48'$ north and $74^{\circ} 52'$ and $77^{\circ} 22'$ east.

Kerala has 590 kilometers of surf-beaten coastline. The area of continental shelf of this coast is about $40,000 \text{ km}^2$ and the overlying waters are considered to be one among the most productive in the Indian waters. The potential annual sustainable yield of Kerala in the 0-50m depth zone is estimated to be 0.599 million t (K.N. Kurup *et. al* M.S. 1988).

Fisheries play a crucial role in the Kerala economy. Although the coastline is only about one tenth of the coastline of India, landings in Kerala constitute more than 30 pct of the country's total marine fish production. This sector provides the main source of income for about 147900 active fishermen and for almost an equal number engaged in the activities of processing and marketing. Earnings from export of marine production from Kerala have during the past two decades increased considerably. The marine fisheries sector is therefore one of the major concerns of the economic planners in the state of Kerala and the object of various development programmes.

About two thirds of the marine fish landings of the state was accounted by the artisanal sector till 1979. Mechanization was experimented in the late fifties under the Indo-Norwegian project by introducing trawlers. The early sixties witnessed an important technological development in gear, the shift from cotton to nylon nets. Commercial purse-seining started during the late seventies.

An attempt was made during the midfifties for motorizing the country craft under the Indo-Norwegian project. During 1979-80, the fishermen of the fishing village Kannamaly (Ernakulam District) successfully carried out the motorization of the country craft, which attracted the attention of the fishermen of other regions also. Soon, the motorization programme gained momentum in Kerala.

Rao (1969) made an attempt to study the distribution pattern of the major exploited marine fishery resources on an all India basis. The present study is an attempt to analyse the various changes that had taken place over the last five decades due to technological innovations in craft, gear and fishing techniques and their effects on the fisheries resources.

1.1 DATA BASE

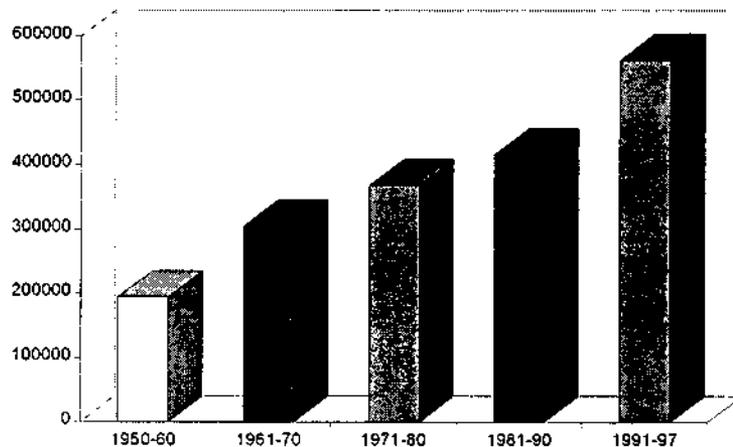
To study the trend in the production of any resource over time and space, a very strong data base built through a sound statistical design, taking into account the different aspects of variation over space, time and nature of resources is needed. Hence, the data collected by the Central Marine Fisheries Research Institute, a nodal Institute for marine fisheries research in the country, through its well tested and universally acclaimed stratified multi-stage random sampling design (Anon.,1983) have been considered for this purpose. Abbreviations used in the text are given in appendix-1.

2. PRODUCTION TRENDS

During the 48 year period, viz., 1950-97, the annual marine fish landings in the state varied from 105457 t in 1955 to 662890 t in 1990. On an average 195426 t fish per year was landed during 1950-60. It was 306228 t during 1961-70 registering a 57 pct increase.

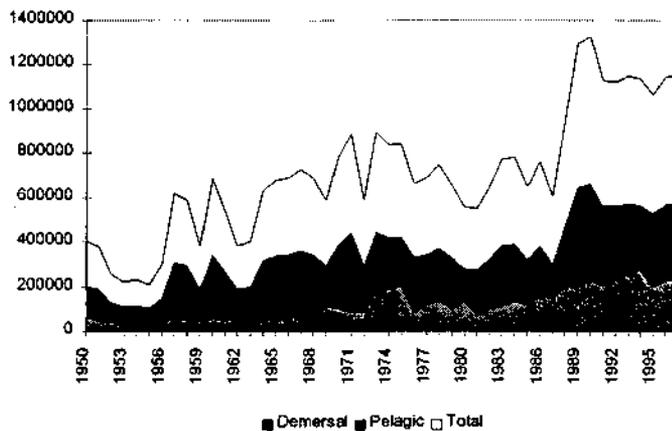
During 1971-80, 1981-90 and 1991-97, it was 368980 t, 417032 t and 563736 t respectively. The above periods registered an increase of 20 pct, 13 pct and 35 pct respectively of the previous periods. On the whole there was steady increase in the marine fish landings in Kerala (Fig.1).

Fig.1. Per year average marine fish landings (in t)



The annual marine fish landings in Kerala have shown heavy fluctuation over the years (Table

Fig.2. Demersal, Pelagic and Total landings (in t)



1). There was a tendency towards an upward swing after a rather poor landing during the previous year. The only exemption was during the period 1988-90. This might be due to a large scale introduction of outboard ringseines and the heavy landings of pelagic fishes during this period (Fig.2). After the large scale introduction of ringseine, the annual marine fish landings

always exceeded 4,70,000 t. During nineties marine fish landings in this state stabilized around 5.7 lakh tonnes.

TABLE 1(a)

**Depthwise percentage contribution of marine fish landings
in Kerala during 1991 and 1997**

Year	Depth (meters)						Total
	0-10	10-20	20-30	30-40	40-50	above 50	
1991	33	32	19	6	3	7	564161
1997	15	25	22	14	10	14	574774

3. RESOURCES

3.1 Pelagics

Broadly classifying the resources as pelagic and demersal, it may be observed that the landing of pelagics varied from 74568 t in 1955 to 439937 t in 1989 almost coinciding with the minimum and maximum of marine fish landings of the period 1950-97 (Table 1, fig 2).

Table 1

Marine fish landings (in t)

Year	Demersal	Pelagic	Total	Year	Demersal	Pelagic	Total
1950	65740	136307	202047	1974	193793	226464	420257
1951	50283	140749	191032	1975	202354	218482	420836
1952	42935	86410	129345	1976	82539	248508	331047
1953	23418	88581	111999	1977	121912	223125	345037
1954	40983	76051	117034	1978	136456	236883	373339
1955	30889	74568	105457	1979	102167	228342	330509
1956	66416	85797	152213	1980	131619	147924	279543
1957	49585	260341	309926	1981	70980	203415	274395
1958	63041	231614	294655	1982	100353	225442	325795
1959	51626	139749	191375	1983	111894	273923	385817
1960	64349	280256	344605	1984	139518	253954	393472
1961	50415	217079	267494	1985	120212	205324	325536
1962	70195	121226	191421	1986	164348	218443	382791
1963	54933	147447	202380	1987	150273	153013	303286
1964	66504	251470	317974	1988	203275	265533	468808
1965	43811	295362	339173	1989	207589	439937	647526
1966	73498	273246	346744	1990	229478	433412	662890
1967	71964	292165	364129	1991	207436	356725	564161
1968	61743	283558	345301	1992	240519	320223	560742
1969	119107	175680	294787	1993	260093	314646	574739
1970	104754	288126	392880	1994	278012	290022	568034
1971	90283	355064	445347	1995	203421	328225	531646
1972	91896	203722	295618	1996	232071	339984	572055
1973	177925	270344	448269	1997	239206	335568	574774

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1952	42935	86410	129345	1976	82539	248508	331047
1953	23418	88581	111999	1977	121912	223125	345037
1954	40983	76051	117034	1978	136456	236883	373339
1955	30889	74568	105457	1979	102167	228342	330509
1956	66416	85797	152213	1980	131619	147924	279543
1957	49585	260341	309926	1981	70980	203415	274395
1958	63041	231614	294655	1982	100353	225442	325795
1959	51626	139749	191375	1983	111894	273923	385817
1960	64349	280256	344605	1984	139518	253954	393472
1961	50415	217079	267494	1985	120212	205324	325536
1962	70195	121226	191421	1986	164348	218443	382791
1963	54933	147447	202380	1987	150273	153013	303286
1964	66504	251470	317974	1988	203275	265533	468808
1965	43811	295362	339173	1989	207589	439937	647526
1966	73498	273246	346744	1990	229478	433412	662890
1967	71964	292165	364129	1991	207436	356725	564161
1968	61743	283558	345301	1992	240519	320223	560742
1969	119107	175680	294787	1993	260093	314646	574739
1970	104754	288126	392880	1994	278012	290022	568034
1971	90283	355064	445347	1995	203421	328225	531646
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Whenever a new gear was introduced in the state, there used to be an upward trend in the landings of the pelagic group of fishes. The introduction of trawling and nylon webbing during 1956 brought about an upward trend in the landings. Due to the unusual heavy landings of oil sardine, there was a spurt in the landings of pelagic group during the period 1964 to 1968. After the introduction of outboard motors in the country craft, employing boat seine, there was further boost in the landings of this group since 1981. It gained further momentum with the introduction of outboard ringseine during 1986-87.

Among the pelagic resources the dominant groups are the oil sardine, mackerel, other sardines, whitebaits, seerfishes, tunnies, carangids and ribbonfishes.

3.1.1 Oil sardine

The contribution from this single component varied from 1554 t in 1994 to 247048 t in 1968 with considerable fluctuations over the years (Tab.2 and Fig.3). During 1960-70, the

Table 2

Landings of major groups of fishes (in t).

Fishes/ Year	OS	OSS	WB	RF	CAR	IM	SF	TU
1960	186219	14504	14164	636	11197	35504	2209	4112
1961	166005	5213	6112	4047	5311	20064	2885	4503
1962	91203	3889	5231	637	1501	11938	1533	723
1963	58950	9310	12084	1279	4891	48917	1587	2286
1964	190401	13808	10461	169	15313	9657	1906	1342
1965	219170	18962	2718	13826	4083	18048	1513	1831
1966	202800	8680	8816	21102	8039	10747	1263	1197
1967	235410	9038	11606	6841	10359	4500	1353	1445
1968	247048	7723	5652	992	4969	3599	3785	1852
1969	137983	9485	10486	7446	3659	29981	1010	978
1970	191683	6139	7948	4922	2797	54659	1731	1226
1971	194977	11403	10842	17380	5310	95164	2800	3043
1972	104426	6790	10672	10459	15869	34516	1386	3626
1973	122783	62421	8940	23897	14572	19780	1690	2699
1974	102135	31335	19463	30192	5534	10335	4909	5927
1975	97183	33652	11432	15175	7539	14930	4065	5845
1976	123937	34305	9987	7687	10911	19978	5936	12880
1977	117356	20754	10105	7440	16484	19968	3250	6705
1978	119937	11713	21203	24207	7621	25917	3354	6548
1979	116834	15914	6552	25718	11635	18585	6275	15391
1980	69667	11017	7772	12937	4760	18474	3763	10611
1981	146986	7629	4293	7066	5050	16200	3330	5509
1982	143215	7388	13597	11034	12691	10717	5617	7211
1983	154879	5315	55042	1112	16528	12683	6999	5750
1984	147139	6022	41505	6464	13672	11746	6174	6168

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1961	166005	5213	6112	4047	5311	20064	2885	4503
1962	91203	3889	5231	637	1501	11938	1533	723
1963	58950	9310	12084	1279	4891	48917	1587	2286
1964	190401	13808	10461	169	15313	9657	1906	1342
1965	219170	18962	2718	13826	4083	18048	1513	1831
1966	202800	8680	8816	21102	8039	10747	1263	1197
1967	235410	9038	11606	6841	10359	4500	1353	1445
1968	247048	7723	5652	992	4969	3599	3785	1852
1969	137983	9485	10486	7446	3659	29981	1010	978
1970	191683	6139	7948	4922	2797	54659	1731	1226
1971	194977	11403	10842	17380	5310	95164	2800	3043
1972	104426	6790	10672	10459	15869	34516	1386	3626
1973	122783	62421	8940	23897	14572	19780	1690	2699
1974	102135	31335	19463	30192	5534	10335	4909	5927
1975	97183	33652	11432	15175	7539	14930	4065	5845
1976	123937	34305	9987	7687	10911	19978	5936	12880
1977	117356	20754	10105	7440	16484	19968	3250	6705
1978	119937	11713	21203	24207	7621	25917	3354	6548
1979	116834	15914	6552	25718	11635	18585	6275	15391
1980	69667	11017	7772	12937	4760	18474	3763	10611
1981	146986	7629	4293	7066	5050	16200	3330	5509
1982	143215	7388	13597	11034	12691	10717	5617	7211
1983	154879	5315	55042	1112	16528	12683	6999	5750
1984	147139	6022	41505	6464	13672	11746	6174	6168

Fishes/ Year	OS	OSS	WB	RF	CAR	IM	SF	TU
1985	79225	2473	36227	25142	12839	18101	8458	9850
1986	40613	8934	27158	11880	71584	21876	4857	14786
1987	44717	8697	16599	15295	22771	10063	5181	10611
1988	60508	12701	45994	8952	47069	43938	10162	12913
1989	184879	13752	45127	7179	50219	85272	8029	22288
1990	179276	12900	26859	9751	69068	78335	5372	32615
1991	106263	23730	45273	2167	78726	53980	4600	13111
1992	54118	16967	48217	6162	85122	37909	8734	16219
1993	49675	22819	49477	7290	72289	59172	6447	13257
1994	1554	16482	31710	15435	59580	111879	5837	14395
1995	13328	46131	36682	4641	102762	78462	5910	10977
1996	30607	6737	29737	21884	61970	128411	4828	17923
1997	93636	15573	25821	18974	54680	82429	5151	19471

average annual contribution was 159592 t; then it went down to 116924 t during 1971-80; then to 118143 t during 1981-90 and 67025 t during 1991-97. Percentage contribution of major gears in the annual landings of oil sardine during 1984-97 is given in table 3.

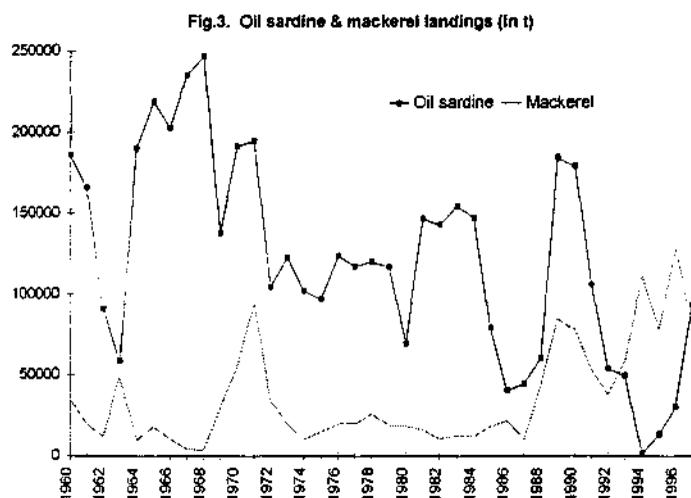


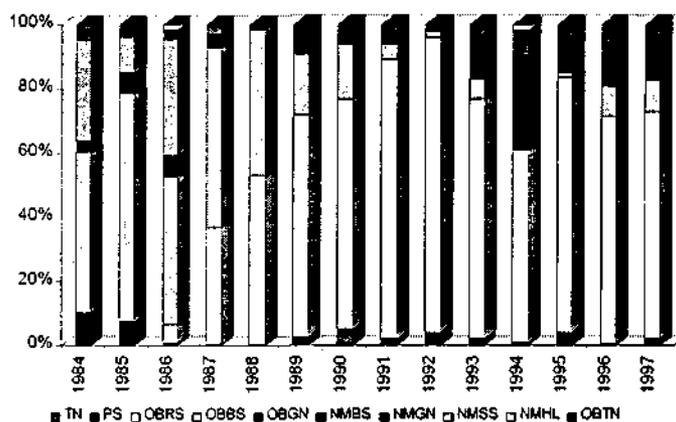
Table 3

Percentage contribution of major gears to oil sardine landings.

Year/ Gear	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
TN	0.1	0.2	--	--	0.1	0.4	3.2	0.2	0.2	0.1	--	0.06	0.09	0.86
PS	10.1	6.9	0.8	0.2	0.1	2.2	1.8	1.8	3.9	2	0.8	4.1	0.5	1.28
OBRS	--	--	5.8	34.6	51	69.1	71.8	86.7	91.5	74.7	60.2	80	70.7	70.38
OBBS	49.5	68.4	46	53	43.5	18.9	17	4.7	2.2	6.4	--	2	9.5	9.88
OBGN	3.3	6.2	6.3	4.3	1.5	8.5	5	3.9	0.8	13.9	29.2	11	13.8	14.18
NMBS	30.6	10.8	35.8	--	--	--	--	--	--	--	--	0.01	0.03	--
NMGN	4.7	3.3	3	2	--	0.4	0.7	2.1	0.6	2.9	7.8	3.8	4.4	3
NMSS	0.1	0.3	1.6	0.3	--	0.19	0.1	--	0.5	--	2	0.07	0.18	0.02
NMHL	--	--	--	0.3	--	--	0.1	--	--	--	--	--	--	--
OBTN	--	--	--	--	--	--	--	--	--	--	--	--	0.8	0.04
Landings (Tonnes)	147139	79225	40613	44717	60508	184879	179276	106263	54118	49675	1554	13328	30607	93636

More than 80 pct of the oil sardine landings during 1984-86 period was shared by OBBS, NMBS, and OBTN. Almost half of it was landed by OBBS alone. After the introduction of OBRS during 1986, it became the major gear for the oil sardine fishery. More than 50 pct of the oil sardine landings during 1988-97 was by this gear. In fact, the share of this gear during 1992 was 91.5 pct (Fig.4).

Fig.4. Percentage contribution of major gears in oil sardine landings (in t)



Prior to the introduction of outboard ring seine during 1984-86, on an average 80 pct of the oil sardine landings was by OBBS and NMBS. From 1987 onwards NMBS has been completely eliminated from the picture. The share of OBBS also started declining from 1988 onwards. In almost all the years oil sardine landings were maximum during the 4th quarter, followed by the first, the third and the second quarters (January-March being the first quarter) (Table 4).

Table 4
Quarterwise oil sardine landings (in t).

Qr / Year	I Qr	II Qr	III Qr	IV Qr	Total
1960	8068	1528	28802	147821	186219
1961	66009	17968	10496	71532	166005
1962	35070	5583	4858	45692	91203
1963	26844	6750	3560	21796	58950
1964	20923	1008	33604	134866	190401
1965	92424	20626	33225	72895	219170
1966	37457	14353	57688	93302	202800
1967	70960	11664	27843	124943	235410
1968	47319	4213	57895	137621	247048
1969	34655	3374	14988	84966	137983
1970	30986	27244	46981	86472	191683
1971	86150	7317	19378	82132	194977
1972	40907	21566	11710	30243	104426
1973	27834	20701	18963	55285	122783
1974	18594	20623	15269	47649	102135
1975	41684	15932	12409	27158	97183
1976	29078	19749	9173	65937	123937
1977	22033	20620	17084	57619	117356
1978	19873	7633	16836	75595	119937

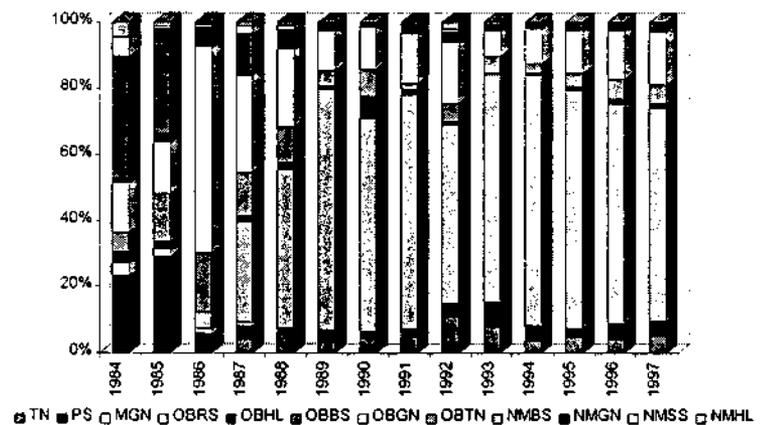
Qr / Year	I Qr	II Qr	III Qr	IV Qr	Total
1979	27340	10665	25578	53251	116834
1980	23766	14401	5952	25548	69667
1981	19768	9225	29520	88473	146986
1982	45012	18998	28629	50576	143215
1983	61285	20977	6463	66154	154879
1984	56146	26054	14082	50857	147139
1985	37235	6881	19244	15865	79225
1986	31184	659	189	8581	40613
1987	1262	723	31540	11192	44717
1988	1304	1540	18905	38759	60508
1989	37496	16073	74671	56639	184879
1990	38137	28726	58066	54347	179276
1991	44562	37468	13165	11068	106263
1992	22620	9796	6634	15068	54118
1993	4495	11505	16211	17464	49675
1994	483	340	368	363	1554
1995	351	32	3889	9056	13328
1996	6817	1462	10871	11457	30607
1997	30188	18305	14906	30237	93636

During 1960-69 the average landings of oil sardine in the fourth quarter was 93543 t, then it went down to 58134 t during 1970-79 and to 41264 t during 1980-89 period and to 18636 t during 1990-'97. Similar trend was noticed during the first quarter also.

3.1.2 Mackerel

Mackerel landings in Kerala varied from 3599 t during 1968 to 128411t in 1996 (Table 2, pg. 4 and Fig.3). It can be observed from the graph that there were two peak landing periods during 1969-73 and 1988-92. The average annual landings of mackerel during 1960-70 was 22510 t, then it went up to 27765 t during 1971-80 and further to 30893 t during 1981-90 and to 78891 t during 1991-'97. Percentage contribution of major gears in the mackerel landings is given in Table 5, Fig.5.

Fig.5. Percentage of contribution of major gears in Mackerel landings (in t)



Qr / Year	I Qr	II Qr	III Qr	IV Qr	Total
1979	27340	10665	25578	53251	116834
1980	23766	14401	5952	25548	69667
1981	19768	9225	29520	88473	146986
1982	45012	18998	28629	50576	143215
1983	61285	20977	6463	66154	154879
1984	56146	26054	14082	50857	147139
1985	37235	6881	19244	15865	79225
1986	31184	659	189	8581	40613
1987	1262	723	31540	11192	44717
1988	1304	1540	18905	38759	60508
1989	37496	16073	74671	56639	184879
1990	38137	28726	58066	54347	179276
1991	44562	37468	13165	11068	106263
1992	22620	9796	6634	15068	54118
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Fig.5. Percentage of contribution of major gears in Mackerel landings (In t)



Table 5

Percentage contribution of major gears to mackerel landings.

Year/ Gear	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
TN	0.1	0.2	1	3.8	6.3	3	4.4	4.6	10.7	7.9	3.7	4.6	4.1	5
PS	23.1	27.9	4.8	3.9	0.5	3.8	1.3	2.2	4	7.3	4.3	2.7	4.8	4.7
MGN	4.1	2.1	1.4	0.9	0.3	0.1	0.3	0.1	0.06	0.1	0.03	0.06	0.02	0.01
OBRs	--	--	4.6	28.9	47	72.4	64.5	67.7	54.1	69	76	72	66.2	64.3
OBHL	3.2	2.1	0.4	1.7	2.2	1.1	6.5	1.7	0.8	0.2	0.4	1	1.5	1.5
OBBS	6	14.3	17.5	12.4	10.5	4.7	8.1	1.7	5.6	5.1	3	4	6	5.4
OBGN	14.8	14.9	61.4	27.4	22.9	11.6	12.7	14.5	18.4	7.5	10.5	13	14.7	16
OBTN	--	--	--	--	--	--	0.2	--	--	--	--	0.02	0.01	0.03
NMBS	1.6	2.8	0.5	--	--	--	--	--	0.02	0.2	0.02	0.02	0.01	0.05
NMGN	36.6	30.3	5.2	11.8	5.2	2	0.8	2	3	1.3	1.6	2	2.06	2.5
NMSS	5.6	0.7	0.8	2.1	1.5	0.7	0.2	0.5	0.8	0.6	0.2	0.15	0.19	0.23
NMHL	4.6	1.2	0.9	1.2	1.1	0.2	0.4	0.8	2.2	0.8	0.2	0.4	0.3	0.3
Landings (Tonnes)	11746	18101	21876	10063	43938	85272	78335	53980	37909	59172	111879	78462	128411	82422

During 1984-86 more than 70 pct of mackerel landings in Kerala was shared by PS, OBGn and NMGN. After the introduction of OBRs in the late 1986, this gear became the major contributor of mackerel landings in Kerala. More than 65 pct of the mackerel landings during 1989-91 was by this gear and it went upto 76% in 1994. After the introduction of OBRs, the role of NMBS became negligible. Generally maximum landings of mackerel were noticed during the fourth quarter, followed by the third and the first quarters (Table 6). Rao (1969) cites Quilon, Alleppy, Cochin, Calicut and Tellicherry as the main production centers for mackerel but at present no such centers of that magnitude exist. The fishery season starts very early in about August in the southern zone and lasts till February.

Table 6

Quarterwise mackerel landings (in t).

Year	I Qr	II Qr	III Qr	IV Qr	Total
1960	6346	27	4304	24827	35504
1961	11345	2009	3358	3352	20064
1962	1357	274	298	10009	11938
1963	3413	703	16711	28090	48917
1964	1405	1287	1142	5823	9657
1965	9033	875	255	7885	18048
1966	935	138	3368	6306	10747
1967	767	29	2180	1524	4500
1968	503	14	248	2834	3599
1969	333	462	11244	17942	29981
1970	8784	5396	9796	30683	54659
1971	53501	29967	722	10974	95164
1972	16727	8602	5015	4172	34516
1973	2546	3539	6657	7038	19780

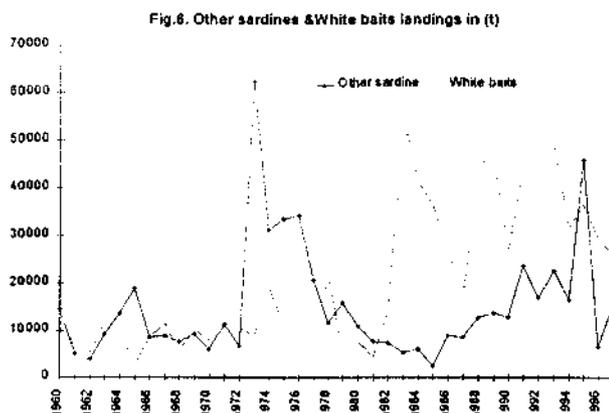
Year	I Qr	II Qr	III Qr	IV Qr	Total
1974	2285	319	2368	5363	10335
1975	5642	7731	199	1358	14930
1976	5760	4773	3434	6011	19978
1977	2865	4283	3534	9286	19968
1978	7411	2835	8868	6803	25917
1979	6864	9875	500	1346	18585
1980	3852	6074	2203	6345	18474
1981	6938	3530	3666	2066	16200
1982	3526	4092	1285	1814	10717
1983	2079	3005	3529	4070	12683
1984	2104	3492	1932	4218	11746
1985	3291	4149	4281	6280	18101
1986	5594	4671	3484	8127	21876
1987	2692	2324	3404	1643	10063
1988	2253	10592	9917	21176	43938
1989	5672	9200	20575	49825	85272
1990	6291	6957	24539	40548	78335
1991	12399	5126	25251	11204	53980
1992	5867	8440	16430	7172	37909
1993	2953	13096	29962	13161	59172
1994	6187	15351	67887	22454	11879
1995	4824	11181	28764	33693	78462
1996	8141	24060	59376	36834	128411
1997	22544	9788	32895	17195	82422

During 1960-'69 on an average 10859 t of mackerel was landed in the fourth quarter. The average fourth quarter landings of mackerel during 1970-79, 1980-89 and 1990-97 were 8303 t, 10516 t and 22783 t respectively.

3.1.3 Whitebaits

The whitebaits are yet another important component in the pelagic group of fishes in Kerala. Their landings in the state varied from 2718 t in 1965 to 55042 t during 1983 (Table 2, pg. 4 and Fig.6). There was a marked increase in the landings of this group from 1982 onwards. The average annual landing of whitebaits during the period 1960-70 was 8662 t, 11697 t during 1971-80 and 31240 t during 1981- 90 and 36702 t during 1991-97.

The percentage contribution of major gears to the whitebaits landings during



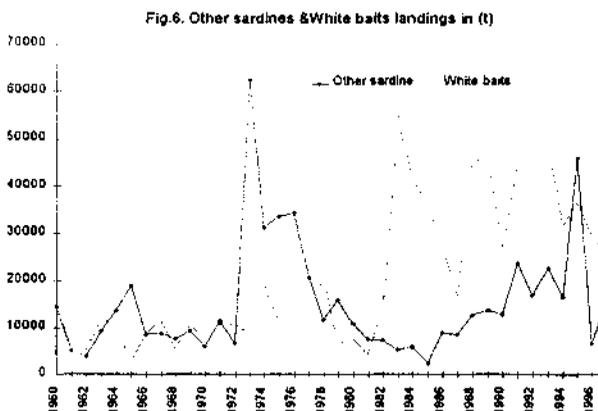
Year	I Qr	II Qr	III Qr	IV Qr	Total
1974	2285	319	2368	5363	10335
1975	5642	7731	199	1358	14930
1976	5760	4773	3434	6011	19978
1977	2865	4283	3534	9286	19968
1978	7411	2835	8868	6803	25917
1979	6864	9875	500	1346	18585
1980	3852	6074	2203	6345	18474
1981	6938	3530	3666	2066	16200
1982	3526	4092	1285	1814	10717
1983	2079	3005	3529	4070	12683
1984	2104	3492	1932	4218	11746
1985	3291	4149	4281	6280	18101
1986	5594	4671	3484	8127	21876
1987	2692	2324	3404	1643	10063
1988	2253	10592	9917	21176	43938
1989	5672	9200	20575	49825	85272
1990	6291	6957	24539	40548	78335
1991	12399	5126	25251	11204	53980
1992	5867	8440	16430	7172	37909
1993	2953	13096	29962	13161	59172
1994	6187	15351	67887	22454	11879
1995	4824	11181	28764	33693	78462
1996	8141	24060	59376	36834	128411
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The percentage contribution of major gears to the whitebaits landings during



1984-97 is given in table 7 and Fig.7.

Table 7

Percentage contribution of major gears in whitebaits landings.

Year/ Gear	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
TN	2.6	3.2	7.9	23.4	13.4	20	14.9	24	18.1	24.7	28	17.8	28.1	51.5
PS	0.1	--	--	--	--	--	--	0.4	0.04	--	--	--	--	--
OBRS	--	--	21.5	--	8.4	48	46.4	14	63.5	51.8	52.7	68	61	30.8
OBBS	52.1	70.5	40.4	19.4	64.5	7.3	0.8	18.8	5.4	1.3	5.6	--	--	8.7
OBGN	12.2	1.6	0.6	2.4	2.4	--	--	16	0.1	0.1	1.7	0.03	0.2	0.3
NMBS	15.4	6.8	9.8	--	1.2	3.5	2.5	1.5	0.8	6.6	1.7	6.4	0.5	1.8
NMGN	7.2	8.1	11.2	25	3.4	8.1	6.4	13	5.6	8	3.5	2.1	3.2	2.9
NMSS	6	9.5	8.2	27.2	5.2	12.7	28.6	12.3	5.8	7.3	6.8	4.3	5.2	3.5
NMHL	3.9	--	--	--	0.2	--	--	--	--	--	--	--	--	0.04
OBTN	--	--	--	--	--	--	--	--	--	0.2	--	--	--	--
Total landings	41505	36227	27158	16599	45994	45127	26859	45273	48217	49477	31710	36682	29737	25821

During the period 1984-85, more than 50 pct of the whitebaits landings was by OBBS. The contribution of purse-seine was very meager. On an average maximum whitebaits landing was observed during the fourth quarter (Table 8).

Fig.7. Percentage contribution of major gears in white bait landings (in t)

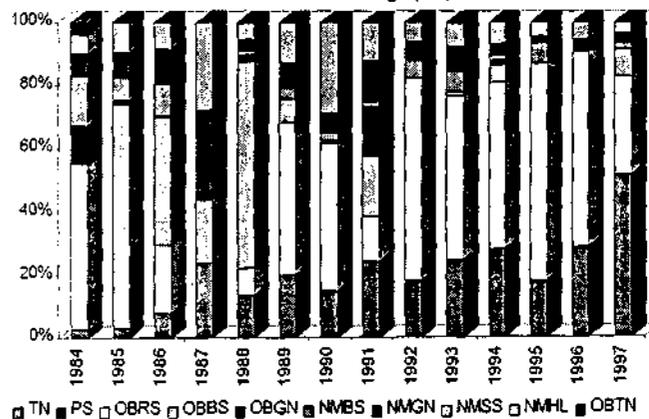


Table 8

Quarterwise whitebaits landings (in t).

Year	I Qr	II Qr	III Qr	IV Qr	Total
1960	367	2247	10350	1200	14164
1961	1811	1617	1226	1458	6112
1962	496	292	2600	1843	5231
1963	236	614	4515	6719	12084
1964	644	1046	6796	1975	10461
1965	76	407	1262	973	2718
1966	1489	3946	480	2901	8816
1967	3017	1498	1480	5611	11606
1968	839	1511	1083	2219	5652
1969	1444	505	2970	5567	10486
1970	858	240	1177	5673	7948
1971	893	315	3865	5769	10842

Year	I Qr	II Qr	III Qr	IV Qr	Total
1972	186	1001	1280	8205	10672
1973	846	749	6595	750	8940
1974	703	4103	4835	9822	19463
1975	823	4898	1480	4231	11432
1976	1104	2270	1331	5282	9987
1977	668	2072	4116	3249	10105
1978	4427	1024	8319	7433	21203
1979	2148	1529	463	2412	6552
1980	1606	1174	2123	2869	7772
1981	142	1373	1073	1705	4293
1982	523	7475	3555	2044	13597
1983	1060	5532	25063	23387	55042
1984	2119	2222	26186	10978	41505
1985	1977	3038	14133	17079	36227
1986	2140	3628	7533	13857	27158
1987	694	3226	6500	6179	16599
1988	1537	4545	24645	15267	45994
1989	1652	21916	6556	15003	45127
1990	1814	7691	8094	9260	26859
1991	2129	5591	11610	25943	45273
1992	3916	5295	22867	16139	48217
1993	7348	18975	13404	9750	49477
1994	3857	10553	13143	4157	31710
1995	2180	12395	9567	12540	36682
1996	3359	4853	6496	15029	29737
1997	4192	5100	8647	7882	25821

followed by the third quarter. The annual average whitebaits landing during the fourth quarter of the years 1960-69, 1970-79, 1980-89 and 1990-97 was 3047 t, 4399 t, 10871 and 12588 t respectively.

3.1.4 Other sardines

Other sardine landings in Kerala varied from 2473 t in 1985 to 62421 t during 1973 (Table 2, pg. 4 and fig. 6). Peak landings were noticed during the period 1973-77. After the introduction of OBRS during 1986, there was an increasing trend in the landings of other sardines. On an average 9705 t of other sardines was landed during 1960-70, it went up to 23930 t during 1971-80 and down to 10542 t during 1981-92 and to 21448 t during 1993-97.

Gearwise percentage contribution of other sardines landings is given in table 9, Fig. 8.

Year	I Qr	II Qr	III Qr	IV Qr	Total
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1974	703	4103	4835	9822	19463
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1984	2119	2222	26186	10978	41505
1985	1977	3038	14133	17079	36227
1986	2140	3628	7533	13857	27158
1987	694	3226	6500	6179	16599
1988	1537	4545	24645	15267	45994
1989	1652	21916	6556	15003	45127
1990	1814	7691	8094	9260	26859
1991	2129	5591	11610	25943	45273
1992	3916	5295	22867	16139	48217
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Gearwise percentage contribution of other sardines landings is given in table 9, Fig. 8.

Table 9

Percentage contribution of other sardines in different gears.

Year / Gear	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
TN	0.1	--	0.5	0.4	2.4	1	1.4	0.3	1.8	0.3	0.7	0.2	1.5	0.3
PS	8.4	8	2.9	--	--	0.6	0.3	2	5.2	4	2	2.2	0.3	1.5
OBRS	--	--	6.9	17	47.3	74.4	77.4	76.9	75.4	57.7	63	82.1	48.2	62.2
OBBS	2.7	23.1	10.5	44.2	11.1	2.8	1	5	1.1	3.6	7.3	4.7	0.2	5.1
OBGN	18.7	12.8	6.6	10.7	4	7.6	9.2	1.7	4.6	23	16.1	5.2	25.4	13.1
NMBS	37	1.6	13.3	--	--	0.9	0.3	--	0.2	0.2	--	0.04	0.3	0.1
NMGN	23.7	30.1	46.3	16.1	29.7	10.5	8.1	5.9	9	7.4	6.4	4.6	17.5	15.5
NMSS	7.9	14.7	12	10.4	3.8	1.5	1.9	7	2.4	3.4	4.5	0.9	6.5	1.3
Year / Gear	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
NMHL	1.1	--	--	--	1.5	0.3	--	--	--	--	--	0.05	--	0.7
Total landings	6022	2473	8934	8697	12701	13752	12900	23730	16967	22819	16482	46131	6737	15573

Fig.8. Percentage Contribution of major gear in other sardine landings (in t)

It is interesting to note that more than 70 pct of other sardines landings was by OBRS during the period 1989-92. In the case of other sardines also, maximum landings were noticed generally in the fourth quarter, during 1960-97 (Table 10).

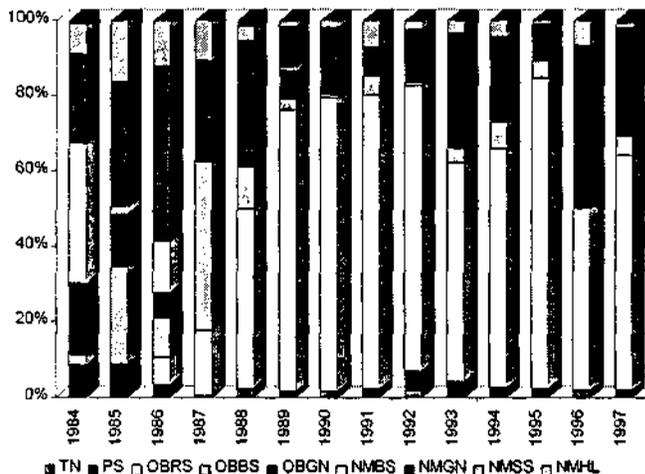


Table 10

Quarterwise other sardine landings (in t).

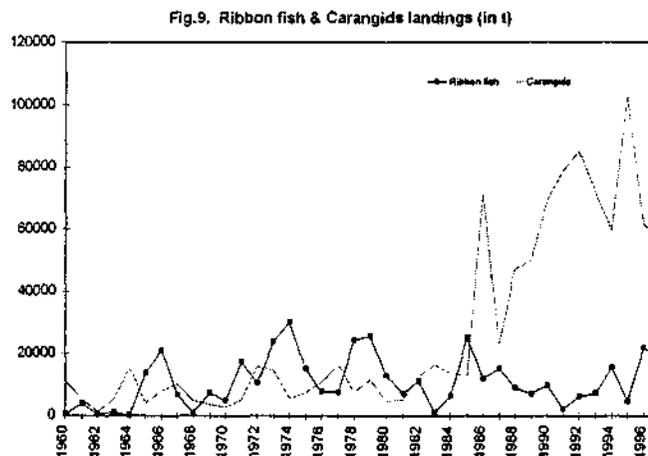
Year	I Qr	II Qr	III Qr	IV Qr	Total
1960	5965	1721	3963	2855	14504
1961	2251	2012	722	228	5213
1962	731	309	416	2433	3889
1963	1934	941	1521	4914	9310
1964	3158	859	4462	5329	13808
1965	7935	1978	5601	3448	18962
1966	1368	1072	2256	3984	8680
1967	814	1525	1989	4710	9038
1968	2433	1902	522	2866	7723
1969	2512	1963	2742	2268	9485
1970	2227	588	564	2760	6139
1971	462	385	5664	4892	11403

Year	I Qr	II Qr	III Qr	IV Qr	Total
1972	1642	2191	1365	1592	6790
1973	5153	5397	20478	31393	62421
1974	4342	1891	14024	11078	31335
1975	4124	9656	3882	15990	33652
1976	6006	5152	15596	7551	34305
1977	7258	5079	3451	4966	20754
1978	1037	2820	1949	5907	11713
1979	1284	2733	1193	10704	15914
1980	2642	1586	2147	4642	11017
1981	1557	1736	379	3957	7629
1982	1014	1489	4009	876	7388
1983	2114	1299	779	1123	5315
1984	1478	665	1971	1908	6022
1985	511	487	220	1255	2473
1986	1474	3130	97	4233	8934
1987	3302	1884	639	2872	8697
1988	1614	2591	177	8319	12701
1989	2282	2108	656	8706	13752
1990	1513	813	368	10206	12900
1991	14594	1072	784	7280	23730
1992	1950	697	5162	9158	16967
1993	3035	758	1013	18013	22819
1994	824	583	636	14439	16482
1995	1094	750	2267	42020	46131
1996	636	1627	1500	2974	6737
1997	1965	964	306	12338	15573

The average landings of other sardines during fourth quarter of 1960-69, 1970-79, 1980-92 and 1993-97 were 3304 t, 9683 t, 4421 t and 17957 t respectively.

3.1.5 Carangids

The maximum landing of 102762 t of carangids during the period 1960-97 was noticed in 1995 and the minimum of 1501 t in the year 1962 (Table 2, pg. 4 and Fig 9). There is an increasing trend in the carangids landings during the period 1986-97. During the period 1960-70, on an average 6556 t of carangids landed in Kerala, it was 10024 t, 40444 t and 70136 t respectively during 1971-80 1981-92 and 1993-97 thereby showing an increasing trend in the landing over the years.



Year	I Qr	II Qr	III Qr	IV Qr	Total
1972	1642	2191	1365	1592	6790
1973	5153	5397	20478	31393	62421
1974	4342	1891	14024	11078	31335
1975	4124	9656	3882	15990	33652
1976	6006	5152	15596	7551	34305
1977	7258	5079	3451	4966	20754
1978	1037	2820	1949	5907	11713
1979	1284	2733	1193	10704	15914
1980	2642	1586	2147	4642	11017
1981	1557	1736	379	3957	7629
1982	1014	1489	4009	876	7388
1983	2114	1299	779	1123	5315
1984	1478	665	1971	1908	6022
1985	511	487	220	1255	2473
1986	1474	3130	97	4233	8934
1987	3302	1884	639	2872	8697
1988	1614	2591	177	8319	12701
1989	2282	2108	656	8706	13752
1990	1513	813	368	10206	12900
1991	14594	1072	784	7280	23730
1992	1950	697	5162	9158	16967
1993	3035	758	1013	18013	22819
1994	824	583	636	14439	16482
1995	1094	750	2267	42020	46131
1996	636	1627	1500	2974	6737
1997	1965	964	306	12338	15573

The average landings of other sardines during fourth quarter of 1960-69, 1970-79, 1980-92 and 1993-97 were 3304 t, 9683 t, 4421 t and 17957 t respectively.

3.1.5 Carangids

The maximum landing of 102762 t of carangids during the period 1960-97 was noticed in 1995 and the minimum of 1501 t in the year 1962 (Table 2, pg. 4 and Fig 9). There is an increasing trend in the carangids landings during the period 1986-97. During the period 1960-70, on an average 6556 t of carangids landed in Kerala, it was 10024 t, 40444 t and 70136 t respectively during 1971-80 1981-92 and 1993-97 thereby showing an increasing trend in the landing over the years.

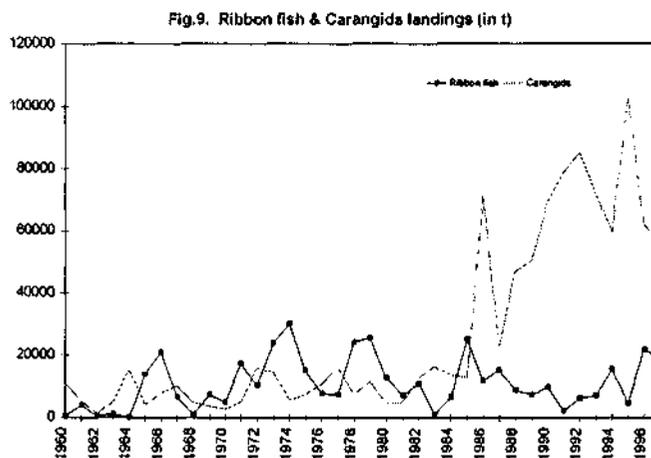


Table 11

Percentage contribution of carangids in different gears

Year / Gear	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
TN	7.2	14.2	5.2	34	28	31.3	33.8	24.1	29.1	52.7	53.5	21.5	51.9	50
PS	5.5	0.2	0.4	0.6	0.7	1.3	--	0.1	0.2	0.6	--	0.2	1.4	0.17
MGN	2.9	3.5	0.7	1	1	0.2	0.3	0.1	0.05	0.1	--	0.03	0.1	0.16
OBRS	--	--	15.5	14.2	27.1	27	41.1	62	56.7	23.1	27.9	66.3	20	25
OBHL	14	22	0.8	11.7	5.5	8.5	6.2	1.2	2	2.7	2.6	5.7	11	10
OBBS	4.4	4.2	67.8	9	14.2	1.1	0.2	0.4	3.8	3.4	1.4	0.9	1.74	1
OBGN	7.5	9.7	3	5.6	3.8	15.7	9.3	2.1	1.7	6.8	3.9	2.1	5.4	7.4
OBTN	--	--	--	--	--	0.1	0.6	--	--	--	--	0.02	0.4	0.12
NMBS	12.4	12.1	2.3	--	0.1	0.7	2.2	0.2	0.7	3.1	--	0.2	0.3	0.86
NMGN	22.5	13	1	3.9	1.6	2.1	1.4	0.7	1.3	0.9	0.9	1	1	1.3
NMSS	11.5	10	0.8	10.9	10.8	3.7	3.2	6.1	2.2	4.2	7.8	0.9	4.7	1.19
NMHL	12.1	10.3	0.9	4.1	2.9	1.8	1.1	2	1.8	2.3	1.6	0.8	1.9	1.8
MHL	--	--	--	--	--	--	--	--	--	0.1	0.4	0.2	0.2	0.38

Fig.10. Percentage contribution of major gears in carangid landings (in t)

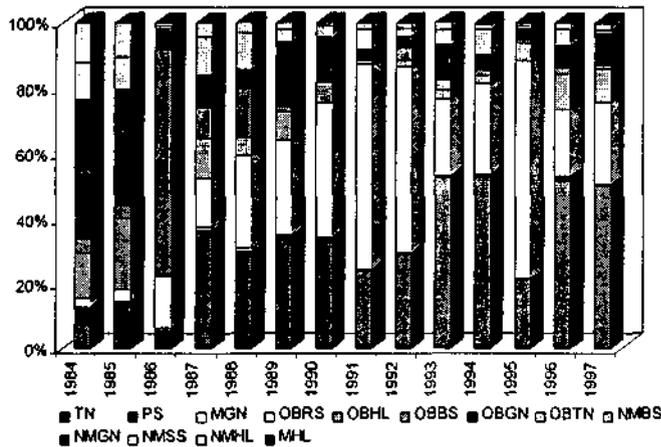


Table 11 and Fig. 10 show the percentage contribution of different gears to the carangids landings in Kerala during the period 1984-97. At present TN and OBRS are the two major gears for carangids fishing in Kerala. In fact 62 pct of the carangids landing in Kerala during 1991 was by OBRS. In most of the years maximum landing was noticed in the third quarter followed by the fourth

quarter (table 12). The maximum average annual in the third quarter landings was observed during 1993-97 (30685 t) followed by 17785 t, 3948 t and 3338 t during 1980-92, 1970-79 and 1960-69 respectively.

Table 12

Quarterwise carangids landings (in t).

Year	I Qr	II Qr	III Qr	IV Qr	Total
1960	584	563	9364	686	11197
1961	414	801	3185	911	5311
1962	393	103	559	446	1501
1963	349	476	1811	2255	4891
1964	637	510	6108	8058	15313
1965	332	343	2822	586	4083
1966	495	390	4787	2367	8039
1967	581	600	1966	7212	10359
1968	466	475	2109	1919	4969
1969	1094	349	667	1549	3659
1970	1081	349	137	1230	2797
1971	1024	200	1117	2969	5310
1972	2083	4116	2442	7228	15869
1973	1495	1049	5634	6394	14572
1974	1592	1713	704	1525	5534
1975	904	2487	859	3289	7539
1976	1139	1712	4735	3325	10911
1977	740	1871	12042	1831	16484
1978	1593	782	2904	2342	7621
1979	1307	104	8904	1320	11635
1980	899	606	1649	1606	4760
1981	1192	1046	883	1929	5050
1982	3443	3840	1322	4086	12691
1983	4506	5059	3036	3927	16528
1984	2808	3762	2919	4183	13672
1985	2204	2255	2957	5423	12839
1986	1574	2327	32520	35163	71584
1987	4549	4432	8934	4856	22771
1988	3386	5626	15462	22595	47069
1989	5390	6174	22781	15874	50219
1990	4199	14672	36831	13366	69068
1991	4622	9972	42762	21370	78726
1992	7110	10268	48511	19233	85122
1993	9139	17303	32108	13735	72289
1994	7812	15758	25798	10212	59580
1995	6094	12704	69249	14715	102762
1996	9317	19173	15631	17849	61970
1997	16566	12730	10639	10336	50271

3.1.6 Tunnies

Tunnies landing in Kerala during 1960-97 varied from 723 t in 1962 to 32615 t in 1990 (Table 2, pg. 4 and fig. 11). There is an increasing trend in the landings of tunnies from 1974 onwards. Maximum landing was noticed during 1985-97. During 1960-70, 1971-80, 1981-92 and 1993-97 the annual average landing of tunnies was 1954 t, 7328 t, 13050 t and 15205 t respectively. The percentage contribution of different gears to tunnies landings in Kerala is given in table 13 & fig. 12.

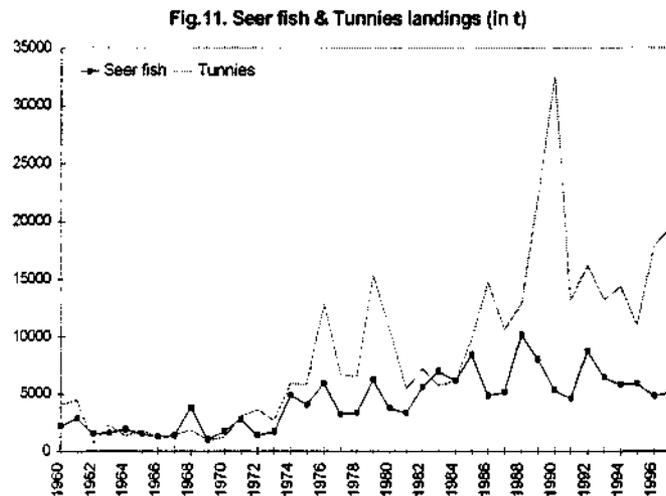
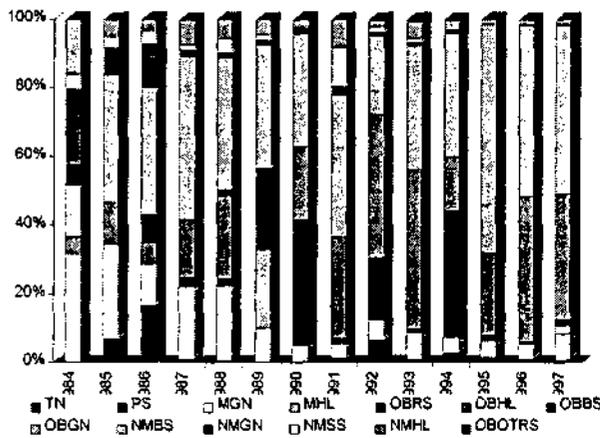


Table 13

Percentage contribution of tunnies by different gears.

Year/ Gear	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
TN	--	--	--	--	--	--	--	0.9	0.1	0.1	0.1	0.07	0.1	0.6
PS	--	6.2	15.7	0.9	0.5	--	--	0.2	6.4	0.7	2.8	1.4	0.8	0.2
MGN	31.6	25.8	11.1	21.1	21.7	10.1	5	4.4	6	7.9	4.2	4.4	4.4	7.4
MHL	--	--	0.1	0.4	0.2	22.6	--	0.2	0.1	0.3	0.5	0.6	0.4	2.8
OBR5	--	--	--	2.4	1.8	23.6	36.4	1.4	18.2	0.7	36.5	1.3	0.06	1.9
OBHL	5	11.2	5.9	16.6	24.1	--	21	29.5	41.4	46.4	15.8	24.2	42.5	36.2
OBBS	--	--	7.5	--	1.7	--	--	--	--	--	--	--	0.1	--
OBGN	15	34.1	34.6	47.1	37.9	35.8	32.8	41.1	23	36.4	36.1	66.4	49.6	48.8
NMBS	6.2	--	8.3	--	0.4	--	--	--	--	--	--	--	--	--
NMGN	21.4	7.4	3.9	2	1.3	1.2	1.8	2.8	0.8	0.6	0.8	0.02	--	0.2
NMSS	4.6	3	3.6	1.6	3.9	1.5	0.3	11.5	2	1.5	0.2	0.09	0.3	0.18
NMHL	16	4.7	3.1	7.3	5.8	4.6	2.3	8	1.9	4.9	3	1.4	1.5	1.3
OBOTRS	--	--	--	--	--	--	--	--	--	0.5	--	--	--	--
Total landings	6168	9850	14786	10178	12913	22288	32615	13111	16219	13257	14395	11088	17923	16018

Fig. 12. Percentage contribution of major gears in Tunnies landings



The gears operated from the OB engine boats for the tunnies and seerfishes were the same as those operated during the later half of the eighties. The contribution by mechanized gillnetters is showing a declining trend. The quarterwise tunnies landings are given in table 14. On an average the maximum of 4490 t was landed in the fourth quarter during 1980-97, followed by 3785 t in the second quarter.

Table 14

Quarterwise tunnies landings (in t)

Year	I Qr	II Qr	III Qr	IV Qr	Total
1960	1208	571	115	2218	4112
1961	1626	1110	750	1017	4503
1962	218	239	70	196	723
1963	1294	290	142	560	2286
1964	159	620	17	546	1342
1965	485	624	16	706	1831
1966	368	247	68	514	1197
1967	175	789	99	382	1445
1968	564	317	50	921	1852
1969	486	163	32	297	978
1970	231	710	93	192	1226
1971	537	813	13	1680	3043
1972	1252	1752	180	442	3626
1973	504	926	715	554	2699
1974	1553	2610	257	1507	5927
1975	1012	2265	468	2100	5845
1976	6142	3917	916	1905	12880
1977	824	2900	1164	1817	6705
1978	1010	2653	1554	1331	6548
1979	1068	10342	2902	1079	15391
1980	1111	8479	329	692	10611
1981	478	2910	631	1490	5509
1982	1907	2561	1659	1084	7211
1983	930	1194	2107	1519	5750
1984	1114	2278	877	1899	6168
1985	1073	3621	1950	3206	9850
1986	1417	5011	1819	6539	14786
1987	1047	1812	5023	2729	10611
1988	1302	3127	4476	4008	12913

Year	I Qr	II Qr	III Qr	IV Qr	Total
1989	1435	4358	5628	10867	22288
1990	2849	8687	4303	16776	32615
1991	3473	3778	2227	3633	13111
1992	2269	1639	4061	8250	16219
1993	1647	6285	2286	3039	13257
1994	1996	2831	7472	2096	14395
1995	999	3284	3040	3654	10977
1996	3722	6417	2787	4997	17923
1997	2626	5649	3283	4460	16018

3.1.7 Seerfishes

During the period 1960-97, the minimum landing of 1010 t seerfishes was noticed in 1969 and the maximum of 10162 t in 1988 (Table 2, pg. 4 and fig. 11). An increasing trend in seerfish landing was observed during 1982-90. The average annual landings of seerfish during 1960-70, 1971-80, 1981-92 and 1993-97 were 1889 t, 3743 t, 6460 t and 5635 t respectively. The maximum landing of seerfish was observed during the fourth quarter in most of the years (Table 15). Of late, an increasing trend in the landings was observed.

Table 15

Quarterwise seerfish landings (in t).

Year	I Qr	II Qr	III Qr	IV Qr	Total
1960	541	89	97	1482	2209
1961	519	138	1297	931	2885
1962	248	54	111	1120	1533
1963	252	13	43	1279	1587
1964	453	90	86	1277	1906
1965	419	22	42	1030	1513
1966	208	46	104	905	1263
1967	140	62	95	1056	1353
1968	2882	74	17	812	3785
1969	279	13	54	664	1010
1970	718	43	45	925	1731
1971	1338	37	7	1418	2800
1972	598	124	56	608	1386
1973	315	82	75	1218	1690
1974	873	509	338	3189	4909
1975	443	695	552	2375	4065
1976	2049	134	1653	2100	5936
1977	545	320	846	1539	3250
1978	578	311	635	1830	3354
1979	1035	174	1513	3553	6275
1980	1112	571	359	1721	3763

Year	I Qr	II Qr	III Qr	IV Qr	Total
1989	1435	4358	5628	10867	22288
1990	2849	8687	4303	16776	32615
1991	3473	3778	2227	3633	13111
1992	2269	1639	4061	8250	16219
1993	1647	6285	2286	3039	13257
1994	1996	2831	7472	2096	14395
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1967	140	62	95	1056	1353
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1970	718	43	45	925	1731
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1973	315	82	75	1218	1690
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1978	578	311	635	1830	3354
1979	1035	174	1513	3553	6275
1980	1112	571	359	1721	3763

Year	I Qr	II Qr	III Qr	IV Qr	Total
1981	465	216	216	2433	3330
1982	1557	399	646	3015	5617
1983	1139	219	1696	3945	6999
1984	718	498	1423	3535	6174
1985	1038	403	1015	6002	8458
1986	490	378	1103	2886	4857
1987	664	650	912	2955	5181
1988	794	1015	1880	6473	10162
1989	1121	364	1983	4561	8029
1990	1043	487	915	2927	5372
1991	846	302	266	3186	4600
1992	1289	583	597	6265	8734
1993	1338	1070	1051	2988	6447
1994	1931	437	1353	2116	5837
1995	453	467	768	4222	5910
1996	1228	1215	537	1848	4828
1997	1049	935	1067	1165	4216

Average seerfish landings of 1056 t, 1876 t, 3852 t and 1930 t were recorded in the fourth quarter of 1960-69, 1970-79, 1980-92 and 1993-97 respectively. Gearwise percentage contribution to seerfish landings is given in table 16 & fig. 13. The main contributors were MGN and OBGN. Of late, OBGN is assuming a major role in the harvest of seerfishes.

Fig. 13. Percentage contribution of major gears in Seerfish landings

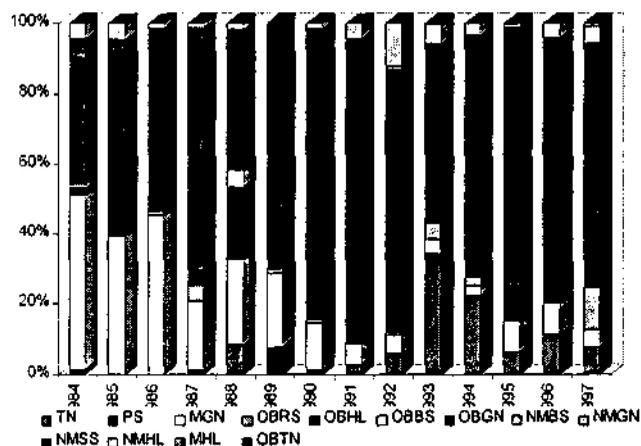


Table 16

Percentage contribution of major gears to seerfish landings

Year/ Gear	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
TN	--	--	--	1	8.3	0.9	1.2	2.7	5.8	34.2	22.2	6.2	11.4	7.6
PS	1.3	--	--	--	--	6.7	--	--	--	--	--	--	--	--
MGN	49.7	39.2	45.1	19.4	23.8	20.5	12.9	5.7	5	4.2	2.8	8.7	8.6	4.9
OBRS	--	--	--	4.3	--	1.1	1.1	0.5	1	4.5	2.6	0.6	0.16	12
OBHL	2.1	1.2	0.3	4.5	20.8	17.3	1	4.2	4.8	7.3	5.4	9.4	14.4	21.1
OBBS	0.9	--	0.9	--	4.9	--	--	--	--	--	--	0.15	--	0.1
OBGN	22.9	53	51	66.2	38.5	51.8	79.6	80.6	69.5	43.6	63.6	73.3	60.6	48.3
NMBS	0.5	--	--	--	--	--	--	--	0.9	--	--	0.03	--	--

Year / Gear	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
NMGN	12.7	1.9	1	2	0.9	--	--	0.9	0.3	0.4	--	0.01	0.3	0.2
NMSS	5.1	--	0.2	0.3	--	0.2	--	--	--	0.1	0.1	0.27	0.1	--
NMHL	4.5	4.5	1.2	1.3	1.8	--	1.5	4.3	12	5.4	3.3	0.64	4	4.9
MHL	--	--	--	--	--	--	--	--	--	0.2	--	0.5	0.08	0.9
OBTN	--	--	--	--	--	--	--	--	--	0.1	--	0.03	--	--
Total landings	6174	8458	4857	5181	10162	8029	5372	4600	8734	6447	5837	5910	4828	4216

3.1.8 Ribbonfishes

The catch of ribbonfishes varied from 169 t in 1964 to 30192 t in 1974 (Table 2, pg. 4 and fig. 9). There were wide fluctuations in the landings over the years. On an average 5627 t, 17509 t, 9350 t and 13645 t of ribbonfish were landed annually during 1960-70, 1971-80, 1981-92 and 1993-97 respectively. The maximum landing was observed during the third quarter of almost all the years (Table 17).

Table 17
Quarterwise ribbonfish landings (in t).

Year	I Qr	II Qr	III Qr	IV Qr	Total
1960	57	216	349	14	636
1961	5	1191	2814	37	4047
1962	4	22	568	43	637
1963	18	214	1043	4	1279
1964	1	21	144	3	169
1965	32	7003	6769	22	13826
1966	21	6733	7635	6713	21102
1967	1726	2340	1553	1222	6841
1968	67	342	348	235	992
1969	31	176	7237	2	7446
1970	39	45	1761	3077	4922
1971	298	551	3203	13328	17380
1972	516	3522	5460	961	10459
1973	1218	2490	18990	1199	23897
1974	819	3704	23384	2285	30192
1975	758	2320	11005	1092	15175
1976	480	1419	5328	460	7687
1977	37	262	6852	289	7440
1978	1153	3418	17984	1652	24207
1979	92	2547	20770	2309	25718
1980	48	1175	11577	137	12937
1981	36	579	6178	273	7066
1982	15	1281	9210	528	11034
1983	27	42	871	172	1112
1984	42	2457	3672	293	6464

Year / Gear	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
NMGN	12.7	1.9	1	2	0.9	--	--	0.9	0.3	0.4	--	0.01	0.3	0.2
NMSS	5.1	--	0.2	0.3	--	0.2	--	--	--	0.1	0.1	0.27	0.1	--
NMHL	4.5	4.5	1.2	1.3	1.8	--	1.5	4.3	12	5.4	3.3	0.64	4	4.9
MHL	--	--	--	--	--	--	--	--	--	0.2	--	0.5	0.08	0.9
OBTN	--	--	--	--	--	--	--	--	--	0.1	--	0.03	--	--
Total landings	6174	8458	4857	5181	10162	8029	5372	4600	8734	6447	5837	5910	4828	4216

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1964	1	21	144	3	169
1965	32	7003	6769	22	13826
1966	21	6733	7635	6713	21102
1967	1726	2340	1553	1222	6841
1968	67	342	348	235	992
1969	31	176	7237	2	7446
1970	39	45	1761	3077	4922
1971	298	551	3203	13328	17380
1972	516	3522	5460	961	10459
1973	1218	2490	18990	1199	23897
1974	819	3704	23384	2285	30192
1975	758	2320	11005	1092	15175
1976	480	1419	5328	460	7687
1977	37	262	6852	289	7440
1978	1153	3418	17984	1652	24207
1979	92	2547	20770	2309	25718
1980	48	1175	11577	137	12937
1981	36	579	6178	273	7066
1982	15	1281	9210	528	11034
1983	27	42	871	172	1112
1984	42	2457	3672	293	6464

Year	I Qr	II Qr	III Qr	IV Qr	Total
1985	135	3857	14024	7126	25142
1986	285	1486	4938	5171	11880
1987	355	3416	9862	1662	15295
1988	693	2702	467	5090	8952
1989	13	522	1049	5595	7179
1990	221	90	7353	2087	9751
1991	29	566	700	872	2167
1992	74	82	2112	3894	6162
1993	1352	760	1694	3484	7290
1994	1856	565	3100	9914	15435
1995	423	479	1526	2213	4641
1996	145	992	10621	10126	21884
1997	1393	4184	6244	7155	18976

The average third quarter landing was maximum during 1970-79 (10857 t). NMBS was the major gear employed during the period 1984-87 and 1990, while the TN was the predominant gear during 1988-97, except in 1990 (Table 18, Fig. 14).

Fig. 14. Percentage contribution of major gears in Ribbon fish landings

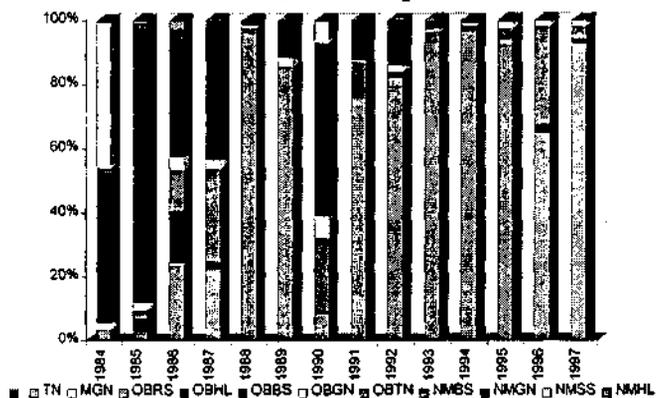


Table 18

Percentage contribution of major gears to ribbonfish landings.

Year / Gear	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
TN	3.4	2.1	23.2	22.2	95.3	84.3	8.6	75.2	79	93.1	96.5	87.2	61.8	91
MGN	--	0.7	1.1	0.3	--	--	0.1	--	--	--	--	--	0.04	0.02
OBRS	--	--	--	--	--	--	0.2	0.6	2.9	0.4	0.2	2	0.03	0.07
OBHL	--	4.1	15.9	2.2	--	--	--	--	1.5	0.1	1.1	--	2.45	1
OBBS	--	2.2	12.6	28.7	1.5	--	23	10.2	--	2.5	0.5	3	28.7	3.7
OBGN	2.3	2.7	4.5	3	0.8	3	6.8	0.7	2.1	1.2	0.9	2.3	1.8	2.2
OBTN	--	--	--	--	--	--	0.5	--	0.1	--	--	0.3	--	0.03
NMBS	46.3	85.3	36.3	41.9	1.5	11.6	53	12.3	13.8	2.3	0.7	0.08	--	--
NMGN	1.4	1.4	2.6	1	--	--	--	--	--	--	--	--	0.04	--
NMSS	45	--	0.5	--	--	--	7	--	0.2	0.2	--	0.08	0.03	0.03
NMHL	0.6	0.9	2.6	0.3	--	--	--	--	--	0.2	--	--	0.28	--
Total landings	6464	25142	11880	15295	8952	7179	9751	2167	6162	7290	15435	4641	21884	18976

3.2 Demersal resources

During the period 1950-92, the landings of demersal group of fishes varied from 23418 t in 1953 to 278012 t in 1994. There was not much variation in the landings of this group during 1950-65. Large scale introduction of trawlers in the 70's brought about increased landings of the demersal groups of fishes in Kerala (Table 1, pg. 3 and fig. 2). During the 80's, modification to the craft and gears and extension of the fishing grounds resulted in higher landings of this group.

Among the demersal resources the dominant ones are the catfishes, perches, croakers, lizardfishes, elasmobranchs, flatfishes, big-jawed jumper, silverbellies, goatfishes, penaeid prawns and cephalopods.

3.2.1 Catfishes

The contribution of catfishes varied from 1029 t in 1992 to 33526 t in 1974 (Table 19 and Fig. 15).

Table 19

Important demersal resources of Kerala (in t).

Name of fish/ Year	ELA	CF	LF	PER	CR	SB	BJ	FF	PP	CEP	GF
1960	7721	11199	16	2424	4478	5809	6368	12715	12798	417	5
1961	8515	3114	5	1316	2501	6060	1426	5882	20627	28	226
1962	3342	1703	339	913	1228	5285	1409	16189	29688	17	526
1963	10509	2007	78	831	1674	4548	2169	7485	22228	180	557
1964	7218	2248	62	791	3647	9100	990	4324	35220	340	189
1965	5969	3565	199	1057	3267	9893	1332	7312	14327	174	305
1966	8080	5793	173	1286	4921	12970	2393	4736	28120	714	2782
1967	7330	7536	192	1717	4310	11987	4824	3201	27164	374	164
1968	4175	4173	581	1649	3630	7099	1771	9495	25356	1122	495
1969	5759	6245	546	2340	3195	14019	1301	10039	34334	164	1548
1970	7490	16380	1066	4336	6392	16167	1443	10212	36940	86	279
1971	4889	15189	1395	3663	4145	8630	2991	8807	31294	473	1573
1972	6986	12636	1426	3939	6137	5057	3034	6119	35866	350	2960
1973	8852	17438	1136	8663	11723	18392	6663	8549	84770	339	1537
1974	10338	33526	8839	20970	9220	17523	2904	12771	59815	2175	3881
1975	10292	32603	11294	14741	16811	5211	983	6932	77207	3342	23
1976	7308	12743	99	3069	6955	2727	468	3567	34478	872	2577
1977	5796	7947	5169	14121	11965	7708	823	5778	40150	4973	240
1978	9302	9125	6246	24989	13045	3040	1533	7276	45034	6516	171
1979	6954	11328	5326	20239	5237	3597	253	4487	29522	2976	127
1980	6803	13936	7080	17814	6164	4148	861	4394	52633	4244	1
1981	4871	9562	5691	8549	3145	2826	879	4876	22268	2376	33
1982	6343	9532	5480	11179	3581	8730	1609	11422	26708	3536	244

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Among the demersal resources the dominant ones are the catfishes, perches, croakers, lizardfishes, elasmobranchs, flatfishes, big-jawed jumper, silverbellies, goatfishes, penaeid prawns and cephalopods.

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1960	7721	11199	16	2424	4478	5809	6368	12715	12798	417	5
1961	8515	3114	5	1316	2501	6060	1426	5882	20627	28	226
1962	3342	1703	339	913	1228	5285	1409	16189	29688	17	526
1963	10509	2007	78	831	1674	4548	2169	7485	22228	180	557
1964	7218	2248	62	791	3647	9100	990	4324	35220	340	189
1965	5969	3565	199	1057	3267	9893	1332	7312	14327	174	305
1966	8080	5793	173	1286	4921	12970	2393	4736	28120	714	2782
1967	7330	7536	192	1717	4310	11987	4824	3201	27164	374	164
1968	4175	4173	581	1649	3630	7099	1771	9495	25356	1122	495
1969	5759	6245	546	2340	3195	14019	1301	10039	34334	164	1548
1970	7490	16380	1066	4336	6392	16167	1443	10212	36940	86	279
1971	4889	15189	1395	3663	4145	8630	2991	8807	31294	473	1573
1972	6986	12636	1426	3939	6137	5057	3034	6119	35866	350	2960
1973	8852	17438	1136	8663	11723	18392	6663	8549	84770	339	1537
1974	10338	33526	8839	20970	9220	17523	2904	12771	59815	2175	3881
1975	10292	32603	11294	14741	16811	5211	983	6932	77207	3342	23
1976	7308	12743	99	3069	6955	2727	468	3567	34478	872	2577
1977	5796	7947	5169	14121	11965	7708	823	5778	40150	4973	240
1978	9302	9125	6246	24989	13045	3040	1533	7276	45034	6516	171
1979	6954	11328	5326	20239	5237	3597	253	4487	29522	2976	127
1980	6803	13936	7080	17814	6164	4148	861	4394	52633	4244	1
1981	4871	9562	5691	8549	3145	2826	879	4876	22268	2376	33
1982	6343	9532	5480	11179	3581	8730	1609	11422	26708	3536	244

Name of fish/ Year	ELA	CF	LF	PER	CR	SB	BJ	FF	PP	CEP	GF
1983	8537	15332	5426	9916	6111	9504	1099	13118	29754	1730	152
1984	7637	11582	6277	26882	9686	3911	1645	17745	35529	6022	75
1985	5972	5170	6300	30649	8624	3417	1041	11309	26684	8283	100
1986	6034	8594	6351	46004	12768	6007	1438	9392	37188	14987	213
1987	4473	4660	5212	30133	8161	6027	618	9917	52866	7535	684
1988	6761	9960	13415	32304	8470	6493	821	12723	67494	15155	9836
1989	4680	4097	7940	48986	11402	5354	1320	20061	53317	23488	6017
1990	6968	2739	11469	67356	10868	6195	2340	14505	45483	24206	6919
1991	3441	1744	11398	41112	8816	5643	623	13885	60318	19468	18824
1992	3323	1029	14126	50159	15603	4480	675	28445	51067	30625	7583
1993	4432	597	13833	74813	14657	6458	907	20618	47988	28471	2489
1994	5887	499	12065	60180	16734	4238	1135	20999	71871	36936	382
1995	4109	308	12581	47620	9979	4005	561	12385	43224	43472	174
1996	4422	390	10825	71157	17720	4536	2208	15768	46143	32445	83
1997	3915	192	7552	46763	9952	4732	1791	20375	56131	37058	111

Peak landing was noticed during 1970-76. The average annual landing during 1960-70 was 5815 t. It shot up to 16647 t during 1971-80 and went down to 7000 t during 1981-92 and further to 393 t during 1993-97. The percentage contribution of major gears to catfish landings during 1984-92 is given in table 20 & fig. 16.

Fig. 15. Elasmobranchs & Catfish landings (in tonnes)

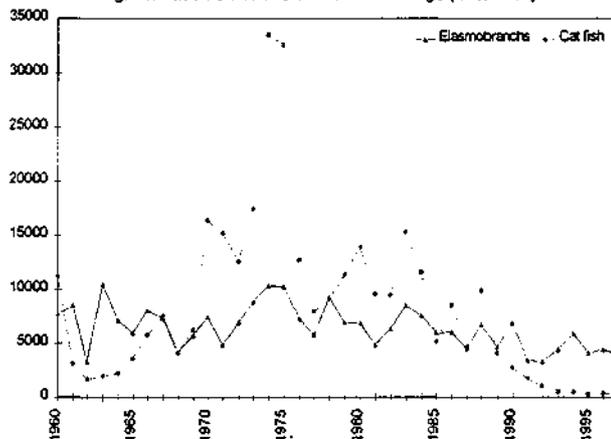
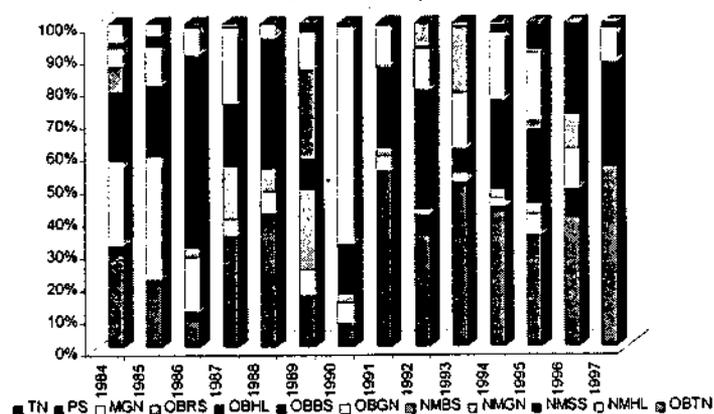


Table 20

Percentage contribution of catfishes by different gears.

Year Gear	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
TN	28.2	20.8	7.9	34	40.6	15.4	7	53.2	33.5	49.4	41.3	34	35.9	53.1
PS	2.8	--	3	--	0.4	0.2	--	0.5	6.7	1.2	1.4	--	8	--
MGN	26	37.6	16.6	5	6.7	8	6.4	4.6	1.3	2.5	2.6	6.2	11.2	--
OBRS	--	--	3.1	16.2	7	24.6	2.9	2.6	--	0.3	3	3.5	9.7	--
OBHL	21.2	21.9	58.8	19	40.2	9.4	15.2	24.8	36.6	7.4	27.2	22.4	21	31
OBBS	7.7	--	0.3	--	--	27.3	--	0.8	--	--	0.4	2.6	--	--
OBGN	5.4	12.3	8.7	23.6	4.4	11.5	67	12.2	12.6	17.4	20.7	21	--	10.4
NMBS	0.3	--	--	--	--	0.4	--	0.4	--	20.4	--	1.3	--	--
NMGN	1.5	1.5	0.5	--	0.2	2.6	0.3	0.1	0.6	0.2	2.4	7.5	4.3	1.6
NMSS	0.3	1.6	--	0.4	--	0.1	0.6	0.4	--	--	--	--	0.2	--
NMHL	5.8	3.8	0.6	0.9	--	--	--	--	--	1.2	0.8	0.3	--	--
OBTN	--	--	--	--	--	--	--	--	7.4	--	--	0.32	0.2	--
Total landings	11582	5170	8594	4660	9960	4097	2739	1744	1029	597	499	308	390	192

Fig. 16. Percentage contribution of major gears in Catfishes landings



The major contributors were TN, MGN, OBHL and NMGN. Contribution of these gears varied from year to year. During 1991 more than 50 pct of the catfish landings was by trawl. The quarterwise catfish landings data for 1960-97 is given in table 21.

Table 21

Quarterwise catfishes landings (in t).

Year	Ist Qr	IInd Qr	IIIrd Qr	IVth Qr	Total
1960	3302	5955	1460	482	11199
1961	309	900	982	923	3114
1962	162	368	124	1049	1703
1963	815	580	250	362	2007
1964	426	181	238	1403	2248
1965	311	776	1075	1403	3565
1966	1624	676	2894	599	5793
1967	454	2923	985	3174	7536
1968	1562	191	912	1508	4173
1969	1300	1038	1540	2367	6245
1970	2750	2513	5203	5914	16380
1971	1338	2932	2811	8108	15189
1972	3433	1914	3541	3748	12636
1973	2542	2081	4689	8126	17438
1974	2959	5627	15139	9801	33526
1975	1377	6936	11116	13174	32603
1976	2609	813	4672	4649	12743
1977	735	2049	4043	1120	7947
1978	983	3637	2859	1046	9125
1979	552	3607	4927	2242	11328
1980	1013	5145	5140	2638	13936
1981	1075	3737	2273	2477	9562
1982	839	2568	2757	3368	9532
1983	1229	1959	3825	8319	15332
1984	2018	3012	4464	2088	11582
1985	919	792	1759	1700	5170
1986	392	445	4974	2783	8594
1987	242	1023	2970	425	4660
1988	319	1396	4605	3640	9960

Year	Ist Qr	IInd Qr	IIIrd Qr	IVth Qr	Total
1989	399	283	2929	486	4097
1990	223	151	1773	592	2739
1991	393	451	538	362	1744
1992	302	219	177	331	1029
1993	17	43	214	323	597
1994	101	129	244	25	499
1995	85	38	142	43	308
1996	140	54	91	105	390
1997	5	13	37	137	192

During the period 1970-97, the maximum landing was noticed during the third quarter. A maximum of 15139 t was landed during the third quarter of 1974.

3.2.2 Perches

The contribution of perches to the marine fish landings in Kerala during 1960-97 varied from 791 t in 1964 to 74813 t in 1993 (Table 19, pg. 22 and fig. 17). There is an increasing trend in the landings of perches from 1973 onwards. The maximum landing was observed during 1984-97. The average annual landing of perch during 1960-70 was 1696 t, it increased to 13221 t during 1971-80 and to 34180 t during 1981-92 and further to 60106 t during 1993-97. Increased landings of perches can be attributed to the large scale introduction of trawlers and the consequent extension of the fishing grounds. The percentage contribution of different gears to perch landings is given in table 22 & fig. 18.

Fig.17. Perches & Croakers landings (in tonnes)

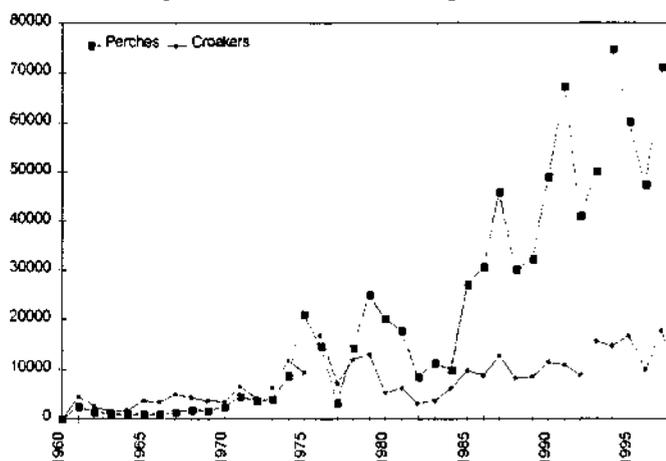


Table 22

Percentage contribution of perches by different gears.

Year / Gear	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
TN	80.5	83.8	86.7	85.7	87.6	88	88.2	87	89.3	90.4	92.9	92.1	93.6	87.3
MGN	0.2	0.1	--	0.2	0.2	--	--	--	--	--	--	0.04	0.02	--
MHL	1	0.2	0.4	2.7	1	6.5	1.3	1.8	0.8	0.9	0.6	0.8	1	3.3
OBRS	--	--	0.6	--	2.2	1.8	1.6	5	3.7	5.3	3.4	2.8	1	1.4
OBHL	0.7	1.2	0.5	1.6	5.2	--	2.1	1.1	2	1.3	1.4	1.3	2.1	5.5
OBBS	9.2	3.6	7	3.7	1	0.12	0.2	2.9	2.4	0.9	0.8	1.3	0.02	0.17
OBGN	0.1	1.5	0.3	0.3	0.4	0.3	0.3	0.4	0.4	0.7	0.6	0.7	1.3	1.5

Year	Ist Qr	IInd Qr	IIIrd Qr	IVth Qr	Total
1989	399	283	2929	486	4097
1990	223	151	1773	592	2739
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1992	302	219	177	331	1029
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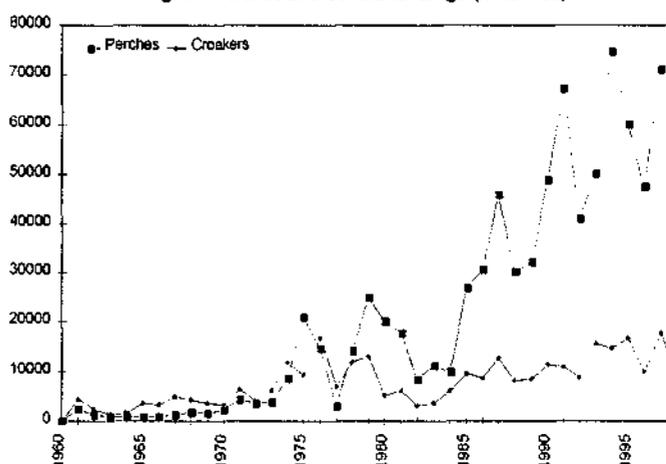


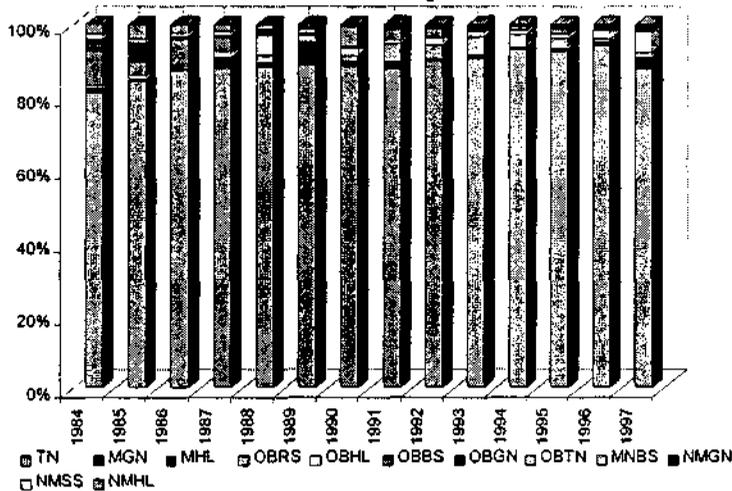
Table 22

Percentage contribution of perches by different gears.

Year / Gear	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
TN	80.5	83.8	86.7	85.7	87.6	88	88.2	87	89.3	90.4	92.9	92.1	93.6	87.3
MGN	0.2	0.1	--	0.2	0.2	--	--	--	--	--	--	0.04	0.02	--
MHL	1	0.2	0.4	2.7	1	6.5	1.3	1.8	0.8	0.9	0.6	0.8	1	3.3
OBRS	--	--	0.6	--	2.2	1.8	1.6	5	3.7	5.3	3.4	2.8	1	1.4
OBHL	0.7	1.2	0.5	1.6	5.2	--	2.1	1.1	2	1.3	1.4	1.3	2.1	5.5
OBBS	9.2	3.6	7	3.7	1	0.12	0.2	2.9	2.4	0.9	0.8	1.3	0.02	0.17
OBGN	0.1	1.5	0.3	0.3	0.4	0.3	0.3	0.4	0.4	0.7	0.6	0.7	1.3	1.5

Year / Gear	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
OBTN	--	--	--	0.1	--	1.6	5.3	--	--	--	--	--	0.01	0.1
NMBS	1.3	1	0.2	--	--	--	--	--	--	--	--	0.06	--	--
NMGN	2.1	2.7	0.4	0.3	0.1	--	0.1	0.1	0.1	0.1	--	0.2	0.4	0.17
NMSS	1.5	1	0.9	1.2	0.3	0.1	0.3	0.3	0.4	0.1	0.1	0.17	0.07	0.1
NMHL	2.7	4.2	2.5	1.9	1.5	1.1	0.5	0.7	0.5	0.3	0.2	0.32	0.3	0.27
Total landings	26882	30649	46004	30133	32304	48986	67356	41112	50159	74813	60180	47620	71157	46763

Fig. 18. Percentage contribution of major gears in Perches landings



More than 80 pct of perch landings during 1984-97 was by trawlers. Generally maximum landings were observed during the third quarter (Table 23).

Table 23

Quarterwise perches landings (in t).

Year	I Qr	II Qr	III Qr	IV Qr	Total
1960	1266	977	59	122	2424
1961	190	82	597	447	1316
1962	232	42	194	445	913
1963	268	65	37	461	831
1964	333	129	43	286	791
1965	521	148	134	254	1057
1966	484	134	198	470	1286
1967	676	99	643	299	1717
1968	240	108	956	345	1649
1969	831	130	886	493	2340
1970	1278	1055	860	1143	4336
1971	322	197	2298	846	3663
1972	1220	172	2043	504	3939
1973	2737	184	4767	975	8663
1974	1717	1104	11644	6505	20970
1975	2555	1415	9765	1006	14741
1976	1498	555	393	623	3069

Year	I Qr	II Qr	III Qr	IV Qr	Total
1977	2027	554	11169	371	14121
1978	972	669	22332	1016	24989
1979	1817	549	17409	464	20239
1980	909	1248	15248	409	17814
1981	1116	712	6294	427	8549
1982	1747	1091	7715	626	11179
1983	1345	1152	6184	1235	9916
1984	3255	2830	19219	1578	26882
1985	5086	2962	19496	3105	30649
1986	4138	2673	31678	7515	46004
1987	8008	2409	16571	3145	30133
1988	8936	3651	15987	3730	32304
1989	10418	7020	24056	7492	48986
1990	12986	13066	38199	3105	67356
1991	7432	3445	25337	4898	41112
1992	8315	4748	27670	9426	50159
1993	14178	11631	44016	4988	74813
1994	13351	10019	29786	7024	60180
1995	11787	6034	24619	5180	47620
1996	11482	6792	43187	9696	71157
1997	18372	9100	12627	6664	46763

The average landings in the third quarter of 1970-79, 1980-92 and 1993-97 were 8268 t, 19568 t and 30849 t respectively.

3.2.3 Croakers

The landings of croakers in Kerala varied from 1228 t in 1962 to 17720 t in 1996 (Table 19, pg. 22 and fig. 17). There were significant annual fluctuations in the landings during 1960-97 and average annual landings of croakers during 1960-70, 1971-80, 1981-92 and 1993-97 were 3568 t, 9140 t, 8936 t and 13808 t respectively. It can be seen from table 24 (fig.19) that the trawlers contributed more than 50 pct of croakers landed in Kerala during 1984-97, except 1986 and 1996.

Table 24

Percentage contribution of croakers by different gears.

Year / Gear	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
TN	62.4	72	26.4	60.6	74.4	52.4	54.4	68.6	49.3	71.1	54.8	67.7	32.6	72.7
PS	0.2	--	--	--	--	--	--	--	0.1	--	--	--	--	--
MGN	0.6	0.3	0.1	--	0.1	--	--	0.6	--	--	--	--	--	--
OBRS	--	--	1	4.1	3.1	20.3	17.6	3.7	22	13.8	16.8	13	38.6	0.4
OBHL	0.1	--	--	--	--	0.2	--	0.4	0.2	1.3	0.3	0.1	0.01	--
OBBS	7.3	15.1	63.4	16.7	9.4	0.9	5	1.6	10.4	4	13.9	5.5	20.5	0.33

Year	I Qr	II Qr	III Qr	IV Qr	Total
1977	2027	554	11169	371	14121
1978	972	669	22332	1016	24989
1979	1817	549	17409	464	20239
1980	909	1248	15248	409	17814
1981	1116	712	6294	427	8549
1982	1747	1091	7715	626	11179
1983	1345	1152	6184	1235	9916
1984	3255	2830	19219	1578	26882
1985	5086	2962	19496	3105	30649
1986	4138	2673	31678	7515	46004
1987	8008	2409	16571	3145	30133
1988	8936	3651	15987	3730	32304
1989	10418	7020	24056	7492	48986
1990	12986	13066	38199	3105	67356
1991	7432	3445	25337	4898	41112
1992	8315	4748	27670	9426	50159
1993	14178	11631	44016	4988	74813
1994	13351	10019	29786	7024	60180
1995	11787	6034	24619	5180	47620
1996	11482	6792	43187	9696	71157
1997	18372	9100	12627	6664	46763

The average landings in the third quarter of 1970-79, 1980-92 and 1993-97 were 8268 t, 19568 t and 30849 t respectively.

3.2.3 Croakers

The landings of croakers in Kerala varied from 1228 t in 1962 to 17720 t in 1996 (Table 19, pg. 22 and fig. 17). There were significant annual fluctuations in the landings during 1960-97 and average annual landings of croakers during 1960-70, 1971-80, 1981-92 and 1993-97 were 3568 t, 9140 t, 8936 t and 13808 t respectively. It can be seen from table 24 (fig.19) that the trawlers contributed more than 50 pct of croakers landed in Kerala during 1984-97, except 1986 and 1996.

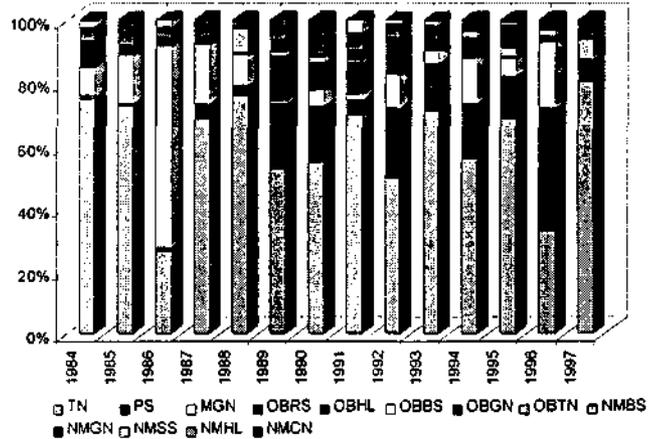
Table 24

Percentage contribution of croakers by different gears.

Year / Gear	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
TN	62.4	72	26.4	60.6	74.4	52.4	54.4	68.6	49.3	71.1	54.8	67.7	32.6	72.7
PS	0.2	--	--	--	--	--	--	--	0.1	--	--	--	--	--
MGN	0.6	0.3	0.1	--	0.1	--	--	0.6	--	--	--	--	--	--
OBRS	--	--	1	4.1	3.1	20.3	17.6	3.7	22	13.8	16.8	13	38.6	0.4
OBHL	0.1	--	--	--	--	0.2	--	0.4	0.2	1.3	0.3	0.1	0.01	--
OBBS	7.3	15.1	63.4	16.7	9.4	0.9	5	1.6	10.4	4	13.9	5.5	20.5	0.33

Year / Gear	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
OBGN	0.2	0.8	0.5	1.5	0.7	14.1	8.4	9.8	9.1	1.8	6.5	0.7	1.9	5.5
OBTN	--	--	--	--	7.2	1.4	1.9	0.9	0.7	0.8	1.7	2.5	2	5.7
NMBS	6.9	2.5	2.4	--	1	4	1.1	3.1	2.1	1	0.5	1.7	0.2	0.63
NMGN	3.5	7.3	3.1	5	1.5	5.5	10.1	5.2	4	3.8	3.1	5.3	2.4	4.3
NMSS	1.6	0.5	2.3	0.3	0.4	0.6	0.5	4.2	1.4	0.3	--	1.1	0.5	0.5
NMHL	0.3	--	--	--	--	--	--	--	--	1.5	--	0.2	0.1	0.1
NMCN	--	--	--	--	--	--	--	--	--	0.4	--	0.5	--	0.07

Fig. 19. Percentage contribution of major gears in Croakers landings



In 1986 the major gear was OBBS (63.4 pct). Maximum landings of croakers was in the third quarter (Table 25). The average third quarter landing during 1960-69 was 1593 t, 3661 t during 1970-79, 2859 t during 1980-92 and 4946 t during 1993-97.

Table 25

Quarterwise croakers landings (in t).

Year	Ist Qr.	IInd Qr.	IIIrd Qr.	IVth Qr.	Total
1960	533	785	2925	235	4478
1961	95	490	1744	172	2501
1962	128	141	274	685	1228
1963	366	442	507	359	1674
1964	226	1314	1643	464	3647
1965	137	531	1650	949	3267
1966	128	596	3664	533	4921
1967	944	920	1293	1153	4310
1968	458	550	1717	905	3630
1969	975	979	511	730	3195
1970	724	679	2964	2025	6392
1971	425	501	1736	1483	4145
1972	1367	1476	1643	1651	6137
1973	1305	2556	5974	1888	11723
1974	1311	3342	1067	3500	9220
1975	1174	4231	7687	3719	16811
1976	731	1982	2424	1818	6955
1977	913	1362	5179	4511	11965
1978	2844	2869	6703	629	13045

Year	Ist Qr.	IInd Qr.	IIIRD Qr.	IVth Qr.	Total
1979	1427	1403	1310	1097	5237
1980	1877	1659	1976	652	6164
1981	843	756	800	746	3145
1982	458	984	1730	409	3581
1983	728	944	3180	1259	6111
1984	2048	1739	3367	2532	9686
1985	2160	2364	2976	1124	8624
1986	1098	1510	1388	8772	12768
1987	1766	1299	3743	1353	8161
1988	1658	1171	2602	3039	8470
1989	2100	3517	2582	3203	11402
1990	1796	2677	3552	2843	10868
1991	2127	1555	2959	2175	8816
1992	1715	2573	3722	7593	15603
1993	4041	2342	4232	4042	14657
1994	2360	2714	8350	3310	16734
1995	3809	2117	2758	1295	9979
1996	2156	2199	6570	6795	17720
1997	2368	2212	2821	2551	9952

3.2.4 Lizardfishes

Catches of lizardfishes varied from 5 t in 1961 to 14126 t in 1992 (Table 19, pg. 22 and fig. 20). There was an increasing trend in the landings from 1970 onwards. The annual average landing of lizardfishes during the period 1960-69 was only 219 t. It went up to 4199 t during 1970-79 and again increased to 8208 t during 1980-92 and it was 11371 t during 1993-97. It is observed from table 26 (fig. 21), that trawlers landed more than 94 pct of the lizardfishes caught in Kerala during 1984-97.

Fig. 20. Lizard fishes & Big-jawed Jumper landings (in tonnes)

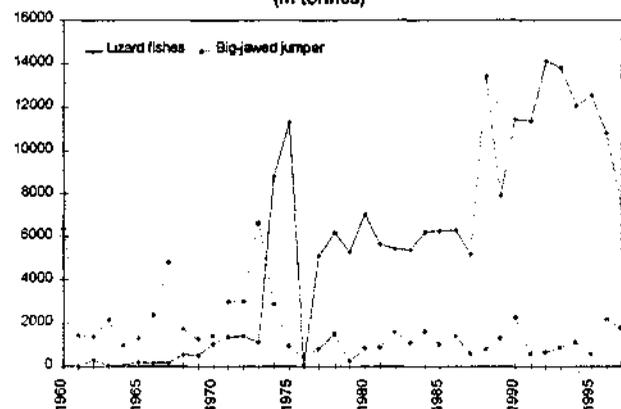


Table 26

Percentage contribution of lizardfishes by different gears.

Year / Gear	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
TN	96.5	98	98.2	97.3	97.6	94.2	98.4	99	98.5	99.5	99.9	99.4	99.2	99.1
PS	--	--	--	--	--	--	--	0.5	--	--	--	--	--	--
OBHL	1.9	--	0.2	0.4	0.3	3.3	0.2	--	--	0.2	--	0.5	0.2	0.2
OBN	0.1	--	--	--	0.1	0.2	0.2	--	0.4	0.1	--	--	0.4	0.1
OBTN	--	--	--	--	--	0.6	0.4	--	--	--	--	--	--	--

Year	Ist Qr.	IInd Qr.	IIIrd Qr.	IVth Qr.	Total
1979	1427	1403	1310	1097	5237
1980	1877	1659	1976	652	6164
1981	843	756	800	746	3145
1982	458	984	1730	409	3581
1983	728	944	3180	1259	6111
1984	2048	1739	3367	2532	9686
1985	2160	2364	2976	1124	8624
1986	1098	1510	1388	8772	12768
1987	1766	1299	3743	1353	8161
1988	1658	1171	2602	3039	8470
1989	2100	3517	2582	3203	11402
1990	1796	2677	3552	2843	10868
1991	2127	1555	2959	2175	8816
1992	1715	2573	3722	7593	15603
1993	4041	2342	4232	4042	14657
1994	2360	2714	8350	3310	16734
1995	3809	2117	2758	1295	9979
1996	2156	2199	6570	6795	17720
1997	2368	2212	2821	2551	9952

3.2.4 Lizardfishes

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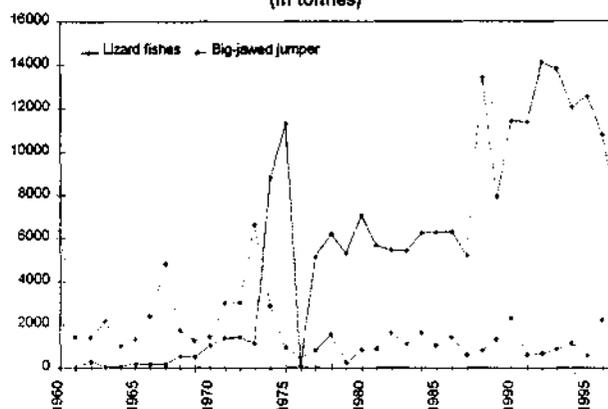


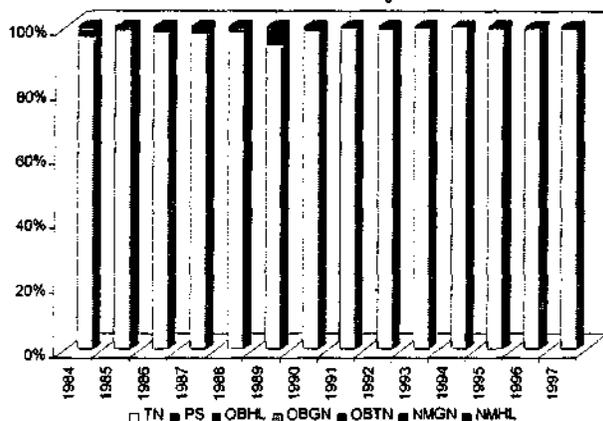
Table 26

Percentage contribution of lizardfishes by different gears.

Year / Gear	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
TN	96.5	98	98.2	97.3	97.6	94.2	98.4	99	98.5	99.5	99.9	99.4	99.2	99.1
PS	--	--	--	--	--	--	--	0.5	--	--	--	--	--	--
OBHL	1.9	--	0.2	0.4	0.3	3.3	0.2	--	--	0.2	--	0.5	0.2	0.2
OBN	0.1	--	--	--	0.1	0.2	0.2	--	0.4	0.1	--	--	0.4	0.1
OBTN	--	--	--	--	--	0.6	0.4	--	--	--	--	--	--	--

Year / Gear	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
NMGN	0.7	0.8	--	--	0.9	0.8	0.3	--	0.5	0.2	--	0.2	--	0.5
NMHL	0.5	0.3	1.4	1.8	0.4	0.7	0.1	--	0.1	--	0.1	0.1	0.2	--
Total landings	6277	6300	6351	5212	13415	7940	11469	11398	14126	13833	12065	12581	10825	7552

Fig. 21. Percentage contribution of major gears in Lizard fish landings



The increase in the landings of lizardfishes can be attributed to the increase in trawling effort. The maximum landing of lizardfishes was found during the third quarter followed by the second quarter (Table 27).

Table 27

Quarterwise lizardfishes landings (in t)

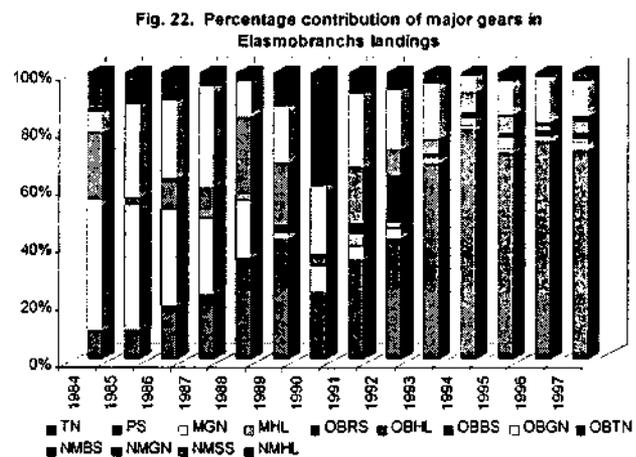
Year	I Qr	II Qr	III Qr	IV Qr	Total
1960	2	2	8	4	16
1961	1	1	--	3	5
1962	14	6	316	3	339
1963	6	18	24	30	78
1964	12	30	1	19	62
1965	40	14	134	11	199
1966	6	29	126	12	173
1967	9	3	4	176	192
1968	91	62	166	262	581
1969	17	180	38	311	546
1970	142	217	167	540	1066
1971	141	88	594	572	1395
1972	95	66	753	512	1426
1973	86	40	785	225	1136
1974	114	1947	4299	2479	8839
1975	372	4829	6077	16	11294
1976	10	25	45	19	99
1977	252	458	3252	1207	5169
1978	308	1766	3372	800	6246
1979	112	1012	3626	576	5326
1980	558	2112	3317	1093	7080
1981	314	1335	3669	373	5691
1982	271	2354	2577	278	5480

Year	I Qr	II Qr	III Qr	IV Qr	Total
1983	257	1560	3100	509	5426
1984	373	2029	2248	1627	6277
1985	1087	2212	2238	763	6300
1986	593	2049	2348	1361	6351
1987	1043	754	2842	573	5212
1988	2054	4479	5450	1432	13415
1989	614	2806	3614	906	7940
1990	1968	4682	2125	2694	11469
1991	1378	2381	3679	3960	11398
1992	4702	3770	3303	2351	14126
1993	3009	3385	6408	1031	13833
1994	2078	3429	4663	1895	12065
1995	1684	2740	5533	2624	12581
1996	1688	1757	4340	3040	10825
1997	1348	1847	3410	947	7552

The average landings during the third quarter of 1970-79 and 1980-92 were found to be 2297 t and 3117 t respectively and it was 4871 t during 1993-97.

3.2.5 Elasmobranchs

The elasmobranchs are yet another group which contributed much to the demersal landings in Kerala during the period 1960-97. The minimum landing of 3323 t was observed in 1992 and the maximum of 10509 t in 1963 (Table 19, pg. 22 and fig.15). When compared to catfishes there was not much variation in the landings of elasmobranchs over the years. The average annual landings of this group varied from 6862 t during 1960-69 to 7821 t and 3753 t to 5816 t during 1970-79, 1980-92 and 1993-97 respectively. TN, MGN and OBGN were the major gears which contributed substantially to the elasmobranchs landings in Kerala during 1984-97 (Table 28, fig. 22).



Year	I Qr	II Qr	III Qr	IV Qr	Total
1983	257	1560	3100	509	5426
1984	373	2029	2248	1627	6277
1985	1087	2212	2238	763	6300
1986	593	2049	2348	1361	6351
1987	1043	754	2842	573	5212
1988	2054	4479	5450	1432	13415
1989	614	2806	3614	906	7940
1990	1968	4682	2125	2694	11469
1991	1378	2381	3679	3960	11398
1992	4702	3770	3303	2351	14126
1993	3009	3385	6408	1031	13833
1994	2078	3429	4663	1895	12065
1995	1684	2740	5533	2624	12581
1996	1688	1757	4340	3040	10825
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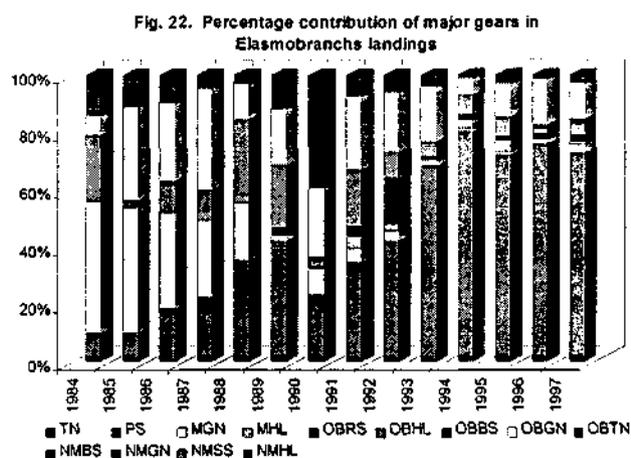


Table 28

Percentage contribution of major gears to elasmobranchs landings.

Year / Gear	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
TN	9.4	10	18.3	22.3	35	38.8	22.8	33.6	41.7	67.7	80.1	71.7	75.5	72.6
PS	0.4	--	--	--	--	--	--	0.2	--	0.5	--	--	--	--
MGN	45.5	43	33.4	26.5	20.3	1.9	8.9	5	3.5	1.6	0.9	1	1.8	2.8
MHL	0.1	--	0.1	3.1	2.4	--	0.2	4.1	2.2	0.5	3.2	4.3	0.3	1.4
OBRS	--	--	--	--	--	2.7	0.5	3.5	16.3	1.2	1.8	1.3	1.7	2.1
OBHL	23	2.2	9.3	7.2	26.1	19.7	3.1	19.5	8.9	4.8	7	5.9	2	3.8
OBBS	0.1	0.1	1.3	--	0.4	0.6	--	--	0.1	0.2	--	0.6	1	1.7
OBGN	7.2	32.4	27.1	35.5	12.6	18.3	23.8	25.4	20.9	19.5	5.7	11.7	16	12.7
OBTN	--	--	--	--	--	--	0.5	--	--	0.1	--	0.1	0.4	0.9
NMBS	1.3	0.4	--	--	--	--	--	--	0.3	0.2	--	--	--	0.07
NMGN	7.6	8	8.3	4	2.9	10.7	38.5	7.4	5.4	3.6	1.3	2.8	0.9	1.7
NMSS	0.1	0.7	0.2	--	--	--	--	--	0.3	--	--	0.07	--	0.07
NMHL	5	2	1.4	0.7	0.3	0.4	--	--	0.1	0.1	--	0.2	0.2	0.05
Total landings	7637	5972	6034	4473	6761	4680	6968	3441	3323	4432	5887	4109	4422	3915

Elasmobranchs as a group are available throughout the year. There is not much variation among the seasons. However, the maximum catch was noticed during the fourth quarter followed by the first quarter (Table 29).

Table 29

Quarterwise elasmobranchs landings (in t).

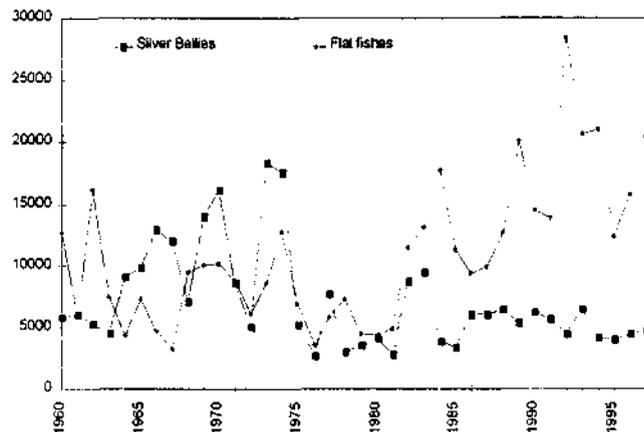
Year	I Qr	II Qr	III Qr	IV Qr	Total
1960	1831	533	1712	3645	7721
1961	1304	1641	2335	3235	8515
1962	1380	623	618	721	3342
1963	3872	2209	1349	3079	10509
1964	2863	1194	545	2616	7218
1965	797	533	1045	3594	5969
1966	1274	2407	2866	1533	8080
1967	1569	1655	1572	2534	7330
1968	1574	374	659	1568	4175
1969	861	649	1840	2409	5759
1970	1607	1427	2036	2420	7490
1971	1266	797	1255	1571	4889
1972	2119	1747	1414	1706	6986
1973	1521	1942	2463	2926	8852
1974	1769	4427	1208	2934	10338
1975	965	2574	2014	4739	10292
1976	2848	1515	979	1966	7308
1977	885	730	2340	1841	5796

Year	I Qr	II Qr	III Qr	IV Qr	Total
1978	1501	2619	1158	4024	9302
1979	1602	1297	2502	1553	6954
1980	2017	1344	1670	1772	6803
1981	1378	981	833	1679	4871
1982	1916	1030	963	2434	6343
1983	1206	1528	1628	4175	8537
1984	2509	2193	1315	1620	7637
1985	1336	533	707	3396	5972
1986	1144	968	1858	2064	6034
1987	1019	1489	822	1143	4473
1988	1700	1511	1922	1628	6761
1989	1401	1019	1054	1206	4680
1990	1428	999	1273	3448	6968
1991	750	788	1006	897	3441
1992	768	583	688	1284	3323
1993	1294	1329	393	1416	4432
1994	2066	1837	656	1328	5887
1995	1700	1358	551	500	4109
1996	916	1016	827	1663	4422
1997	949	1076	749	1141	3915

3.2.6 Flatfishes

During the period 1960-97, the maximum landing of flatfishes was observed during the year 1992 (28445 t) and the minimum of 3201 t in the year 1967 (Table 19, pg 22 and fig.23). There was a sharp increase in the landings of flatfishes during the period 1982-97 due to increased operation of trawlers which is the main gear for this group (Table 30, fig. 24).

Fig. 23. Silver bellies & Flat fishes landings (in tonnes)



Year	I Qr	II Qr	III Qr	IV Qr	Total
1978	1501	2619	1158	4024	9302
1979	1602	1297	2502	1553	6954
1980	2017	1344	1670	1772	6803
1981	1378	981	833	1679	4871
1982	1916	1030	963	2434	6343
1983	1206	1528	1628	4175	8537
1984	2509	2193	1315	1620	7637
1985	1336	533	707	3396	5972
1986	1144	968	1858	2064	6034
1987	1019	1489	822	1143	4473
1988	1700	1511	1922	1628	6761
1989	1401	1019	1054	1206	4680
1990	1428	999	1273	3448	6968
1991	750	788	1006	897	3441
1992	768	583	688	1284	3323
1993	1294	1329	393	1416	4432
1994	2066	1837	656	1328	5887
1995	1700	1358	551	500	4109
1996	916	1016	827	1663	4422
1997	949	1076	749	1141	3915

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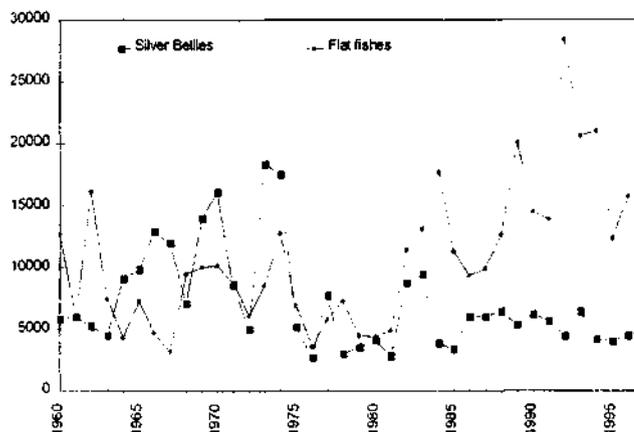
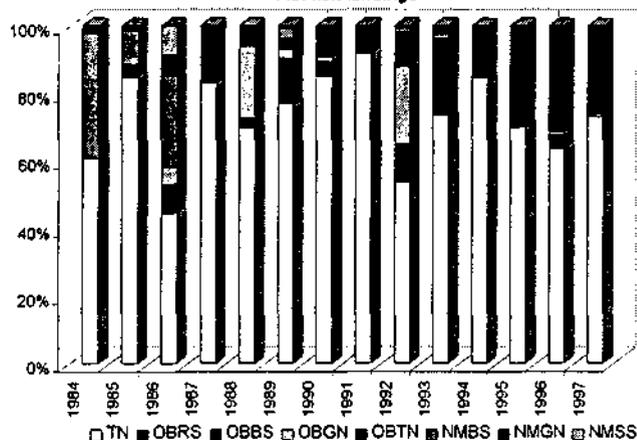


Table 30

Percentage contribution of flatfishes by different gears.

Year / Gear	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
TN	58.7	84.1	44.2	76.5	66.5	76.7	82.5	82	53	72.1	81.9	65.1	59	71
OBRS	--	--	--	--	0.5	8.2	4.1	0.7	9.5	3	--	0.3	3.5	0.04
OBBS	--	3.7	8.4	4.7	2.2	5.2	--	--	1.7	--	--	--	0.06	--
OBGN	--	--	5.3	0.2	20.3	2.7	1.4	0.3	22.6	0.1	--	0.35	1	1
OBTN	--	--	--	8.4	5	3	7.5	4.6	9.8	18.9	13.7	23.7	28	24.7
NMBS	35.7	9.9	26.9	--	0.1	3.1	--	0.1	1.2	1.2	--	0.08	--	--
NMGN	2	1.4	6.1	1.9	0.5	0.6	1.3	1.5	0.7	2.4	1.1	3.5	0.8	0.4
NMSS	0.2	--	8.5	0.4	0.2	0.1	--	0.3	0.1	--	--	0.04	--	--
Total landings	17745	11309	9392	9917	12723	20061	14505	13885	28445	20618	20999	12385	15768	20375

Fig. 24. Percentage contribution of major gears in Flat fish landings



The average annual landings during the periods 1960-69, 1970-79, 1980-92 and 1993-97 were 8138 t, 7450 t, 13321 t and 18029 t respectively. The maximum landing of flatfishes was observed during the third and fourth quarters of every year (Table 31).

Table 31

Quarterwise flatfish landings (in t)

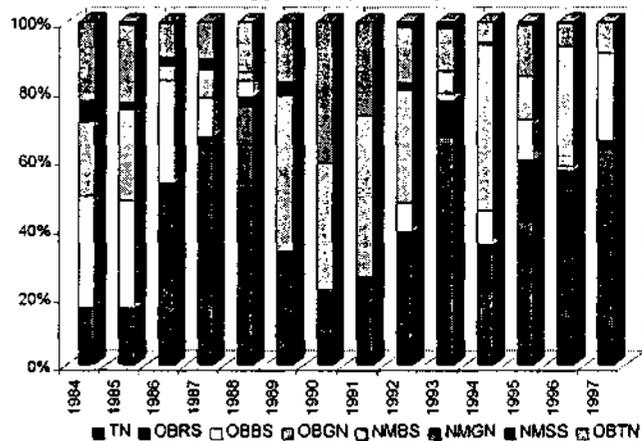
Year	I Qr	II Qr	III Qr	IV Qr	Total
1960	347	275	11377	716	12715
1961	27	193	3374	2288	5882
1962	21	32	1207	14929	16189
1963	662	165	4054	2604	7485
1964	245	839	2774	466	4324
1965	750	853	4088	1621	7312
1966	407	929	666	2734	4736
1967	229	838	491	1643	3201
1968	1375	1888	2928	3304	9495
1969	1374	2950	4887	828	10039
1970	1530	1873	2984	3825	10212
1971	1287	775	4674	2071	8807

Year	I Qr	II Qr	III Qr	IV Qr	Total
1972	1211	917	2833	1158	6119
1973	788	1585	2497	3679	8549
1974	1887	1470	3429	5985	12771
1975	1227	1104	2966	1635	6932
1976	595	1034	1163	775	3567
1977	688	800	3147	1143	5778
1978	1410	2664	2698	504	7276
1979	1075	692	2298	422	4487
1980	899	1099	1757	639	4394
1981	971	1435	1637	833	4876
1982	659	991	6638	3134	11422
1983	1397	1431	4509	5781	13118
1984	1943	1553	10348	3901	17745
1985	2645	2372	3447	2845	11309
1986	1438	1125	4579	2250	9392
1987	1576	3578	2511	2252	9917
1988	2791	2291	2259	5382	12723
1989	2114	3090	1768	13089	20061
1990	4652	2599	1957	5297	14505
1991	3830	1520	1610	6925	13885
1992	8374	2699	11039	6333	28445
1993	3922	2540	3819	10337	20618
1994	4588	3723	2717	9971	20999
1995	3307	2273	2951	3854	12385
1996	2595	2737	4063	6373	15768
1997	7646	4860	789	7080	20375

3.2.7 Big-jawed jumper

Landings of big-jawed jumper varied from 253 t in 1979 to 6663 t in 1973 (Table 19, pg 22 & fig.21). There was a declining trend in the landings from 1973 onwards. In the 80's there was not much variation in the annual landings. The average annual landings recorded 2398 t, 2110 t, 1147 t and 1320 t during 1960-69, 1970-79, 1980-92 and 1993-97 respectively. The major gears which contributed to the landings of big-jawed jumper during 1984-92 were TN, OBBS, OBGN and NMGN (Table 32, fig. 25).

Fig. 25. Percentage contribution of major gears in Big-jawed jumper landings



Year	I Qr	II Qr	III Qr	IV Qr	Total
1972	1211	917	2833	1158	6119
1973	788	1585	2497	3679	8549
1974	1887	1470	3429	5985	12771
1975	1227	1104	2966	1635	6932
1976	595	1034	1163	775	3567
1977	688	800	3147	1143	5778
1978	1410	2664	2698	504	7276
1979	1075	692	2298	422	4487
1980	899	1099	1757	639	4394
1981	971	1435	1637	833	4876
1982	659	991	6638	3134	11422
1983	1397	1431	4509	5781	13118
1984	1943	1553	10348	3901	17745
1985	2645	2372	3447	2845	11309
1986	1438	1125	4579	2250	9392
1987	1576	3578	2511	2252	9917
1988	2791	2291	2259	5382	12723
1989	2114	3090	1768	13089	20061
1990	4652	2599	1957	5297	14505
1991	3830	1520	1610	6925	13885
1992	8374	2699	11039	6333	28445
1993	3922	2540	3819	10337	20618
1994	4588	3723	2717	9971	20999
1995	3307	2273	2951	3854	12385
1996	2595	2737	4063	6373	15768
1997	7646	4860	789	7080	20375

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Fig. 25. Percentage contribution of major gears in Big-jawed jumper landings

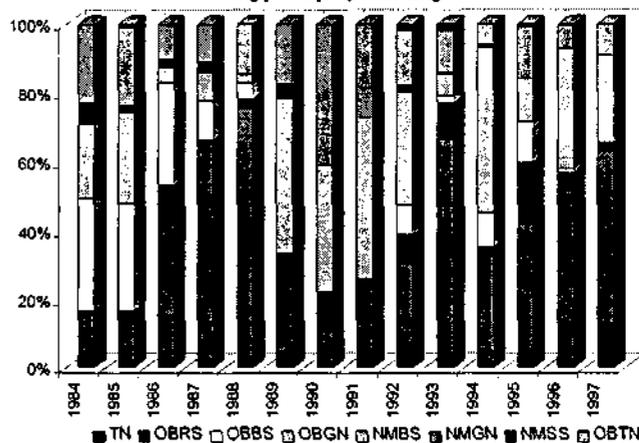


Table 32

Percentage contribution of major gears to big-jawed jumper landings

Year / Gear	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
TN	16.5	16.4	52.5	66	74	26.8	10.5	25.2	30	66.5	32.5	41.3	51.5	62.3
OBRS	--	--	0.5	--	2.6	6.2	10.5	--	8.8	10.8	2.8	17.8	5	2.7
OBBS	31.9	31.1	29.4	11.1	4.5	--	0.6	--	8.4	1.9	9.7	11.7	1.1	--
OBGN	21.2	26.5	4.2	8.2	2.4	45	36	45.5	32.6	6.3	48.2	12.4	34.8	25
NMBS	6.3	2.1	2.7	3.3	--	4.1	--	--	2.3	0.2	0.8	--	--	--
NMGN	22.4	22.4	9.6	10.8	14.6	17.3	40	26.3	16	12.3	6	14.8	6.8	9.1
NMSS	--	1	0.6	--	--	--	--	--	1.6	1.9	--	0.9	0.04	0.1
OBTN	--	--	--	--	--	--	--	--	--	0.1	--	0.1	0.2	0.05
Total landings	1645	1041	1438	618	821	1320	2340	623	675	907	1135	561	2208	1791

Maximum landing of this fish was noticed during the third quarter (Table 33).

Table 33

Quarterwise big-jawed jumper landings (in t)

Year	I Qr	II Qr	III Qr	IV Qr	Total
1960	57	3024	3051	236	6368
1961	14	1090	245	77	1426
1962	15	167	1168	59	1409
1963	85	720	1097	267	2169
1964	19	280	401	290	990
1965	143	713	340	136	1332
1966	12	1344	936	101	2393
1967	14	406	4210	194	4824
1968	40	227	1315	189	1771
1969	24	621	475	181	1301
1970	169	399	446	429	1443
1971	757	959	988	287	2991
1972	67	1450	1293	224	3034
1973	59	2060	4071	473	6663
1974	130	1166	1564	44	2904
1975	147	297	480	59	983
1976	60	114	126	168	468
1977	20	276	498	29	823
1978	49	260	1157	67	1533
1979	2	141	88	22	253
1980	84	127	618	32	861
1981	9	331	410	129	879
1982	65	193	1224	127	1609
1983	296	31	445	327	1099
1984	150	247	1163	85	1645
1985	38	329	574	100	1041

Year	I Qr	II Qr	III Qr	IV Qr	Total
1986	266	415	450	307	1438
1987	251	84	180	103	618
1988	96	277	123	325	821
1989	32	255	727	306	1320
1990	15	1151	1117	57	2340
1991	20	122	428	53	623
1992	56	75	426	118	675
1993	2	338	308	259	907
1994	86	253	673	123	1135
1995	97	154	216	94	561
1996	87	671	1016	434	2208
1997	101	239	962	489	1791

3.2.8 Silverbellies

The silverbellies landings in Kerala varied from 2727 t in 1976 to 18392 t in 1973. There was drastic reduction in the landings of silverbellies from 1975 onwards (Table 19, pg. 22 and fig. 23). The average annual landing of silverbellies was 8677 t during 1960-69 and 8805 t during 1970-79. It went down to 5688 t during 1980-92 and to 4794 during 1993-97. Trawl is the major gear for this group (Table 34, fig. 26).

Fig. 26. Percentage contribution of major gears in Silver bellies landings

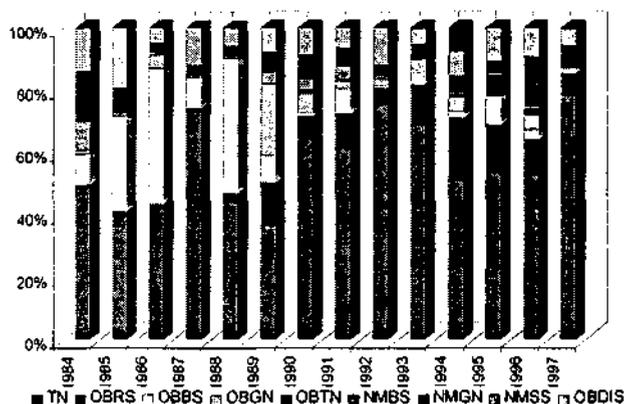


Table 34

Percentage contribution of major gears to silverbellies landings.

Year / Gear	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
TN	48.4	41	43.3	72.8	43	36.6	63.6	60.6	74.6	68.1	55	52.4	52.3	77.7
OBRS	--	--	--	0.6	2.8	13.3	7.2	11.3	5.4	13	22	15.3	11.4	7
OBBS	9.7	30	43.4	9.9	42.3	8.7	1	7.8	0.9	0.2	1.9	9.1	3.2	0.3
OBGN	1.2	--	4.3	0.8	1	23	6.2	2.7	1.9	8	5.1	0.1	4.7	1.5
OBTN	--	--	--	--	1	--	1.3	0.2	0.2	0.1	0.7	6.5	1.9	0.06
NMBS	9.3	1.6	1.1	1.1	0.4	3.8	3.6	4.8	1.3	1	1	1	0.7	0.4
NMGN	15.8	7.6	2.8	2.1	1.4	6.3	7.5	5.6	3.1	3.4	5.8	3.5	16.1	6.8
NMSS	13.7	19.6	5.1	12.1	6	8	8.9	6.5	12.1	5.3	8.5	10.8	9.4	5.6
OBDIS	--	--	--	--	--	--	--	--	--	0.3	8.5	--	--	0.2
Total landings	3911	3417	6007	6027	6493	5354	6195	5643	4480	6458	4238	4005	4536	4732

Year	I Qr	II Qr	III Qr	IV Qr	Total
1986	266	415	450	307	1438
1987	251	84	180	103	618
1988	96	277	123	325	821
1989	32	255	727	306	1320
1990	15	1151	1117	57	2340
1991	20	122	428	53	623
1992	56	75	426	118	675
1993	2	338	308	259	907
1994	86	253	673	123	1135
1995	97	154	216	94	561
1996	87	671	1016	434	2208
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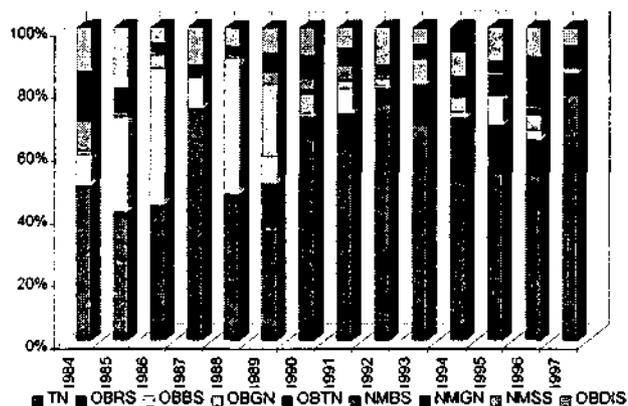


Table 34

Percentage contribution of major gears to silverbellies landings.

Year / Gear	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
TN	48.4	41	43.3	72.8	43	36.6	63.6	60.6	74.6	68.1	55	52.4	52.3	77.7
OBRS	--	--	--	0.6	2.8	13.3	7.2	11.3	5.4	13	22	15.3	11.4	7
OBBS	9.7	30	43.4	9.9	42.3	8.7	1	7.8	0.9	0.2	1.9	9.1	3.2	0.3
OBGN	1.2	--	4.3	0.8	1	23	6.2	2.7	1.9	8	5.1	0.1	4.7	1.5
OBTN	--	--	--	--	1	--	1.3	0.2	0.2	0.1	0.7	6.5	1.9	0.06
NMBS	9.3	1.6	1.1	1.1	0.4	3.8	3.6	4.8	1.3	1	1	1	0.7	0.4
NMGN	15.8	7.6	2.8	2.1	1.4	6.3	7.5	5.6	3.1	3.4	5.8	3.5	16.1	6.8
NMSS	13.7	19.6	5.1	12.1	6	8	8.9	6.5	12.1	5.3	8.5	10.8	9.4	5.6
OBDIS	--	--	--	--	--	--	--	--	--	0.3	8.5	--	--	0.2
Total landings	3911	3417	6007	6027	6493	5354	6195	5643	4480	6458	4238	4005	4536	4732

The third quarter is the main season for this fish (Table 35).

Table 35
Quarterwise silverbellies landings (in t).

Year	I Qr.	II Qr	III Qr	IV Qr	Total
1960	298	379	4496	636	5809
1961	314	499	5010	237	6060
1962	245	188	4525	327	5285
1963	201	260	3902	185	4548
1964	106	1956	6878	160	9100
1965	240	824	8267	562	9893
1966	285	3306	8377	1002	12970
1967	1113	3408	6819	647	11987
1968	644	2249	3654	552	7099
1969	270	1792	11398	559	14019
1970	474	748	12588	2357	16167
1971	694	1630	5800	506	8630
1972	444	944	2770	899	5057
1973	955	3315	12863	1259	18392
1974	2154	2822	10878	1669	17523
1975	763	2098	889	1461	5211
1976	710	991	452	574	2727
1977	720	1041	5603	344	7708
1978	762	784	1180	314	3040
1979	827	1233	1165	372	3597
1980	908	590	2459	191	4148
1981	405	904	1162	355	2826
1982	703	654	6629	744	8730
1983	1066	706	5790	1942	9504
1984	747	703	2195	266	3911
1985	618	1006	1057	736	3417
1986	557	2019	2874	557	6007
1987	2050	1876	808	1293	6027
1988	1493	1399	2448	1153	6493
1989	926	1646	1972	810	5354
1990	2109	1908	1016	1162	6195
1991	1536	1059	1371	1677	5643
1992	1606	976	446	1452	4480
1993	2972	1337	391	1758	6458
1994	1395	1136	395	1312	4238
1995	1319	1167	968	551	4005
1996	789	1709	727	1311	4536
1997	1652	1132	723	1225	4732

3.2.9 Goatfish

During the period 1960-97, the minimum landing of goatfish was noticed in the year 1980 (1 t) and the maximum of 18824 t in 1991. There were wide annual variations in the landings of this fish (Table 19, pg. 22 and fig. 13). On an average, annually 680 t of goatfish was landed during 1960-69, 1337 t during 1970-79, 4224 t during 1980-92 and 648 t during 1993-97. During 1970-92, the maximum landing was observed in the first quarter (Table 36).

Fig. 27. Cephalopods & Goat fishes landings (in tonnes)

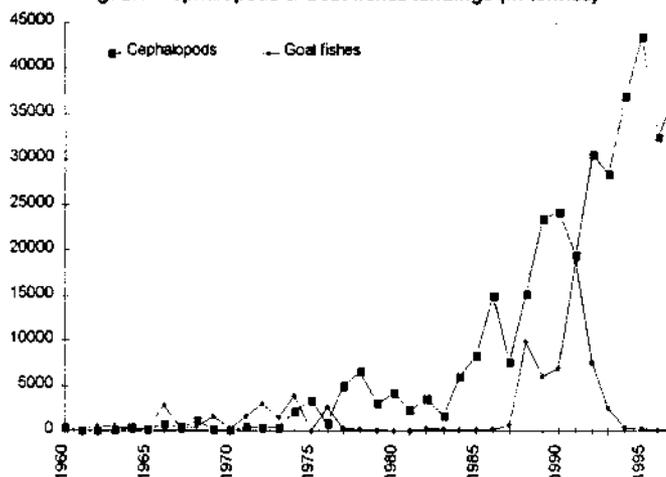


Table 36

Quarterwise goatfish landings (in t)

Year	I Qr	II Qr	III Qr	IV Qr	Total
1960	--	1	--	4	5
1961	--	--	110	116	226
1962	--	24	499	3	526
1963	65	178	158	156	557
1964	11	66	110	2	189
1965	33	118	141	13	305
1966	32	118	2630	2	2782
1967	--	55	86	23	164
1968	48	205	146	96	495
1969	52	123	1263	110	1548
1970	158	3	1	117	279
1971	168	239	162	1004	1573
1972	107	427	1611	815	2960
1973	415	112	47	963	1537
1974	1923	18	25	1915	3881
1975	20	--	--	3	23
1976	2274	47	170	86	2577
1977	39	2	16	183	240
1978	32	34	96	9	171
1979	126	--	--	1	127
1980	--	--	--	1	1
1981	--	30	2	1	33
1982	5	10	162	67	244
1983	134	16	1	1	152

Year	I Qr	II Qr	III Qr	IV Qr	Total
1984	40	23	1	11	75
1985	2	93	--	5	100
1986	14	35	2	162	213
1987	17	75	578	14	684
1988	647	1343	2984	4862	9836
1989	3459	764	25	1769	6017
1990	3518	1277	1562	562	6919
1991	6687	772	8454	2911	18824
1992	4158	1180	350	1895	7583
1993	1295	809	245	140	2489
1994					382
1995	109	52	1	12	174
1996	9	65	9	-	83
1997	12	33	39	27	111

During the period 1986-972, trawl was the major gear for this fish. More than 80 pct was landed by this gear. During 1984-85 NMGN was the major gear (Table 37, fig. 28).

Fig. 28. Percentage contribution of major gears in Goatfish landings



Table 37

Percentage contribution of major gears to goatfish landings

Year / Gear	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
TN	--	2	79.8	99.2	95.6	97.5	99.5	99.5	98.8	96	99.7	99.4	86.7	55
OBBS	--	--	3.8	--	--	--	--	--	--	--	--	--	7.2	--
OBGN	34.6	--	--	--	0.1	--	--	--	--	1.1	0.3	--	--	--
NMBS	--	1	1.4	--	--	0.3	--	--	0.1	--	--	0.6	3.6	--
NMGN	64	90	12.6	0.5	1.9	1.8	0.5	0.3	0.8	1.9	--	--	--	29.7
NMSS	--	5	2.3	--	2.2	0.2	--	--	--	--	--	--	--	--
NMHL	--	2	--	--	--	--	--	--	--	0.9	--	--	--	--
OBHL	--	--	--	--	--	--	--	--	--	0.1	--	--	--	--
OBDIS	--	--	--	--	--	--	--	--	--	--	--	--	2.4	12.6
Total landings	75	100	213	684	9836	6017	6919	18824	7583	2489	382	174	83	111

3.2.10 Penaeid prawns

Penaeid prawns landings in Kerala varied from 12798 t in 1960 to 84770 t in 1973 (Table 19, pg. 22 and Fig. 29). There is an increasing trend in the penaeid prawns landings in Kerala over the years. Peak landings were noticed during 1972-76 and again during 1986-97. The average annual landing was 26073 t during 1960-70, 49077 t during 1971-80, 42390 t during 1981-92 and 53071 t during 1993-97. The landings during 1981-85 were very low when compared with the previous years. The percentage contribution of different gears to penaeid prawns landings during 1984-97 is given in Table 38 & fig. 30.

Fig. 29. Penaeid prawns landings (in tonnes)

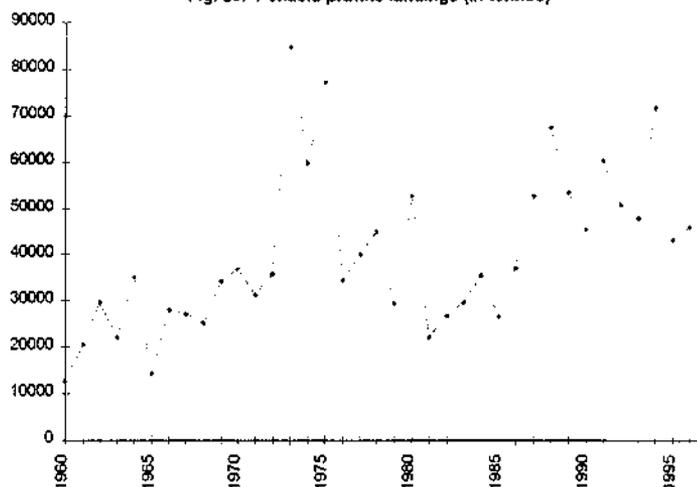
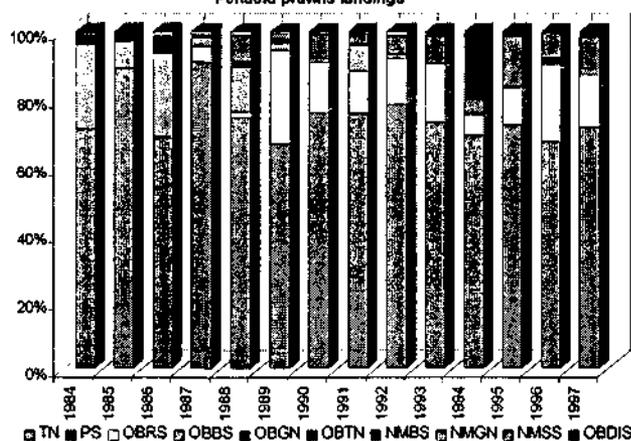


Table 38

Percentage contribution of penaeid prawns by different gears

Year / Gear	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
TN	70.2	87.7	67.4	89.7	73.5	66.4	75.1	73.6	78	73	86.4	72.2	67.2	78.5
PS	--	0.1	--	--	--	--	--	0.2	0.1	--	0.2	0.05	0.01	--
OBRS	--	--	0.4	4.4	1.8	27.3	14.5	12	13.4	17.1	7.2	10.6	22.3	17
OBBS	24.8	7.6	24.1	2.7	13.1	2.3	1.1	7.7	1.3	0.2	0.2	0.6	0.6	1.6
OBGN	0.1	--	2.5	0.3	1.9	1.4	0.2	0.2	0.1	0.1	0.8	0.05	1.8	--
OBTN	--	--	--	0.5	7	1.3	7	3	5.2	8.1	4.5	14.8	7.3	10.6
NMBS	3	3.2	2.8	--	0.3	--	0.3	0.1	--	0.2	--	0.03	--	--
NMGN	0.6	--	1.1	0.9	1.2	0.7	0.7	0.6	1.5	0.4	0.2	0.23	0.12	0.28
NMSS	0.5	--	0.3	0.2	--	0.2	--	0.2	0.1	--	--	0.06	0.04	--
OBDIS	--	--	--	--	--	--	--	--	--	0.9	25.5	1.2	0.5	1.6
Total landings	35529	26684	37188	52866	67494	53317	45483	60318	51067	47988	71871	43224	46143	56131

Fig. 30. Percentage contribution of major gears in Penaeid prawns landings



In all the years more than 66 pct of the penaeid prawns landings was by trawl. Before the introduction of OBRS, till 1986, OBBS was second to trawl, but after 1988, OBRS took the place of OBBS. The maximum landing was observed during the third quarter followed by the second quarter (Table 39). On an average, the third quarter of 1960-69, 1970-79, 1980-92 and 1993-97 landed 10724 t, 25890 t, 144192 t and 18697 t respectively.

Table 39

Quarterwise penaeid prawns landings (in t)

Year	I Qr	II Qr	III Qr	IV Qr	Total
1960	740	2132	9605	321	12798
1961	1069	8197	7542	3819	20627
1962	877	3472	14584	10755	29688
1963	3343	4935	4553	9397	22228
1964	4317	6837	21378	2688	35220
1965	1994	3269	7874	1190	14327
1966	4811	10219	8986	4104	28120
1967	2894	3514	15155	5601	27164
1968	5219	3315	12295	4527	25356
1969	11959	12377	5267	4731	34334
1970	10547	11150	6749	8494	36940
1971	4736	5236	16907	4415	31294
1972	3630	9556	18630	4050	35866
1973	6720	17851	55963	4236	84770
1974	9880	15610	24046	10279	59815
1975	5874	14575	52492	4266	77207
1976	3485	10579	14989	5425	34478
1977	6117	4170	25493	4370	40150
1978	5071	11660	27303	1000	45034
1979	6826	5843	14331	2522	29522
1980	4839	12391	33494	1909	52633
1981	3269	4216	12753	2030	22268
1982	2811	4553	14348	4996	26708
1983	8391	5704	13691	1968	29754
1984	4737	7046	12459	11287	35529
1985	6376	9424	5677	5207	26684
1986	7782	12879	10840	5687	37188
1987	8574	20536	13095	10661	52866
1988	11243	16031	25471	14749	67494
1989	11044	28327	5746	8200	53317
1990	16462	17561	5273	6187	45483
1991	9803	14417	18422	17676	60318
1992	16285	10586	16038	8158	51067
1993	7530	10592	20505	9361	47988
1994	11032	27838	22275	10726	71871
1995	9403	12817	17883	3121	43224
1996	7207	11499	20233	7204	46143
1997	17018	14447	12591	12075	56131

3.2.11 Cephalopods

Cephalopods landings in Kerala varied from 17 t in 1962 to 43472 t in 1995 (Table 19, pg.22 and fig. 27). There was a marked increase in the landings of cephalopods from 1977 onwards. The rate of increase in cephalopods landings was maximum during the period 1986-97 due to increasing demand in the international market and higher market price. Of late, cephalopods became a targeted group. The introduction of larger trawlers widened the area of operation for cephalo-pods. The annual average landing of cephalopods was only 353 t during 1960-69, 2210 t during 1970-79, 12561 t during 1980-92 and 35676 t during 1993-97. More than 90 pct of cephalopods landings during the period 1987-89, 1991-93 and 1996-97 was by trawls. During the year 1990 it was 77 pct by trawl and 5.5 pct by OBGN (Table 40, fig. 31).

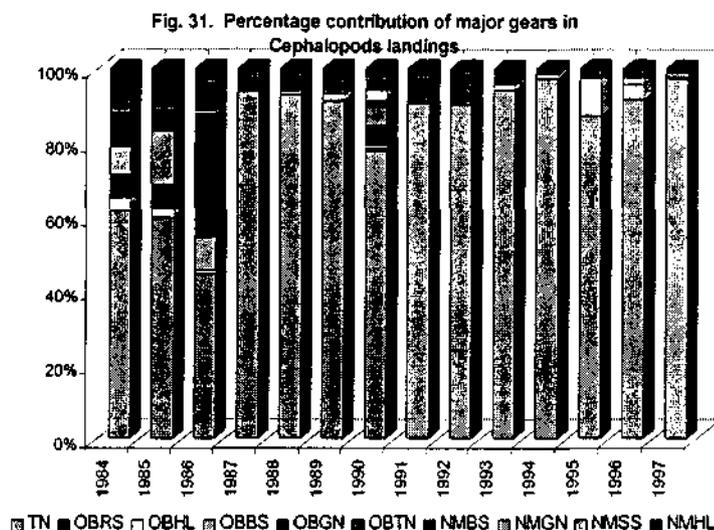


Table 40

Percentage contribution of cephalopods by different gears

Year / Gear	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
TN	61.4	59.5	44	92.5	92.3	90.5	77.2	90	89.9	94.1	97.2	87	91.4	96.8
OBRS	--	--	--	--	--	0.6	0.8	1.1	--	0.1	0.2	--	0.2	--
OBHL	3.4	2.4	1.1	0.3	0.6	1.4	0.8	0.4	0.8	1.4	1.2	9.9	3.6	0.6
OBBS	--	--	8.8	0.3	0.5	0.5	--	--	--	0.1	--	0.12	2	0.8
OBGN	5.9	0.4	--	1.4	--	--	5.5	1.2	2.4	1.5	--	--	0.01	0.02
OBTN	--	--	--	--	--	0.7	4.6	--	--	--	0.4	0.18	--	--
NMBS	0.4	6	33.3	--	1	0.8	1.7	2.8	4.1	1.2	--	0.29	0.5	--
NMGN	7.2	14.1	0.8	0.2	--	--	2.9	0.2	--	0.1	--	--	--	--
NMSS	9.2	5.8	7.4	1.4	--	0.7	2.7	1	0.6	0.2	0.4	0.14	0.4	0.08
NMHL	12	11.4	4	2.8	5	4.4	3.2	2.9	1.9	1.3	0.7	2.16	1.6	1.3
Total landings	6022	8283	14987	7535	15155	23488	24206	19468	30625	28471	36936	43472	32445	37058

Trawl net was the major gear for this group over the years. Maximum landing of cephalopods was observed during the third and the fourth quarter (Table 41). On an average 5521 t of cephalopods was landed during the third quarter and 4616 t in the fourth quarter of 1980-92.

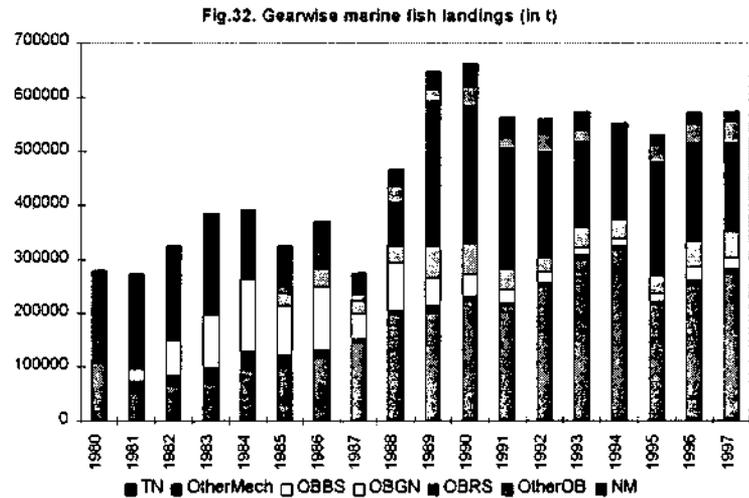
Table 41

Quarterwise cephalopods landings (in t)

Year	I Qr	II Qr	III Qr	IV Qr	Total
1960	66	2	347	2	417
1961	9	4	2	13	28
1962	1	0	8	8	17
1963	115	34	18	13	180
1964	12	3	129	196	340
1965	63	--	37	74	174
1966	200	52	162	300	714
1967	231	24	71	48	374
1968	263	32	279	548	1122
1969	123	14	--	27	164
1970	12	--	2	72	86
1971	60	4	31	378	473
1972	157	41	46	106	350
1973	129	23	154	33	339
1974	19	228	923	1005	2175
1975	136	592	1046	1568	3342
1976	305	45	153	369	872
1977	411	127	1633	2802	4973
1978	706	155	3821	1834	6516
1979	140	146	799	1891	2976
1980	836	228	1561	1619	4244
1981	69	123	617	1567	2376
1982	595	487	1037	1417	3536
1983	265	183	506	776	1730
1984	812	883	1561	2766	6022
1985	1954	1536	2285	2508	8283
1986	906	840	8040	5201	14987
1987	2617	1035	1822	2061	7535
1988	2988	2860	4030	5277	15155
1989	3071	3970	11432	5015	23488
1990	4126	5487	7369	7224	24206
1991	4682	3303	4773	6710	19468
1992	8025	4539	9057	9004	30625
1993	7722	4838	10389	6022	28471
1994	7712	7011	13844	8359	36936
1995	5510	4512	24942	8508	43472
1996	5142	4244	12716	10343	32445
1997	8032	8464	9409	11153	37058

4. THE CHANGING SCENARIO

Fluctuations in the landings of marine fish depend on fishery independent factors and fishery dependent factors. The latter include the nature, size and shape of the gears, their mesh size and the fishing effort. Mechanization of craft and gear was started in the early fifties in the state under the Indo-Norwegian Project in the Quilon area. During the sixties cotton webbing gave place to nylon webbing. Purse-seining was introduced for the first time in the state in the late seventies. Motorization of the country craft was started in the eighties. There were significant changes in the gear used by the artisanal sector. Boatseine has been converted into the mini purse-seine (ringseine) and the country craft converted into the mini trawls.



During 1980-97, there were heavy fluctuations in the total marine fish landings in Kerala ranging from 273978 t in 1981 to 662890 t in 1990. Gearwise marine fish landing during 1980-97 is given in Table 42 and fig. 32.

Table 42

Gearwise marine fish landings (in t)

Gear / year	TN	Other Mech	OBBS	OBGN	OBRS	Other OB	Total OB	NM	G.Total
1980	106061 (38.01)	28722 (10.29)	---	---	---	---	---	144238 (51.70)	*279021
1981	49313 (18.00)	23743 (8.66)	22848 (8.34)	---	---	---	22848 (8.34)	178074 (65.00)	*273978
1982	62321 (19.15)	22869 (7.03)	63050 (19.38)	---	---	---	63050 (19.38)	177127 (54.44)	*325367
1983	67908 (17.63)	30162 (7.83)	99082 (25.72)	---	---	---	99082 (25.72)	188128 (48.82)	*385280
1984	93835 (23.88)	35806 (9.11)	133313 (33.93)	---	---	---	133313 (33.93)	129939 (33.08)	*392893
1985	97037 (29.81)	23905 (7.34)	92002 (28.26)	23345 (7.17)	---	12122 (3.72)	127469 (39.15)	77125 (23.70)	325536

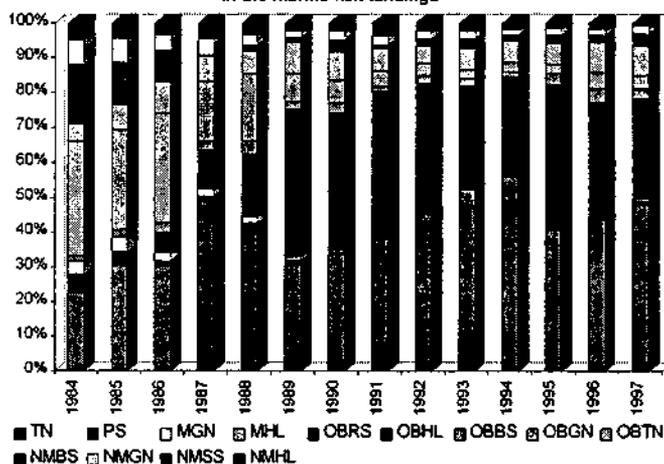
Gear / year	TN	Other Mech	OBBS	OBN	OBR	Other OB	Total OB	NM	G.Total
1986	115507 (30.17)	14278 (3.73)	118433 (30.94)	34263 (8.95)	22498 (5.88)	110 (2.90)	186282 (48.67)	66724 (17.43)	382791
1987	143913 (47.45)	7723 (2.54)	48416 (15.96)	21074 (6.94)	3155 (10.40)	10678 (3.52)	111726 (36.83)	39924 (13.16)	303286
1988	196020 (41.81)	9896 (2.11)	87800 (18.73)	31166 (6.65)	81886 (17.47)	29548 (6.30)	230400 (49.14)	32492 (6.93)	468808
1989	199217 (30.76)	14512 (2.24)	51477 (7.94)	58397 (9.01)	270903 (41.83)	19454 (3.00)	400231 (61.80)	33566 (5.18)	647526
1990	221955 (33.48)	9617 (1.45)	42162 (6.36)	55541 (8.38)	257853 (38.90)	33068 (4.99)	388624 (58.63)	42694 (6.44)	662890
1991	212736 (37.71)	6945 (1.23)	24973 (4.43)	36558 (6.48)	226330 (40.12)	17335 (3.07)	305196 (54.10)	39284 (6.96)	564161
1992	248356 (44.29)	8482 (1.51)	18898 (3.37)	28095 (5.01)	196416 (35.03)	30396 (5.42)	273805 (48.83)	30099 (5.37)	560742
1993	299301 (52.08)	9335 (1.62)	13075 (2.27)	36755 (6.40)	159772 (27.80)	21281 (3.70)	230884 (40.17)	35220 (6.13)	574739
1994	317285 (55.8)	7997 (1.4)	13733 (2.4)	35026 (6.1)	154619 (27.2)	1791 (3.5)	221295 (39.0)	21457 (3.8)	568034
1995	215287 (40.50)	6564 (1.23)	13963 (2.62)	32358 (6.08)	213502 (40.15)	30598 (5.75)	290421 (54.62)	19374 (3.65)	531646
1996	249694 (43.66)	10691 (1.87)	25071 (4.38)	49934 (8.72)	180432 (31.54)	34630 (6.05)	290067 (50.71)	21603 (3.78)	572055
1997	273858 (47.65)	9822 (1.70)	19372 (3.36)	48801 (8.49)	163335 (28.42)	40103 (6.98)	271611 (47.26)	19483 (3.38)	574774

* excluding deep sea trawler catch

Figures between the brackets are percentages to total catch.

During the period 1980-82 more than 50 pct of the marine fish landed in Kerala was by the non-motorized traditional craft. After the motorization of the country craft, the contribution from the non-motorized country craft which was 65 pct in 1981, decreased to 3.38 pct in 1997. The contribution from mechanized trawlers varied from 17.63 pct in 1983 to 47.65 pct in 1997 while the contribution from the other mechanized gears decreased from 10.29 pct in 1980 to 1.23 pct in 1991 and 1995. On the other hand the contribution from the motorized country craft started increasing from 8.34 pct in 1981 to 61 pct in 1989. Though OBRS was introduced in 1986, when its contribution was only

Fig.33. Percentage contribution of major gears in the marine fish landings



5.88 pct, its contribution went up to 41 pct in 1989 (Table 42, fig. 33). The contribution from OBBS declined with the introduction of OBRS.

Landings from the non-motorized sector varied from 19374 t in 1995 to 188128 t in 1983. After the imposition of a partial ban on trawling during the monsoon period, there was an increasing trend in the landings by this sector as well as in the total landings. The major gears in operation in the state and their roles are discussed below.

4.1 SMALL INDUSTRIAL SECTOR

4.1.1 Trawlers

The realization of the need for the development of marine fisheries even in the early periods of this century led to the acquisition of some deep-sea trawlers by the then Madras presidency which included the Malabar coast also. In 1909 a 12 ton sailing vessel (Scottish design) called Sutherland and a 25 ton 15 HP motor vessel of Arklow design called Turbinella were commissioned to do fishing experiments beyond the range of local boats, off Cannanore till 1910-11. The experiment was not a success (Anon.,1925). In the year 1922 a 48.5 foot 35 HP sea going launch called Sea scout with hauling winch and rope coiler was introduced. Captain Cribb, an experienced North Sea fisherman was appointed to man the vessel. In 1923 Captain Cribb attempted fishing with this motor launch off Cochin. The launch however proved a great disappointment from the start both in design and equipment for fishing with a Danish seine and the experiment was terminated in 1924. The life of the net was exceptionally short. Captain Cribb conducted trawling operation off Calicut in the last two months of 1928- 29 with the vessel 'S.T.Lady Goschen'. He found the region extending from 62 to 70 m to be rich in the young ones of many species of food fishes except the oil sardine and the mackerel. Another factor that emerged from the survey off Calicut in November 1928 and April 1929 was that the sea bottom off Calicut between 42 and 60 m was subject to great changes, apparently due to the drift in mud and sand. While trawling in this area met with rocks at a depth of 70 m during November, no rocks were encountered in April 1929. The strong southerly currents set by the southwest monsoon sweep the soft mud and sand off the sea bottom and leave the rocks exposed. He also reported the shifting of soft mud banks of the coast of Ponnani to Alleppy. The trawl catch comprised carangids, sharks, rays, catfish, sciaenids, perches and big-jawed jumper. Captain Cribb described the virgin ground off Trivandrum to be rich in seafans, black coral trees (antipatharians) and extensive patches of sponges and other growths which prevent the trawl from descending to the bottom. He conducted experimental trawling operations off Cannanore and Kasarkode within a depth of 30 to 94 m, often in the areas beyond the range of the local fishermen. Trawling off Cochin revealed a muddy bottom. Off Quilon the sea bottom at 84 m was of sand, mud and flat rocks. In fact, the credit for suggesting diversified fishing techniques for the capture of oil sardine and mackerel with indigenous nets goes to Captain Cribb (Anon.,1929). During 1952 'Tai-o-Maru' of the New India Fisheries Company conducted trawling between 26 and 52 m northwest of Cochin (George, 1952). The results were not very encouraging.

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After Independence, mechanization of fishing craft was initiated in the first five year plan. By the end of the first five year plan about 650 boats were mechanized, most of them in the states of Maharashtra and Gujarat. Due to the incentives offered in the shape of technical and financial assistance, new designs of mechanized boats have been developed in Kerala.

Under the Indo-Norwegian Project (INP) in the fifties, engines and boats were given to fishermen at subsidized rates. During the early sixties there were about 150 mechanized boats. There were a few fishermen training centres organized with the guidance of experts provided by the FAO and the INP. In the meantime, steps were taken to develop fishing boats of improved designs. The development of pablo boats and prototypes of surf boats are best examples. The pablo boats designed on the basis of Danish built vessels sent to India by the FAO in 1953 were modified in 1953, 1958 and 1960. The newly designed boats were fairly successful in the waters of Kerala.

Realising the need for developing a suitable craft, the CIFT conducted new experiments, with the assistance of the FAO and the INP. The CIFT offered training courses in boat building as a result of which many boat building yards came up as a cottage industry. In the initial years, the improved trawlers were 31'9" in length with a 30 HP BUKH engine and a controllable pitch propeller fitted with winches and heavy trawl gallows on the aft deck. Another variation was the 32' shrimp trawler with a 36 HP engine designed for stern trawling. These boats were mainly used for investigative purposes. Improvements were made on the existing pablo boat which resulted in the 25 foot open fishing type with transverse stern, a sharp forebody and middle space for engine, gear and catch. Yet another model was the 32' shrimp trawler with a sharp body, generous fish hold, cork insulation, proper air circulation, 40 HP engine (in the aft) power takeoff for winches and decks equipped for stern trawling.

When the pressure for mass production of shrimp trawlers and other fishing boats increased some of the indigenous designs of trawlers emerged. The vessels operating along the Kerala coast do not conform to any of the vessels introduced initially, but combine all the good features of more than one design. During the third five year plan the 30' and 32' vessels formed the basis for mechanization. In the mid sixties a standardization programme was initiated to increase the efficiency of trawlers. As a result, the design of 30' and 32' trawlers was accepted as the standard. At present the great demand for larger vessels has rendered these boats obsolete. The following types of mechanized vessels are in operation in Kerala: 32' open type gillnetter, 30' half decked trawler and gillnetter, 30' fully decked trawler, 32' and 36' shrimp trawler. However, the 32' and 34' trawlers form the mainstay of shrimp trawling in Kerala.

In the initial years of mechanisation the fishing communities were hostile to rapid mechanization. Fishermen were tradition-bound and weary of accepting modern methods of fishing and other related activities. A beginning was made with small mechanized boats of low cost on which traditional gears could be successfully employed. This was followed by bigger boats and newer types of gears.

Experimental trawling with small mechanized boats (10.9 m.OAL) was carried out even during 1954-59 by the Indo-Norwegian Project along the Kerala coast in shallow waters. Commercial shrimp trawling started in the latter half of the sixties. Beam trawl, the simplest among the dragged gear, was in operation for some time, Kurian (1953) used a 6 feet beam trawl for the survey of the bottom fauna of the Travancore coast. The attempt of Deshpande (1960) with 10' beam trawl in 1959 was probably the first detailed experiment to study the fishing features of this gear. The results of this experiment indicated that the catch per hour of beam trawl and the indigenous thanguvala was more or less equal. The catches of beam and otter trawls on the basis of the volume of water filtered, did not show much difference. Comparative fishing experiments with 15' beam trawl and 45' nylon four seam overhang otter trawl were subsequently conducted (Kurian 1962). The quantitative and qualitative analysis made on the basis of the horizontal opening and the towing speed showed that bottom burrowing forms including prawns were more in the catches of the beam trawl, while the bottom swimmers dominated the catches of the otter trawl. To increase the efficiency of the beam trawl in the capture of prawn, a tickler chain was attached to a 10' beam trawl. The results showed that the beam trawls yielded more prawns (Deshpande and Siven, 1962).

Commercial otter trawling for prawns commenced off Cochin in 1958. Several new designs of otter trawl were introduced (Satyanarayana *et al.*, 1962; Kurian *et al.*, 1964). The initial experiments were mainly directed towards the operational aspects of this gear. To increase the catch of prawns in relation to fish, the vertical height of the net was reduced by adjusting the floats on the head rope for low buoyancy and making the ground rope heavy. A tickler chain for increasing the prawn catch of otter trawls was tried successfully (Deshpande and George, 1964). Designs of the common shrimp trawl used in Japan have long wings (Kurien 1964). A long wing trawl can cover more horizontal distance on the ground and increase the prawn catches. Trawl with long sweeps was found to improve prawn catches. At Cochin otter trawl has become the predominant gear in mechanized fishing for prawns.

Two distinct vessel layouts were in general use - the side trawler in which the net is set and retrieved over the side, and the stern trawler in which the operation takes place over the stern. Almost from the beginning in Kerala the stern trawler was in use and a few side trawlers operated experimentally disappeared in due course of time.

Generally, in Kerala two seam trawls are for shrimp while four seam trawls are used for fish. Larger trawlers are used for operation in deeper waters especially for cuttlefish. Large bottom trawls are of two seam construction. Shrimp trawls are usually not provided with an overhang (Nair, 1969).

The modest mechanised fishing which started with a few INP boats and the Fishery Survey of India (FSI) exploratory boats, has developed into a strong full-fledged commercial activity. The vessels include the 6m to 9m pablo boats powered by 10 BHP to 30 BHP engines and the slightly bigger shrimp trawlers. They make single day cruises starting from the base early in the morning and returning in the evening after making on an average 3 to 4 hauls of about one hour duration each. The major gear is the conventional two or four seam shrimp trawl

varying from 13m to 18m in head rope length and 25 mm for codend mesh. The depth of operation is 9m to 36 m. The bottom in these grounds is mostly muddy. In the late fifties fishing used to commence by November or December and end by May. But with increased activities in the early sixties fishing operations were suspended only during the peak monsoon and commenced by September and continued upto June (George *et al.*, 1963).

The INP schooners (50 to 70' long) carried out exploration all along the Kerala coast. It was found that the areas north and south off Cochin were the most productive (Per Sandven, 1959). Encouraged by these findings the INP brought four medium sized boats known as M-boats (8.8m long) from Norway and commissioned them for shrimp trawling operations in these areas in the beginning of 1957. At the same time, with the establishment of the FSI base at Cochin, three medium sized trawlers also started operating for prawns in the same grounds (Tholasilingam *et al.*, 1964). The operations of these vessels were restricted mainly to a radius of 20 miles off Cochin. Prawns generally appeared in the 32 to 60 m deep grounds and consisted of *Metapenaeus affinis* and *Parapenaopsis stylifera*. By November/December these species appeared in large numbers in the 8 to 22 m area where *M. dobsoni* and *Penaeus indicus* also occurred. The season starts by September/October. *M. affinis* was dominant in the catches in the first half of the season upto December whereas *M. dobsoni* was abundant in the later half of the fishing season. *P. stylifera* was obtained in large quantities in the beginning of the season and sometimes at the end of the season also. The major portion of fish catch was treated as trash fish. The dominant species were the sciaenids, nemipterids, flatheads, *Opisthopterus tardoorecarangids*, ribbonfishes, lizardfishes and *Lactarius lactarius*. *Opisthopterus tardoore* was present in the 8 to 30 m depth zone throughout the season. *Lactarius lactarius* was available throughout the fishing season in the shallower zone within the 30 m isobath. It was caught in large quantities in the 32 to 46 m depth zone from October to February with a peak in December (Tholasilingam *et al.*, 1964).

The mechanised boats are constructed in timber, fiberglass and steel. Wooden boats have so far been the cheapest and the most popular in Kerala. The present mechanised trawler fleet in Kerala is medium-sized 10 to 14 meters in length with engines between 45 and 120 HP. The trawlers operate along the whole length of Kerala's coastline. The largest concentration is in the Quilon region.

Most of the mechanized trawling effort in Kerala is expended from the Sakthikulangara-Neendakara base and nominally from Cochin and Calicut bases, besides other bases of sporadic operation. Based on the time series data on catch and effort optimal trawler effort has been estimated by the following equations

$$y = a + b_1f - b_2f^2 \quad (1)$$

where, a, b₁ and b₂ are constants, y is catch in t, and f is effort in units of trawler operation. The maximum catch is estimated by the equation,

$$M_{catch} = \frac{b_1^2}{4b_2} + a \quad (2)$$

And the effort required to generate the M_{catch} ie fm_{catch} by

$$fm_{catch} = \frac{b_1}{2b_2} \quad (3)$$

The fitted equation (1) has resulted in the relation,

$$y = -312754 + 1584.41 f - 1.105999 f^2 \quad (4)$$

from which M_{catch} has been estimated to be 254,687 t and fm_{catch} to be 716,280 units of operation of trawlers per year. If the mechanized trawlers operate in the present fishing grounds at the maximum of 200 days a year, the optimal number of units required per year is 3581 trawlers as against the 4424 trawlers operating at present.

The increasing demand for prawns for export prompted the trawlers to operate even during the southwest monsoon period (June to August) off Sakthikulangara and Cochin from about the beginning of the seventies. Monsoon trawling, thereafter, became a regular feature at both these centres except during the ban period. During the peak trawling activities at Sakthikulangara and Cochin during the southwest monsoon period, several hundreds of trawlers from the neighbouring areas also carry out intensive trawling from these centres. The mainstay of the trawl catch is *Parapenaeopsis stylifera* (popularly known as the karikkadi chemmeen). In the total karikkadi landings in the state, shrimp trawls account for about 95 pct of which nearly 60 pct is landed during the southwest monsoon period. On an average 75 pct of penaeid prawn landing in Kerala during 1984-97 was accounted for by trawls (Table 38, pg. 41). During the monsoon season, the trawls land considerable quantities of by-catches which comprise a large group of finfishes, other crustaceans and cephalopods.

Fig.34. Trawl landings (in t)

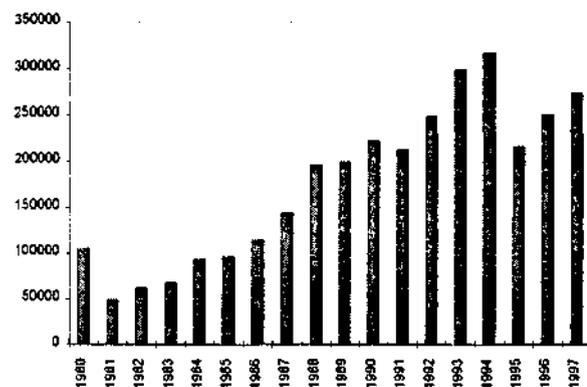
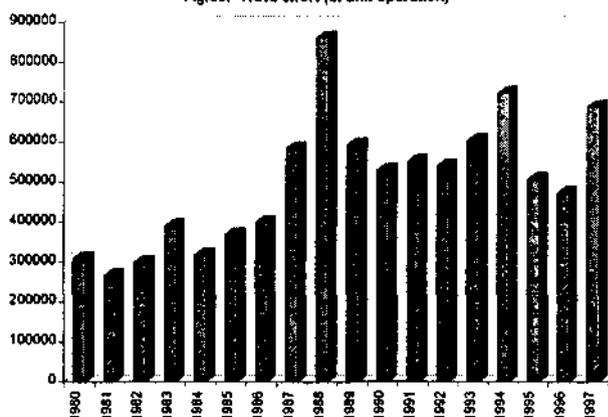


Fig.35. Trawl effort (in unit operation)



During the period 1980-97, trawl landings in Kerala varied from 49,313 t in 1981 to 317,285 t in 1994 accounting for 18 pct in 1981 to 47.67 pct in 1997 of the total landings (Table 42 pg. 45, fig. 34). Trawling effort in units of operation varied from 268000 in 1981 to 863000 in 1988. There was an increasing trend in trawl effort in Kerala during 1981-88 and decreasing trend from 1989 onwards (Table 43, fig. 35).

Table 43

Catch, effort and CPUE data for trawl, purseseine, MGN and MHL

Year /year	1980	1981	1982	1983	1984	1985	1986	1987	1988
Trawl									
Catch	106061	49313	62321	67908	93835	97037	115507	143913	196020
Effort	310000	268000	300000	393000	319000	370000	402000	586000	863000
CPUE	342	184	207	172	294	262	287	245	227
Purseseine									
Catch	16479	17673	11496	14274	20799	11482	4648	904	760
Effort	5000	9000	9000	7000	7000	5000	2500	1100	570
CPUE	3296	1963	1277	2039	2971	2296	1859	822	1333
MGN									
Catch	9809	6021	11322	15780	14707	12361	9384	5341	8563
Effort	68000	50000	80000	87000	88000	84000	70000	45000	71000
CPUE	144	120	141	181	167	147	134	118	120
MHL									
Catch	2434	49	51	108	300	62	246	1011	729
Effort	22000	3000	1000	1000	1000	300	1300	4000	2637
CPUE	110	16	51	108	300	206	189	252	276

Table 43 contd..

Year/ Gear	1989	1990	1991	1992	1993	1994	1995	1996	1997
Trawl									
Catch	199217	221955	212736	248356	299301	317285	215287	2496944	273858
Effort	595000	532000	553000	542000	605727	725000	509000	474000	689000
CPUE	334	417	384	458	494	438	423	527	397
Purseseine									
Catch	8796	4649	4107	6196	6844	6160	4228	8131	5630
Effort	3700	2000	3000	3000	3984	3744	1600	4200	2800
CPUE	2932	2324	1369	2065	1718	1645	2643	1936	2010
MGN									
Catch	5131	4041	1844	1776	1604	985	1380	1597	1854
Effort	33000	29000	14000	11000	10632	8316	11000	11000	6800
CPUE	155	139	131	161	151	118	125	145	273
MHL									
Catch	685	927	994	510	887	852	956	963	2338
Effort	3100	1676	3882	2200	2802	3211	4000	2300	4300
CPUE	221	553	256	238	317	265	239	418	543

Note: Catch landings in t, Effort in units operation, CPUE in kg.

CPUE data for trawl during 1980-97 is given table 43 (fig. 36). CPUE varied from 172 kg in 1983 to 527 kg in 1996. There is an increasing trend in CPUE as well as total catch during the period 1988-97. This may be due to the increased size of the trawlers and the extension of fishing ground. The partial banning of trawling during the monsoon period might have influenced this trend. Quarterwise catch, effort and CPUE data for trawl net is given in table 44 (fig. 37, 38 & 39).

Fig.36. Trawl CPUE (in kg)

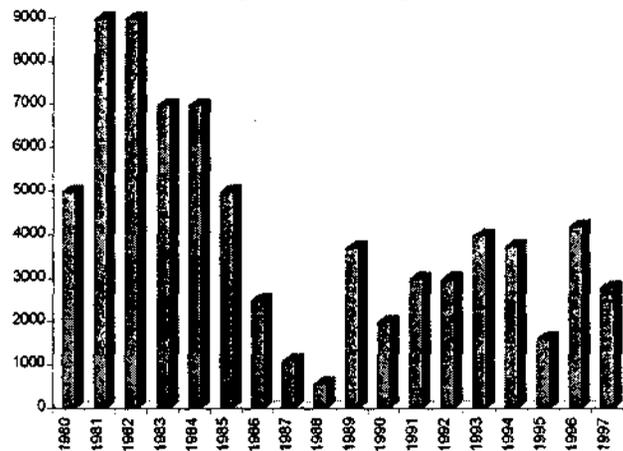
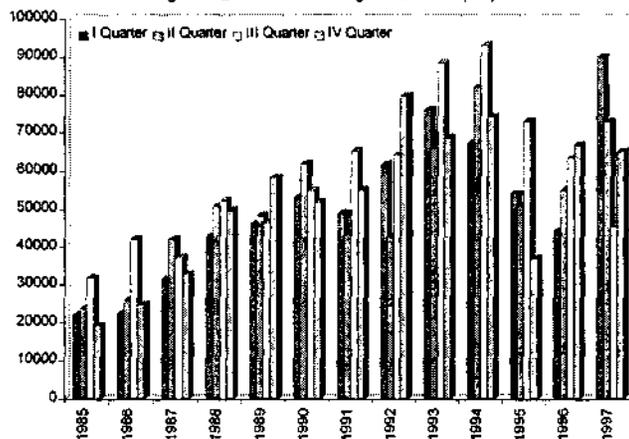


Fig.37. Quarterwise landings of trawl net (in t)



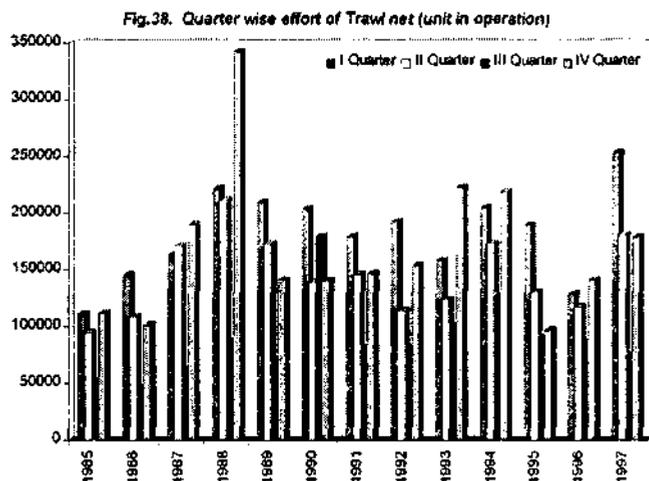
There was an increase of 29% in the trawl landings in 1997 when comprised that of 1991. This was due to the increased contribution of marine fishes from the depth range beyond 30 meters. During 1997, trawlers were able to catch more fishes from deepwaters because of the modification made in their size.

Table 44

Quarterwise catch, effort and CPUE data for trawlers in Kerala.

Year	I Quarter			II Quarter			III Quarter			IV Quarter		
	Catch	Effort	CPUE	Catch	Effort	CPUE	Catch	Effort	CPUE	Catch	Effort	CPUE
1985	22247	111200	200	23820	94400	252	31693	51900	610	19277	112500	171
1986	22558	145700	155	25956	108600	239	42186	46800	901	24807	101300	245
1987	31658	163200	194	42194	170900	247	37201	62300	597	32860	189900	173
1988	42990	221800	194	50952	211500	241	52362	87000	602	49716	342800	145
1989	46347	210200	220	48345	172600	280	46298	71300	649	58227	141000	413
1990	53321	204169	261	61977	138552	447	54828	179270	306	51829	140098	370
1991	49035	179624	273	43367	145823	297	65309	81463	802	55025	146728	375
1992	61701	193000	319	42543	114000	373	64137	81000	792	79975	154000	519
1993	76264	158357	482	66033	123788	533	88421	100270	882	68586	223312	307
1994	67470	205000	329	82314	173000	476	93195	126000	740	74306	219000	339
1995	54212	190000	285	50926	130000	392	73186	91000	804	36963	97000	381
1996	44429	129000	344	55098	117000	471	63373	86000	737	66794	141000	475
1997	90170	254000	355	72964	181000	403	45520	75000	607	65160	179000	365
Avg	41232	178612	227	42394	144547	297	49252	82629	657	46465	166041	301

Note: Catch in t, effort in units of operation, CPUE in kg.



During 1985-97, maximum CPUE was observed during the third quarter in almost all the years. After the imposition of partial ban since 1988, catch and CPUE have increased in all the years. Though the effort was minimum during the third quarter of each year, catch and CPUE were much higher during this quarter.

This may be due to the effect of the partial ban on monsoon trawling in Kerala. The percentage of trawl catch in the landings of major group of fishes during 1984-97 is given in table 45.

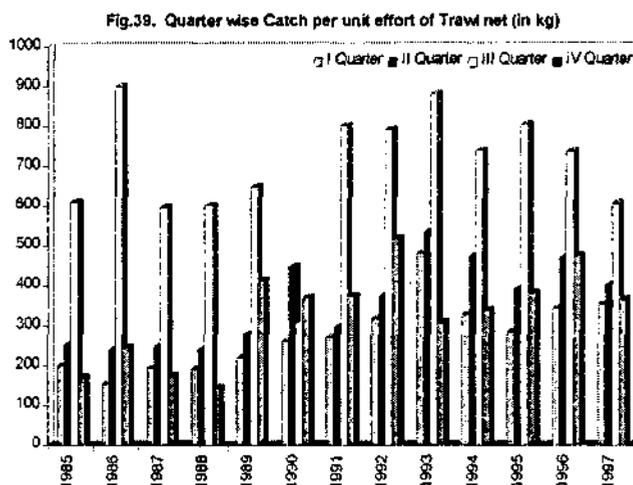


Table 45

Percentage contribution of trawl to the landings of major groups of fishes.

Groups	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
Elasmobranchs	9.4	10	18.3	22.3	35.2	38.8	22.8	33.6	41.7	67.7	80.1	71.7	75.5	72.6
Catfishes	28.2	20.8	7.9	34	40.6	15.4	7	53.2	33.5	49.4	41.2	34	35.8	53.12
Oil Sardine	0.1	0.2	--	--	0.1	0.4	3.2	0.2	0.2	0.1	--	0.6	0.09	0.86
Other sardines	0.1	--	0.5	0.4	2.4	1	1.4	0.8	1.7	0.3	7.6	0.25	1.5	0.38
Whitebaits	2.6	3.2	7.9	23.4	13.4	20	14.9	24	18.1	24.7	28	17.8	28.1	51.48
Lizardfishes	96.5	98	98.2	97.3	97.6	94.2	98.4	99	98.5	99.5	99.9	99.3	99.2	99.13
Perches	80.5	83.8	86.7	85.7	87.6	88	88.2	87	89.3	90.4	92.8	92.1	93.6	87.3
Goatfishes	--	2	79.8	99.2	95.6	97.5	99.5	99.5	98.8	96	100	99.4	86.7	54.9
Croakers	62.4	72	26.4	60.6	74.4	52.4	54.4	68.6	49.3	71.1	54.89	67.7	32.6	72.76
Ribbonfishes	3.4	2.1	23.2	22.2	95.3	84.7	8.6	75.2	79	93.1	96.5	87.2	61.18	90.9
Carangids	7.2	14.2	5.2	34	28	31.3	33.8	24.4	29.2	52.7	53.5	21.4	51.8	50
Silverbellies	48.4	41	43.3	72.8	43	36.6	63.6	60.6	74.6	68.1	55	52.4	52.3	77.76
Big-jawed jumper	16.5	16.4	52.5	66	74	26.8	10.5	25.2	29.9	66.5	32.5	41.3	51.5	62.36
Mackerel	0.1	0.2	1	3.8	6.3	3	4.4	4.6	10.7	7.9	3.7	4.5	4.1	4.9
Seerfishes	--	--	--	1	8.3	0.9	1.2	2.7	5.8	34.2	--	6.2	11.4	7.59

Groups	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
Tunnies	--	--	--	--	--	--	--	0.9	0.1	0.1	--	0.07	0.1	0.63
Flatfishes	58.7	84.1	44.2	76.5	66.5	76.7	82.5	82	53.1	72.1	81.5	65.15	59	71
Penaeid prawns	70.2	87.7	67.4	89.7	73.5	66.4	75.1	73.6	78	73	86.3	72.2	67.2	78.5
Cephalopods	61.4	59.5	44	92.5	92.3	90.5	77.2	90	89.9	94.1	97.29	87.1	91.5	96.8

Lizardfishes, perches, goatfishes, croakers, silverbellies, big-jawed jumper, flatfishes, ribbonfishes, penaeid prawns and cephalopods were the major groups landed by trawl. More than 95 pct of the landings of lizardfishes were contributed by trawl. Lizardfishes account for more than 5 pct of trawl landings during the second, third and fourth quarters (Table 46). Contribution of trawls to the perch landings varied from 80.5 pct in 1984 to 93.6 pct in 1996. Among the perches the threadfin breams were the dominant and available in the trawl catches almost throughout the year with maximum landings in the third quarter. Goatfishes were a meager 2 pct in the landings of trawl in 1985, but increased significantly to 79.8 pct in 1986 and 99.5 pct in 1990 and '91. Goatfishes were absent in the second quarter throughout the study period, and the maximum of 15 pct in trawl landings was noticed during the third quarter of 1991. More than 50 pct of the croakers landed were from the trawl except in '86 (26.4 pct). The silverbellies landings from trawls varied from 36.6 pct in '89 to 77.76 pct in '97. The Big-jawed jumper landings from trawls varied from 10.5 pct in '90 to 74 pct in '88. There was an increasing trend in the total contribution of this species from 52.5 pct in '86 to 74 pct in '88, but it started declining subsequently. A minimum contribution of 44.2 pct (in '86) to a maximum of 82.5 pct (in '90) of the flatfishes landings was contributed by the trawl. During '84 to '97 the penaeid prawns, the target group were the most dominant in the trawl landings. Trawl contribution to the landings of penaeid prawns varied from 66.4 pct in '89 to 89.7 pct in '87. They are caught throughout the year, but the maximum catch is landed during the second quarter followed by the first. For the period under discussion, economic factors made the trawlers target the cephalopods with the trawl, contributing 44.4 pct (in '86) to 92.5 pct (in '87) of the total cephalopod catch, trawlers landed cephalopods in all the quarters, with maximum in the fourth quarter. The contribution of trawl to the landings of ribbonfishes was more than 75 pct during '88, '89, '91 to '97 and 1997. The trawlers landed considerable quantities of stomatopods, with maximum catches during the first quarter followed by the fourth. Stomatopods were absent in the trawl catches during the third quarter (except in 1988) as the trawlers concentrate on the karikkadi prawn in depths where stomatopods are negligible.

TABLE 46A

Depthwise percentage contribution of marine fish in trawl landings during 1991 and 1997

Year	Depth (meters)						Total
	0-10	20-Oct	20-30	30-40	40-50	Above 50	
1991	6.6	29.6	28.2	14.1	7.4	14.0	212736
1997	6.6	22.5	14.3	19.6	18.1	18.8	273858

Table 46

Quarterwise percentage contribution of trawl by major groups of fishes.

Groups	OS	WB	LF	TF	OP	GF	CR	RF	CAR	SB	FF	PP	CAB	STO	CEP	OTH	Total (t)
FIRST QUARTER																	
1985	--	--	5	12	7	--	9	--	--	--	10	25	--	15	5	12	22247
1986	--	--	--	9	--	--	--	--	--	--	5	30	--	22	--	34	22558
1987	--	--	--	13	5	--	5	--	7	6	--	23	--	11	8	22	31658
1988	--	--	--	11	5	--	--	--	--	--	6	25	--	14	6	33	42990
1989	--	--	--	16	--	7	--	--	7	--	--	23	--	14	5	28	46347
1990	--	--	--	8	7	7	--	--	--	--	7	23	5	14	5	24	53321
1991	--	--	--	8	--	13	--	--	--	--	6	18	--	12	9	34	49035
1992	--	--	--	7	5	6	--	--	7	--	9	23	--	9	12	22	61701
1993	--	3	4	10	6	2	5	2	9	3	5	9	3	10	9	20	76264
1994	--	--	--	10	7	--	--	--	8	--	--	15	--	11	11	32	67470
1995	--	--	--	13	--	--	7	--	8	--	--	14	--	11	10	32	54212
1996	--	5	--	16	5	--	--	--	11	--	--	13	--	6	11	33	44429
1997	--	--	--	10	7	--	--	--	10	--	--	17	--	14	9	26	90170
SECOND QUARTER																	
1985	--	--	9	10	--	--	9	--	--	--	8	33	--	7	5	19	23820
1986	--	--	8	8	--	--	5	--	--	6	--	34	--	7	--	32	25956
1987	--	--	--	--	--	--	--	--	5	--	8	45	--	5	--	37	42194
1988	--	7	9	5	--	--	--	5	5	--	--	27	--	--	6	36	50952
1989	--	5	6	11	--	--	--	--	8	--	5	30	--	8	--	27	48345
1990	--	--	8	15	--	--	--	--	16	--	--	22	--	8	--	31	61977
1991	--	--	5	6	--	--	--	--	16	--	--	27	--	5	7	34	43367
1992	--	5	8	6	--	--	--	--	19	--	--	20	--	--	●	33	42543
1993	--	8	5	10	6	1	3	1	21	1	2	11	3	5	7	16	66033
1994	--	--	--	6	--	--	--	--	17	--	--	29	--	5	9	34	82314
1995	--	5	5	7	--	--	--	--	21	--	--	18	--	6	9	29	50296
1996	--	--	--	7	--	--	--	--	26	--	--	17	--	--	8	42	55098
1997	--	--	--	8	--	--	--	6	13	--	--	17	5	5	12	29	72964
THIRD QUARTER																	
1985	--	--	7	56	--	--	--	--	--	--	9	16	--	--	5	7	31693
1986	--	--	5	71	--	--	--	--	--	--	--	15	--	--	--	9	42186
1987	--	--	7	42	--	--	--	--	--	--	5	29	--	--	--	17	37201
1988	--	--	10	29	--	5	--	--	--	--	--	30	--	7	--	19	52362
1989	--	--	7	48	--	--	--	--	11	--	--	5	--	--	23	6	46298
1990	--	--	--	68	--	--	--	--	6	--	--	6	--	--	8	12	54828
1991	--	--	6	30	--	15	--	--	9	--	--	21	--	--	7	12	65309
1992	--	--	6	39	--	--	--	--	5	--	--	18	--	--	12	20	64137
1993	--	1	7	45	2	--	2	1	8	--	3	15	--	--	11	5	88421
1994	--	--	5	29	--	--	--	--	10	--	--	21	--	--	14	21	93195
1995	--	--	8	22	7	--	--	--	--	--	--	17	--	--	28	18	73186
1996	--	--	5	44	--	--	--	--	7	--	--	12	--	--	14	18	83373
1997	--	--	8	18	--	--	--	10	--	--	--	15	--	--	20	29	45520

Groups	OS	WB	LF	TF	OP	GF	CR	RF	CAR	SB	FF	PP	CAB	STO	CEP	OTH	Total (t)
FOURTH QUARTER																	
1985	--	--	--	--	--	--	5	--	--	--	14	26	--	14	9	32	19277
1986	--	--	5	12	--	--	--	7	5	--	--	13	--	9	17	32	24807
1987	--	8	--	--	--	--	5	--	--	--	--	31	--	14	6	36	32860
1988	--	--	--	5	--	10	--	10	11	--	--	19	--	6	10	29	49716
1989	--	11	--	10	--	--	5	9	--	--	19	13	--	8	7	18	58227
1990	11	6	5	--	--	--	5	--	8	--	9	10	--	--	11	35	51829
1991	--	13	7	--	--	5	--	--	6	--	11	21	--	--	10	27	55025
1992	--	7	6	5	5	--	5	5	13	--	6	7	--	--	11	30	79975
1993	--	6	1	2	4	--	5	5	14	2	11	10	2	11	8	19	68583
1994	--	--	--	7	--	--	--	14	6	--	--	13	--	9	12	28	70306
1995	--	7	7	6	--	--	--	6	12	--	--	6	--	--	20	30	36963
1996	--	7	5	6	5	--	--	14	10	--	--	9	--	--	14	24	66794
1997	--	7	--	5	--	--	--	11	8	--	--	14	--	--	16	32	65160

Table 47, show the quarterwise pelagic and demersal group of fishes landed by trawlers.

Table 47

Quarterwise pelagic and demersal landings in trawl (in t)

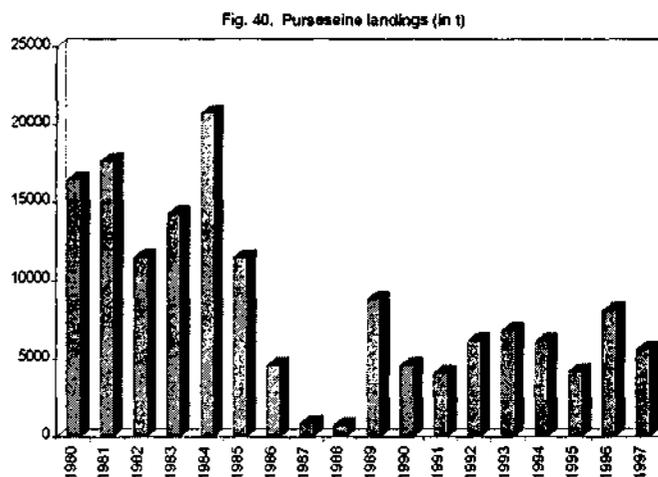
Year	I Quarter			II Quarter			III Quarter			IV Quarter			G. total	
	P	D	Total	P	D	Total	P	D	Total	P	D	Total	P	D
1985	1062	21185	22247	1229	22591	23820	366	31327	31693	2445	16832	19227	5102	91935
1986	1625	20933	22558	3461	22495	25956	135	42051	42186	5777	19030	24807	10998	104509
1987	3800	27858	31658	6691	35503	42194	1592	35609	37201	7147	25713	32860	19230	124683
1988	5428	37562	42990	14533	36419	50952	2615	49747	52362	15916	33800	49716	38492	157528
1989	6599	39748	46347	11491	36854	48345	5562	40736	46298	16520	41707	58227	40172	159045
1990	5790	47531	53321	16794	45183	61977	3844	50984	54828	17211	34618	51829	43639	178316
1991	5643	43392	49035	14252	29551	43803	8649	56060	65309	14574	40451	55025	43118	170054
1992	8359	53342	61701	14396	28147	42543	9530	54607	64137	27794	52181	79975	60079	188277
1993	1654	59750	76264	26037	39996	66033	10262	78159	88421	25094	43489	68583	77907	221394
1994	14342	53128	67470	22266	60048	82314	14705	78490	93195	23897	50409	74306	75210	242075
1995	10239	43973	54212	18485	32441	50926	7231	65955	73186	13401	23562	36963	49356	165931
1996	10052	33777	44429	22959	32139	55098	9773	73600	83373	26614	40180	66794	69398	179696
1997	20406	69764	90170	22066	50898	72964	9815	35705	45520	22884	42276	65160	75171	198643

In all the years, maximum landings of pelagics take place in the fourth quarter and the least in the third quarter. During the third quarter the trawlers target the demersal fishes and prawns, especially the threadfin breams, lizardfishes and *P. stylifera*, but during the fourth quarter (subsequent to the declining demersal catches), the trawlers employ the fish trawl, augmenting the catches of the pelagics. During the third quarter, the demersal landings varied from about 31000 t in 1985 to 78490 in 1994 and in the fourth quarter they ranged from 16832 t in 1985 to 52181 t in 1992. During the fourth quarter, the fish trawl lands large quantities of high quality market fishes. There was an overall increase in trawl landings and their CPUE over the

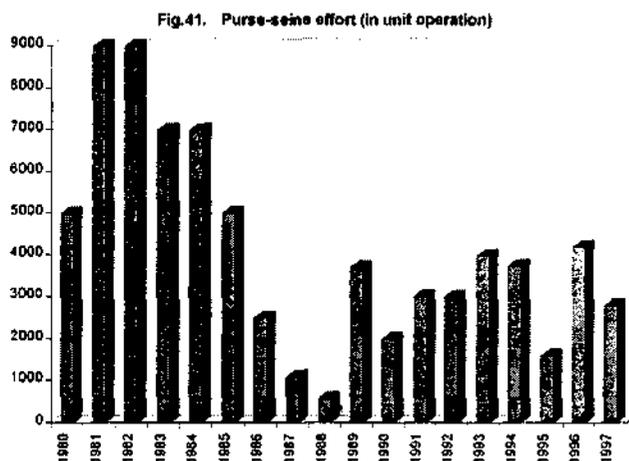
years in both the pelagics and the demersals due to the extended areas of operation beyond 50 m depth, increase in the size of the trawlers and the consequent longer voyages.

4.1.2 Purseseine

Commercial purseseining started in the state by the end of 1979 with a small fleet of 20 purseseiners. By 1980 the number rose to 70. Unlike in Karnataka, where purseseining is the mainstay of the fishery, it did not pick up in Kerala. The sudden introduction of a large number of purseseiners boosted the production of catfishes. The steady increase in the yield of catfishes along Kerala began to show a decreasing trend, after purseseine operations became massive in Karnataka (James *et al.*, 1989). At present there are only 76 purseseiners in Kerala confined only to the Ernakulam district.



Purseseining is mainly meant for harvesting the pelagic fishes. It has also helped to some extent in augmenting the production of demersal groups. During the period 1980-97, purseseine landings in the state varied from 760 t in 1988 to 20799 t in 1984 (Table 43 pg.52, fig. 40).



The contribution of purseseiners to the total landings varied from 0.1 pct in 1988 to 5 pct in 1984 (Table 48). Purseseine effort in terms of units of operation varied from 570 in 1988 to 9000 in 1982. There was a decreasing trend in purseseine effort during 1981-1988 (fig. 41).

Table 48

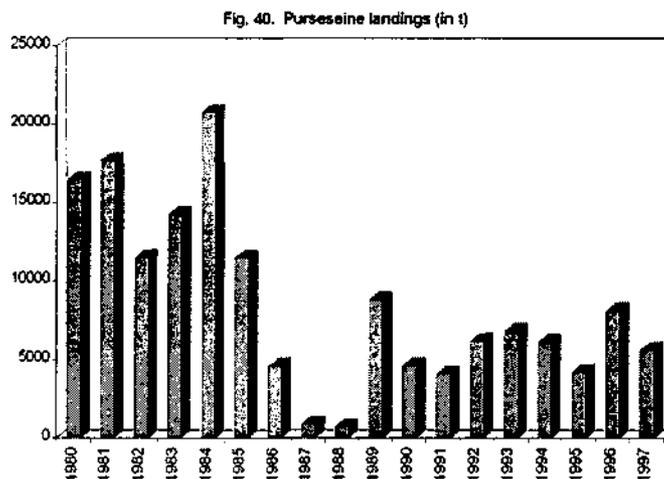
Percentage contribution of major gears to the marine fish landings

Year / Gear	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
TN	23	30	30.1	47.4	41.8	30.7	33.4	37.7	44.9	52.1	55.8	40.49	43.65	47.65
PS	5	4	1.2	0.2	0.1	1.4	0.7	0.7	1.1	1.2	1	0.8	1.42	1
MGN	3.5	4	2.4	1.7	1.8	0.8	0.6	0.3	0.3	0.3	0.1	0.26	0.28	0.32
MHL	0.07	0.01	0.06	0.3	0.1	0.7	0.1	0.1	0.1	0.1	0.1	0.18	0.17	0.42
OBRS	--	--	5.8	10.4	17.4	41.8	38.8	40.1	35	27.8	27.4	40.16	31.54	28.42

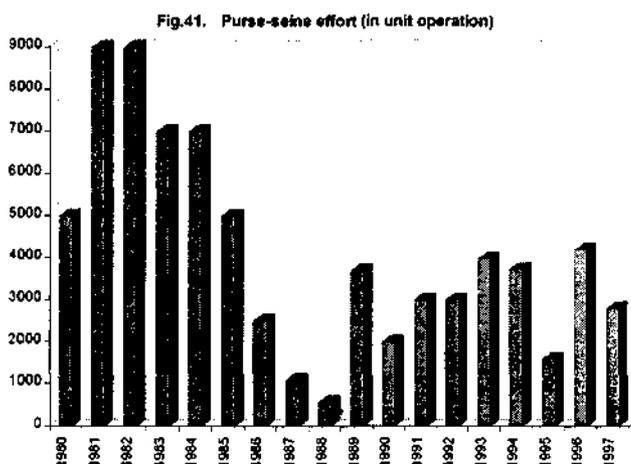
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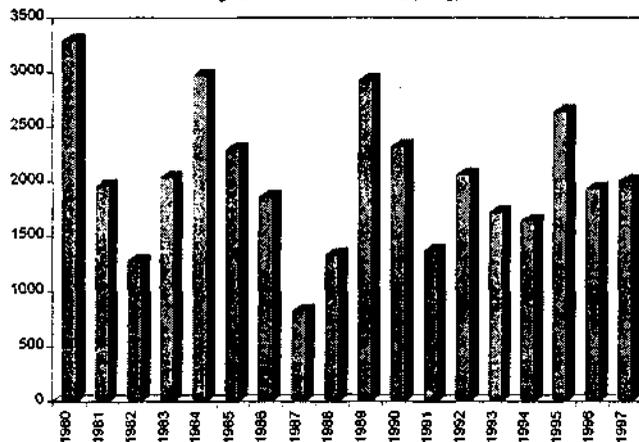
Table 48

Percentage contribution of major gears to the marine fish landings

Year / Gear	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
TN	23	30	30.1	47.4	41.8	30.7	33.4	37.7	44.9	52.1	55.8	40.49	43.65	47.65
PS	5	4	1.2	0.2	0.1	1.4	0.7	0.7	1.1	1.2	1	0.8	1.42	1
MGN	3.5	4	2.4	1.7	1.8	0.8	0.6	0.3	0.3	0.3	0.1	0.26	0.28	0.32
MHL	0.07	0.01	0.06	0.3	0.1	0.7	0.1	0.1	0.1	0.1	0.1	0.18	0.17	0.42
OBRS	--	--	5.8	10.4	17.4	41.8	38.8	40.1	35	27.8	27.4	40.16	31.54	28.42

Year / Gear	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
OBHL	1.5	2.2	2.5	2.3	3.6	2	2.8	1.3	2.1	2	1.2	2.98	3.69	2.99
OBBS	33	28.2	30.9	15.9	18.7	8	6.3	4.4	3.4	2.3	2.6	2.63	4.38	3.47
OBGN	5	7.1	8.9	6.9	6.6	9	8.3	6.4	5	6.4	6.3	6.08	8.73	8.49
OBTN	--	--	--	0.4	1.3	0.5	2	0.5	1.3	1.5	1.6	2.37	2	3.23
NMBS	17	12	9.3	--	0.4	0.8	1.4	0.5	0.8	1.3	0.2	0.25	0.23	0.37
NMGN	7	6.8	4.2	4.2	2.7	2	2.3	2.7	2.1	2.1	1.4	1.86	1.8	2.18
NMSS	3	1.9	2.4	3.4	1.1	1.7	2	2.8	1.4	1.6	1.6	0.87	1.13	0.46
NMHL	2	2.6	1.1	1.1	2.4	0.6	0.6	0.8	0.9	0.8	0.4	0.64	0.61	0.44
Total landings	393472	325536	382791	303286	468808	647526	662890	564161	560742	574739	568034	531646	572055	574774

Fig.42. Purse-seine CPUE (in kg)



Purse-seine operation gained momentum from 1989 onwards. The CPUE varied from 822 kg in 1987 to 3296 kg in 1980 (table 43, pg. 52, fig. 42). Quarterwise catch, effort and CPUE in respect of purse-seine are given in table 49.

Table 49

Quarterwise catch, effort and CPUE in respect of purse-seiners

Year	I Quarter			II Quarter			III Quarter			IV Quarter		
	Catch	Effort	CPUE	Catch	Effort	CPUE	Catch	Effort	CPUE	Catch	Effort	CPUE
1985	4019	1800	2233	1163	649	1792	2991	808	3702	3309	1373	2410
1986	135	100	1350	764	1000	764	2089	760	2749	1660	600	2767
1987	97	409	237	111	500	222	696	250	2784	--	--	--
1988	1	3	333	55	37	1486	285	364	783	419	167	2509
1989	2096	900	2329	749	400	1873	4308	1150	3746	1643	500	3286
1990	1416	462	3065	914	368	2484	842	332	2536	1477	575	2569
1991	1095	1525	718	1369	1809	757	875	377	2321	768	499	1539
1992	963	700	1376	1445	800	1806	1887	500	3774	1901	1000	1901
1993	1009	995	1014	637	792	804	2345	711	3298	2853	1486	1920
1994	668	1000	668	1245	1000	1245	3401	1000	3401	846	700	1209
1995	68	80	85	268	200	134	686	290	236	3186	1070	298
1996	821	468	175	2459	1490	165	1829	682	268	3022	1595	189
1997	3409	1497	228	600	301	199	531	303	175	1090	710	153
Avg	1228	737	1455	821	695	1398	1747	568	2799	1397	589	2123

Note: Catch in tonnes, Effort in units of operation, CPUE in kg.

The CPUE is at its maximum during the third and the fourth quarters followed by the first quarter. The period from June to August is generally closed for this gear. There is an increasing trend in the landings of purseseiners after the imposition of the partial ban on monsoon trawling. The contribution of purseseine to the landings of the major groups of fishes is given in Table 50.

Table 50

Percentage contribution of purseseine to the landings of major groups of fishes.

Groups	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
Elasmobranchs	0.4	--	--	--	--	--	--	0.2	--	0.5	--	--	--	--
Catfishes	2.8	--	3	--	0.4	2	--	0.5	6.7	1.2	0.1	--	7.9	--
Oil sardine	10.1	6.9	0.8	0.2	0.1	2.2	1.8	1.8	3.9	2	0.2	4.1	0.5	1.2
Other sardines	8.4	8	2.9	--	--	0.6	0.3	2	5.2	4	5.3	2.19	0.3	1.5
Whitebaits	0.1	--	--	--	--	--	--	0.4	--	--	--	--	--	--
Croakers	0.2	--	--	--	--	--	--	--	0.1	--	--	--	--	--
Carangids	5.5	0.2	0.4	0.6	0.7	1.3	--	0.1	0.2	0.6	4.7	0.18	1.36	0.17
Mackerel	23.1	27.9	4.8	3.9	0.5	3.8	1.3	2.2	4	7.3	77.8	2.69	4.85	4.7
Seerfishes	1.3	--	--	--	--	6.7	1	--	--	--	--	--	--	--
Tunnies	--	6.2	15.7	0.9	0.5	--	--	0.2	8.2	0.7	6.5	1.36	0.75	0.26
Penaeid prawns	--	0.1	--	--	--	--	--	0.2	0.1	--	2.4	0.02	0.01	--

The oil sardine, mackerel, tunnies, carangids and other sardines were the major shoaling pelagic constituents of purseseine landings. Catfishes, seerfishes and penaeid prawns were landed to a limited extent. Contribution of purseseine to the landings of oil sardine varied from 0.1 pct in '88 to 10.1 pct in '84. In most of the years more than 80 pct of purseseine landings in the first quarter was oil sardine (Table 51). The absence of oil sardine was conspicuous in the third quarter. In the case of the carangids the contribution of purseseine varied from 0.1 pct in '91 to 5.5 pct in '84. Carangids were landed mostly in the third quarter. There were stray catches of carangids in the fourth quarter of 1988. Among the carangids, the scads and the horse mackerel were prominent. Mackerel which varied from 0.5 pct in '88 to 23.1 pct in '84 in the purseseine catches, were landed throughout the year by this gear, with poor catch in the first quarter and the maximum during the third quarter and the fourth quarters. Tunnies which varied from 0.2 pct in '91 to 15.7 pct in 86, in the purseseine catches were landed by this gear during 1985-88 and 1991-97. Maximum other sardine landings in purseseine were observed in the third quarter. Almost all the groups exhibit a declining trend in the purseseine catches over the years.

Table 51

Quarterwise percentage composition of purseseine landings by major groups of fishes

Groups	CF	OS	OSS	WB	HM	SC	OTCR	POM	IM	SF	TU	PP	OTRS	Total
I QUARTER														
1985	--	90	--	--	--	--	--	--	9	--	--	--	1	4019
1986	--	100	--	--	--	--	--	--	--	--	--	--	--	135
1987	--	--	--	--	--	--	5	--	20	--	70	--	5	97
1988	--	--	--	--	--	--	--	--	--	--	100	--	--	1
1989	--	96	--	--	--	--	--	--	--	--	--	--	4	2096
1990	--	82	--	--	--	--	--	--	12	--	--	--	6	1416
1991	--	84	--	--	--	--	--	--	12	--	--	--	4	1095
1992	--	27	--	--	6	--	--	--	54	--	--	7	6	963
1993	1	54	2	--	--	--	1	--	40	--	--	2	--	1009
1994	--	--	22	--	--	--	--	6	32	--	13	21	6	668
1995	--	93	--	--	--	--	--	--	7	--	--	--	--	68
1996	--	7	--	--	--	--	13	--	72	--	--	--	8	821
1997	--	10	--	--	--	--	--	--	89	--	--	--	1	3409
II QUARTER														
1985	--	74	--	--	--	--	--	--	21	--	--	--	5	1163
1986	--	25	6	--	--	--	--	--	13	--	50	--	6	764
1987	--	--	--	--	--	--	--	--	68	--	19	--	13	111
1988	--	16	--	--	--	--	--	--	12	--	71	--	1	55
1989	--	19	--	--	--	--	--	7	73	--	--	--	1	749
1990	--	85	--	--	--	--	--	--	15	--	--	--	--	914
1991	--	56	--	11	--	--	--	--	23	--	--	7	3	1369
1992	--	--	96	--	--	--	--	--	--	--	--	--	4	1445
1993	--	--	--	--	5	3	1	1	77	--	12	--	1	637
1994	--	--	--	--	--	--	--	8	69	--	18	--	5	1245
1995	--	--	--	--	--	--	6	--	62	--	19	--	13	288
1996	--	--	--	--	--	--	--	--	99	--	--	--	1	2459
1997	--	77	--	--	--	--	--	--	16	--	--	--	7	600
III QUARTER														
1985	--	--	--	--	--	--	--	--	88	--	10	--	2	2991
1986	--	--	--	--	--	--	5	--	27	--	57	--	11	2089
1987	--	--	16	--	12	--	6	21	43	--	--	--	2	696
1988	--	--	11	--	15	38	9	--	17	--	6	--	4	285
1989	--	--	14	--	--	14	--	--	58	12	--	--	2	4308
1990	--	--	32	--	--	6	--	--	60	--	--	--	2	842
1991	--	--	9	--	--	8	--	--	79	--	--	--	4	875
1992	--	--	--	--	--	--	--	--	32	--	54	--	14	1887
1993	--	2	--	--	1	11	3	--	81	--	--	--	2	2345
1994	--	--	--	--	--	--	7	--	90	--	--	--	3	3401
1995	--	--	25	--	--	9	--	24	39	--	--	--	3	686
1996	--	--	--	--	7	14	--	27	49	--	--	--	3	1829
1997	--	--	--	--	--	--	--	16	74	--	--	--	10	531

Groups	CF	OS	OSS	WB	HM	SC	OTCR	POM	IM	SF	TU	PP	OTRS	Total
IV QUARTER														
1985	--	31	6	--	--	--	--	--	54	--	5	--	4	3309
1986	15	--	13	--	--	--	--	--	24	--	43	--	5	1660
1987	--	--	--	--	--	--	--	--	--	--	--	--	--	----
1988	10	10	--	--	22	--	16	--	40	--	--	--	2	419
1989	--	86	--	--	--	--	--	--	11	--	--	--	3	1643
1990	--	79	--	--	--	--	--	--	16	--	--	--	5	1477
1991	--	22	58	--	--	--	--	--	7	--	--	--	13	768
1992	--	25	46	--	--	--	--	--	18	--	--	--	11	1901
1993	--	13	31	--	--	--	--	--	55	--	--	--	1	2853
1994	--	--	20	--	--	--	--	--	79	--	--	--	1	846
1995	--	15	26	--	--	--	--	--	52	--	--	--	7	3186
1996	--	--	--	--	--	7	--	--	76	--	--	--	17	3022
1997	--	36	22	--	--	--	--	--	38	--	--	--	4	1090

The dominance of the pelagics over the demersals is obvious in Table 52. Though the purseseine is chiefly a gear for the pelagics, there were stray catches of demersals also.

Table: 52

Quarterwise pelagic and demersal landings by purseseine (in t).

Year	I Quarter			II Quarter			III Quarter			IV Quarter			Total	
	P	D	Total	P	D	Total	P	D	Total	P	D	Total	P	D
1985	3991	28	4019	1152	11	1163	2978	13	2991	3309	--	3309	11430	52
1986	135	--	135	761	3	764	2019	70	2089	1397	263	1660	4312	336
1987	94	3	97	103	8	111	547	149	696	--	--	--	744	160
1988	1	--	1	55	--	55	285	--	285	377	42	419	718	42
1989	2094	2	2096	698	51	749	4295	13	4308	1641	2	1643	8728	68
1990	1416	--	1416	914	--	914	824	18	842	1471	6	1477	4625	24
1991	1079	16	1095	1268	101	1369	875	--	875	734	34	768	3956	151
1992	888	75	963	1442	3	1445	1871	16	1887	1784	117	1901	5985	211
1993	979	30	1009	630	7	637	2341	4	2345	2829	24	2853	6779	65
1994	466	202	668	1140	105	1245	3401	-	3401	836	10	846	5843	317
1995	68	-	68	284	4	288	523	163	686	3168	18	3186	4043	185
1996	814	7	821	2459	-	2459	1336	493	1829	2900	122	3022	7510	621
1997	3378	31	3409	593	7	600	445	86	531	1090	-	1090	5506	124

4.1.3 Gillnetter (mechanised)

The mechanized gillnetter which operates the passive gillnet is more fuel efficient per unit of production than the mechanised trawler. Gillnet can be operated in a variety of ways. They can be operated as anchored floating nets for mid water fish and as free driftnets for the surface as well as midwater fishes. In some parts of Kerala, gillnet is used as an encircling

Groups	CF	OS	OSS	WB	HM	SC	OTCR	POM	IM	SF	TU	PP	OTRS	Total
IV QUARTER														
1985	--	31	6	--	--	--	--	--	54	--	5	--	4	3309
1986	15	--	13	--	--	--	--	--	24	--	43	--	5	1660
1987	--	--	--	--	--	--	--	--	--	--	--	--	--	----
1988	10	10	--	--	22	--	16	--	40	--	--	--	2	419
1989	--	86	--	--	--	--	--	--	11	--	--	--	3	1643
1990	--	79	--	--	--	--	--	--	16	--	--	--	5	1477
1991	--	22	58	--	--	--	--	--	7	--	--	--	13	768
1992	--	25	46	--	--	--	--	--	18	--	--	--	11	1901
1993	--	13	31	--	--	--	--	--	55	--	--	--	1	2853
1994	--	--	20	--	--	--	--	--	79	--	--	--	1	846
1995	--	15	26	--	--	--	--	--	52	--	--	--	7	3186
1996	--	--	--	--	--	7	--	--	76	--	--	--	17	3022
1997	--	36	22	--	--	--	--	--	38	--	--	--	4	1090

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	P	D	Total	P	D	Total	P	D	Total	P	D	Total	P	D
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1987	94	3	97	103	8	111	547	149	696	--	--	--	744	160
1988	1	--	1	55	--	55	285	--	285	377	42	419	718	42
1989	2094	2	2096	698	51	749	4295	13	4308	1641	2	1643	8728	68
1990	1416	--	1416	914	--	914	824	18	842	1471	6	1477	4625	24
1991	1079	16	1095	1268	101	1369	875	--	875	734	34	768	3956	151
1992	888	75	963	1442	3	1445	1871	16	1887	1784	117	1901	5985	211
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1995	68	-	68	284	4	288	523	163	686	3168	18	3186	4043	185
1996	814	7	821	2459	-	2459	1336	493	1829	2900	122	3022	7510	621
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net for the mackerel. Whenever the gear is operated as an encircling net, the foot rope touches the bottom at lower depths. The operation of encircling gillnet takes place only when large shoals of fishes were sighted.

Mesh size is the most important aspect influencing the efficiency of this gear. Table 53 gives the specifications of gillnets operating in Kerala during 1950 and 1991.

Table 53

DISTRICTWISE GILL NET SPECIFICATION (1950-1991)

Dist	LN	EE	TL(m) of netting		MU		MS(mm)		DO(m)		TO		M/NM		Season		FC	
			1950	1991	1950-1991	1950-1991	1950-1991	1950-1991	1950-1991	1950-1991	1950-1991	1950-1991	1950-1991	1950-1991	1950-1991	1950-1991	1950-1991	
TVM	EV	MN	250	280-1400	Cot	S.M	52	44	17-33	50	DGN	DGN	NM	M	Sep-May	Jul-Aug	a/b	a
	CV	SAN	187	240-280	"	"	26	38	17-33	30	DN	DGN	NM	"	Aug-Dec	Dec-Feb	"	"
	KV	AN	70	8-330	"	"	15	14	11-26	30-40	DN	DGN	NM	"	Aug-Jun	Aug-Sep	"	"
	KGV	--	--	250-370	--	"	--	58-60	--	--	--	--	--	--	---	---	--	--
	PV	DGN	--	800-950	--	--	--	--	--	--	--	--	--	--	---	---	--	--
	OV	DGN	256	800-1120	Hemp	"	175	100-130	25-35	120	DGN	DGN	NM	NM/M	Nov-Mar	Jan-Aug	"	"
	TV	BSGN	--	100-150	"	"	--	60	--	--	--	--	--	--	---	---	--	--
DV	TRN	--	120	--	"	--	48-250	--	5-15	DN	DN	--	NM/M	---	May-Sep	"	"	
QLN	EV	MN	140-1470	200-300	Cot.	"	51	52-57	17-26	26	DGN	DGN	NM	NM/M	Sep-Jan	Jun-Aug	"	a
	CV	SAN	282	300-800	"	"	25	32-35	17-26	30	DN	DGN	NM	NM	Nov-Mar	Jun-Aug	"	"
	KV	AN	--	80-380	--	"	15	14	--	--	--	--	--	--	---	---	--	--
	EDV	AN	--	--	--	"	--	38	--	--	--	--	--	--	---	---	--	--
	NV	--	--	--	"	--	52	--	--	--	--	--	--	--	---	---	--	--
	TV	BSGN	--	--	--	"	--	--	--	--	--	--	--	--	---	---	--	--
	KGV	--	--	200	--	"	--	50	--	12-15	--	DGN	NM	M	---	Jul-Aug	--	"
	RV	LBN	150	115	Hemp	"	110	85-105	9	13	BSGN	SN	NM	M/NM	Aug-Nov	Aug-Nov	"	"
	OV	DGN	157	2910	Cot.	"	141	83	11-17	90	DGN	DN	NM	M	Sep-Nov	Aug-Oct	"	d
	DV	TRN	--	475	--	"	--	40-270	5	15	--	DN	NM	NM/M	---	May-Sep	"	c
TDV	RN	--	--	--	--	--	--	--	--	--	DN	NM	--	---	---	--	--	
ALP	AV	MN	167-185	800	"	"	50	40-50	17-33	40-50	DGN	DGN	NM	M	Sep-Mar	Oct-May	"	"
	CV	SAN	175-221	800	"	"	28	42	17-22	15	"	DN	NM	"	Jun-Sep	Sep-Feb	"	"
	MV	SAN	--	800	--	--	--	38	--	--	--	--	--	--	---	---	--	--
	OV	DGN	193-260	1720-2150	Hemp	"	128	90-110	22-40	25	DGN	DGN	NM	"	Aug-Dec	Aug-Sep, May	"	d
EKM	AV	MN	191-286	220-280	Cot.	"	50-52	52	--	10	DGN	DGN	NM	M	Sep-Mar	Sep-Mar	"	a
	CV	SAN	168-224	193-225	"	"	38	38	8-12	11-12	"	"	"	"	Sep-Aug	Oct-Dec	"	"
	KV	PRN	--	200-300	--	"	--	33	--	10-12	--	"	--	NM	---	Nov-Apr	--	"
	OV	DGN	110-260	1400	Hemp	"	128	90-110	22-39	40	DGN	"	NM	M	Aug-Dec	Sep-Jun	"	d

Dist	LN	EE	TL(m) of netting		MU		MS(mm)		DO(m)		TO		M/NM		Season		FC
			1950	1991	1950-1991	1950-1991	1950-1991	1950-1991	1950-1991	1950-1991	1950-1991	1950-1991	1950-1991	1950-1991	1950-1991		
TCR	AV	MN	50	500	Cot.	"	50	52	17-20	25-30	DN	DGN	NM	M	Oct-Apr	Sep-Apr	"
	CV	SAN	--	500	"	"	--	5-15	5-15	12-25	"	DGN	NM	M	Apr-Oct	Sep-Apr	"
	AVV	PN	--	300	"	"	--	--	32	3-5	DGN	DGN	--	NM/M	Apr-Oct	Sep-Apr	--
	CMV	PRN	--	300	"	"	--	33	--	10-12	DN	DN	NM	NM	---	Nov-Apr	"
	OV	DGN	400	900-1100	Hemp	"	110	90	10	30	DGN	DGN	NM	M	Aug-Dec	Sep-Dec	"
SV	SHGN	--	350	Cot.	"	110-150	130-150	10-14	20-25	DGN	DGN	NM	M	Jun-Mar	Nov-Mar	"	
MAL	AV	MN	110-136	700-800	"	"	50	52	17-20	25-30	DN	DGN	NM	M	Oct-Apr	Sep-Apr	"
	MV	SAN	--	600	"	"	--	38	--	15	--	"	"	"	---	---	--
	AVV	PRN	--	600-700	"	"	--	100	--	15-20	"	DGN	--	M	---	Oct-Jan	--
	CMV	PRN	--	---	"	"	--	--	--	--	--	--	--	--	---	---	--
	OV	DGN	450	500	Hemp	"	130	90	5-15	25-35	DGN	DGN	NM	M	Aug-Feb	Oct-Jan	"
CLT	AV	MN	60-165	650-850	Cot.	"	50	60	11-16	15-20	DN	DGN	NM	M	Apr-Jun	Mar-Aug	"
	CV	SAN	--	600	"	"	--	--	--	10	--	--	--	--	---	---	--
	AVV	PN	--	600-700	--	--	--	100	--	15-20	--	DGN	--	M	---	Oct-Jan	--
	RV	LBN	155	200-300	Hemp	"	110	105	9	13	BSG N	BSG N	NM	M/NM	Aug-Nov	Aug-Oct	"
	MLV	MUN	--	--	"	"	--	--	--	--	--	--	--	--	---	---	--
OV	DGN	400	700-900	Hemp	"	50	90	5-15	25-35	DN	DN	NM	M	Aug	Oct-Jan	"	
CNR	PAV	MN	--	600-700	Cot.	"	63	50	11-14	20-25	25	DN	NM	M	Sep-Dec	Oct-Feb	"
	MKV	SAN	--	400-800	"	"	30	35	4-11	20-25	25	"	NM	M	Dec-Mar	Dec-Mar	"
	AVV	PN	--	500-700	"	"	--	105	--	20-25	25	--	--	M	---	Nov-Jan	--
	VV	WSN	--	250-400	"	"	--	24	--	5-10	10	--	--	NM	---	Feb-Mar	--
	DV	TRN	--	200-300	"	"	--	35	--	7	7	--	--	NM	---	Jan-Aug	--
CHV	LBN	--	150-250	"	"	110	80-110	10	15	15	--	NM	M	Aug-Nov	Aug-Nov	"	
OV	DGN	--	900-1000	"	"	130	90	12-15	40-50	50	DGN	NM	M	Sep-Feb	Sep-Dec	"	
KAS	KNV	MN	170-115	600-800	"	"	50	45-60	25-30	--	-	DN	NM	M	Oct-Jan	---	"
	MKV	SAN	100-120	400-800	"	"	35	30	25-30	--	-	"	NM	M	Dec-Mar	---	"
	AVV	PN	--	700-800	"	"	--	120	--	15-20	20	--	--	M	---	Nov-Feb	"
	VV	WSN	--	350	"	"	--	20	--	5-10	10	--	--	NM	---	Feb-Dec	--
	DV	TRN	--	--	--	"	--	--	--	--	--	--	--	--	---	---	"
CHV	LBN	155	190-320	Hemp	"	113	85-106	10	13	3	BSG N	NM	M	Aug-Nov	Aug-Oct	"	
OV	DGN	350	500-1500	Hemp	"	140	90	12-15	40-50	50	DGN	NM	M	Sep-Feb	Sep-Feb	"	

Note : (i) a-canoe, b-catamaran, c-plyvallam, d-gillnetter

(ii) Abbreviations used :

Dist - District

TVM - Trivandrum

EKM - Ernakulam

CLT - Calicut

QLN - Quilon

TCR - Trichur

CNR - Canannore

ALP - Aleppey

MAL - Malapuram

KAS - Kasargode

LN	-	Local Name	EE	-	English Equivalent
TL	-	Total Length	MU	-	Material Used
MS	-	Mesh Size	DO	-	Depth of Operation
TO	-	Type of Operation	M	-	Motorized
NM	-	Non-Motorized	FC	-	Fishing Craft
EV	-	Eacha Vala	MN	-	Mackerel Net
CV	-	Chala Vala	SAN	-	Sardine Net
KV	-	Kacha Vala	AN	-	Anchovie Net
KGV	-	Kangoor Vala	PV	-	Pattu Vala
DGN	-	Drift Gillnet	OV	-	Ozhukku Vala
TV	-	Thappu Vala	BSGN	-	Bottomset Gillnet
DV	-	Disco Vala	TRN	-	Trammel Net
EDV	-	Edakettu Vala	NV	-	Noo Vala
RV	-	Real Vala	LBN	-	Lobster Net
TDV	-	Thirandi Vala	RN	-	Ray Net
AV	-	Ayila Vala	MV	-	Mathi Vala
AVV	-	Avoli Vala	PN	-	Pomfret net
CMV	-	Chemmeen Vala	PRN	-	Prawn net
MLV	-	Mullan Vala	MUN	-	Mullet Net
PAV	-	Pachu Vala	MKV	-	Mathikettu Vala
CHV	-	Chitten Vala	KNV	-	Kantha Vala
Cot.	-	Cotton	SM	-	Synthetic Material
DN	-	Drift Net			

The efficiency of present day gill net was increased several times by replacement of natural fibers to synthetic fibers and especially by transparent monofilaments. This change has resulted in considerable expansion of gill net fishery in the recent years. It has also proved possible to fish in clear water and during day time. The table 53 illustrates the various changes that has taken place from 1950 to 1991 in the type of craft used, the fishing gear material and type and depth of operation.

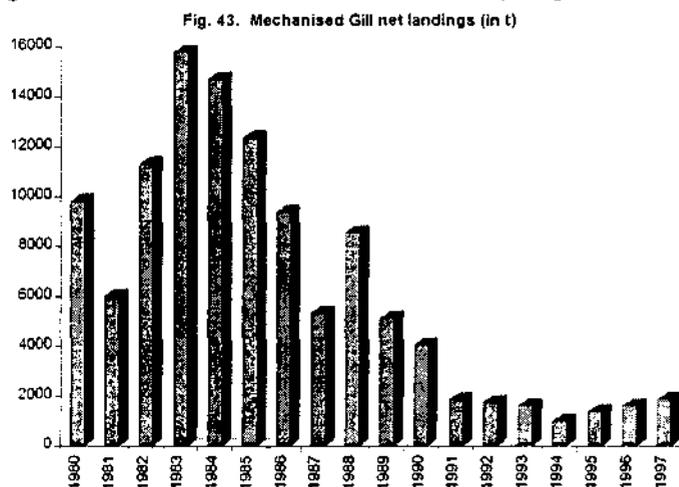
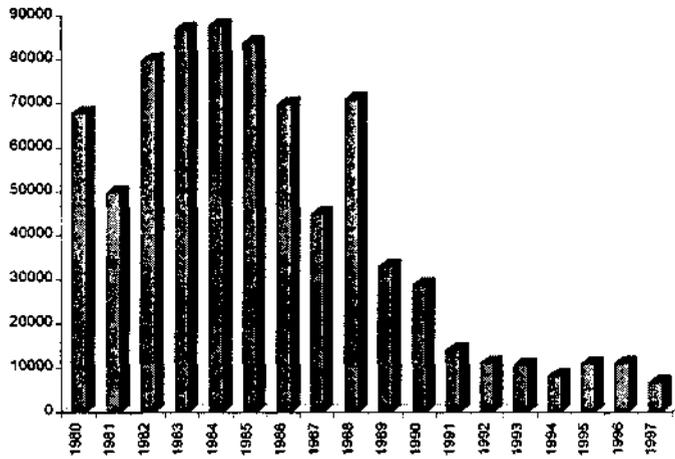


Fig.44. Mechanised gillnet effort (in unit operation)



There was an increasing trend of gill net effort during the period 1981 to 1984 and a decreasing trend from 1985 onwards but for in 1987 (Fig. 44 and table 43). CPUE of gill net was given in table 43 (fig. 45). CPUE varied from 118 kg in 1987 to 273kg. in 1997. Quarterwise catch, effort and CPUE of mechanized gill netters is given in table 54. It can be seen that during the period 1985-97 maximum CPUE was observed during third quarter in almost all the years.

During the period 1980-97 mechanized gill net landings in Kerala varied from 1776 t in 1992 to 15780 t in 1983. (Fig. 43 and table 43, pg. 52). Percentage contribution of mechanised gill net to the total landings during the period 1984 to 1997 varied from 0.1 pct in 1994 to 4.0 in 1985 (table 48, pg. 58 and fig. 33). Gill net effort in terms of unit operation varied from 6800 in 1997 to 88000 in 1984.

Fig.45. Mechanised Gill net CPUE (in kg)

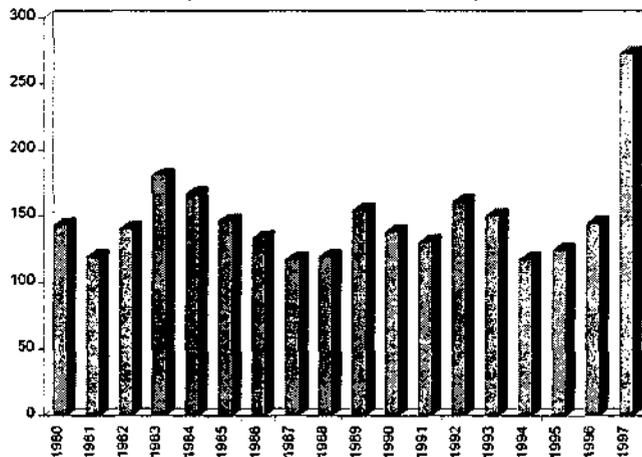


Table 54

Quarterwise catch, effort and CPUE of mechanized gill net.

Year	I Quarter			II Quarter			III Quarter			IV Quarter		
	Catch	Effort	CPUE	Catch	Effort	CPUE	Catch	Effort	CPUE	Catch	Effort	CPUE
1985	2117	18000	118	2172	20300	107	2386	13600	175	5686	32200	177
1986	969	14300	68	1798	14200	127	2162	15000	144	4455	26400	169
1987	645	8992	72	864	9500	91	2586	10900	237	1246	15600	80
1988	1108	11000	101	1033	7672	135	3003	13300	226	3419	39000	88
1989	224	6800	33	844	7000	121	2949	11900	248	1114	7500	149
1990	433	4100	106	1887	11888	159	888	7006	127	833	6860	121
1991	200	3440	58	335	2200	152	636	4021	158	237	1622	146
1992	104	1300	80	273	2700	101	865	4000	216	534	3200	167
1993	186	2260	82	519	2876	180	662	3665	189	237	1831	129
1994	22	270	81	436	2655	164	396	3390	117	131	2001	65
1995	80	2100	38	91	1470	62	655	3514	186	554	3664	151
1996	125	1755	71	296	2981	99	536	2821	190	640	3278	195
1997	97	621	156	512	1879	272	956	3483	274	289	874	330

Note: Catch in tonnes; Effort in unit operation; CPUE in kg.

Percentage contribution of MGN in the landings of major group of fishes is given in Table 55.

Table 55

Percentage contribution of MGN in the landings of major groups of fishes.

Groups	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
Elasmobranchs	45.5	43	33.4	26.5	21.3	1.9	8.9	5	3.5	1.6	5.5	0.99	1.8	2.8
Cat fishes	26	37.6	16.6	5	6.7	8	6.4	4.6	1.3	2.5	1.3	6.1	11.2	3.6
Perches	0.2	0.1	--	0.2	0.2	--	--	--	--	-	0.4	0.04	0.02	-
Croakers	0.6	0.3	0.1	--	0.1	--	--	0.6	--	-	0.2	0.02	0.01	-
Ribbon fishes	--	0.7	1.1	0.3	--	--	0.1	--	--	-	-	--	0.04	0.02
Carangids	2.9	3.5	0.7	1	1	0.2	0.3	0.1	--	0.1	5.2	0.03	0.12	0.16
Big jawed jumper	--	--	--	--	1.3	--	--	--	--	-	-	--	--	--
Mackerel	4	2.1	1.4	0.9	0.3	0.1	0.3	0.1	--	0.1	3.1	0.06	0.02	0.01
Seer fishes	49.7	39.2	45.1	19.4	23.8	20.5	12.9	5.7	5	4.2	16.8	8.7	8.63	4.9
Tunnies	31.6	25.8	11.1	21.1	21.7	10.1	5	4.4	7.6	7.9	61	4.4	4.4	7.4
Flat fishes	--	--	--	--	0.2	--	--	--	--	-	-	--	--	--

Elasmobranchs, catfishes, carangids, seerfishes, tunnies and mackerel were the major components in the landings of MGN during '84 to '97. It was observed that percentage contribution of MGN in the landings of elasmobranchs varied from 1.9 pct in '89 to 45.5 pct in '84. This group was available throughout the year, maximum was in the first followed by fourth. There was decreasing trend in the percentage contribution of elasmobranchs over the years. During the period 1984 to 97 there was a decreasing trend in the contribution of MGN to the catfish landings. Maximum contribution of 37.6 pct was observed in '85. Catfishes were mainly landed during the first, third and fourth quarters (Table 56). MGN's contribution to the carangids landings varied from 0.03 pct in '95 to 3.5 pct in '85. Seer fish is yet another important group in MGN landings in Kerala. A minimum of 4 pct in '93 to a maximum of 49.7 pct in '84 was observed in this gear. Seer fishes were landed throughout the year, maximum contribution came in the first and fourth quarters. In '84 MGN contributed more than 31 pct of tunnies landings in Kerala while it was least in '91 (4.4 pct). More than 50 pct of gill net landings in the second quarter during 85-89 was tunnies and it was available throughout the year. Mackerel was also present in the MGN landings. Contribution of this gear to mackerel landings ranged from 0.01 pct in '97 and '91 to 4 pct in '84. A decreasing trend was observed over the years.

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Table 56.

Quarterwise percentage contribution by major groups of fishes in APON landings

Groups / Year	ELA	CAT	RC	RF	CAR.	POM	IM	SF	Cochin	CRKS	Total (in t)
I Quarter											
1985	32	19	--	--	--	--	--	25	9	15	2117
1986	21	10	--	--	--	--	13	26	11	19	969
1987	17	12	9	--	--	--	--	36	18	8	645
1988	27	8	--	--	--	--	--	26	22	17	1108
1989	11	--	--	--	--	--	--	50	25	14	224
1990	7	--	--	--	--	--	--	26	49	18	433
1991	17	--	--	--	--	--	--	20	46	17	200
1992	9	--	--	--	--	--	--	33	43	15	104
1993	2	1	--	--	--	--	6	9	58	24	186
1994	14	--	9	--	--	--	--	14	41	22	22
1995	5	--	15	--	5	--	8	11	28	28	80
1996	--	23	--	--	6	--	--	26	25	20	125
1997	--	--	--	--	--	--	--	20	62	18	97
II Quarter											
1985	11	--	--	--	--	--	6	6	62	15	2172
1986	13	--	--	--	--	--	--	7	61	19	1798
1987	27	--	--	--	--	--	--	7	49	17	864
1988	18	--	--	--	--	--	--	9	57	16	1033
1989	12	--	--	--	--	--	5	10	59	14	844
1990	14	--	--	--	--	--	1	14	50	21	1887
1991	9	1	--	--	12	--	4	5	36	33	335
1992	12	--	--	--	3	1	3	5	72	4	273
1993	4	--	--	--	2	--	1	7	81	5	519
1994	--	--	--	--	--	--	--	7	82	11	436
1995	--	--	--	--	5	--	6	32	46	11	91
1996	6	--	--	--	7	--	7	22	47	11	296
1997	8	--	--	--	--	--	--	6	64	22	512
III Quarter											
1985	17	32	--	5	6	--	--	14	9	17	2386
1986	26	26	--	--	--	9	--	22	--	17	2162
1987	12	--	--	--	6	5	--	12	49	16	2586
1988	12	10	--	--	7	--	--	14	44	13	3003
1989	6	9	--	--	--	--	--	33	37	15	2949
1990	11	15	--	--	10	--	8	11	24	21	888
1991	12	11	--	--	8	--	6	7	41	15	636
1992	6	1	--	--	4	--	1	14	72	2	865
1993	6	2	--	--	6	1	2	27	53	3	662
1994	7	--	--	--	10	--	--	20	49	14	396
1995	--	--	--	--	--	--	5	30	33	32	655
1996	6	--	--	--	--	--	--	21	62	11	536
1997	7	--	--	--	5	--	--	9	71	8	956

Groups / Year	ELA	CAT	RC	RF	CAR.	POM	IM	SF	TU	OTRS	Total (in t)
IV Quarter											
1985	21	13	--	--	--	--	--	41	--	25	5686
1986	20	17	--	--	7	6	--	28	5	17	4455
1987	14	6	--	--	--	--	5	32	19	24	1246
1988	11	7	--	--	--	--	--	44	14	24	3419
1989	--	--	--	--	--	--	--	42	35	23	1114
1990	25	--	--	--	5	--	16	21	17	16	833
1991	7	--	--	--	--	--	--	66	8	19	237
1992	4	--	--	--	2	3	--	52	18	21	534
1993	3	1	--	--	--	--	1	16	68	11	237
1994	5	--	--	--	6	--	5	39	29	16	131
1995	--	--	--	--	--	--	--	51	37	12	554
1996	--	--	--	--	5	--	--	33	45	17	640
1997	--	--	--	--	6	--	--	24	49	21	289

In table No.57 quarterwise pelagic and demersal group of fishes landed by mechanized gill netters is given.

Table 57

Quarterwise Pelagic and Demersal landings in Mechanized Gillnet (t).

Year	I Quarter			II Quarter			III Quarter			IV Quarter			G. Total	
	P	D	Total	P	D	Total	P	D	Total	P	D	Total	P	D
1985	862	1255	2117	1836	336	2172	1105	1281	2386	3614	2072	5686	7417	4944
1986	625	344	969	1430	368	1798	810	1352	2162	2437	2018	4455	5302	4082
1987	377	268	645	585	279	864	1960	626	2586	936	310	1246	3858	1483
1988	658	450	1108	794	239	1033	2261	742	3003	2616	803	3419	6329	2234
1989	187	37	224	709	135	844	2453	496	2949	1024	90	1114	4373	758
1990	388	45	433	1481	406	1887	602	286	888	591	242	833	3062	979
1991	157	43	200	278	57	335	469	167	636	191	46	237	1095	313
1992	88	16	104	234	39	273	799	66	865	402	132	534	1523	253
1993	149	37	186	496	23	519	599	63	662	227	10	237	1471	133
1994	15	7	22	417	19	436	344	52	396	123	8	131	899	86
1995	50	30	80	89	2	91	598	57	655	528	26	554	1268	112
1996	87	38	125	268	28	296	482	54	536	586	54	640	1424	173
1997	95	2	97	469	43	512	885	71	956	274	15	289	1723	131

It can be seen that in most of the years maximum landings of pelagic group was observed in fourth quarter. Major share in gill net landings was contributed by pelagic group. It varied from 1095 t in 1991 to 7417 t in 1985. Except in 1988 and 89 there was a declining trend in the landings of pelagic group. Similar trend was also noticed in the case of demersal group. Maximum landing was from the depth zone beyond 30 meters.

4.1.4. Mechanized Hook & Lines

Though trawl is the chief gear for bulk perch fishing, for kalava, hook and line fishing was in existence for a long time. Kalava fishery existing along the rocky outgrowths along the Kerala coast was known to local fishermen. It was a seasonal fishery starting by December and closing by March. Since 1957 several exploratory line fishing trips were organized by INP for the survey of Kalava grounds covering all rocky patches of continental shelf in 73-110 m depth zone from Trivandrum to Cannanore. Some very productive grounds for hooks and line fishery was discovered off Cochin, Chetuwayi and Ponnani. In these grounds the catch composition showed *Epinephelus* spp and *Pristipomoidestypus*. According to Grace Mathew (1990) hooks and line fishery in an organized manner was initiated in the eighties. Migratory fishermen from Kannyakumari engage in Kalava fishing with help of small mechanised boats using hooks and lines. The area of operation of hook and line is on the outer continental shelf off Ponnani, Cochin and Alleppy, where the depth varies from 75-125 m.

The earliest account of fishing gear for shark is that of Hornell (1938) dealing with the fishing techniques of Malabar region. The exploitation of shark is mainly undertaken by long lines; especially from the offshore waters. According to Rao *et al*(1989) long lines can be grouped into three main categories 1. drift lines operated for small sharks and other predatory fishes in coastal waters 2. drift or set line operated for medium sharks in offshore waters and 3. set or drift long lines operated in deeper waters for large sharks.

There had been changes in respect of material used, in course of time and a number of variation can be found from region to region. In the line operated for small sharks, the snoods used were of cotton. Migrant fishermen operating from Cochin use snoods prepared partly either of twisted G.I.wire or stainless steel wire and synthetic fiber. The type of snoods used for operation from Cochin consisted of two sections, of which the section proximal to mainline is made of synthetic twine while distal section is of twisted G.I.wire/stainless steel wire. In certain cases a swivel is used in between two sections of the snood (Rao *et al*,1989). In the case of hooks higher efficiency was achieved with the development of circular hooks.

Fig. 46. Mechanised Hooks & lines landings (in t)

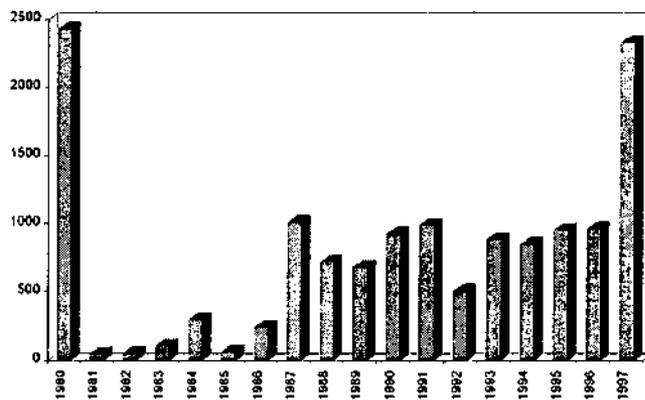
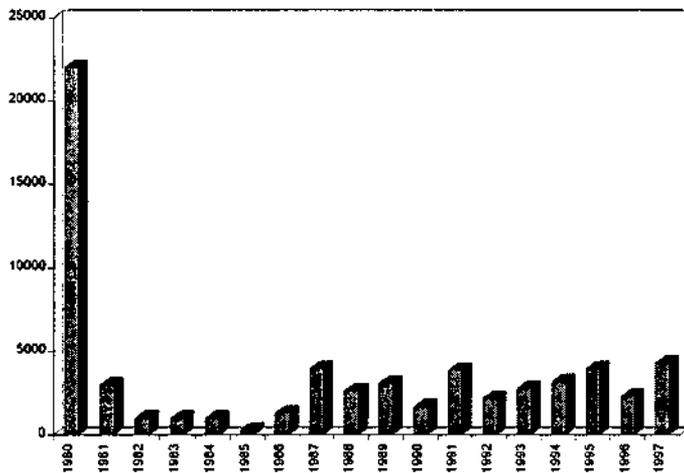


Fig. 47. Mechanised Hooks & lines Effort (in Unit operation)



300 units in 1985 to 22000 units in 1980. There was a declining trend in mechanized hooks & line operation during 1980 to 1985. It gained momentum from 1986 onwards (fig. 47). The catch per unit effort varied from 16 Kg in 1981 to 553 Kg. in 1990. During the period 1988 to 1997 CPUE varied from 221 Kg. in 1989 to 553 Kg. in 1990 (fig. 48). Percentage contribution of MHL in the landings of major groups of fishes is given in table 58.

Mechanized Hooks & lines (MHL) is mainly meant for harvesting demersal group of fishes. During the period 1980 to 1997 mechanized hooks & line landings in the state varied from 49 t in 1981 to 2434 t in 1980 (Table 43, pg. 53, fig. 46). Percentage contribution of this gear to the total landings varied from .01 pct in 1985 to 0.7 pct in 1989 (Table 48 pg. 59). Mechanized hooks & lines effort in unit operation varied from

Fig. 48. Mechanised Hooks & lines CPUE (in kg)

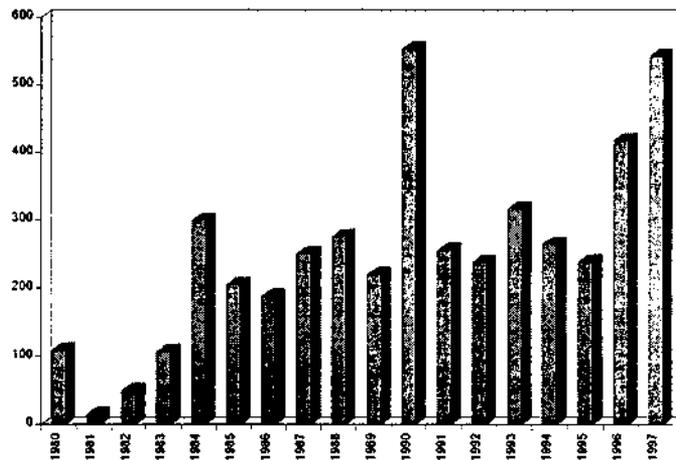


Table 58

Percentage contribution of MHL in the landings of major groups of fishes

Groups	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
Elasmobranchs	0.1	--	0.1	3.1	2.4	--	0.2	4.1	2.2	0.5	3.1	4.3	0.31	1.3
Cat fishes	--	--	--	--	--	9.4	--	0.1	--	-	0.2	0.9	--	--
Perches	1	0.2	0.4	2.7	1	6.5	1.3	1.8	0.8	0.9	0.6	0.81	1.06	3.28
Carangids	--	--	--	--	--	8.5	--	--	--	0.1	0.3	0.02	0.15	0.38
Tunnies	--	--	0.1	0.4	0.2	22.6	--	0.2	0.1	0.3	0.5	4.4	0.4	2.57

Sharks, perches and tunnies were the major group of fishes landed by this gear during '84-'97. Contribution of this gear to the landings of sharks varied from 0.1 pct in '84 to 4.3 pct in '95. Mechanized hooks & lines landed rock cods during first and fourth quarter only. During fourth quarter more than 40 pct of the MHL were contributed by this species and in the first quarter it varied from 14 pct in '91 to 75 pct in '85. In the case of perches it

varied from 0.2 pct in '85 to 6.5 pct in '89. MHL landed rock cods during first and fourth quarters. During the fourth quarter more than 40 pct of landings from this gear was contributed by rock cods and in the first quarter it varied from 14 pct in '91 to 75 pct in '85. Like rock cods snappers were also landed by this gear during the first and fourth quarters only. During first quarter the contribution of snappers in the landings of this gear varied from 11 pct in '86 to 54 pct in '89 and in fourth quarter it varied from 2 pct in '92 to 48 pct in '88 (Table 59). Contribution of tunnies during 1989 was 22.6 pct by this gear.

Table 59.

Quarterwise percentage contribution by major group of fishes in MHL landings

Groups / year	SH	RA	CF	RC	SN	OP	OTCR	TU	BAR	OTRS	Total (in t)
FIRST QUARTER											
1985	--	--	--	75	25	--	--	--	--	--	52
1986	--	--	--	55	11	12	--	5	8	9	195
1987	--	--	--	56	38	--	--	--	--	6	572
1988	19	--	--	37	30	--	--	--	--	14	485
1989	--	--	--	35	54	--	7	--	--	4	513
1990	--	--	--	40	53	--	--	--	--	7	871
1991	--	--	5	14	--	11	15	22	--	17	675
1992	--	--	--	38	50	6	--	3	--	3	200
1993	2	--	--	31	2	41	15	3	3	3	563
1994	6	--	--	30	--	30	26	5	--	3	454
1995	5	--	--	36	--	11	6	9	--	33	543
1996	--	--	--	30	--	39	12	6	--	13	391
1997	--	--	--	31	--	49	6	8	--	6	1026
SECOND QUARTER											
1988	84	--	--	13	--	--	--	--	--	3	88
1989	97	--	--	--	--	--	--	--	--	3	60
1990	94	6	--	--	--	--	--	--	--	--	16
1991	12	--	--	--	--	--	--	64	9	15	73
1992	100	--	--	--	--	--	--	--	--	--	25
1993	53	--	--	--	--	--	--	38	--	9	13
1994	85	--	--	--	--	--	--	12	--	3	149
1995	69	--	--	--	--	--	--	8	--	23	83
1996	9	--	--	20	--	26	7	26	--	12	69
1997	13	--	--	14	13	--	6	42	--	12	211
THIRD QUARTER											
1987	98	--	--	--	--	--	--	--	--	2	92
1991	17	23	11	--	--	--	5	6	24	14	80
1992	97	3	--	--	--	--	--	--	--	--	37
1993	--	--	--	--	--	--	--	--	--	--	--
1994	64	--	--	--	--	--	--	--	--	36	36
1995	81	--	--	--	--	--	--	--	--	19	104
1996	30	--	--	--	--	--	--	30	--	40	10
1997	8	--	--	--	--	--	--	72	--	20	78

Groups / year	SH	RA	CF	RC	SN	OP	OTCR	TU	BAR	OTRS	Total (in t)
FOURTH QUARTER											
1985	--	10	--	60	20	--	--	--	10	--	10
1986	12	--	--	43	37	--	--	--	--	8	51
1987	--	--	--	52	33	--	--	--	--	15	347
1988	--	--	--	45	48	--	--	--	--	7	156
1989	9	--	--	46	11	27	--	--	--	7	112
1990	--	--	--	58	37	--	--	--	--	5	40
1991	--	--	--	53	45	--	--	--	--	2	166
1992	--	--	--	46	2	44	--	5	--	5	248
1993	1	--	--	47	1	40	1	6	--	4	311
1994	--	--	--	24	--	17	--	12	--	47	213
1995	--	--	--	24	--	30	27	--	--	19	226
1996	--	--	--	43	--	47	--	6	--	4	493
1997	--	--	--	32	25	5	10	--	--	28	1023

Quarterwise catch, effort and CPUE of mechanized hooks & lines in Kerala during 1985 to 1992 is given in table 60.

Table 60

Quarterwise Catch, Effort and CPUE of Mechanised Hooks and Lines

Year	I Quarter			II Quarter			III Quarter			IV Quarter		
	Catch	Effort	CPUE	Catch	Effort	CPUE	Catch	Effort	CPUE	Catch	Effort	CPUE
1985	52	200	260	--	--	--	--	--	--	10	66	151
1986	195	1100	177	--	--	--	--	--	--	51	230	222
1987	572	2787	205	--	--	--	92	70	1314	347	1146	303
1988	485	1900	255	88	237	371	--	--	--	156	500	312
1989	513	2300	223	60	200	300	--	--	--	112	600	187
1990	871	1442	604	16	37	432	--	--	--	40	197	203
1991	675	2638	256	73	302	243	80	224	357	166	718	231
1992	200	1100	182	25	100	250	37	200	185	248	900	275
1993	563	1733	325	13	104	125	--	--	--	311	965	322
1994	454	1475	308	149	248	601	36	235	153	213	1253	150
1995	543	2736	198	83	215	386	104	471	220	226	611	370
1996	391	875	447	69	499	138	10	28	357	493	926	532
1997	1026	1471	697	211	803	262	78	457	171	1023	1559	657

Note: Catch in tonnes, Effort in unit operation, CPUE in kg.

Mechanized hooks & lines are mainly operated during first and fourth quarter of the year. During the first quarter CPUE varied from 177 Kg. in 1986 to 697 Kg. in 1997 whereas in fourth quarter it varied from 151 Kg. in 1985 to 657 Kg. in 1997. Mechanized hooks & lines started operation during second quarter also from 1988 onwards.

Table 61 gives quarterwise pelagic and demersal landings in mechanized Hooks & lines.

Table 61

Quarterwise Pelagic and Demersal landings by Mechanised Hooks and Lines (in t)

Year	I Quarter			II Quarter			III Quarter			IV Quarter			G. Total	
	P	D	Total	P	D	Total	P	D	Total	P	D	Total	P	D
1985	--	52	52	--	--	--	--	--	--	1	9	10	1	61
1986	37	158	195	--	--	--	--	--	--	4	47	51	41	205
1987	35	537	572	--	--	--	2	90	92	40	307	347	77	934
1988	66	419	485	3	85	88	--	--	--	--	156	156	69	660
1989	13	500	513	--	60	60	--	--	--	--	112	112	13	692
1990	32	839	871	--	16	16	--	--	--	1	39	40	33	894
1991	67	608	675	--	73	73	4	76	80	1	165	166	72	922
1992	11	189	200	--	25	25	--	37	37	12	236	248	23	487
1993	131	432	563	5	8	13	--	--	--	27	284	311	163	724
1994	152	302	454	19	130	149	12	24	36	109	104	213	292	560
1995	221	322	543	11	72	83	18	86	104	92	134	226	344	612
1996	106	285	391	31	38	69	7	3	10	42	451	493	186	777
1997	185	841	1026	120	91	211	70	8	78	363	660	1023	738	1600

This gear landed mainly demersal group of fishes. It was observed that during the period 1988 to 1997 i.e., after the imposition of partial ban of trawling there is an increasing trend in landings of mechanized hooks & lines in Kerala. Maximum landing by this gear was from depth zone beyond 50 meters.

4.2 Artisanal or Traditional Sector

To catch pelagic, column and bottom dwelling fishes, fishermen of Kerala developed a number of tackles in the course of time. Fishing methods prevailed in the erstwhile Travancore, Cochin and Malabar regions were primitive but varied. The fishery as practised in these regions was described as "inshore". Long lines and a few drift nets were the only gears plied at and beyond 20 m line while the majority of seine nets and a few cast nets were usually operated in depth from 10 to 20 m which was the most heavily fished area along the coast. Most of the cast nets, drag nets and shore seines were used only within 10 m area. Considering the role of fish economy in the lives of fisher folk and its impact on the fish oil industry, an intensive investigations into the life histories of oil sardine and mackerel was initiated during 1922 at Calicut Government fisheries office (Hornell 1923). The aim was to study the correlation of the movements of the inshore shoals with the abundance or otherwise of certain food organisms. The credit of first describing the fishing tackles and methods along Malabar Coast goes to Hornell (1928). He classified the fishing gears under the following groups.

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	P	D	Total	P	D	Total	P	D	Total	P	D	Total	P	D
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1986	37	158	195	--	--	--	--	--	--	4	47	51	41	205
1987	35	537	572	--	--	--	2	90	92	40	307	347	77	934
1988	66	419	485	3	85	88	--	--	--	--	156	156	69	660
1989	13	500	513	--	60	60	--	--	--	--	112	112	13	692
1990	32	839	871	--	16	16	--	--	--	1	39	40	33	894
1991	67	608	675	--	73	73	4	76	80	1	165	166	72	922
1992	11	189	200	--	25	25	--	37	37	12	236	248	23	487
1993	131	432	563	5	8	13	--	--	--	27	284	311	163	724
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4.2 Artisanal or Traditional Sector

To catch pelagic, column and bottom dwelling fishes, fishermen of Kerala developed a number of tackles in the course of time. Fishing methods prevailed in the erstwhile Travancore, Cochin and Malabar regions were primitive but varied. The fishery as practised in these regions was described as "inshore". Long lines and a few drift nets were the only gears plied at and beyond 20 m line while the majority of seine nets and a few cast nets were usually operated in depth from 10 to 20 m which was the most heavily fished area along the coast. Most of the cast nets, drag nets and shore seines were used only within 10 m area. Considering the role of fish economy in the lives of fisher folk and its impact on the fish oil industry, an intensive investigations into the life histories of oil sardine and mackerel was initiated during 1922 at Calicut Government fisheries office (Hornell 1923). The aim was to study the correlation of the movements of the inshore shoals with the abundance or otherwise of certain food organisms. The credit of first describing the fishing tackles and methods along Malabar Coast goes to Hornell (1928). He classified the fishing gears under the following groups.

S.No	Class of implements	Chief implements used
1	Lines	Beppu (Valia beppu, cheria beppu), choonda
2	Drift nets	Ozhukkuvala, Oduvala, Bameen vala, Sravu vala, Kadungani vala, Therandi vala
3	Wall nets	Kantha vala
4	Shore seine	Kairampani
5	Seine nets	Chala vala, Aiyla vala, Aiyla chala vala, Mathivala, Pattavala, Thattuvala, Thattamvala
6	Small trawl type nets	Paithuvala, Kollivala, Aiyla kollivala, Mathikollivala, Nooluvala, Vakkuvla, Vadakken vala, Marivala, Chemmeen vala, Sultan vala
7	Drag nets	Koruvala
8	Hand nets	Vattavala
9	Cast nets	Veeshuvala, Karavala, Nethal vala

In literature and legislation fishing gears were classified as active and passive gears. The active fishing gears are mobile gears by means of which fish are caught, whereas fishes swim voluntarily into fixed passive gears. Seine nets and trawls are example of active gears, traps and gill nets are passive gears.

Seine nets are intended for bulk fishing, of pelagics generally operated in shallow coastal waters. They have a typical form with a strong centre for holding the fish, long wings on both sides, long hauling lines attached to the wings. For collecting the caught fish in the centre of the seine net is a net bag attached between the wings or with a retarding device to prevent the escaping of the fish. These constitute two basic types of seines, the seines without bags and with bags. The type of boat seine prevalent in the Northern Kerala can be pushed beneath shoal of fish and can encircle it from each side. The net bag is made of small meshed netting, the wings are made of coarse material with wider meshes. Mostly seine nets are set and hauled from nearly the same place round the area it is proposed to fish. The seine nets can be set either from single boat or two boats, as is the practice in the northern part of Kerala. Many seine nets are used in coastal fishing, depending on whether the nets are handled from a boat or from the beach, they are called boat seines or beach seines. Beach seines are set from the beach by means of a boat in such a way that the drag line of one wing remains on the beach, while one wing, the net bag and the other wing with its drag line are taken out in a craft and then brought back to the beach.

Common types of seine nets used in the early sixties in different parts of Kerala are (Anon, 1970). Ayilakollivala, Pattenkollivala, Arakollivala, Odamvala, Paithuvala, Nethalvala, Thanguvala, Madivala, Thattumadi, Karamadi and Karvala. Of these the last two are shore seines. Table 67 lists the various types of boat seines which were in use till ring seines became popular. Although they are known by different names, all these gears fall into the basic category of boat seines; varying only in size of the net and mesh size.

Aiylakollivala is the most important type of gear (boat seine) for mackerel fishery. Aiylakollivala has the same general design as that of Odam vala but differs from it in two or three important constitutional details. The wings, here are quite short, about one third of the length they have in Odamvala. Except for a peripheral sections consisting of 1.83 m broad cotton netting, the bag is made of hemp twine with rather large mesh in contrast to small meshed cotton twine bag of Odamvala.

The platform or 'Kolli' and its sides in 'Aiylakollivala' are of cotton netting of small mesh instead of large meshed coir of Odam vala. Because of these features Aiylakollivala can be operated more easily and efficiently making it the most versatile. It has a bag of 11 m long and a platform measuring 22 m. The wings on either side of the platform or 'Kolli' are rather short measuring 15 m. The mesh of the bag varies from 15 mm at cod end and to 25 mm at the mouth; while the mesh of the platform also measures 25 mm.

The net is operated from a pair of canoes with a crew of 7-8 men. Each canoe carrying half the net, sail to the fishing ground and when a shoal is sighted the canoes separate and the net is shot across the path of the shoal. The lead line is shot and the float line is set far back. The wings and the nets are well stretched by paddling the canoes. By adjustment the lead line is allowed to sink below the level of the shoal and the head rope is kept afloat above the level of the shoal. As soon as enclosed shoal passes over the platform and towards the mouth of the bag, the canoes converge. The wings are hauled till the lead line comes above the surface, thus driving the fish into the bag. By hauling the float line vertically the catch is concentrated at the cod end which is then lifted up between the canoes. The catch is emptied into one of the canoes and the boats move out for the next operation.

According to Antony Raja (1969) the Kollivala of cotton has yielded to that of nylon twine in the northern part of Kerala coast and was operated as Pattenkollivala. The net was introduced at Calicut towards the end of 1956 and spread to other fishing centres of Kerala rapidly. As Pattenkollivala contained features both of Aiylakolli and Mathikolli, it was used effectively for capturing both mackerel and oil sardine. Pattenkolli was found much effective in capturing the shoaling species (Rao, 1970). This feature has increased its popularity among fishermen. The net was larger than Aiylakolli and Mathikolli, it measured 25-30m, of which the bag itself occupied half of the length. The mesh of the bag varied from 10-14 mm at the cod end to about 22 mm at the mouth of the bag.

Mathikolli, Arakolli, Arathattamvala, Thattamvala and Paithuvala are all same type of boat seine, only the size of the net varying. Similarly Odamvala and Nethal vala are similar type of bag net, the latter especially operated for small sized juveniles, white baits and small sized oil sardine during July-September and October-December (Prabhu, 1966). So is the case with Noonavala of Cochin which represent a smaller form of thanguvala and similarly employed for capturing small sized juveniles. Nair (1953, 1960) described Mathikollivala, Mathi-chalavala and Thanguvala. Mathikollivala had a length of 18m, breadth 5.5m and mesh size 15 mm. It consisted of a wide mouthed bag,

the lower lip of which is continued and raised to form the body "kolli" and on the sides as two wings. While the net proper - the bag and the body - was made up of cotton, the wings were of coconut fibre. The net was operated from two dug out canoes with 7 or 8 men in each. The lead line was very short while the float line was set back very far. Each canoe carried half the net and when the shoal was sighted, the net was paid out while the canoes separate. The net and wings were well stretched out by paddling the canoes. The lead line of the net sinks below the level at which the fish were swimming and by adjusting the length of "Kaavi", snoods, the float line was kept above the level of the shoal. The encircled shoal was driven into the net by the loud noise produced by the auxiliary boats. When the shoal has moved beyond the level of the wings towards the mouth, the two canoe converge and the wings were hauled till the lead line can be lifted above the surface, thus enveloping the fish in the bag. By hauling the float line vertically the catch gets concentrated in the bag.

In the fifties Thanguvala was constructed with cotton yarn. The introduction of synthetic yarn brought about a revolutionary change in both quality and quantity. This net was extensively used till 1985 in the Alleppey, Ernakulam, Trichur fishing belt. The net was rectangular in shape and operated from a single boat, 50-60 m in length and 30-40 m width which tapers 5-6 m at either ends. The mesh size is 20 mm. At the sight of the shoal, one person jumps into water and paying out the net around the shoal, hands over one end of the net to the crew in the boat which retains the other end. The net, then, is hauled and lifted up vertically (Antony Raja, 1969).

The well known fact is that in the traditional fishery dug out canoes were the main stay of fishery operations, plank built canoes were used when bulk fishing is carried out. However, in the southern part of Kerala due to various reasons, operational as well as economic, catamaran have taken the place of the dug out canoe. By using catamaran and dug out canoes, various types of traditional gears were engaged in this part of Kerala. Thattumadi is a boat seine operated mainly during monsoon and post-monsoon period. The net is composed of three parts. A short wide mouthed conical portion called the 'Madi' or the net proper made of cotton, (2) a coir platform known as 'Thattu' attached to the lower lip of the net and (3) two long coir wings attached to the margin of the 'Thattu' on either side known as Eravala. The madi or the net proper is a conical bag shaped net with a constriction in the middle. The net is made up of four pieces. The pieces are known as Aravala, Kurulumadi, Thelingamadi and Kavala. Aravala is the bottom most portion of the net constituting the net proper 7 mm from knot to knot inside. Kurulumadi is the portion attached just in front of the Aravala and mesh size is that of Aravala. Thelingamadi is the portion attached to the front margin of the Aravala. To the floor of the lower lip of the net is attached to a coir platform known as the 'Thattu' which is comprised of three rectangular pieces one in the middle and two at the sides. The middle portion is known as Thattu and the side pieces are known as the Mevalai. Slight variations are found in the size of the net from place to place. Eravala or the wings are made of coir and are attached to the side portions of the Thattu. To the distant extremity of the wings on either side are attached two coir ropes or Kampa (Nair, 1958).

Two catamarans or canoes are employed for operating this net. The net and other parts are attached and loaded in one catamaran or boat and the fishing vessels paddle along. As soon as a shoal is sighted the net is shot and one of the warps is handed over to the crew in the other catamaram or boat. Then they take a course away from one another and encircle the shoal. After encircling the shoal the two vessels come closer and meet, and the two begin to haul up the net simultaneously. When the bag portion of the net is hauled up the catch is emptied into one, and the operation is repeated until a satisfactory catch is made. The net is always shot in the direction opposite to the movement of the shoal.

Balan (1980) made a review of the changes in the traditional fishing gears of Kerala. According to him 'Mathikollivala' was in use since 1895 in the northern part of Kerala. After the introduction of Pattenkolli made of synthetic material Mathikollivala was rarely used. The proven efficiency of Pattenkolli also paved the way for the replacement of less efficient Nooluvala and Thattamvala. While in the central region of Kerala boat seines, Vattavala, Thanguvala and Nonavala did not undergo much of a change except in the case of building material, cotton yarn has been replaced by synthetic yarn.

The operational advantages of synthetic material are manifold. When cotton yarn was replaced by synthetic material net making took the shape of an industry. The handling of the cotton seine during fishing operations is more tiresome and hence results in reduction of number of hauls. Adhesion of mud, water and fish mucus is extensive in cotton net which renders it heavier and vulnerable to rotting. Cotton nets are difficult to clean and absorption of water is high and requires longer period of time for drying. Mathikollivala was a species oriented gear chiefly for oil sardine whereas synthetic Pattenkolli is multi species oriented thus makes it more efficient. Synthetic yarn is comparatively high resistant to rotting hence durability and longevity is high. Slightly coloured synthetic yarn blends well with the marine environment and hence the catch rate is high.

Balan (1980) lists below the type of boat seines which were in use in the sixties and seventies:

S.No		Length (m)	Width (m)	Mesh size (mm)	Remarks
1	Mathikolli	50	56	17 - 18	Cotton yarn, knotted netting now almost extinct. Full sized coir wings and coir platform.
2	Nylon Patten kolli	42.5	47	17	Nylon yarn, Knotted webbing coir platform reduced. Coir or nylon wings full sized.
3	Pattenkolli (old type)	-	-	-	Cotton yarn, platform much reduced. Full sized coir wings.
4	Thattamvala (Noovala)	22.5	39.5	14	Cotton yarn netting. Wings and platform full sized.

S.No		Length (m)	Width (m)	Mesh size (mm)	Remarks
5	Paithuvala (old type) same as Arakolli	12	14	15	Cotton yarn, wings and platform in the same size of Nylon Paithuvala.
6	Paithuvala (Nylon) same as Vattavala of Central Kerala	10.5	12	15	Nylon webbing. Platform and coir wings small sized
7	Nethal vala	19.75	23	10	Cotton yarn, Platform and coir wings small sized.
8	Ayilakollivala	40	60	25	Cotton yarn, cod and meshes made of thick hemp twine, now replaced by Patten kolli
9	Edakkan vala	14.85	36	16	Thick cotton yarn netting. Full sized coir wings and platform.
10	Thalayan vala				Cotton yarn, old Nooluvala or Vakkuvala converted.
11	Vakkuvala (Ettavala)	12.56	25	30	Thick hemp twine. Full sized coir wings and platform.

The present trend is entirely different, almost all types of boat seines are being replaced by much efficient Ring seines.

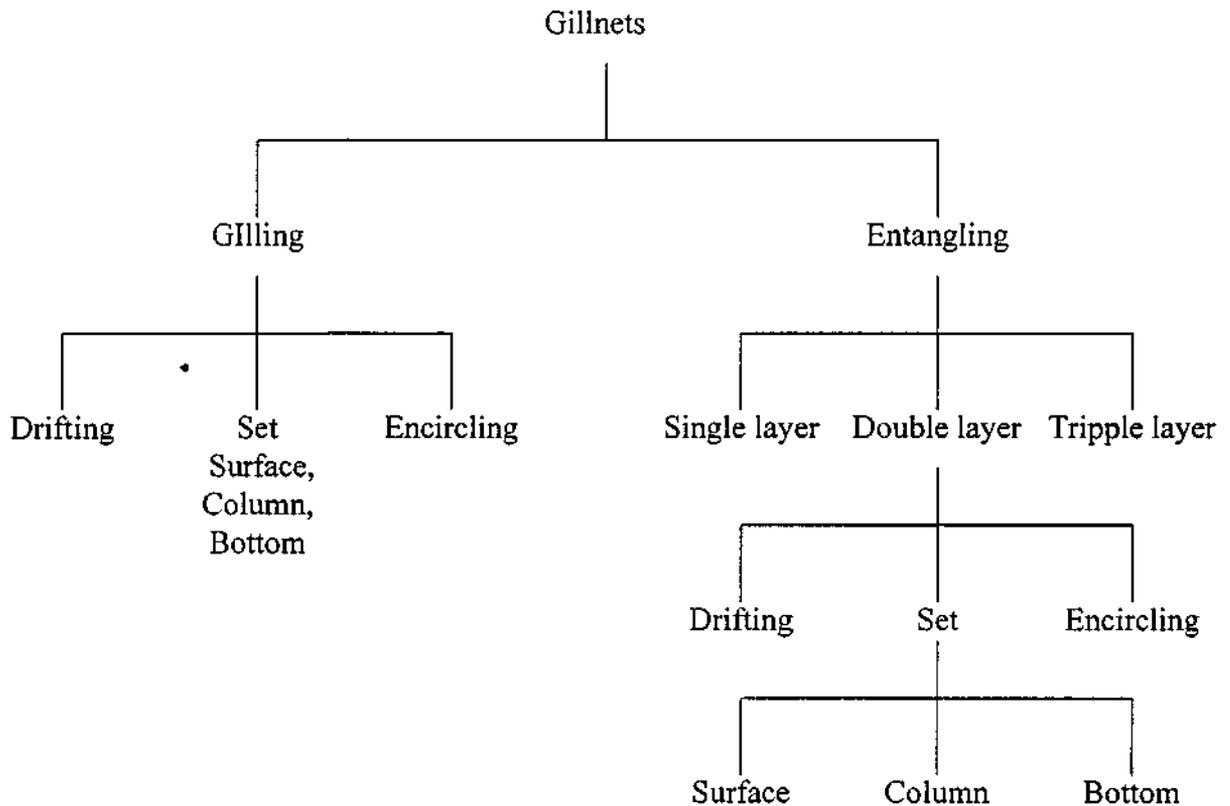
Among the seine nets Karamadi or Shore seine is widely operated in the southern part of Kerala. It consists of three parts (1) the warps or Kamba (2) the wings or Kayaru (3) the net or madi. The net is funnel shaped with two wings and warps. The net or the madi is made up of two pieces called the melmadi or neriyavala and the aravala, the lower most portion of the net. melmadi is attached to the exterior margin of Aravala. The wings made of coir are attached along the anterior margin of the melmadi. The mesh size increases from the proximal to the distal extremity. The warp or kamba are also made of coir. These are attached to the wings.

The net is loaded into the canoe and before leaving the shore one of the warp is handed over to a party on the shore. The net is operated from the shore as the name implies. The canoe makes a semicircular course all the while paying out the net and as soon as the canoe reaches the shore, after paying out the net, the other warp is also handed over to another party. The two parties on the shore began to haul up the net simultaneously. As the hauling progresses the parties on the shore come closer and closer and when they meet the net is dragged ashore. The season is October to May and the target group is pelagics.

Churukkumadi is yet another partially modified shore seine used for capturing tunnies and large sized carangids shoaling along the coastal waters. In addition to the various parts found in the Karamadi the net has got a funnel shaped portion attached to the inner edge towards the mouth side of the melmadi. Along the narrow edge of this funnel shaped netting runs a cord by pulling which the net can be closed. This mechanism renders it capable to close the net after the fishes have been caught, preventing their escape.

With many gears it is found that fish try to swim through the net wall and the meshes formed a noose around their bodies. Gilling is often combined with entangling. Gill nets are net walls whose lower end is weighed by sinkers and whose upper end is raised above by floats. They are set in the transverse direction of the moving fish. Gill nets are passive gears. The most important property of passive gill net is that they do not act like impenetrable wall. Gill nets should be invisible as far as possible; cotton nets would contrast far too much the clear waters. The efficiency of gill net is increased by the introduction of synthetic fibres especially by transparent monofilaments (Von Brandt, 1959).

Hornell (1932) described mainly two types of gill nets which were prevalent along the Malabar coast at that time viz., Ayilavala and Mathivala. In the year 1951 Bal and Banerji estimated that nearly 10000 units of gill nets were in operation in the area between Cape Comorin and Mangalore. According to Miyamoto (1956) gill nets can be broadly classified into two groups depending on the way fishes are caught namely gilling and entangling, having one or one to three layers respectively. These are further grouped based on the method of construction, operation and depth of operation. Von Brandt (1959) classified both gill nets and tangle nets into two main types on the basis of structure and design. They are single walled net and multiwalled or Trammel nets. Satyanarayana and Sadanandan (1965) described two types of gill nets Ayilavala and Mathichalavala which were extensively used in the central Kerala. Satyanarayana *et al* (1965) offers yet another classification.



Accordingly, chalavala, used to capture oil sardine and mackerel in Kerala, is a surface encircling, gill net. The dimensions are 800 meshes in length and 40 meshes in depth. The mesh is uniform throughout and is 19mm bar. Hand twisted twines were used for construction. The net is operated from a dug out canoe. Usually five fishermen form the crew. Fishing is usually a combined effort of a few boats operating their nets together; the number of boats depending upon the size of the shoal encountered. After scouting a shoal, a few boats are rowed well ahead of the moving shoal, which is then encircled from all sides paying the nets from the respective boats. After encircling, the fishes are scared by beating on the sides of the boats. The average depth of operation for sardine and mackerel is 8 and 12 m respectively, Due to various reasons, this type of fishing operation is becoming rare in the central part of Kerala.

From southern part of Kerala, Nair (1958) described three types of gill nets: chalavala, netholivala, and valavala. Chalavala is operated from a catamaran, often by two men. When the shoal is sighted the net is shot perpendicular to the direction of the movement of the fish and after sometime the head and foot ropes which were tied on the craft are dragged in and the net is slowly hauled into the catamaran, Noovala is drift gill net and the method of operation is same. Rao (1965) described Vangadavala and Vakkuvla also from Vizhinjam used for capturing mackerel during October-April.

In the northern part of Kerala there were a variety of gill nets which were slowly replaced by more efficient gill nets. Ayilachalavala is a gill net made of cotton twine

designed to capture mackerel and is similar to Pattubala in design and operation. The net is operated from two small canoes manned by a crew of 2-4 in each. Each net section usually measures 14.6 to 21.9 m long and 9-11 m deep with a mesh of 25-55 mm (Rao, 1970). The two canoes carry aboard 6-9 such pieces laced together end to end. The head rope of the net is provided with wooden floats at regular intervals and similarly the foot rope is weighted with stone sinkers.

When the shoal is sighted, the canoes separate and the net is paid out quickly in a semicircular manner across the direction of the shoal, the shoal is encircled. Then the crew frighten the fish by making loud noise by beating on the sides of the canoe and splashing water; the terrified fish scatter in all directions and get firmly gilled in the surrounding net. Then the net is hauled up on board to remove the fish. The fishermen use several combinations of net pieces of different mesh sizes to capture different size groups as the season demands.

The 'kanthavala' of northern Kerala is similar to 'Ayilavala', with a difference that kanthavala is operated as anchored gill net. Generally, they are set from a single canoe in shallow waters at dusk and anchored in position by heavy stone sinker tied, one on either side of the foot rope, to prevent it from displacement. The net is hauled only after a lapse of few hours.

During the period 1950 these nets were made of cotton and hemp and beginning of 1960 saw a total change in the gear material used all along the Kerala coast (vide Table 53, pg. 64 & Table 67, pg. 91). Cotton and hemp nets were totally replaced by nylon nets.

Mathichalavala is a gill net made of cotton and operated from one or two canoes (Anon, 1969). The dimensions of each piece of net is 2.5 - 3 m long, 4-6 m broad and with a mesh of 9-25 mm. Each canoe or both canoes together carry 7-8 pieces together and when the shoal is sighted the net is paid out quickly from the canoe in semicircular manner across the direction of the movement of the shoal. The range of mesh size is so wide to enable necessary combinations of different meshed pieces depending upon the size combination of the shoal. With the out break of monsoon or when regular shoals start appearing the gear is used and the season lasts till October. 'Mathichalavala' is a selective gear.

Fishing operations by drift gill nets were in vogue off Malabar region on a medium scale since the beginning of the century (Balan, 1985). Four types of drift gill nets operated aboard the canoes, were extant since that time; they were (1) a thick large meshed and heavy (325 mm, mesh size) hemp drift gill net locally called 'Sravuvavala' (Shark net) employed for the capture of large sharks, bill fishes etc. from deep waters. (2) A thin meshed (12-20 cm mesh size) hemp drift net called 'Thirandivala' (Ray fish net) used mainly for the capture of rays, (3) a small meshed (7-8.5 cm) cotton or hemp made drift gill net called 'Kandadivala' used for the capture of small sized cybids etc., (4) slightly bigger meshed hemp drift net called 'Oduvavala' (9 - 12 cm) used for the capture of

big sized fishes. After the thirties of this century the 'Sravuvala' became obsolete. The 'Thirandivala' and 'Kandadivala' operations were continued till about the end of fifties only, all along the coast. Hence the big meshed hemp oduvala gained importance since the sixties and continues so till date with the change that the hemp has been replaced by nylon webbing. The oduvala were in operation from Chavakkad to Kasarkod in Kerala. In the seventies migrant fishermen from Kanyakumari introduced small mechanized boats for the operation of oduvala (nylon) and this spread all along the coast of Kerala. In the initial stage there were protests from the local fishermen but the introduction of small mechanized boats paved the way for a major development in the drift gill net fishery. The area of operation has been extended beyond the range of canoes to deeper shelf waters. It has also caused an overall increase in the number of drift gill nets and had effected an increase in the dimension of the drift gill nets to cope up with the operation at greater depths. At present this drift gill net is popularly known as "Ozhukkuvala".

Another type of gill net that is more distinctly used for catching fish and prawn by entangling them is the trammel net or more popularly called 'Discovala'. This is a trap net wall. Between wide mesh stretched outer walls a rather loose interior net is inserted. Trammel nets are stationary gears but they can also be used as drift nets and can even be towed.

Joel *et al* (1985) first reported the introduction of discovala in the Trivandrum district during 1984. It is tri walled and designed to set up at bottom. It has a fine net of smaller meshes hung loosely between vertical walls of coarser net of much larger meshes so that the fish passing through the outer wall carry some part of the finer net through the wall of the other side and are entangled in the pocket thus formed. Though mainly operated for prawn, this net also pockets other crustaceans, molluscs and fishes that move near the bottom of the sea. Gilling of larger fishes in the outer walls has also been reported. The net is operated from catamaran by one or two persons at depth upto 35 m.

Gill nets and its various combinations in traditional fisheries do not require special requirements for operations. With the introduction of monofilaments in gill nets, the efficiency of the gear could be increased. But it is found that in bulk fisheries for oil sardine and mackerel the proportion between the quantity of netting needed to catch a certain amount of fish is very unfavourable one when compared with the gear used for bulk fisheries like trawls and purse-seiners. Therefore the trend is to note that gill nets with all its combinations of fishing are profitable only for high quality fishes.

There are two types of hooks and lines in vogue in the southern part of Kerala; they are valiyachoonda and choonda kayaru. Valiyachoonda is a long line type of hook and line, line ranges from 900 - 1000 ft in length. Hooks of many sizes are attached at six feet intervals by 10 feet snoods, usually 150 hooks are attached. One end of line is tied to the catamaran or canoe and to the other extremity a float and a sinker are attached. Sharks and other big fishes are caught by this line. Choondakayaru is yet another type of line about 600 ft in length. A small rope of 3 ft length is tied at the middle to the extremity of the long rope, used for catching medium sized fishes like seer fishes,

tunnies, leather jackets etc. (Nair, 1958). The practice of fishing large sized sharks etc. with harpoons on board canoes though very common in the old days, is not quite popular now. The old practice of fishing of big-sized seer fish, barracudas etc. by wiffing line has also been, of late, dropped to a great extent in many villages (Balan, 1980). Sam Bennet (1967) recorded a purely indigenous gear, Kachal, which has been in use for the last 100 years or more in the southern most district of Kerala. Kachal is a specific gear used to capture balistids, the fishery season for which is from December to March. Kachal is scoop net using bait.

The Kachal is operated from a catamaran or canoe. One person can operate two units at a time. After selecting a suitable site for operation advantage is taken of the habit of the file-fish of cutting its food into small bits, to locate file fish in the area. A hand line with one or two hooks baited with cuttle fish meat is lowered. If the bait is eaten up completely without the fish being caught by the hooks it indicates that the bait has been taken by file fish.

Hand cast nets are today widely used all over the world. It is believed that cast nets were originally developed in India. Generally these are circular nets, which as the name implied are thrown. They fall flat upon the water surface then quickly sink by the reason of weighted edges. The nets are cast from beach or from a boat. Skill is required of the man casting the net. Sometimes a group of fishermen cast their nets together. The boats encircle a shoal of fish frightening them together by voice with the oars during the process of narrowing the circle more and more. On a given signal all fishermen cast their nets so carefully that the nets nearly touch each other. Mostly cast nets have a radius of 2 - 3 m. The gear can be a simple circle of netting and the fishes are entangled in the net webbing which collapses when carefully hauled.

With the increased use of the efficient gears all along Kerala the 'Kettumvala' (a stringless large meshed cast net) which was extensively used along the Malabar coast for fishing mainly the big sized oil sardine has gone out of use in recent years. The stringed nylon small meshed (16 - 23 mm) cast nets called 'Neychuvalla' and 'Patchivalla' are used on a small scale now-a-days for sardine fishing and other small fishes in near shore waters (Balan, 1980).

4.2.1 Non-Motorized Sector

About two third of the fish landings in Kerala was accounted for the artisanal sector till 1979 (Anon.1987). Traditional craft operated in Kerala were plank built boats, dug out canoes and catamarans. This pattern has been fast changing due to large scale motorization of the country craft. During the period 1980-'97 contribution of non-motorized sector varied from 3.38 pct in 1997 to 65 pct in 1981 (Table 42). After the introduction of outboard engine fitted country craft, contribution of non-motorized sector was fast decreasing. Landings of this sector varied from 19374 t in 1995 to 188128 t in 1983. At present in Kerala non-motorized gill net, boat seine, shore seine and Hooks & Lines are in operation.

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4.2.1.1 Non-motorized gill net

Non-motorized gill net landings in Kerala varied from 8396 t in 1994 to 58104 t in 1983 during the period 1980-97 (table 62, fig. 49). During 1984 to 1997 the contribution of non-motorized gill net to the total landings varied from 1.4 pct in 1994 to 7 pct in 1984 (table 48, pg. 59).

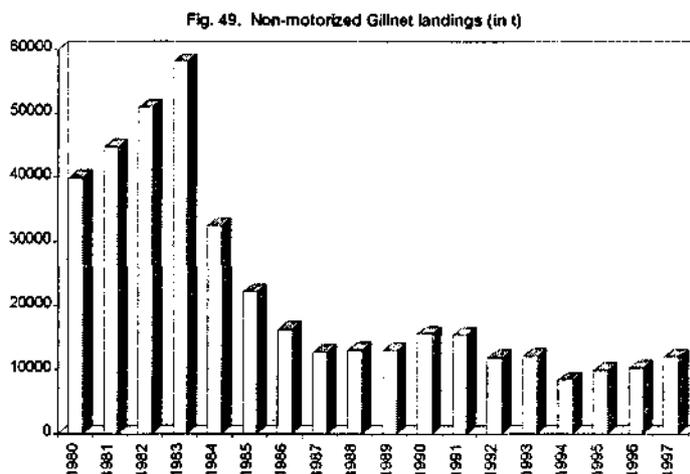


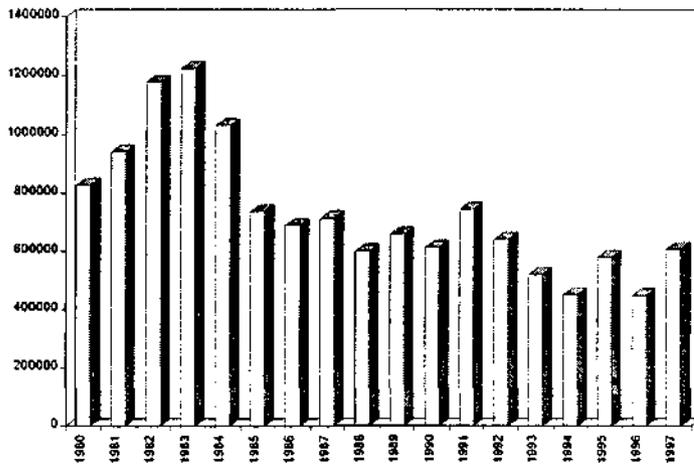
Table 62

Catch, Effort and CPUE of different gears.

Year	NMBS			NMGN		
	Catch	Effort	CPUE	Catch	Effort	CPUE
1980	73837	429000	172	39835	827000	48
1981	112697	448000	251	44726	940000	48
1982	93007	445000	209	50910	1178000	43
1983	94541	268000	352	58104	1224000	47
1984	76928	336000	229	32413	1030000	31
1985	39688	197000	201	22132	737000	30
1986	35712	179000	200	16304	691000	24
1987	---	---	---	12710	714000	18
1988	1927	27000	70	13069	602000	22
1989	5536	50000	110	12928	659000	20
1990	9325	74000	126	15566	615000	25
1991	2866	46000	62	15413	745000	21
1992	4560	52700	87	11906	642000	19
1993	7279	53387	136	12095	520613	23
1994	1131	15352	74	8396	451914	19
1995	1357	14000	97	9871	580000	17
1996	1331	19000	70	10306	448000	23
1997	2132	24000	89	12010	609000	20

Note: Catch in tonnes; Effort in units operation; CPUE in kg.

Fig. 50. Non-motorized Gillnet Effort (in Unit operation)



Effort in terms of unit operation varied from 451914 in 1994 to 1224000 in 1983 (Fig. 50). There was a declining trend in the effort of non-motorized gill net from 1985 onwards when compared to 1980-84. At present there are about 3379 NM. gill nets of different sizes operating in Kerala. Catch per unit effort varied from 17 kg in 1995 to 48 kg. in 1980 (Fig. 51).

It showed a declining trend during the period 1980 to '87, then showed slight improvement. Quarterwise catch, effort and CPUE is given in table 63.

Fig. 51. Non-motorized Gillnet CPUE (in kg)

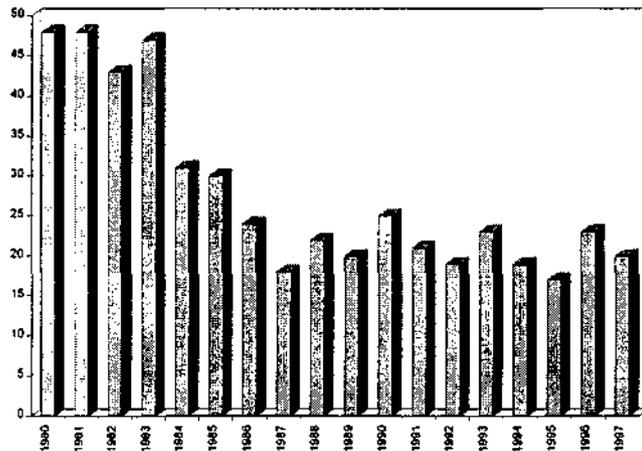


Table 63

Quarterwise Catch, Effort and CPUE of Non-motorized gill net

Year	I Quarter			II Quarter			III Quarter			IV Quarter		
	Catch	Effort	CPUE	Catch	Effort	CPUE	Catch	Effort	CPUE	Catch	Effort	CPUE
1985	6344	269400	24	5506	166400	33	3933	72200	54	6349	229600	28
1986	2512	180000	14	7315	285900	26	921	56300	16	5556	169000	33
1987	2124	182770	12	2745	178600	15	3695	149600	25	4146	203500	20
1988	2791	151300	18	4572	188900	24	2420	92200	26	3286	170200	19
1989	1595	192400	8	3702	215000	17	3817	100800	38	3814	151400	25
1990	1313	91199	14	3514	183500	19	4967	160469	31	5772	180393	32
1991	2546	176954	14	4624	223098	21	2654	133059	20	5589	212002	26
1992	2143	195000	11	4420	217000	20	3449	126000	27	1894	104000	18
1993	3546	167034	21	3206	158316	20	1448	75945	19	3895	119318	33
1994	2593	139000	19	2000	109000	18	1301	53000	25	2502	150000	17
1995	1764	175000	11	1857	126000	15	1990	78000	26	4260	202000	21
1996	1640	129000	13	3092	137000	23	1587	63000	25	3987	119000	34
1997	2325	181000	13	3082	139000	22	2241	66000	34	4362	223000	20

Note: Catch in tonnes, Effort in unit operation, CPUE in kg.

It can be seen that during the period 1985-97 maximum CPUE was noticed during III and IV quarters.

Percentage contribution of NMGN in the landings of major groups of fishes during '84-'97 is given in table 64.

Table 64

Percentage contribution of NMGN in the landings of major group of fishes

Groups	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
Elasmobranchs	7.6	8	8.3	4	2.9	10.7	38.5	7.4	5.4	3.6	1.2	2.8	0.9	1.7
Cat fishes	1.5	1.5	0.5	--	--	2.6	0.3	0.1	0.7	0.2	-	7.4	4.3	1.5
Oil Sardine	4.7	3.3	3	2	--	0.4	0.7	2.1	0.6	2.9	7.8	3.8	4.4	3
Other Sardines	23.7	30.1	46.3	16.1	29.7	10.5	8.1	5.9	9	7.4	6.1	4.6	17.5	15.4
White baits	7.2	8.1	11.2	25	3.4	8.1	6.4	13	5.6	8	3.5	2	3.2	2.87
Lizard fishes	0.7	0.8	--	--	0.9	0.8	0.3	--	0.5	0.2	-	0.2	0.05	0.26
Perches	2.1	2.7	0.4	0.3	0.1	--	0.1	0.1	0.1	0.1	0.07	0.2	0.39	0.17
Goat fishes	64	90	12.6	0.5	1.9	1.8	0.5	0.3	0.8	1.9	-	-	-	29.7
Croakers	3.5	7.3	3.1	5	1.5	5.5	10.1	5.2	4	3.8	3.1	5.3	2.3	4.3
Ribbon fishes	1.4	1.4	2.6	1	--	--	--	--	--	-	-	0.4	-	0.03
Carangids	22.5	13	1	3.9	1.6	2.1	1.4	0.7	1.3	0.9	0.9	1	1	1.3
Silver bellies	15.8	7.6	2.8	2.1	1.4	6.3	7.5	5.6	5.4	3.4	5.8	3.5	16.1	6.8
Big jawed jumper	22.4	22.4	9.6	10.8	14.6	17.3	40	26.3	16	12.3	6	14.8	6.8	9.1
Mackerel	36.6	30.3	5.2	11.8	5.2	2	0.8	2	3	1.3	1.5	2	2	2.5
Seer fishes	12.7	1.9	1	2	0.9	--	--	0.9	0.3	0.4	-	0.1	0.37	0.16
Tunnies	21.4	7.4	3.9	2	1.3	1.2	1.8	2.8	0.8	0.6	0.8	0.2	0.02	0.18
Flat fishes	2	1.4	6.1	1.9	0.5	0.6	1.3	1.5	1.1	2.4	1.1	3.5	0.8	0.4
P.Prawns	0.6	--	1.1	0.9	1.2	0.7	0.7	0.6	1.4	0.4	0.2	0.2	0.12	0.8
Cephalopods	7.2	14.1	0.8	0.2	--	--	2.9	0.2	--	0.1	-	0.01	-	1.3

Elasmobranchs, other sardines, goat fishes, carangids, big-jawed jumper, mackerel and ribbon fishes were the major groups. Percentage contribution of NMGN in the landings of elasmobranchs varied from 0.9 pct in '96 to 38.5 pct in '90. In the case of other sardines it varied from 4.6 pct in '95 to 46.3 pct in '86. Maximum landings was observed in the first quarter (Table 65). There was a declining trend in contribution of this gear to the other sardine landings from '89 onwards. Share of this gear to the goat fish landings varied from .3 pct in '91 to 90 pct in '85. From '86 onwards there was drastic reduction in the contribution of this gear to goat fish landings. NMGN contributed 22.5 pct of the carangids in '84 and the decline was set in thereafter, it was only 0.7 pct in '91. NMGN is one of the major gear for harvesting big-jawed jumper, contribution of this gear varied from 6.8 pct in '96 to 40 pct in '90. In the case of mackerel contribution from this gear varied from 36.6 pct '84 to 0.8 pct in '90 thereby showing a declining trend. Mackerel was available in the non-motorized gill net catch during first, second and fourth quarters in almost all the years. During '84-86 ribbon fishes were present in the landings of NMGN and its contribution varied from 1 pct in '87 to 2.6 pct in '86. However this group was almost absent in the landings of this gear from '88 onwards.

Table 65

Quarterwise percentage contribution by major group of fishes in NMGN landings

Groups/ Year	SH	RA	WH	OS	OSS	WB	TY	OC	OP	CR	RF	SC	OT	SB	BJ	IM	TU	MUL	FF	PP	CA	CE	OT	RS Tot(t)	
FIRST QUARTER																									
1985	-	-	-	10	-	15	-	-	-	-	-	-	9	-	-	29	-	-	-	-	-	17	20	6344	
1986	9	-	-	14	29	10	-	-	-	-	-	-	14	-	-	10	-	-	-	-	-	-	14	2512	
1987	-	-	-	-	18	-	7	-	-	-	-	-	6	-	-	31	-	-	-	-	-	-	-	28	2124
1988	-	-	-	-	42	-	-	-	-	-	-	-	-	-	-	14	-	-	-	-	-	-	-	44	2791
1989	-	6	-	12	18	6	-	-	-	14	-	-	-	-	-	24	-	-	-	-	-	-	-	20	1595
1990	-	-	-	20	12	15	-	-	-	-	-	9	6	-	-	17	-	-	-	-	-	-	-	21	1313
1991	-	-	9	-	10	19	-	-	-	-	-	-	5	-	-	28	-	-	-	-	-	-	-	29	2546
1992	-	-	-	-	18	-	5	6	-	-	-	6	12	-	-	15	-	-	-	-	-	8	-	30	2143
1993	1	2	1	3	4	58	2	1	1	2	-	1	5	2	-	8	2	-	1	-	1	-	5	3546	
1994	-	-	-	-	11	6	14	21	-	-	-	-	6	5	-	18	-	-	-	-	-	-	-	19	2593
1995	--	--	--	--	26	10	--	--	--	--	--	--	--	--	--	33	--	--	--	--	--	--	--	31	1764
1996	--	--	--	10	11	7	5	--	--	--	--	--	--	--	--	32	--	--	--	--	--	--	--	35	1640
1997	--	--	--	16	36	--	--	--	--	--	--	--	--	--	--	19	--	--	--	--	--	--	--	29	2325
SECOND QUARTER																									
1985	-	-	-	12	6	5	-	5	-	-	-	-	8	-	-	43	-	-	-	-	-	-	-	21	5506
1986	-	-	-	37	-	26	-	-	-	-	-	-	-	-	-	9	-	-	-	-	-	-	-	28	7315
1987	-	-	-	5	5	45	-	5	-	-	-	-	5	-	-	12	-	-	-	-	-	-	-	23	2745
1988	-	-	-	-	52	12	-	9	-	-	-	6	-	-	-	7	-	-	-	-	-	-	-	14	4572
1989	-	-	-	12	18	27	-	-	-	6	-	-	-	-	-	-	-	-	-	6	-	-	-	31	3702
1990	-	-	-	7	18	29	-	7	-	5	-	-	-	-	9	-	-	-	-	5	-	-	-	20	3514
1991	-	-	-	36	15	21	-	-	-	-	-	-	-	-	-	6	-	-	-	5	-	-	-	17	4624
1992	-	-	2	-	7	39	-	-	-	-	-	8	-	-	14	-	-	-	-	-	-	-	-	32	4420
1993	-	1	-	-	8	51	-	2	-	4	-	6	4	2	-	9	1	-	2	1	1	-	7	3208	
1994	-	-	-	-	-	48	-	-	-	10	-	-	-	-	-	9	5	-	-	-	-	-	-	28	2000
1995	-	-	-	-	12	22	5	9	-	9	-	-	-	-	-	15	-	-	-	-	-	-	-	28	1957
1996	-	-	-	6	11	20	-	-	-	-	-	-	-	21	-	18	-	-	-	-	-	-	-	24	3092
1997	-	-	-	30	11	5	-	-	-	-	-	-	-	-	-	29	-	-	-	-	-	-	-	25	3082
THIRD QUARTER																									
1985	-	-	-	-	-	15	-	25	-	12	-	-	5	-	-	5	-	8	-	-	-	-	-	30	3933
1986	-	8	-	-	-	5	-	-	-	21	-	-	-	-	7	-	-	-	19	12	5	-	-	23	921
1987	-	-	-	-	-	43	-	12	-	7	-	-	-	-	-	-	-	-	-	11	-	-	-	27	3695
1988	-	-	-	34	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	32	-	-	-	34	2420
1989	-	-	-	-	-	37	-	-	-	-	-	5	-	-	-	12	-	-	-	-	-	-	-	46	3817
1990	-	-	-	11	-	-	-	13	-	18	-	-	-	6	13	-	-	-	-	-	-	-	14	25	4967
1991	-	8	-	10	-	25	-	-	-	8	-	-	-	7	6	-	6	-	6	5	-	-	-	19	2654
1992	-	-	-	-	9	27	-	7	-	11	-	-	5	-	-	-	-	-	-	19	-	-	-	27	3449
1993	-	2	-	3	2	17	4	4	-	19	-	-	5	5	7	-	-	-	6	7	3	1	15	1448	
1994	-	-	-	-	-	-	-	9	-	16	-	-	-	-	5	35	-	-	9	-	-	-	5	21	1301
1995	-	-	-	-	-	-	6	17	-	13	-	-	11	-	-	8	-	9	-	-	-	-	-	36	1990
1996	-	-	-	14	-	7	17	11	-	13	-	-	-	-	6	-	-	-	-	-	-	-	-	32	1587
1997	-	-	-	18	-	12	21	5	-	11	-	-	-	6	7	-	-	-	-	-	-	-	-	20	2241

Groups/ Year	SH	RA	WH	OS	OSS	WB	TY	OC	OP	CR	RF	SC	OT	SB	BJ	IM	TU	MUL	FF	PP	CA	CE	OT	RS Tot(t)	
FOURTH QUARTER																									
1985	-	-	-	22	-	18	-	-	5	-	-	-	7	-	-	17	-	-	-	-	-	-	-	31	6349
1986	-	-	-	11	12	15	7	5	-	-	5	-	6	-	-	5	-	-	7	-	-	-	-	27	5556
1987	-	-	-	15	20	31	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	34	4146
1988	-	-	-	-	7	14	-	8	-	-	-	-	-	-	-	46	-	-	-	-	-	-	-	25	3286
1989	-	8	-	-	9	31	-	-	-	-	-	8	-	-	-	22	-	-	-	-	-	-	-	22	3814
1990	-	44	-	-	5	9	-	-	-	-	-	-	6	-	-	6	7	-	-	-	-	-	-	23	5772
1991	-	-	-	-	9	67	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	24	5589
1992	-	-	-	8	27	-	10	14	-	-	-	-	-	-	-	10	-	-	-	-	-	-	-	31	1894
1993	1	-	1	33	32	1	3	1	1	2	-	1	1	1	-	5	-	1	8	-	2	-	6	3895	
1994	-	-	-	-	26	-	8	9	-	-	-	-	-	-	-	25	-	-	-	-	-	-	-	32	2502
1995	-	-	-	11	32	-	-	6	-	-	-	-	-	-	-	13	-	5	-	5	-	-	-	28	4260
1996	-	-	-	20	15	-	-	-	5	-	-	-	-	-	-	37	-	-	-	-	-	-	-	23	3987
1997	-	-	-	26	27	6	5	-	-	-	-	-	-	-	-	15	-	-	-	-	-	-	-	21	4362

Quarterwise pelagic and demersal landings in non-motorized gill net during 1985-97 is given in table 66 and fig.52.

Table 66

Quarterwise Pelagic and Demersal landings in Non-motorized gill net.

Year	I Quarter			II Quarter			III Quarter			IV Quarter			G Total	
	P	D	Total	P	D	Total	P	D	Total	P	D	Total	P	D
1985	4740	1604	6344	4901	605	5506	2742	1191	3933	5437	912	6349	17820	3772
1986	2025	487	2512	6790	325	7315	171	750	921	4425	1131	5556	13411	2893
1987	1820	304	2124	2436	309	2745	2675	1020	3695	3845	301	4146	10776	1934
1988	2435	356	2791	4235	337	4572	1323	1097	2420	2968	318	3286	10961	2108
1989	1163	432	1595	2757	945	3702	3059	758	3817	3014	800	3814	9993	2935
1990	1156	157	1313	2579	935	3514	1741	3226	4967	2648	3124	5772	8124	7442
1991	2306	240	2546	3995	629	4624	1451	1203	2654	5131	458	5589	12883	2530
1992	1745	398	2143	3729	691	4420	2007	1442	3449	1723	171	1894	9204	2702
1993	3194	352	3546	2736	470	3206	592	856	1443	3276	619	3895	9798	2297
1994	2275	318	2593	1602	398	2000	734	567	1301	2049	453	2502	6660	1736
1995	1620	144	1764	1455	402	1857	1222	768	1990	3539	721	4260	7836	2035
1996	1404	236	1640	2221	871	3092	1076	511	1587	3439	548	3987	8140	2166
1997	2100	225	2325	2699	383	3082	1499	742	2241	3923	439	4362	10221	1789

Note: P - Pelagic D - Demersal

Non-motorized gill net landed mainly pelagic group of fishes. During the fourth quarter the contribution of pelagic group showed a declining trend upto 1988. Afterwards it showed an upward trend. This may be the effect of partial banning of trawling in monsoon season during 89-97.

4.2.1.2 Non-motorized boat seine

Non-motorized boat seine (NMBS) is mainly meant for harvesting pelagic group of fishes. There are about 898 non-motorized boat seines under operation in Kerala. Current specification of boat seines is given in Table 67. It has also helped to some extent in augmenting demersal fish production. During the period 1980-97, non-motorized boat seine landings in Kerala varied from 1331 t in 1996 to 112697 t in 1981 (Table 62 pg. 86 & fig. 52).

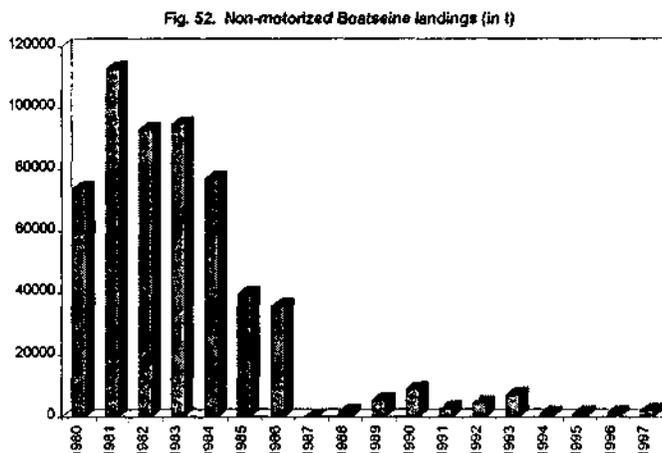
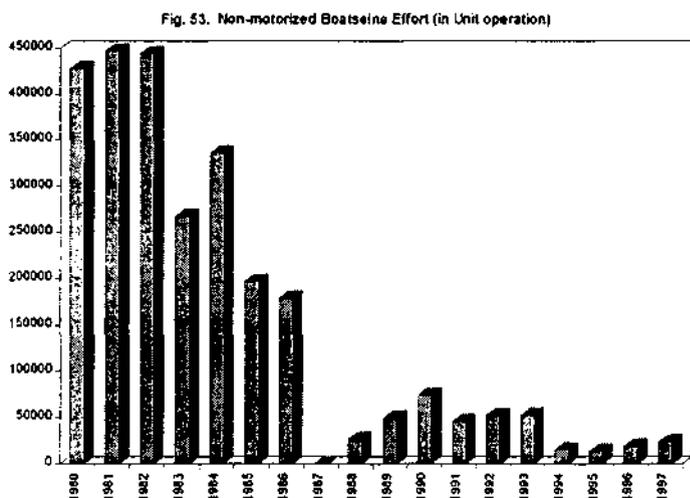


Table 67

CURRENT BOATSEINE SPECIFICATION

S.No	Local Name	Season of operation	Mesh size	Area of operation	NM/ Mot.	Mode of operation
1	Thattumadi	Jun-Dec	5-15	TVM,QLN	NM/Motor	Encircling
2	Thanguvala	Jan-Dec	8-15	ALPY,EKM,TCR	"	"
3	Choodavala	Sep-Dec	8-10	ALPY,EKM,TCR,MAL	"	"
4	Aiyalavala	Oct-Jan	8-15	CLT,CNR,KAS	"	"
5	Arakollivala	Oct-Jan	--	"	"	"
6	Koruvava	Jan-Dec	8-15	EKM,TCR,MAL	"	"
7	Mathikollivala	"	10-24	CLT,CNR,MAL	"	"
8	Netholivala	Sep-Nov	10-12	"	"	"
9	Pailhuvala	Jan-Dec	10-20	MAL,CLT,CNR	"	"
10	Pattonkollivala	Jun-Dec	10-20	CLT,CNR,KAS	"	"
11	Vadakkanvala	---	10-20	TCR,MAL	"	"
12	Vattavala	Jun-Jul	20	EKM,TCR	"	"
13	Remivala	---	--	---	--	--
14	Vettukilivala	Jun-Dec	10-20	CLT,CNR	"	"
15	Kollivala	Jun-Dec	10-20	CLT,CNR,KAS	"	"
16	Kudukuvava	Oct-May	14-18	CNR,KAS	"	"
17	Odamvava	Oct-May	--	---	"	"
18	Madivala	---	--	---	--	--
19	Noonavala	Oct-Jan	--	---	"	"



There is a decreasing trend in the landings by this gear from 1981 onwards upto 1988, then it started increasing till '90. The percentage contribution of this gear to the total landings varied from 0.20 pct in 1994 to 17.8 pct in 1984 (Table No.48 pg.59). Non-motorized boat seine effort in terms of unit operation varied from 14000 in 1995 to 448000 in 1981 (fig. 53). There was an increasing trend in boat seine

operations from 1988 onwards. Catch per unit effort varied from 62 Kg. in 1991 to 352 Kg. in 1983 (Table No. 62 pg. 86 & fig. 54). Catch per unit effort showed a decreasing trend over the years. Quarterwise catch, effort and CPUE of NMBS during 1985-97 is given in Table No.68 .

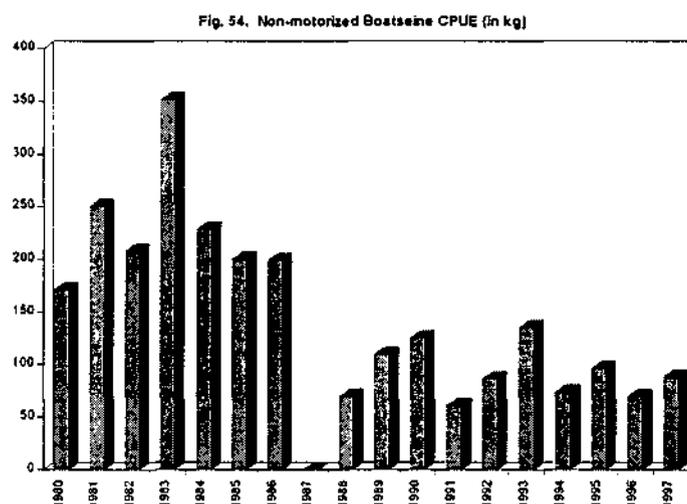


Table 68

Quarterwise Catch, Effort and CPUE of NMBS

Year	I Qr			II Qr			III Qr			IV Qr		
	Catch	Effort	CPUE	Catch	Effort	CPUE	Catch	Effort	CPUE	Catch	Effort	CPUE
1985	5724	37300	153	5236	42000	125	21947	81100	271	6781	36700	185
1986	15496	36900	420	1281	16400	78	14935	10360	144	4000	22400	179
1988	--	--	--	273	4500	61	1654	22900	72	--	--	--
1989	200	4600	43	466	5200	90	4047	37300	108	823	3134	263
1990	73	2019	36	323	8010	40	7078	55764	127	1851	8489	218
1991	175	11626	15	74	1499	49	2146	35335	60	471	5097	92
1992	724	6600	110	1227	7200	170	2609	39000	67	--	--	--
1993	14	1048	13	292	5223	56	6833	44189	155	140	2927	48
1994	35	800	44	162	3000	54	926	11000	84	8	150	53
1995	0	0	0	331	3000	110	1010	11000	92	16	473	34
1996	10	380	26	199	3000	66	1111	16000	69	11	200	55
1997	375	7000	54	64	3000	21	1693	14000	121	0	0	0

Note: Catch in tonnes; Effort in unit operation; CPUE in kg.

Maximum landings was observed during third quarter in almost all the years during this period.

In table 69 quarterwise pelagic and demersal landings of NMBS is given.

Table 69

Quarterwise Pelagic and Demersal landings of NMBS (in t)

Year	I Qr			II Qr			III Qr			IV Qr			Total	
	P	D	Total	P	D	Total	P	D	Total	P	D	Total	P	D
1895	4531	1193	5724	4130	1106	5236	20927	1020	21947	6657	124	6781	36245	3443
1986	14503	993	15496	618	663	1281	7502	7433	14935	3577	423	4000	26200	9512
1988	--	--	--	251	22	273	1008	646	1654	--	--	--	1529	668
1989	158	42	200	276	190	466	3196	851	4047	168	655	823	326	697
1990	43	30	73	196	127	323	6197	881	7018	1784	67	1851	8220	1105
1991	115	60	175	55	19	74	1221	925	2146	--	471	471	1391	1475
1992	68	656	742	557	770	1227	1714	895	2609	--	--	--	2339	2221
1993	13	1	14	11	281	292	5917	196	6833	99	41	140	6040	1239
1994	6	29	35	87	75	162	701	225	926	0	8	8	794	337
1995	0	0	0	177	154	331	636	374	1010	3	13	16	816	541
1996	1	9	10	120	79	199	846	265	1111	6	5	11	973	358
1997	350	25	375	33	31	64	1346	347	1693	0	0	0	1729	403

Note: P - Pelagic; D - Demersal.

Maximum landings of pelagic group was observed during the third quarter except in 1986.

Percentage contribution of NMBS in the landings of major group of fishes is given in table 70.

Table 70

Percentage contribution of NMBS in the landings of major group of fishes

Groups	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
Elasmobranchs	1.3	0.4	--	--	--	--	--	--	0.2	0.2	0.01	--	--	0.07
Cat fishes	0.3	--	--	--	0.2	0.4	--	0.4	--	20.4	--	1.3	--	--
Oil Sardine	30.6	10.8	35.8	--	--	--	--	--	--	--	--	0.01	0.03	0.03
Other Sardines	37	1.6	13.3	--	--	0.9	0.3	--	0.6	0.2	--	0.03	0.25	0.1
White baits	15.4	6.8	9.8	--	1.2	3.5	2.5	1.5	9.1	6.6	1.7	0.54	0.48	1.8
Lizard fishes	--	--	--	--	--	0.6	--	--	--	--	--	0.01	--	--
Perches	1.3	1	0.2	--	--	--	--	--	0.4	--	0.07	0.06	--	--
Goat fishes	--	1	1.4	--	--	--	--	--	0.3	--	--	0.6	3.6	--
Croakers	6.9	2.5	2.4	--	1	4	1.1	3.1	7.5	1	0.6	1.7	0.2	0.6
Ribbon fishes	46.3	85.3	36.3	--	1.5	11.6	53	12.3	18.6	2.3	0.7	2.3	1.8	2.2
Carangids	12.4	12.1	2.3	--	0.1	0.7	2.2	0.2	14.2	3.1	0.05	0.19	0.3	0.86
Silver bellies	9.3	1.6	1.1	--	0.4	3.8	3.6	4.8	1.4	1	1	1	0.7	0.4
Big jawed jumper	6.3	2.1	2.7	--	--	4.1	--	--	0.3	0.2	0.8	--	--	--
Mackerel	1.6	2.8	0.5	--	--	--	--	--	0.1	0.2	0.02	0.02	0.01	0.05

Groups	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
Seer fishes	0.5	--	--	--	--	0.3	--	--	--	--	--	0.03	--	--
Tunnies	6.2	--	8.3	--	0.4	--	--	--	--	--	--	--	--	--
Flat fishes	35.7	9.9	26.9	--	0.1	3.1	--	0.1	7.5	1.2	0.04	0.08	--	0.01
P.Prawns	3	3.2	2.8	--	0.3	--	3	0.1	0.4	0.2	0.04	0.03	--	0.08
Cephalopods	0.4	6	33.3	--	1	0.8	1.7	2.8	27.7	1.2	0.08	0.3	0.5	--

Oil sardine, other sardines, white baits, ribbon fishes, flat fishes and P. prawns were the major groups available in the landings of NMBS. Contribution of this gear to the oil sardine landings varied from 10.8 pct in '85 to 35.8 pct in '86. Oil sardine was landed by this gear in '85,'86 and '89 during first quarter contribution being more than 74 pct. In the case of other sardines, major share was observed during '84-86. NMBS's contribution varied from 1.2 pct in '88 to 15.4 pct in '84 in the landings of white baits. There is a declining trend in the contribution of this gear from '88 onwards. White baits were landed mainly in the third quarter (Table 71). Share of NMBS to the landings of ribbon fishes varied from 1.5 pct in '88 to 85.3 pct in '85. In most of the years ribbon fish was available in NMBS during second, third and fourth quarters. In fact during the fourth quarter of '90 this fish contributed 77 pct of NMBS landings. The availability of flat fishes in this gear showed declining trend, minimum share of 0.1 pct was in '91 while the maximum was in '84 (35 pct). Penaeid prawns was another component available to some extent in the landings of this gear.

Table 71

Quarterwise percentage contribution of NMBS landings by major group of fishes

Groups / Year	OS	OSS	WB	OC	HB	OP	CR	RF	SC	OTCR	SB	TU	FF	PP	NP	CEP	Othrs	Total	
FIRST QUARTER																			
1985	77	--	--	--	--	--	--	--	--	--	--	--	7	11	--	--	5	5724	
1986	93	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	7	15496	
1989	74	--	--	--	--	--	--	--	--	--	12	--	--	--	--	9	5	200	
1990	--	--	--	56	--	32	--	--	--	--	8	--	--	--	--	--	4	73	
1991	--	58	--	--	--	--	--	--	--	--	--	--	--	--	--	--	31	11	175
1992	--	--	--	--	--	--	--	--	7	--	--	--	--	--	--	--	85	8	724
1993	--	--	--	57	--	--	--	--	--	7	7	--	--	--	--	--	29	14	
1994	--	--	11	--	--	6	--	--	--	--	49	--	--	--	--	--	17	17	35
1995	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1996	--	--	--	--	--	--	--	--	--	--	30	--	--	--	--	--	50	20	10
1997	--	--	--	5	--	--	--	--	63	--	--	--	--	--	--	--	--	32	375

Groups / Year	OS	OSS	WB	OC	HB	OP	CR	RF	SC	OTCR	SB	TU	FF	PP	NP	CEP	Othrs	Total
SECOND QUARTER																		
1985	--	--	--	--	--	--	--	70	--	--	--	--	8	--	--	--	12	5236
1986	--	--	24	--	--	--	--	23	--	--	--	--	7	36	--	--	10	1281
1988	--	--	--	--	--	--	--	--	--	8	--	--	--	--	--	--	92	273
1989	--	--	--	--	47	--	26	--	--	--	--	--	7	--	--	--	20	466
1990	10	--	--	35	--	--	10	--	--	5	8	--	--	--	12	--	20	323
1991	--	12	19	5	--	--	--	30	--	--	14	--	--	--	--	--	20	74
1992	--	--	--	--	--	--	--	--	40	--	--	--	--	--	--	50	10	1227
1993	--	--	--	1	--	2	10	--	--	--	--	--	--	8	--	39	40	292
1994	--	--	29	14	--	--	15	--	--	--	12	--	--	7	--	--	23	926
1995	--	5	22	7	--	--	--	28	15	--	--	--	--	--	9	--	14	331
1996	--	--	40	--	--	--	13	--	10	--	--	--	--	--	--	23	14	199
1997	--	--	--	38	--	--	--	9	--	--	19	--	--	--	27	--	7	64
THIRD QUARTER																		
1985	9	--	11	--	--	--	--	62	5	--	--	--	--	--	--	--	13	21947
1986	--	--	12	--	--	--	--	25	11	--	--	--	12	--	--	33	7	14935
1988	--	--	34	8	--	--	5	8	--	--	--	--	14	--	8	--	23	1654
1989	--	--	36	8	--	--	8	21	6	--	--	--	--	--	--	--	21	4047
1990	--	--	6	--	--	--	--	53	21	--	--	--	--	--	--	6	14	7078
1991	--	--	31	--	--	--	13	12	8	--	12	--	--	--	9	--	15	2146
1992	--	--	15	9	--	--	13	33	--	--	--	--	13	--	--	--	17	2609
1993	--	--	47	2	--	--	2	2	32	--	--	--	3	1	1	3	7	6833
1994	--	--	53	--	--	--	7	12	--	--	--	--	--	--	5	--	23	926
1995	--	--	12	11	8	--	7	10	10	5	--	--	--	--	7	13	17	1010
1996	--	--	6	7	--	--	--	36	12	--	--	--	--	--	7	11	21	1111
1997	--	--	28	9	--	--	--	25	10	--	--	--	--	--	8	--	20	1693
FOURTH QUARTER																		
1985	31	--	--	--	--	--	--	62	--	5	--	--	--	--	--	--	2	6781
1986	--	30	14	--	--	--	--	9	--	--	--	31	8	--	--	--	8	4000
1989	--	--	19	--	--	--	--	--	--	--	--	--	71	--	--	--	10	823
1990	--	--	15	--	--	--	--	77	--	--	--	--	--	--	--	--	8	1851
1991	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	97	3	471
1992	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1993	--	11	53	--	--	--	--	--	--	1	28	--	--	--	--	--	7	140
1994	--	--	--	--	--	12	--	--	--	--	25	--	--	50	--	--	13	8
1995	--	--	--	--	--	--	--	--	6	--	31	--	--	--	--	--	63	16
1996	--	--	--	--	--	--	--	--	--	--	36	--	--	--	--	--	64	11
1997	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

4.2.1.3 NON-MOTORIZED SHORE SEINE

Non-motorized shore seine (NMSS) is mainly meant for harvesting pelagic group of fishes. During the period 1985 to '97, NMSS landings in this state varied from 2684 t in 1997 to 15927 t in 1991 (Table 72, fig. 55).

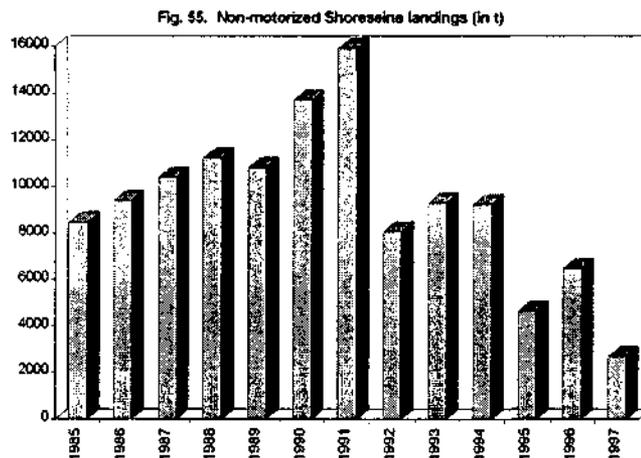
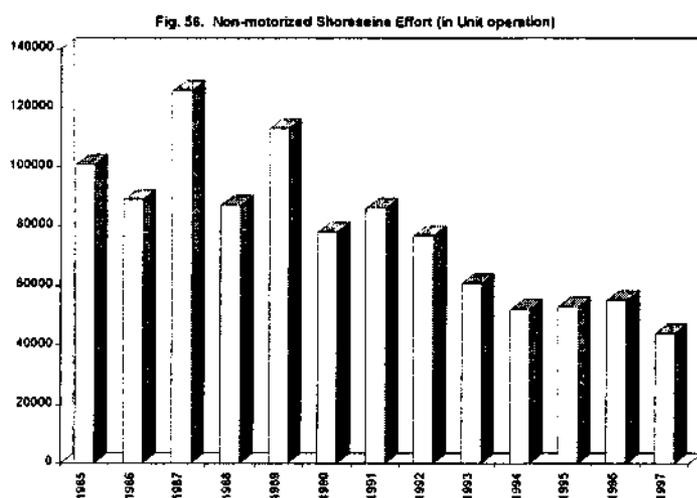


Table 72

Catch, Effort and CPUE of different gears

Year	OBTN			NMSS			NMHL		
	Catch	Effort	CPUE	Catch	Effort	CPUE	Catch	Effort	CPUE
1985	---	---	---	8467	101000	84	6385	764000	8
1986	---	---	---	9403	89000	106	4587	330000	14
1987	1454	18000	81	10432	126000	82	3369	287000	12
1988	6470	31000	208	11247	87000	129	5352	458000	12
1989	3027	37000	82	10832	113000	96	4270	429000	10
1990	13256	81000	163	13726	78000	176	1844	179300	10
1991	3013	67000	50	15927	86000	185	4939	379000	13
1992	7515	100000	75	8046	76900	104	5185	325000	16
1993	8739	130808	67	9307	60860	153	4641	328946	14
1994	9169	144000	64	9242	52170	177	2502	272000	9
1995	12584	146000	86	4626	53000	87	5402	306000	18
1996	11428	130000	88	6464	55000	118	3502	335000	10
1997	18600	256000	73	2684	44000	61	2556	314000	8

Note: Catch in tonnes; Effort in units operation; CPUE in kg.



The percentage contribution of NMSS to the total landings varied 0.46 pct in '97 to 3.4 pct in '87 (Table 48, pg. 59). NMSS effort in terms of unit operation varied from 44000 units in 1997 to 126000 units in 1987 (fig. 56). The present strength of non-mechanised shore seine is 900 units (Anon.91). Catch per unit effort varied from 61 kg in 1997 to 185 kg in 1991.

After the imposition of partial ban on trawling operations during monsoon season there is an increasing trend in the catch per unit effort, which varied from 61 kg in 1997 to 185 kg in 1991 (fig. 57).

Quarterwise catch effort and CPUE of NMSS is given in table 73.

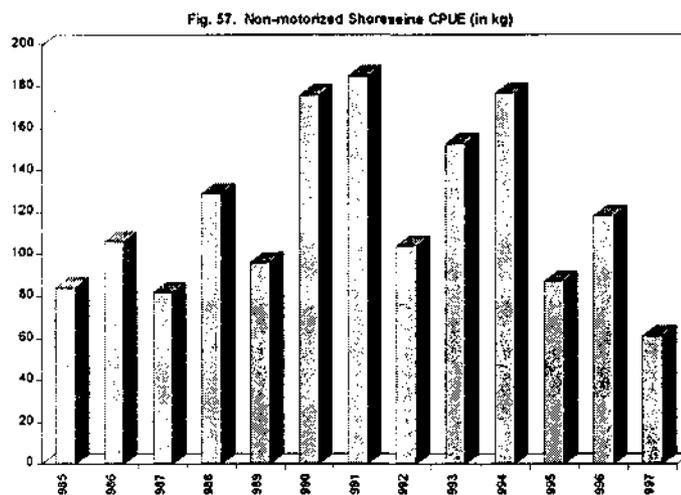


Table 73

Quarterwise Catch, Effort and CPUE of NMSS

Year	I Qr			II Qr			III Qr			IV Qr		
	Catch	Effort	CPUE	Catch	Effort	CPUE	Catch	Effort	CPUE	Catch	Effort	CPUE
1985	2333	33100	70	2065	19300	107	219	14400	15	3850	34500	112
1986	3589	47300	76	928	13000	71	2023	8900	227	2863	20300	141
1987	1916	45400	42	2160	24400	89	1681	8400	200	4675	48600	96
1988	867	34100	25	1028	10900	94	1350	5000	270	8002	37200	215
1989	2810	49800	56	1225	16600	74	408	6700	61	6389	40200	159
1990	2855	26149	109	6341	18737	338	1681	7821	215	2849	26122	109
1991	2608	41294	63	1487	10560	141	1141	6480	176	10691	31842	336
1992	1722	26700	64	2082	15800	131	1359	10000	136	2883	24400	118
1993	1947	19221	101	4084	22305	183	1753	4930	356	1523	14404	106
1994	1661	19000	87	162	3000	54	959	8000	120	5985	17000	352
1995	1238	20000	62	798	11000	73	565	4500	126	2025	17000	119
1996	1463	17000	86	580	5800	100	265	2600	102	4156	19000	218
1997	867	18000	48	534	6000	89	315	5800	54	970	14000	69

Note: Catch in tonnes, Effort in units operation, CPUE in kg.

It can be observed that the maximum catch per unit effort was in the third quarter followed by fourth quarter in most of the years. Catch per unit effort was more in all the quarters after the imposition of partial ban of trawling in the monsoon season when compared with the pre-ban period.

Table 74

Percentage contribution of NMSS in the landings of major group of fishes

Groups	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
Elasmobranchs	0.1	0.7	0.2	--	--	--	--	--	0.1	--	0.06	0.07	--	0.07
Cat fishes	0.3	1.6	--	0.4	--	0.1	0.6	0.4	--	--	--	--	0.25	--
Oil Sardine	0.1	0.3	1.6	0.3	--	0.2	0.1	--	3.6	--	1.9	0.08	0.19	0.02
Other Sardines	7.9	14.7	12	10.4	3.8	1.5	1.9	7	5.2	3.4	4.5	0.87	6.5	1.3
White baits	6	9.5	8.2	27.2	5.2	12.7	28.6	12.3	35	7.3	6.8	4.3	5.16	3.4
Perches	1.5	1	0.9	1.2	0.3	0.1	0.3	0.3	2.5	0.1	0.13	0.17	0.07	0.1
Goat fishes	--	5	2.3	--	2.2	0.2	--	--	--	--	--	--	--	--
Croakers	1.6	0.5	2.3	0.3	0.4	0.6	0.5	4.2	2.8	0.3	0.08	1.1	0.49	0.55
Ribbon fishes	45	--	0.5	--	--	--	7	--	0.1	0.2	0.03	0.08	--	--
Carangids	11.5	10	0.8	10.9	10.8	3.7	3.2	6.1	23.2	4.2	7.8	1	4.7	1.2
Silver bellies	13.7	19.6	5.1	12.1	6	8	8.9	6.5	6.7	5.3	8.1	10.8	9.4	5
Big jawed jumper	--	1	0.6	--	--	--	--	--	0.1	1.9	--	1	0.04	0.11
Mackerel	5.6	0.7	0.8	2.1	1.5	0.7	0.2	0.5	3.9	0.6	0.2	0.35	0.19	0.23
Seer fishes	5.1	--	0.2	0.3	--	0.2	--	--	--	0.1	0.2	0.27	0.1	--
Tunnies	4.6	3	3.6	1.6	3.9	1.5	0.3	11.5	4.2	1.5	0.2	0.1	0.37	0.18
Flat fishes	0.2	--	8.5	0.4	0.2	0.1	--	0.3	0.6	--	--	0.04	--	--
P.Prawns	0.5	--	0.3	0.2	--	0.2	--	0.2	0.8	--	--	0.06	0.04	0.03
Cephalopods	9.2	5.8	7.4	1.4	--	0.7	2.7	1	2.3	0.2	0.3	0.14	0.47	0.08

In Table 74 the percentage contribution of NMSS in the landings of major group of fishes is given. Other sardines, white baits, carangids, silver bellies and tunnies were the major group of fishes for which NMSS had contributed substantially. Share of this gear to the landings of the other sardines varied from 1.3 pct in '97 to 14.7 pct in '85. From '85 onwards share of this gear showed a declining trend till 1989. Other sardines was landed by NMSS mainly in first and fourth quarter (Table 75). Contribution of NMSS for white bait landings ranged from 3.4 pct in 1997 to 35 pct in '92. NMSS landed white baits throughout the year. During the first quarter its contribution varied from 22 pct in '87 to 61 pct in '88, whereas in second quarter it was 25 pct in '88 and 89 pct in '90. In the case of large sized carangids NMSS played a major role, contribution varied from 0.8 pct in '86 to 23.2 pct in '92. NMSS contributed a minimum of 5.1 pct in '86 to a maximum of 19.6 pct in '85 in the case of silver bellies. Silver bellies were mainly landed during the first quarter. Contribution of this gear showed a decreasing trend in the case of coastal species of tunnies except in '91.

Table 75

Quarterwise percentage contribution of NMSS landings by major group of fishes.

Group /Year	RA	CF	OS	OS S	WB	OC	HB	SN	OP	GF	CR	RF	HM	SC	OT CR	SB	BJ	PO M	IM	TU	FF	PP	CE P	OT RS	Total (in t)
FIRST QUARTER																									
1985	--	--	--	14	42	--	--	--	7	--	--	--	--	--	--	5	--	--	--	10	--	--	7	15	2333
1986	--	--	19	--	41	--	--	--	5	--	--	--	--	--	--	--	--	--	--	11	--	--	--	24	3589
1987	--	--	--	13	22	--	--	--	5	--	--	--	--	13	20	8	--	--	--	5	--	--	--	14	1916
1988	--	--	--	--	61	--	--	--	--	--	--	--	--	--	--	13	--	--	--	--	--	--	--	26	867
1989	--	--	4	6	34	--	--	--	--	--	--	--	--	14	--	7	--	--	--	8	--	--	--	27	2810
1990	--	--	5	--	46	--	--	7	--	--	--	--	--	--	8	7	--	--	--	--	--	--	14	13	2855
1991	--	--	6	--	28	--	--	--	--	--	--	--	11	--	5	6	--	--	--	15	--	--	5	24	2608
1992	--	--	--	-8	30	--	--	--	--	--	--	--	--	15	--	10	--	--	--	5	--	--	--	32	1722
1993	--	--	24	--	51	--	--	--	1	--	--	--	--	10	2	4	--	1	1	1	--	--	--	5	1947
1994	--	--	--	7	58	--	--	--	--	--	--	--	--	--	--	8	--	--	--	--	--	--	--	27	1661
1995	--	--	--	11	40	--	--	--	--	--	--	--	--	--	6	18	--	--	--	7	--	--	--	18	1238
1996	--	--	--	6	36	--	--	--	--	--	--	--	--	25	--	12	--	--	--	5	--	--	--	16	1463
1997	--	--	--	12	32	--	--	--	--	--	--	--	--	11	5	12	--	--	--	10	--	--	--	18	867
SECOND QUARTER																									
1985	--	--	--	--	53	--	--	--	--	--	--	--	--	--	--	15	--	--	--	--	--	--	14	18	2065
1986	--	--	22	--	35	10	--	--	--	--	--	--	--	--	--	--	--	--	5	5	--	--	--	23	928
1987	--	--	--	8	45	--	--	--	--	--	--	--	--	--	23	--	--	--	--	--	--	--	--	24	2160
1988	--	--	7	--	25	12	--	--	6	--	--	--	--	--	--	9	--	--	16	14	--	--	--	11	1028
1989	--	--	--	--	65	--	--	--	--	--	--	--	--	--	--	7	--	--	--	--	--	--	--	28	1225
1990	--	--	--	--	89	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	11	6341
1991	--	--	--	--	64	--	--	--	--	--	--	--	14	--	5	--	--	--	--	--	--	--	--	17	1487
1992	--	--	--	--	53	--	--	--	--	--	--	--	--	13	--	9	--	--	--	5	--	--	--	20	2082
1993	--	--	--	--	4	49	6	--	1	--	--	--	--	19	2	3	--	--	6	4	--	--	1	5	4084
1994	--	--	--	--	58	--	--	--	--	--	--	--	--	--	9	--	9	--	--	6	--	--	--	18	637
1995	--	--	--	--	35	18	--	--	--	--	--	--	--	7	--	14	--	--	--	--	--	--	--	26	798
1996	--	--	--	11	56	--	--	--	--	--	--	--	--	--	--	9	--	--	--	--	--	--	--	24	580
1997	--	--	--	5	43	8	--	--	--	--	--	--	--	13	--	9	--	--	--	7	--	--	--	15	534
THIRD QUARTER																									
1985	17	37	--	--	--	--	--	--	--	7	6	--	9	--	--	--	--	--	--	--	--	--	6	10	219
1986	--	--	--	--	--	--	--	--	--	--	11	--	--	--	--	--	--	--	--	--	39	--	43	7	2023
1987	--	--	--	--	78	5	--	--	--	--	--	--	--	--	--	5	--	--	--	--	--	--	--	12	1681
1988	--	--	--	--	7	--	--	--	--	8	--	--	--	--	75	--	--	--	--	--	--	--	--	10	1350
1989	--	--	--	--	22	--	--	--	--	--	--	--	--	22	10	--	--	--	--	--	--	15	--	31	408
1990	--	--	--	--	6	--	--	--	--	--	35	--	16	--	--	8	--	--	--	--	--	--	5	13	1681
1991	--	--	--	--	48	--	--	--	--	27	--	--	11	--	--	--	--	--	--	--	--	--	--	14	1141
1992	--	--	--	--	30	--	--	--	--	5	--	--	--	18	--	13	--	--	--	--	--	--	6	28	1359
1993	--	--	--	1	15	1	--	--	--	--	1	--	--	72	3	1	1	--	2	--	--	--	1	2	1753
1994	--	--	--	10	48	7	--	--	--	--	--	--	--	--	7	5	--	--	7	--	--	--	--	16	959
1995	--	--	--	7	8	7	--	--	--	11	--	--	25	8	--	--	--	--	19	--	--	--	--	15	565
1996	--	--	--	--	34	--	--	--	--	17	--	--	22	--	6	--	--	--	7	--	--	--	--	14	265
1997	--	--	--	--	29	9	--	--	5	--	5	--	--	19	--	--	--	--	7	--	--	--	--	26	313

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Group /Year	RA	CF	OS	OS S	WB	OC	HB	SN	OP	GF	CR	RF	HM	SC	OT CR	SB	CB	JP	MT	FF	CE P	OT RS	Total (in t)	
FOURTH QUARTER																								
1985	--	--	--	--	35	--	6	--	--	--	--	--	--	25	--	7	--	--	--	--	--	--	27	3850
1986	--	--	20	6	15	6	--	--	8	--	--	--	--	5	9	6	--	9	--	--	--	--	16	2863
1987	--	--	--	11	39	--	--	--	5	--	--	--	--	9	15	8	--	--	--	--	--	--	13	4675
1988	--	--	--	6	19	6	--	--	--	--	--	--	--	47	--	--	--	--	6	--	--	--	16	8002
1989	--	--	--	--	61	--	--	--	--	--	--	--	--	12	7	--	--	--	5	--	--	--	15	6389
1990	--	--	--	--	24	--	--	--	--	--	--	--	--	42	--	--	--	--	--	--	--	5	29	2849
1991	--	--	--	14	32	--	--	--	--	--	--	--	--	11	26	--	--	--	10	--	--	--	7	10691
1992	--	--	6	7	27	--	--	--	--	5	--	--	--	17	8	6	--	--	6	--	--	--	18	2883
1993	--	--	--	8	22	3	--	--	2	--	1	1	4	11	30	7	--	--	3	1	--	1	5	1023
1994	--	--	--	9	6	--	--	--	--	--	--	--	--	9	64	--	--	--	--	--	--	--	12	5985
1995	--	--	--	10	38	--	--	--	--	--	--	--	--	13	18	5	--	--	--	--	--	--	16	2025
1996	--	--	--	7	14	--	--	--	--	--	--	--	--	56	--	--	--	--	--	--	--	--	23	4156
1997	--	--	--	7	28	--	--	--	--	--	--	--	--	5	26	11	--	--	--	--	--	--	23	970

Quarterwise pelagic and demersal landings by NMSS during 1985-97 is given in table 76.

Table 76

Quarterwise Pelagic and Demersal landings by NMSS (in t)

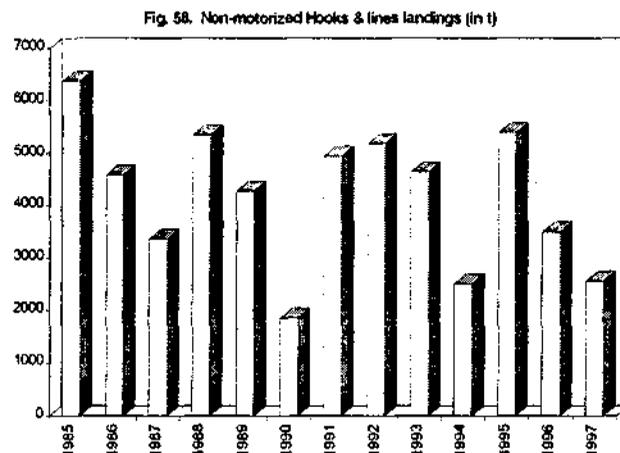
Year	I Qr			II Qr			III Qr			IV Qr			Total	
	P	D	Total	P	D	Total	P	D	Total	P	D	Total	P	D
1985	1752	581	2333	1403	662	2065	46	173	219	3347	503	3850	6548	1919
1986	3002	587	3589	822	106	928	76	1947	2023	1996	867	2863	5896	3507
1987	1506	410	1916	1902	258	2160	1560	121	1681	3901	774	4675	8869	1555
1988	698	169	867	855	173	1028	1173	177	1350	7508	494	8002	10234	1013
1989	2250	560	2810	1006	219	1225	271	137	408	6151	238	6389	9678	1154
1990	2029	826	2855	6175	166	6341	1404	277	1681	2540	309	2849	12148	1578
1991	2032	576	2608	1399	88	1487	753	388	1141	10330	361	10691	14514	1413
1992	1284	438	1722	1726	356	2082	1106	253	1359	2401	482	2883	6517	1529
1993	1846	101	1947	3862	222	4084	1678	75	1753	1320	203	1523	8706	601
1994	1449	212	1661	541	96	637	869	90	959	5778	207	5985	8637	605
1995	952	286	1238	611	187	798	453	112	565	1835	190	2025	3851	775
1996	1201	262	1463	515	65	580	196	67	263	3764	392	4156	5676	786
1997	716	151	867	464	70	534	242	71	313	791	179	970	2213	471

Note: P - Pelagic; D - Demersal.

NMSS was operated throughout the year. Maximum landings of pelagic group of fishes were observed during the fourth quarter except in 1986. In that year maximum was observed during the first quarter.

4.2.1.4 NON-MOTORIZED HOOKS AND LINES

Non-motorized Hooks & Lines (NMHL) landings in Kerala during 1985 to 1997 varied from 1844 t in 1990 to 6385 t in 1985. Overall there is a decreasing trend in the landing by this gear (Table 72 pg. 96, fig. 58). Percentage contribution of NMHL to total landings varied from 0.44 pct in 1977 to 2.6 pct in 1985 (Table 48 pg. 59). Effort in unit operation varied from 179300 units in 1990 to 764000 in 1985 (fig. 59).



During '90-91 there were 3800 units of NMHL in operation in Kerala (Anon.91). There

was a decreasing trend of NMHL effort during 1985 to 1987. The CPUE varied from 8 Kg. in 1985 and 1997 to 18 Kg. in 1995. During 1985-1997, there was not much variation in catch per unit effort (fig. 60). Quarterwise catch, effort and CPUE of NMHL is given in table 77. It was observed that maximum CPUE was during the third quarter.

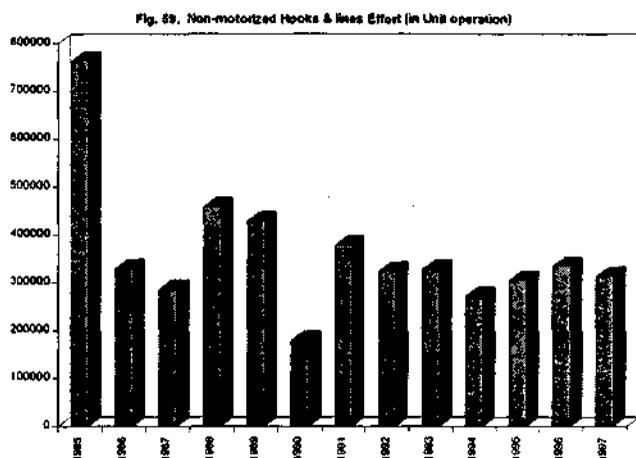
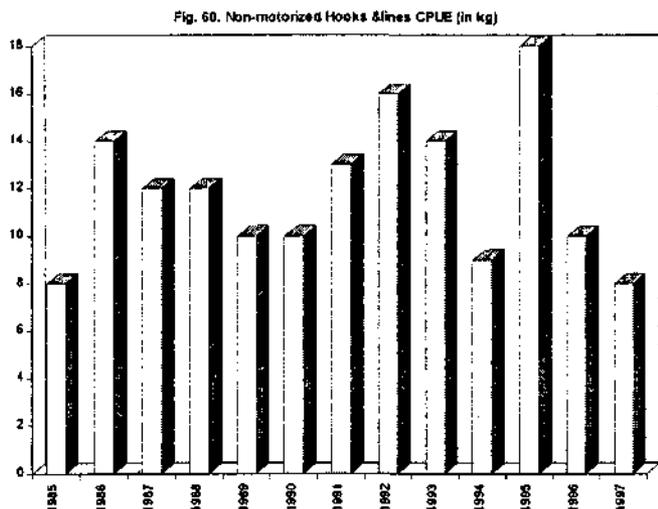


Table 77: Quarterwise Catch, Effort and CPUE of NMHL.

Year	I Qr			II Qr			III Qr			IV Qr		
	Catch	Effort	CPUE	Catch	Effort	CPUE	Catch	Effort	CPUE	Catch	Effort	CPUE
1985	1476	120700	12	1128	60200	19	574	32600	18	3207	550700	6
1986	1380	154000	9	869	65500	13	1030	35900	29	1308	74600	18
1987	836	93200	9	1027	77600	13	664	41406	16	842	75300	11
1988	1746	162800	11	1036	95700	11	1076	64500	17	1494	134900	11
1989	1541	179600	9	832	99700	8	850	54800	16	1047	95600	11
1990	1174	111388	11	670	67890	10	--	--	--	--	--	--
1991	1801	134374	13	1048	70616	15	583	37219	16	1507	137105	11
1992	3206	165000	19	635	39400	16	427	47600	12	917	72400	13
1993	1588	114229	14	912	52194	17	928	50640	18	1213	111883	11
1994	1042	121000	9	752	59000	13	158	23000	7	500	67000	7
1995	415	76000	5	811	61000	13	587	28000	21	1589	140000	11
1996	1290	135000	10	733	71000	10	222	20000	11	1257	106000	12
1997	838	114000	7	453	61000	7	259	22000	12	1006	115000	9

Note: Catch in tonnes; Effort in units operation; CPUE in kg.



Percentage contribution of NMHL in the landings of major group of fishes is given in Tale 78. Perches, carangids, mackerel, seerfishes, tunnies and cephalopods were the major group of fishes landed by this gear during '84-97. Contribution of NMHL in the perch landings varied from 0.27 pct in '96 and '97 to 5.5 pct in '92. In the case of carangids, maximum contribution of 28 pct was noticed during '92 with a minimum of 0.8 pct in '95 and in the case of mackerel the contribution of NMHL varied from 0.2 pct in 1989 to 16.2 pct in 1992. In the case seer fishes it varied from 20.3 pct in 1992 to 1.2 pct in 1986. NMHL's contribution to the tunnies landings varied from 1.3 pct in '97 to 16 pct in '85.

Table 78

Percentage contribution of NMHL in the landings of major group of fishes

Groups	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
Elasmobranchs	5	2	1.4	0.7	0.3	0.4	--	--	--	0.1	0.01	0.17	0.2	0.05
Cat fishes	5.8	3.8	0.6	0.9	--	--	--	--	--	1.2	0.8	0.3	--	--
Other Sardines	1.1	--	--	--	1.5	0.3	--	--	--	--	0.03	0.05	--	0.7
White baits	3.9	--	--	--	0.2	--	--	--	--	--	--	--	0.01	0.04
Lizard fishes	0.5	0.3	1.4	1.8	0.4	0.7	0.1	--	0.7	--	0.06	0.1	0.13	0.06
Perches	2.7	4.2	2.5	1.9	1.5	1.1	0.5	0.7	5.5	0.3	0.23	0.33	0.27	0.27
Goat fishes	--	2	--	--	--	--	--	--	--	0.9	--	--	--	--
Croakers	0.3	--	--	--	--	--	--	--	0.1	1.5	0.04	0.19	0.1	0.11
Ribbon fishes	0.6	0.9	2.6	0.3	--	--	--	--	--	0.2	--	--	0.04	--
Carangids	12.1	10.3	0.9	4.1	2.9	1.8	1.1	2	28	2.3	1.5	0.8	1.86	1.8
Mackerel	4.6	1.2	0.9	1.2	1.1	0.2	0.4	0.8	16.2	0.8	0.19	0.39	0.27	0.3
Seer fishes	4.5	4.5	1.2	1.3	1.8	--	1.5	4.3	20.3	5.4	7.7	0.64	4	4.8
Tunnies	16	4.7	3.1	7.3	5.8	4.6	2.3	8	5.8	4.9	3	1.4	1.5	1.3
Flat fishes	--	--	--	--	0.3	0.6	0.1	--	--	--	--	--	--	--
Cephalopods	12	11.4	4	2.8	5	4.4	3.2	2.9	6	1.3	0.48	2.1	1.56	1.37

Quarterwise percentage species composition in NMHL landings is given in Table 79.

Table 79

Quarterwise percentage contribution of NMHL landings by major group of fishes

Group / Year	CF	OS S	WB	OC	LF	HB	RC	SN	PF	TF	OP	RF	SC	OT CR	IM	SF	TU	BF	BA R	CE	OT RS	Total (in t)
FIRST QUARTER																						
1985	11	--	--	--	--	--	11	5	--	5	--	--	--	16	5	7	--	--	--	8	32	1476
1986	--	--	--	--	--	--	8	--	11	5	--	--	--	11	--	--	9	--	5	15	36	1380
1987	--	--	--	--	6	--	7	5	--	5	--	--	--	13	--	--	11	--	--	9	44	836
1988	--	10	7	--	--	--	--	--	7	7	--	--	5	8	--	--	12	--	--	18	26	1746
1989	--	--	--	--	--	--	--	--	--	17	--	--	6	16	--	--	14	--	--	17	30	1541
1990	--	--	--	--	--	--	--	--	--	--	--	--	7	23	25	5	18	--	--	--	22	1174
1991	--	--	--	--	--	--	--	--	--	--	--	--	--	29	--	--	12	--	--	9	50	1801
1992	--	--	--	--	--	--	--	--	--	6	--	--	--	30	21	18	5	--	--	6	14	3206
1993	--	--	--	--	--	--	1	1	4	1	1	--	3	35	10	7	5	--	--	5	27	1588
1994	--	--	--	--	--	--	--	--	--	--	--	--	--	23	--	15	15	--	--	9	38	1042
1995	--	--	--	--	--	--	--	--	--	6	--	--	8	19	7	--	9	--	--	13	38	415
1996	--	--	--	--	--	--	--	5	--	--	--	--	--	17	5	5	7	--	--	--	61	1290
1997	--	--	--	--	--	--	--	--	--	--	--	--	6	15	8	23	6	--	--	27	15	838
SECOND QUARTER																						
1985	--	--	--	17	--	--	--	--	--	7	--	--	--	45	--	10	8	--	--	--	27	1128
1986	--	--	--	10	--	--	--	--	--	--	--	--	10	18	22	--	27	--	--	--	13	869
1987	--	--	--	--	--	--	--	--	--	--	--	--	33	6	--	--	24	--	10	--	27	1027
1988	--	--	--	--	--	--	--	--	--	--	--	--	37	--	6	--	21	--	--	--	36	1036
1989	--	--	--	--	--	--	--	--	--	6	--	--	--	6	9	--	45	--	--	22	12	832
1990	--	--	--	--	--	--	--	--	--	--	--	--	--	22	6	--	50	--	--	--	22	670
1991	--	--	--	--	--	--	--	--	--	--	--	--	--	15	--	--	32	--	--	--	53	1048
1992	--	--	--	--	--	--	--	--	--	--	--	--	23	15	26	9	15	--	--	--	12	635
1993	--	--	--	1	--	--	--	--	--	--	--	--	14	21	12	8	38	--	--	--	6	912
1994	--	--	--	--	--	--	--	--	--	9	--	--	32	9	17	--	25	--	--	--	8	752
1995	--	--	--	5	--	--	--	--	--	9	--	--	19	10	21	--	9	--	--	--	27	811
1996	--	--	--	17	--	--	--	--	--	--	--	--	19	21	13	--	13	--	--	--	17	733
1997	--	--	--	--	--	--	--	--	--	--	--	--	24	15	15	--	13	--	--	--	33	453
THIRD QUARTER																						
1985	--	--	--	--	--	--	--	--	--	16	--	--	15	--	--	--	13	--	--	50	6	574
1986	--	--	--	--	8	--	--	--	--	56	--	16	5	--	--	--	--	--	--	6	9	1030
1987	--	--	--	--	6	--	--	--	--	31	--	8	--	9	8	--	29	--	--	--	9	664
1988	--	--	--	30	--	--	--	--	--	5	--	--	6	18	6	--	--	--	--	13	22	1076
1989	--	--	--	--	--	--	--	--	--	15	--	--	25	10	7	--	18	--	--	14	11	850
1991	--	--	--	--	--	--	--	--	--	--	8	--	18	12	--	--	42	--	--	--	20	583
1992	--	--	--	--	--	--	--	--	--	12	--	--	14	--	--	--	--	--	--	64	10	427
1993	--	--	--	--	--	--	--	2	--	2	--	--	41	3	10	--	8	--	--	27	7	928
1994	--	--	--	15	--	--	--	--	--	--	--	--	23	--	--	--	--	--	--	31	31	158
1995	--	--	--	--	--	--	--	--	--	--	--	--	25	--	10	--	--	--	--	52	13	587
1996	--	--	--	--	--	--	--	--	--	--	--	--	5	5	9	6	--	--	--	67	8	222
1997	--	--	--	15	--	--	--	--	6	--	--	--	38	10	5	--	--	--	--	12	14	259

Table 79

Quarterwise percentage contribution of NMHL landings by major group of fishes

Group / Year	CF	OS S	WB	OC	LF	HB	RC	SN	PF	TF	OP	RF	SC	OT CR	IM	SF	TU	BF	BA R	CE	OT RS	Total (in t)	
FIRST QUARTER																							
1985	11	--	--	--	--	--	11	5	--	5	--	--	--	16	5	7	--	--	--	8	32	1476	
1986	--	--	--	--	--	--	8	--	11	5	--	--	--	11	--	--	9	--	5	15	36	1380	
1987	--	--	--	--	6	--	7	5	--	5	--	--	--	13	--	--	11	--	--	9	44	836	
1988	--	10	7	--	--	--	--	--	7	7	--	--	5	8	--	--	12	--	--	18	26	1746	
1989	--	--	--	--	--	--	--	--	--	17	--	--	6	16	--	--	14	--	--	17	30	1541	
1990	--	--	--	--	--	--	--	--	--	--	--	--	7	23	25	5	18	--	--	--	22	1174	
1991	--	--	--	--	--	--	--	--	--	--	--	--	--	29	--	--	12	--	--	9	50	1801	
1992	--	--	--	--	--	--	--	--	--	6	--	--	--	30	21	18	5	--	--	6	14	3206	
1993	--	--	--	--	--	--	1	1	4	1	1	--	3	35	10	7	5	--	--	5	27	1588	
1994	--	--	--	--	--	--	--	--	--	--	--	--	--	23	--	15	15	--	--	9	38	1042	
1995	--	--	--	--	--	--	--	--	--	6	--	--	8	19	7	--	9	--	--	13	38	415	
1996	--	--	--	--	--	--	--	5	--	--	--	--	--	17	5	5	7	--	--	--	61	1290	
1997	--	--	--	--	--	--	--	--	--	--	--	--	6	15	8	23	6	--	--	27	15	838	
SECOND QUARTER																							
1985	--	--	--	17	--	--	--	--	--	7	--	--	--	45	--	10	8	--	--	--	27	1128	
1986	--	--	--	10	--	--	--	--	--	--	--	--	10	18	22	--	27	--	--	--	13	869	
1987	--	--	--	--	--	--	--	--	--	--	--	--	33	6	--	--	24	--	10	--	27	1027	
1988	--	--	--	--	--	--	--	--	--	--	--	--	37	--	6	--	21	--	--	--	36	1036	
1989	--	--	--	--	--	--	--	--	--	6	--	--	--	6	9	--	45	--	--	22	12	832	
1990	--	--	--	--	--	--	--	--	--	--	--	--	--	22	6	--	50	--	--	--	22	670	
1991	--	--	--	--	--	--	--	--	--	--	--	--	--	15	--	--	32	--	--	--	53	1048	
1992	--	--	--	--	--	--	--	--	--	--	--	--	--	23	15	26	9	15	--	--	12	635	
1993	--	--	--	1	--	--	--	--	--	--	--	--	--	14	21	12	8	38	--	--	6	912	
1994	--	--	--	--	--	--	--	--	--	9	--	--	--	32	9	17	--	25	--	--	8	752	
1995	--	--	--	5	--	--	--	--	--	9	--	--	--	19	10	21	--	9	--	--	27	811	
1996	--	--	--	17	--	--	--	--	--	--	--	--	--	19	21	13	--	13	--	--	17	733	
1997	--	--	--	--	--	--	--	--	--	--	--	--	--	24	15	15	--	13	--	--	33	453	
THIRD QUARTER																							
1985	--	--	--	--	--	--	--	--	--	16	--	--	--	15	--	--	--	13	--	--	50	6	574
1986	--	--	--	--	8	--	--	--	--	56	--	16	5	--	--	--	--	--	--	6	9	1030	
1987	--	--	--	--	6	--	--	--	--	31	--	8	--	9	8	--	29	--	--	--	9	664	
1988	--	--	--	30	--	--	--	--	--	5	--	--	6	18	6	--	--	--	--	13	22	1076	
1989	--	--	--	--	--	--	--	--	--	15	--	--	25	10	7	--	18	--	--	14	11	850	
1991	--	--	--	--	--	--	--	--	--	--	8	--	18	12	--	--	42	--	--	--	20	583	
1992	--	--	--	--	--	--	--	--	--	12	--	--	14	--	--	--	--	--	--	64	10	427	
1993	--	--	--	--	--	--	--	2	--	2	--	--	41	3	10	--	8	--	--	27	7	928	
1994	--	--	--	15	--	--	--	--	--	--	--	--	--	23	--	--	--	--	--	31	31	158	
1995	--	--	--	--	--	--	--	--	--	--	--	--	--	25	--	10	--	--	--	52	13	587	
1996	--	--	--	--	--	--	--	--	--	--	--	--	5	5	9	6	--	--	--	67	8	222	
1997	--	--	--	15	--	--	--	--	6	--	--	--	38	10	5	--	--	--	--	12	14	259	

Group / Year	CF	OS S	WB	OC	LF	HB	RC	SN	PF	TF	OP	RF	SC	OT CR	IM	SF	TU	BF	BA R	CE	OT RS	Total (in t)
FOURTH QUARTER																						
1985	--	--	--	--	--	--	--	--	--	7	16	8	--	13	--	--	--	--	6	17	33	3207
1986	--	--	--	--	--	--	--	--	--	--	--	12	--	11	--	--	--	--	28	26	23	1308
1987	--	--	--	--	--	--	--	--	--	13	--	--	9	20	--	--	23	--	--	11	24	842
1988	--	--	--	--	--	13	--	--	--	6	--	--	13	19	--	5	--	--	--	21	23	1494
1989	--	--	--	--	--	--	--	--	--	--	--	--	--	17	7	--	18	--	--	47	11	1047
1991	--	--	--	--	--	--	--	--	--	--	--	--	--	25	--	7	6	--	6	27	29	1507
1992	--	--	--	--	--	--	--	--	--	--	--	--	--	15	--	46	--	--	--	11	28	917
1993	--	--	--	--	--	6	1	--	1	1	1	1	5	23	9	13	12	--	1	5	21	1213
1994	--	--	--	7	--	--	--	--	--	--	--	--	--	17	8	5	18	--	--	7	38	550
1995	--	--	--	--	--	8	--	--	--	--	--	--	--	7	--	--	--	--	--	37	48	1589
1996	--	--	--	--	--	--	--	--	--	--	--	--	12	13	14	10	7	--	--	27	17	1257
1997	--	11	--	--	--	--	--	--	--	--	--	--	--	22	11	--	9	--	--	23	24	1006

Table 80 gives quarterwise pelagic and demersal landings by NMHL during 1985-97. It was observed that during the second and fourth quarter landings of pelagic group was more than that of demersal group.

Table 80

Quarterwise Pelagic and Demersal landings of NMHL (in t)

Year	I Qr			II Qr			III Qr			IV Qr			Total	
	P	D	Total	P	D	Total	P	D	Total	P	D	Total	P	D
1985	649	827	1476	981	147	1128	199	375	574	1642	1565	3207	3471	2914
1986	625	755	1380	802	67	869	233	797	1030	806	502	1308	2466	2121
1987	446	390	836	960	67	1027	367	297	664	535	307	842	2308	1061
1988	1012	734	1746	1009	27	1036	851	225	1076	1023	471	1494	3895	1457
1989	830	711	1541	584	248	832	580	270	850	517	530	1047	1414	957
1990	930	244	1174	591	79	670	--	--	--	--	--	--	1521	323
1991	1452	349	1801	1012	36	1048	471	112	583	978	529	1507	3913	1026
1992	2741	465	3206	609	26	635	88	339	427	773	144	917	4211	974
1993	1250	338	1588	907	5	912	599	329	928	936	277	1213	3692	949
1994	878	164	1042	664	88	752	107	51	158	482	68	550	2131	371
1995	286	133	419	560	251	811	263	324	587	788	864	1652	1897	1572
1996	1060	230	1290	675	58	733	65	157	222	847	410	1257	2647	855
1997	537	301	838	402	51	453	196	63	259	760	246	1006	1895	661

Note: P - Pelagic; D - Demersal

4.2.2 **MOTORIZED SECTOR**

Large scale motorization of country craft in Kerala began in early eighties, even though experimental projects on motorization were tried much earlier (Jacob *et al*; 1987). Experiments conducted on motorization of country craft under Indo-Norwegian Project in mid fifties found that the programme would not be feasible. It was during seventies that

Group / Year	CF	OS	WB	OC	LF	HB	RC	SN	PF	TF	OP	RF	SC	OT	IM	SF	TU	BF	BA	CE	OT	Total
		S												CR				R		RS	(in t)	
FOURTH QUARTER																						
1985	--	--	--	--	--	--	--	--	--	7	16	8	--	13	--	--	--	--	6	17	33	3207
1986	--	--	--	--	--	--	--	--	--	--	--	12	--	11	--	--	--	--	28	26	23	1308
1987	--	--	--	--	--	--	--	--	--	13	--	--	9	20	--	--	23	--	--	11	24	842
1988	--	--	--	--	--	13	--	--	--	6	--	--	13	19	--	5	--	--	--	21	23	1494
1989	--	--	--	--	--	--	--	--	--	--	--	--	--	17	7	--	18	--	--	47	11	1047
1991	--	--	--	--	--	--	--	--	--	--	--	--	--	25	--	7	6	--	6	27	29	1507
1992	--	--	--	--	--	--	--	--	--	--	--	--	--	15	--	46	--	--	--	11	28	917
1993	--	--	--	--	--	6	1	--	1	1	1	1	5	23	9	13	12	--	1	5	21	1213
1994	--	--	--	7	--	--	--	--	--	--	--	--	--	17	8	5	18	--	--	7	38	550
1995	--	--	--	--	--	8	--	--	--	--	--	--	--	7	--	--	--	--	--	37	48	1589
1996	--	--	--	--	--	--	--	--	--	--	--	--	12	13	14	10	7	--	--	27	17	1257
1997	--	11	--	--	--	--	--	--	--	--	--	--	--	22	11	--	9	--	--	23	24	1006

Table 80 gives quarterwise pelagic and demersal landings by NMHL during 1985-97. It was observed that during the second and fourth quarter landings of pelagic group was more than that of demersal group.

Table 80

Quarterwise Pelagic and Demersal landings of NMHL (in t)

Year	I Qr			II Qr			III Qr			IV Qr			Total	
	P	D	Total	P	D	Total	P	D	Total	P	D	Total	P	D
1985	649	827	1476	981	147	1128	199	375	574	1642	1565	3207	3471	2914
1986	625	755	1380	802	67	869	233	797	1030	806	502	1308	2466	2121
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1989	830	711	1541	584	248	832	580	270	850	517	530	1047	1414	957
1990	930	244	1174	591	79	670	--	--	--	--	--	--	1521	323
1991	1452	349	1801	1012	36	1048	471	112	583	978	529	1507	3913	1026
1992	2741	465	3206	609	26	635	88	339	427	773	144	917	4211	974
1993	1250	338	1588	907	5	912	599	329	928	936	277	1213	3692	949
1994	878	164	1042	664	88	752	107	51	158	482	68	550	2131	371
1995	286	133	419	560	251	811	263	324	587	788	864	1652	1897	1572
1996	1060	230	1290	675	58	733	65	157	222	847	410	1257	2647	855
1997	537	301	838	402	51	453	196	63	259	760	246	1006	1895	661

Note: P - Pelagic; D - Demersal

4.2.2 **MOTORIZED SECTOR**

Large scale motorization of country craft in Kerala began in early eighties, even though experimental projects on motorization were tried much earlier (Jacob *et.al.*; 1987). Experiments conducted on motorization of country craft under Indo-Norwegian Project in mid fifties found that the programme would not be feasible. It was during seventies that

attempts were made for motorizing traditional craft in the South West coast of India. In 1970 under Indo Belgium fisheries projects, about 100 catamarans were fitted with out board engine (OB) at Muttom in Kannyakumari district (John Kurian and Jaya Kumar 1980). In 1974 Marinad Fisheries Co-operative Society in Trivandrum district initiated a similar experiment (Gillet F.P.1981). Unlike in Gujarat where motorization of country craft started in fifties, the experiments in Kannyakumari and Trivandrum districts were not a success. The results of Purakkad trials conducted in 1980 showed encouraging trends. The successful trials carried out at the fishing village Kannamaly in Ernakulam district during 1979-80 attracted the fishermen of this region with suitable modification in the craft. Soon motorization programme picked up acceleration in Kerala and the credit for the initiative and large scale adoption were that of fishermen of Alleppey, Ernakulam and Quilon districts. At present OB engines fitted in the country craft are being used for fishing with Boat seines, Gill nets, Hooks & line, ringseines and Trawl nets. Contribution of motorized sector during '81-97 varied from 22848 t in 1981 to 400231 t in 1989. Its percentage contribution to the total landings varied from 8.3 pct in 1981 to 61.8 pct in 1989. From 1989 onwards more than 50 pct of the marine fish landings in Kerala was accounted for by motorized sector except in 1992 (Table 42 pg.45).

4.2.2.1 OUT-BOARD BOAT SEINE

Out Board Engines fitted in the country craft using the traditional gear boat seines (OB Boat seine) were started operation in Kerala during the second half of 1980. During the period 1981 to 1997, OB Boat seine landings in Kerala varied from 22848 t in 1981 to 133313 t in 1984 (Table 42, pg. 45 & Table 81). There is an increasing trend in the landing of this gear upto 1986. After the introduction of OB ring seine in 1986 the landings started decreasing (fig. 61).

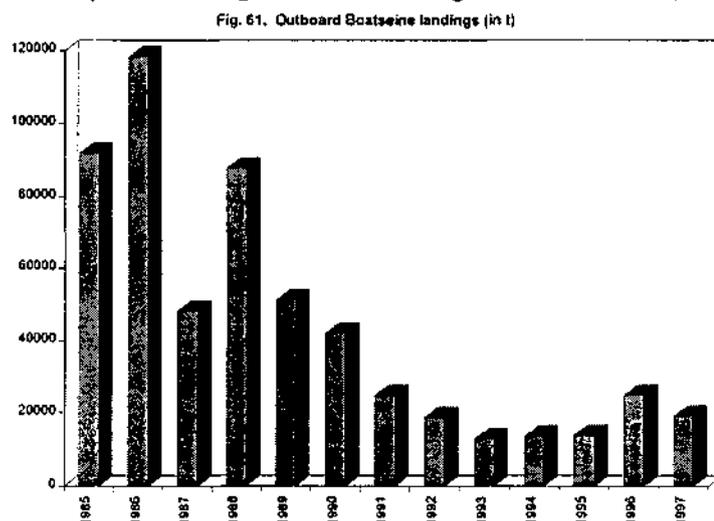


Table 81

Catch, Effort and CPUE of different OB gears

Year	OBBS			OBGN			OBHL			OBRs		
	Catch	Effort	CPUE	Catch	Effort	CPUE	Catch	Effort	CPUE	Catch	Effort	CPUE
1985	92002	203000	453	23345	349000	67	7487	139000	54	---	---	---
1986	118433	329000	360	34263	467000	73	9701	105000	92	22498	29000	775
1987	48416	170000	295	21074	318000	66	7054	111000	63	31558	80000	394
1988	87800	196000	444	31166	450000	69	16803	219000	77	81886	129000	634
1989	51477	96000	536	58397	600000	97	16427	223000	73	270903	323000	838
1990	42162	68000	620	55541	560000	99	18888	158000	119	257853	250000	1031

attempts were made for motorizing traditional craft in the South West coast of India. In 1970 under Indo Belgium fisheries projects, about 100 catamarans were fitted with out board engine (OB) at Muttom in Kanyakumari district (John Kurian and Jaya Kumar 1980). In 1974 Marinad Fisheries Co-operative Society in Trivandrum district initiated a similar experiment (Gillet F.P.1981). Unlike in Gujarat where motorization of country craft started in fifties, the experiments in Kanyakumari and Trivandrum districts were not a success. The results of Purakkad trials conducted in 1980 showed encouraging trends. The successful trials carried out at the fishing village Kannamaly in Ernakulam district during 1979-80 attracted the fishermen of this region with suitable modification in the craft. Soon motorization programme picked up acceleration in Kerala and the credit for the initiative and large scale adoption were that of fishermen of Alleppey, Ernakulam and Quilon districts. At present OB engines fitted in the country craft are being used for fishing with Boat seines, Gill nets, Hooks & line, ringseines and Trawl nets. Contribution of motorized sector during '81-97 varied from 22848 t in 1981 to 400231 t in 1989. Its percentage contribution to the total landings varied from 8.3 pct in 1981 to 61.8 pct in 1989. From 1989 onwards more than 50 pct of the marine fish landings in Kerala was accounted for by motorized sector except in 1992 (Table 42 pg.45).

4.2.2.1 OUT-BOARD BOAT SEINE

Out Board Engines fitted in the country craft using the traditional gear boat seines (OB Boat seine) were started operation in Kerala during the second half of 1980. During the period 1981 to 1997, OB Boat seine landings in Kerala varied from 22848 t in 1981 to 133313 t in 1984 (Table 42, pg. 45 & Table 81). There is an increasing trend in the landing of this gear upto 1986. After the introduction of OB ring seine in 1986 the landings started decreasing (fig. 61).

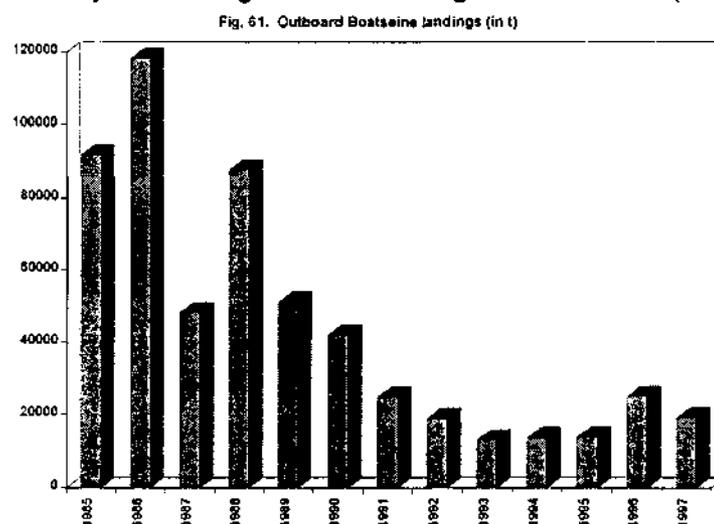


Table 81

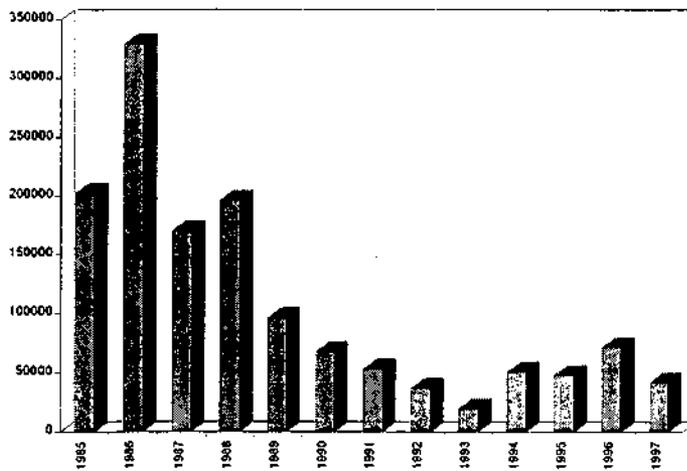
Catch, Effort and CPUE of different OB gears

Year	OBBS			OBGN			OBHL			OBRS		
	Catch	Effort	CPUE	Catch	Effort	CPUE	Catch	Effort	CPUE	Catch	Effort	CPUE
1985	92002	203000	453	23345	349000	67	7487	139000	54	---	---	---
1986	118433	329000	360	34263	467000	73	9701	105000	92	22498	29000	775
1987	48416	170000	295	21074	318000	66	7054	111000	63	31558	80000	394
1988	87800	196000	444	31166	450000	69	16803	219000	77	81886	129000	634
1989	51477	96000	536	58397	600000	97	16427	223000	73	270903	323000	838
1990	42162	68000	620	55541	560000	99	18888	158000	119	257853	250000	1031

Year	OBBS			OBGN			OBHL			OBRS		
	Catch	Effort	CPUE	Catch	Effort	CPUE	Catch	Effort	CPUE	Catch	Effort	CPUE
1991	24973	53000	471	36558	453000	81	7720	109000	71	226330	278000	814
1992	18898	36800	513	28095	468500	60	11674	118100	99	196416	251100	782
1993	13075	19955	655	36755	542426	68	11288	152144	74	159772	274981	581
1994	13733	50922	270	35026	561729	62	6850	130345	52	154619	219664	703
1995	13963	48000	291	32358	598000	54	15837	246000	64	213502	191000	1118
1996	25071	72000	348	49934	785000	63	21100	306000	69	180432	234000	771
1997	19372	42000	461	48801	726000	67	17170	263000	65	163335	251000	650

Note: Catch in t; Effort in units operation; CPUE in kg.

Fig. 62. Outboard Boatseine Effort (in Unit operation)



The percentage contribution of OBBS to the total landings varied from 2.27 pct in 1993 to 33.9 pct in 1984 (Table 42 and 48, pg. 45 & 59). OB Boat seine effort in terms of unit operation varied from 36800 units in 1992 to 329000 in 1986. There is a declining trend in OB effort during 1986 to 1993 (fig. 62).

This is due to the large scale introduction of OB ring seine in this period. The catch per unit effort varied from 270 kg. in 1994 to 655 kg. in 1993 (fig. 63). Quarterwise catch, effort and CPUE during 1985-97 is given in table 82.

Fig. 63. Outboard Boatseine CPUE (in kg)

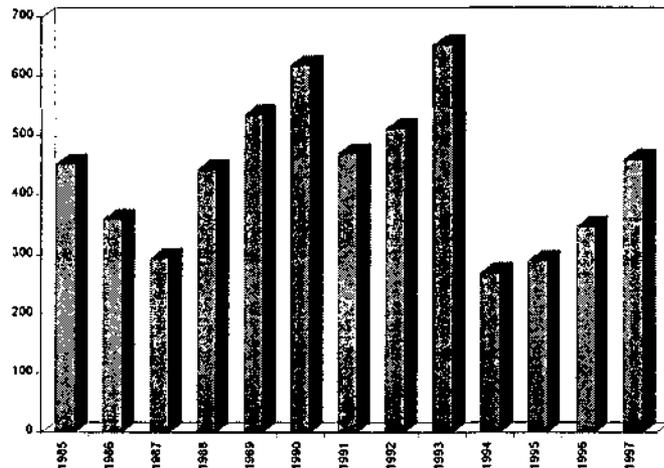


Table 82

Quarterwise Catch, Effort and CPUE of OBBS.

Year	I Qr			II Qr			III Qr			IV Qr		
	Catch	Effort	CPUE	Catch	Effort	CPUE	Catch	Effort	CPUE	Catch	Effort	CPUE
1985	23996	36900	650	7661	21900	350	35093	92600	379	25252	52000	486
1986	15079	48900	308	4334	54600	79	49056	131000	374	49964	95100	525
1987	2943	15300	192	3598	25800	139	34864	111100	314	7011	18342	382
1988	1286	8130	158	3798	15800	240	48371	117300	412	34345	54800	627
1989	10254	19400	529	7032	13200	532	26064	51000	511	8127	12800	635
1990	10377	15344	676	856	5057	170	22656	39768	570	8273	8371	988
1991	3657	15311	239	10428	23276	448	6293	17543	359	4595	7064	650
1992	744	2500	297	2326	12500	186	12807	18800	681	3021	3000	1007
1993	1608	2263	711	108	896	121	11359	16796	676	--	--	--
1994	--	--	--	227	2407	94	8496	33596	252	5010	14919	336
1995	82	700	117	3970	14000	283	5886	26000	226	4025	6000	671
1996	--	--	--	693	3700	187	23479	66000	355	899	2200	409
1997	673	5000	134	48	2200	22	8168	26000	314	10483	8000	1310

Note: Catch in t; Effort in units operation; CPUE in kg.

It can be seen that maximum landing was during third quarter followed by fourth quarter. During the third quarter it varied from 6293 t in 1991 to 49056 t in 1986. Like catch, effort also was maximum during the third quarter. Catch per unit effort was maximum during fourth quarter except in 1985. Percentage contribution of OBBS in the landings of major group of fishes is given in Table 83.

Table 83.

Percentage contribution of OBBS in the landings of major group of fishes

Groups	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
Elasmobranchs	0.1	0.1	1.3	--	0.4	0.6	--	--	--	0.2	0.5	0.35	0.1	0.4
Cat fishes	7.7	--	0.3	--	--	27.3	--	0.8	--	--	0.4	2.6	--	--
Oil Sardine	49.5	68.4	46	53	43.5	18.9	17	4.7	6.5	6.4	--	2	9.5	8.8
Other Sardines	2.7	23.1	10.5	44.2	11.1	2.8	1	5	0.9	3.6	7.3	4.7	0.2	5.1
White baits	52.1	70.5	40.4	19.4	64.5	7.3	0.8	18.8	14.8	1.3	5.6	6.4	1.8	8.7
Perches	9.2	3.6	7	3.7	1	0.12	0.2	2.9	6.4	0.9	0.7	1.3	0.02	0.1
Croakers	7.3	15.1	63.4	16.7	9.4	0.9	5	1.6	8.6	4	13.7	5.5	20.5	0.3
Ribbon fishes	--	2.2	12.6	28.7	1.5	--	23	10.2	--	2.5	0.4	3	28.7	5.7
Carangids	4.4	4.2	67.8	9	14.2	1.1	0.2	0.4	17.4	3.4	1.2	1	1.7	1
Silver bellies	9.7	30	43.4	9.9	42.3	8.7	1	7.8	--	0.2	1.8	9.1	3.2	0.3
Big jawed jumper	31.9	31.1	29.4	11.1	4.5	--	0.6	--	--	1.9	9.3	11.7	1.1	--
Mackerel	6	14.3	17.5	12.4	10.5	2.7	8.1	1.7	11.2	5.1	3	4	6	5.4
Seer fishes	0.9	--	0.9	--	4.9	--	--	--	--	--	--	0.1	--	0.09
Tunnies	--	--	7.5	--	1.7	--	--	--	--	--	--	--	0.1	--
Flat fishes	--	3.7	8.4	4.7	2.2	5.2	--	--	2.6	--	--	0.05	0.06	--
P.Prawns	24.8	7.6	24.1	2.7	13.1	2.3	1.1	7.7	3.7	0.2	0.1	0.6	0.6	1.6
Cephalopods	--	--	8.8	0.3	0.5	0.5	--	--	--	0.1	0.1	0.1	2	0.8

Oil sardine, other sardines, white baits, croakers, ribbon fishes, carangids, silver bellies, big jawed jumper, mackerel and P.prawns were the major group of fishes landed by OBBS. Contribution of this gear to the oil sardine landings varied from 2 pct in 1995 to 68.4 pct in '85 thereby showing a declining trend over the years. This fish was available in landings of this gear throughout the year in most of the years. Maximum contribution was during the first quarter except in '87 (Table 84). It varied from 68 pct in '88 to 100 pct in '90. In the case of other sardines contribution of OBSS varied from 0.2 pct in '96 to 44.2 pct in '87. During the period '84-97 contribution to the landings of white baits varied from 0.8 pct in '90 to 70.5 pct in '85, while showing two peaks in '85 and '88. White baits were landed by this gear mostly during third and fourth quarters. In '91, this fish contributed more than 50 pct of the landings of this gear. in these two quarters. Maximum contribution of 63.4 pct of the croakers landing in Kerala during '86 was by OBBS and in the case of ribbon fish it was 28.7 pct in '87. OBBS contribution to the carangids landings ranged from 0.2 pct in '90 to 67.8 pct in '86 and in the case of silver bellies it was 6.2 pct in '93 and 43.4 pct in '86. The production of big jawed jumper by OBBS varied from 0.6 in '90 to 31.9 pct in '84 while for mackerel it was 1.7 pct in '91 to 17.5 pct in '86. In the case of mackerel maximum contribution of 43 pct in OBBS landings was noticed during the fourth quarter of 1990. Contribution of this gear in the landings of penaeid prawns varied from 0.2 pct in '93 to 24.8 pct in '84. Landings of this gear was observed in maximum number of years during the second quarter.

Table 84.

Quarterwise percentage contribution of OBBS landings by major group of fishes

Group /Year	OS	OSS	WB	THY	OC	OP	CR	RF	SC	OT CR	SB	IM	FF	PP	OTH	Total (in t)
FIRST QUARTER																
1985	98	--	--	--	--	--	--	--	--	--	--	--	--	--	2	23996
1986	95	--	--	--	--	--	--	--	--	--	--	--	--	--	5	15079
1987	12	71	--	--	--	--	--	--	--	--	--	--	--	6	11	2943
1988	68	--	--	--	--	--	--	--	--	--	--	31	--	--	1	1286
1989	99	--	--	--	--	--	--	--	--	--	--	--	--	--	1	10254
1990	100	--	--	--	--	--	--	--	--	--	--	--	--	--	--	10377
1991	71	20	--	--	--	--	--	--	--	--	--	--	--	--	9	3657
1992	91	--	--	--	5	--	--	--	--	--	--	--	--	--	4	744
1993	8	51	--	--	2	29	--	--	--	--	--	8	--	--	2	1608
1994	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1995	--	--	45	--	--	40	--	--	--	--	--	--	--	--	15	82
1996	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1997	--	--	--	--	7	--	--	--	--	13	--	45	--	--	2	673

Group / Year	OS	OSS	WB	THY	OC	OP	CR	RF	SC	OT CR	SB	IM	FF	PP	OTH	Total (in t)
SECOND QUARTER																
1985	60	--	16	--	--	--	--	--	--	--	--	5	--	17	2	7661
1986	--	--	7	--	--	--	--	12	--	--	--	--	--	63	18	4334
1987	5	32	--	--	9	--	--	27	--	--	--	11	5	--	11	3598
1988	33	--	--	--	--	--	--	--	--	--	--	--	--	48	19	3798
1989	75	--	--	--	--	--	--	--	--	--	--	21	--	--	4	7032
1990	68	--	--	--	--	10	--	--	--	--	--	--	--	10	12	856
1991	--	--	10	--	--	--	--	16	--	7	--	26	--	28	13	10428
1992	--	--	--	17	5	17	43	--	--	--	--	--	--	11	7	2326
1993	--	--	2	--	62	--	9	--	--	--	--	2	--	25	--	108
1994	--	--	22	--	28	--	28	--	--	--	--	--	--	--	22	227
1995	--	--	38	20	10	--	--	--	--	--	7	8	--	--	17	3970
1996	6	--	23	--	29	--	12	--	--	--	--	10	--	7	13	693
1997	--	--	--	--	73	17	--	--	--	--	--	--	--	--	10	48
THIRD QUARTER																
1985	49	--	32	--	--	--	--	--	--	--	--	--	--	--	19	35093
1986	--	--	11	--	6	--	7	--	41	13	5	--	--	8	16	49056
1987	49	--	9	--	10	--	--	10	--	--	--	--	--	--	22	34864
1988	18	--	41	--	--	--	--	--	6	--	5	7	--	12	11	48371
1989	60	--	12	--	--	--	--	--	--	--	--	7	--	--	21	26064
1990	68	--	--	--	--	--	--	10	--	--	--	13	--	--	9	22656
1991	18	--	60	--	--	--	--	--	--	--	--	--	--	5	17	6293
1992	--	--	15	--	33	--	--	--	25	--	--	16	--	--	11	12807
1993	27	--	6	1	10	1	5	2	15	6	--	25	--	--	2	11359
1994	--	--	20	--	14	6	26	--	8	--	--	11	--	--	15	8496
Group / Year	OS	OSS	WB	THY	OC	OP	CR	RF	SC	OT CR	SB	IM	FF	PP	OTH	Total (in t)
1995	--	--	7	--	9	10	7	--	8	7	--	27	--	--	25	5886
1996	12	--	--	--	--	--	15	27	--	--	--	31	--	--	15	23479
1997	--	--	28	--	6	--	--	9	--	--	--	30	--	11	16	8168
FOURTH QUARTER																
1985	35	--	52	--	--	--	--	--	--	--	--	6	--	--	7	25252
1886	8	--	11	--	--	21	15	--	6	35	--	--	--	--	19	49964
1987	85	8	--	--	--	--	--	--	--	--	--	--	--	--	7	7011
1988	46	--	29	6	--	--	--	--	--	--	--	--	--	--	19	34345
1989	48	--	--	--	--	--	--	--	33	--	--	11	--	--	8	8127
1990	50	--	--	--	--	--	--	--	--	--	--	43	--	--	7	8273
1991	29	10	50	--	--	--	--	--	--	--	--	6	--	--	5	4595
1992	18	6	29	--	--	23	16	--	--	--	--	--	-5	--	3	3021
1993	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1994	--	24	--	--	25	--	--	--	--	--	--	49	--	--	2	5010
1995	--	54	9	--	--	--	--	--	--	--	--	30	--	--	7	4025
1996	--	--	--	--	--	--	--	--	34	--	--	52	--	--	14	899
1997	76	--	--	--	--	--	--	--	--	--	--	16	--	--	18	10483

In table 85 quarterwise pelagic and demersal landings by OBBS during 1985-92 is been given.

Table 85

Quarterwise Pelagic and Demersal landings by OBBS (in t)

Year	I Qr			II Qr			III Qr			IV Qr			Total	
	P	D	Total	P	D	Total	P	D	Total	P	D	Total	P	D
1985	23766	230	23996	6260	1401	7661	30726	4367	35093	24931	321	25252	85683	6319
1986	14628	451	15079	1060	3274	4334	39725	9331	49056	36725	13239	49964	92138	26295
1987	2536	407	2943	3201	397	3598	31202	3662	34864	6747	264	7011	43686	4730
1988	1286	0	1286	1907	1891	3798	39086	9285	48371	32089	2256	34345	74368	13432
1989	10254	0	10254	6977	55	7032	22137	3927	26064	7748	379	8127	76811	5355
1990	10377	0	10377	640	216	856	21628	1028	22656	7880	393	8273	40525	1637
1991	3504	153	3657	4925	5503	10428	5510	783	6293	4448	147	4595	18387	6586
1992	720	24	744	577	1749	2326	11709	1098	12807	1667	1354	3021	14673	4225
1993	1131	477	1608	71	37	108	10441	918	11359	--	--	--	11643	1432
1994	--	-	--	128	99	227	5380	3116	8496	4932	78	5010	10440	3293
1995	37	45	82	3299	671	3970	4423	1463	5886	3989	36	4025	11748	2215
1996	--	-	-	523	170	693	18795	4684	23479	852	47	899	20170	4901
1997	669	4	673	39	9	48	6611	1557	8168	10388	95	10483	17707	1665

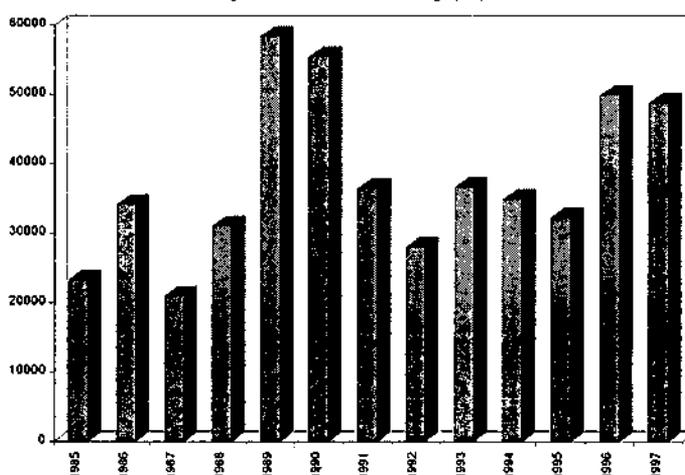
Note: P - Pelagic; D - Demersal.

In almost all the years contribution of pelagic group of fishes is more than that of demersal group of fishes. In fact during the first quarter, the contribution of demersal group was negligible when compared to pelagics.

4.2.2.2 OUTBOARD GILLNET

The operation of OB Gill net was started in Kerala during '84. During the period 1984 to 1997 OB-Gill net landings in Kerala varied from 21074 t in 1987 to 58397 t in 1989 (Table 81 pg. 105, fig. 64). The percentage contribution of OBGN to the total landings varied from 5.0 pct in 1984 to 9 pct in 1989 (Table 48 pg. 59).

Fig. 64. Outboard Gillnet landings (in t)



In table 85 quarterwise pelagic and demersal landings by OBBS during 1985-92 is been given.

Table 85

Quarterwise Pelagic and Demersal landings by OBBS (in t)

Year	I Qr			II Qr			III Qr			IV Qr			Total	
	P	D	Total	P	D	Total	P	D	Total	P	D	Total	P	D
1985	23766	230	23996	6260	1401	7661	30726	4367	35093	24931	321	25252	85683	6319
1986	14628	451	15079	1060	3274	4334	39725	9331	49056	36725	13239	49964	92138	26295
1987	2536	407	2943	3201	397	3598	31202	3662	34864	6747	264	7011	43686	4730
1988	1286	0	1286	1907	1891	3798	39086	9285	48371	32089	2256	34345	74368	13432
1989	10254	0	10254	6977	55	7032	22137	3927	26064	7748	379	8127	76811	5355
1990	10377	0	10377	640	215	856	21628	1028	22656	7880	393	8273	40525	1637
1991	3504	153	3657	4925	5503	10428	5510	783	6293	4448	147	4595	18387	6586
1992	720	24	744	577	1749	2326	11709	1098	12807	1667	1354	3021	14673	4225
1993	1131	477	1608	71	37	108	10441	918	11359	--	--	--	11643	1432
1994	--	-	--	128	99	227	5380	3116	8496	4932	78	5010	10440	3293
1995	37	45	82	3299	671	3970	4423	1463	5886	3989	36	4025	11748	2215
1996	--	-	-	523	170	693	18795	4684	23479	852	47	899	20170	4901
1997	669	4	673	39	9	48	6611	1557	8168	10388	95	10483	17707	1665

Note: P - Pelagic; D - Demersal.

In almost all the years contribution of pelagic group of fishes is more than that of demersal group of fishes. In fact during the first quarter, the contribution of demersal group was negligible when compared to pelagics.

4.2.2.2 OUTBOARD GILLNET

The operation of OB Gill net was started in Kerala during '84. During the period 1984 to 1997 OB-Gill net landings in Kerala varied from 21074 t in 1987 to 58397 t in 1989 (Table 81 pg. 105, fig. 64). The percentage contribution of OBGN to the total landings varied from 5.0 pct in 1984 to 9 pct in 1989 (Table 48 pg. 59).

Fig. 64. Outboard Gillnet landings (in t)

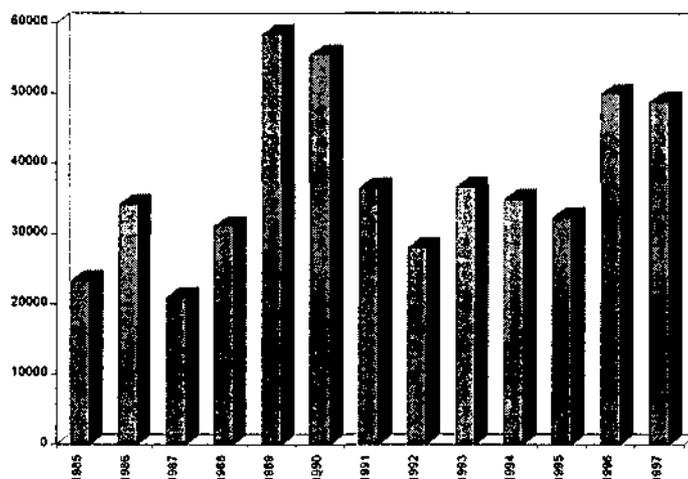
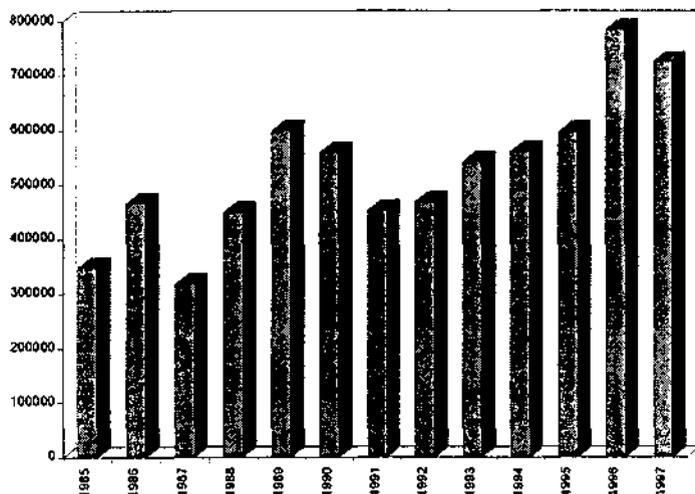


Fig. 65. Outboard Gillnet Effort (in Unit operation)



OBGN effort in terms of unit operations varied from 318000 units in 1987 to 785000 in 1996 (fig. 65). The catch per unit effort varied from 54kg in 1995 to 99 kg in 1990. There is an increasing trend in the catch per unit effort after the imposition of partial ban on trawl net operation during monsoon period from 1988 to '90 (fig. 66).

Quarterwise catch, effort and CPUE of OBGN is given in table 86.

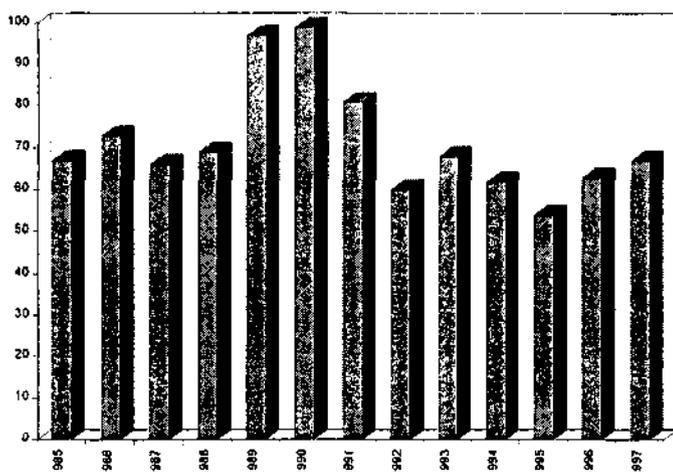
Table 86

Quarterwise Catch, Effort and CPUE of OBGN

Year	I Qr			II Qr			III Qr			IV Qr		
	Catch	Effort	CPUE	Catch	Effort	CPUE	Catch	Effort	CPUE	Catch	Effort	CPUE
1985	4717	100700	47	3438	57500	60	2893	47700	61	12297	143100	86
1986	8472	131700	64	8403	142900	59	4572	52400	87	12816	140000	92
1987	2803	74500	37	2313	45500	51	8418	76100	111	7540	121800	62
1988	3005	114400	26	3509	64300	55	4580	69500	66	20072	202200	99
1989	14673	147600	99	7151	120900	59	21293	188300	113	15280	113692	106
1990	11768	151109	78	13036	156986	83	16757	138855	121	13980	113692	123
1991	9923	157023	14	7673	116751	66	6949	72706	96	12013	107136	112
1992	4283	119600	35	6456	137600	47	5223	56900	92	12233	154400	79
1993	6579	154382	43	3687	79008	47	7719	34191	92	18770	224845	83
1994	7889	170450	46	10783	152000	71	7518	89000	84	8836	150000	59
1995	4615	150000	31	6974	127000	55	8108	125000	65	12841	195000	66
1996	10070	255000	39	19134	214000	89	8716	96000	91	12014	218000	55
1997	17347	239000	73	13634	191000	71	9787	140000	70	8033	154000	52

Note: Catch in tonnes; Effort in units operation; CPUE in kg.

Fig. 86. Outboard Gillnet CPUE (in kg)



The maximum landings by this gear was observed during the fourth quarter in most of the years. Maximum effort as well as CPUE was also observed during the fourth quarter.

Percentage composition of OBGN in the landings of major group of fishes during '84-97 is given in Table 87.

Table 87

Percentage contribution of OBGN in the landings of major group of fishes

Groups	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
Elasmobranchs	7.2	32.4	27.1	35.5	13.6	18.3	23.8	25.4	2.4	19.5	5.2	11.7	16	12.6
Cat fishes	5.4	12.3	8.7	23.6	4.4	11.5	67	12.2	0.4	17.4	20.6	20.7	8.7	10.4
Oil Sardine	3.3	6.2	6.3	4.3	1.5	8.5	5	3.9	1.5	13.9	29.2	11.8	13.6	14.1
Other Sardines	18.7	12.8	6.6	10.7	4	7.6	9.2	1.7	2.8	23	16.1	5.1	25.3	13.1
White baits	12.2	1.6	0.6	2.4	2.4	--	--	16	--	0.1	1.7	0.03	0.01	0.3
Lizard fishes	0.1	--	--	--	0.1	0.2	0.2	--	0.2	0.1	--	--	0.36	0.1
Perches	0.1	1.5	0.3	0.3	0.4	0.3	0.3	0.4	0.7	0.7	0.6	0.7	1.28	1.4
Goat fishes	34.6	--	--	--	0.1	--	--	--	--	1.1	0.2	--	--	--
Croakers	0.2	0.8	0.5	1.5	0.7	14.1	8.4	9.8	5	1.8	6.6	0.7	1.9	5.5
Ribbon fishes	2.3	2.7	4.5	3	0.8	3	6.8	0.7	0.4	1.2	0.9	2.3	5.6	1.3
Carangids	7.5	9.7	3	5.6	3.8	15.7	9.3	2.1	5.3	6.8	3.6	2.1	5.4	7.4
Silver bellies	1.2	--	4.3	0.8	1	23	6.2	2.7	0.3	8	5.1	0.9	4.7	1.5
Big jawed jumper	21.2	26.5	4.2	8.2	2.4	45	36	45.5	0.7	6.3	48.2	12.4	34.8	25
Mackerel	14.8	14.9	61.4	27.4	22.9	11.6	12.7	14.5	24.8	7.5	10.5	13.2	14.7	15.7
Seer fishes	22.9	53	51	66.2	38.5	51.8	79.6	80.6	21.6	43.6	63.5	73.1	60.6	48.2
Tunnies	15	34.1	34.6	47.1	37.9	35.6	32.8	41.1	13.2	36.4	36.1	66.3	49.6	48.8
Flat fishes	--	--	5.3	0.2	20.3	2.7	1.4	0.3	0.8	0.1	--	0.2	0.9	1
P.Prawns	0.1	--	2.5	0.3	1.9	1.4	0.2	0.2	0.2	0.1	0.7	0.05	1.83	0.08
Cephalopods	5.9	0.4	--	1.4	--	--	5.5	1.2	2.7	1.5	--	0.01	0.01	0.02

The major group of fishes landed by this gear were elasmobranchs, cat fishes, other sardines, big jawed jumper, mackerel, seerfishes and tunnies. Contribution of this gear to the landings of elasmobranchs varied from 2.4 pct in '92 to 35.5 pct in '87. In the case of cat fishes it was 0.4 pct in '92 and 67 pct in '90. Catfish was observed during third quarter in some of the years (Table 88). Maximum contribution of 12 pct was observed in '87. OBGN's contribution to the other sardine landings showed a declining trend over the years. Maximum contribution of oil sardine was observed during the first quarter. During 1985 and '89 it constituted 68 pct and 67 pct respectively of the landings of this gear.

Share of OBGN in the landings of big jawed jumper ranged from 0.7 pct in '92 to 45.5 pct in '91. There is a marked improvement during '89-92. In the landings of mackerel OBGN contributed maximum 61 pct in '86 with a minimum of 11.6 pct in '89. During '85-'92 mackerel was observed in OBGN landings throughout the year. Except in '84 '88 and '92 more than 50 pct of the seer fish landings was by OBGN, maximum was in '91 (80 pct). Contribution of this group was maximum in the fourth quarter. Nearly 35 pct of the tunnies landings was by OBGN except in '84 and '92.

Quarterwise percentage species composition of OBGN is given in table 88.

Table 88

Quarterwise percentage contribution of OBGN landings by major group of fishes

Group / Year	SH	CF	OS	OS S	WB	TH Y	OC	CR	RF	SC	OC CR	SB	BJ	PO M	IM	SF	TU	FF	PP	OTR S	Total (in t)
FIRST QUARTER																					
1985	--	--	68	--	--	--	--	--	--	--	--	--	--	--	14	--	5	--	--	13	4717
1986	--	--	21	--	--	--	7	--	--	--	--	--	--	--	58	--	--	--	--	14	8472
1987	10	--	10	--	--	--	--	--	--	--	9	--	--	--	24	11	15	--	--	21	2803
1988	--	--	6	--	--	--	5	--	--	--	--	--	--	--	22	--	7	--	14	46	3005
1989	--	--	67	6	--	--	--	--	--	--	--	--	--	--	13	--	--	--	--	14	14673
1990	--	--	24	10	--	--	--	--	--	--	--	--	--	--	29	5	--	--	--	32	11768
1991	--	--	11	--	--	--	--	--	--	--	--	--	--	--	43	5	18	--	--	23	9923
1992	--	--	--	--	--	--	10	--	--	--	5	--	--	--	33	10	22	--	--	20	4183
1993	6	--	3	17	--	2	12	--	--	--	6	2	--	--	21	10	9	--	--	12	6579
1994	--	--	--	--	--	--	--	--	--	--	9	--	--	--	45	10	13	--	--	23	7889
1995	--	--	--	--	--	--	6	--	--	--	--	--	--	--	52	--	13	--	--	29	4615
1996	26	--	--	--	--	--	9	--	--	--	--	--	--	--	21	6	17	--	--	21	10070
1997	--	--	25	--	--	--	--	--	--	--	--	--	--	--	46	--	8	--	--	21	17347
SECOND QUARTER																					
1985	--	--	9	--	--	--	--	--	--	--	--	--	--	--	27	--	41	--	--	23	3438
1986	--	--	--	--	--	--	--	--	--	--	--	--	--	--	41	--	25	--	9	25	8403
1987	23	--	--	7	--	--	--	--	--	--	--	--	--	--	16	15	29	--	--	10	2313
1988	--	--	--	--	--	--	--	--	--	7	--	--	--	--	45	--	35	--	--	13	3509
1989	--	--	9	--	--	--	--	--	--	--	--	--	--	--	22	--	32	--	9	28	7151
1990	--	--	18	--	--	6	6	5	--	--	--	--	5	--	12	--	31	--	--	17	13036
1991	--	--	33	--	--	--	--	--	--	--	--	--	--	--	30	--	16	--	--	21	7673
1992	--	--	--	--	--	--	--	--	--	--	--	--	--	--	62	--	15	--	--	23	6450
1993	2	--	4	--	--	--	1	1	--	1	13	--	--	--	24	4	36	--	--	14	3687
1994	--	--	--	--	--	--	--	--	--	--	--	--	--	--	55	--	15	--	--	30	10783
1995	--	--	--	7	--	--	--	--	--	--	--	--	--	--	45	--	30	--	--	18	6794
1996	--	--	--	--	--	--	--	--	--	--	--	--	--	--	58	--	16	--	--	26	19134
1997	--	--	42	--	--	--	--	--	--	--	--	--	--	--	13	--	23	--	--	22	13634

Group / Year	SH	CF	OS	OS S	WB	TH Y	OC	CR	RF	SC	OC CR	SB	BJ	PO M	IM	SF	TU	FF	PP	OTR S	Total (in t)
THIRD QUARTER																					
1985	--	7	--	--	--	--	--	--	--	--	--	--	6	--	12	19	22	--	--	34	2893
1986	18	7	--	--	--	--	--	--	--	--	9	5	--	--	17	9	--	--	--	35	4572
1987	--	12	17	--	--	--	--	--	5	--	--	--	--	--	7	--	29	--	--	30	8418
1988	--	--	7	--	--	--	--	--	--	--	6	--	--	--	10	12	37	--	--	28	4580
1989	--	--	11	--	--	--	7	6	--	27	6	5	--	--	12	--	7	--	--	19	21293
1990	6	10	--	--	--	--	1	1	3	2	23	1	--	6	13	4	18	--	--	12	16757
1991	--	--	7	--	19	15	--	10	--	--	--	--	--	--	9	--	15	--	--	25	6949
1992	--	--	--	--	--	5	17	6	--	--	5	--	--	--	8	6	11	--	--	42	5223
1993	1	--	--	3	--	2	7	2	1	9	33	2	1	1	2	9	17	--	--	10	7719
1994	--	--	--	--	--	8	16	10	--	--	--	--	6	--	10	16	19	--	--	15	7518
1995	--	--	--	9	--	--	--	--	--	--	--	--	--	--	30	6	29	--	--	26	8108
1996	--	--	--	--	--	--	--	--	10	--	--	--	6	--	32	--	18	--	10	24	8716
1997	--	--	30	--	--	--	--	5	--	--	--	--	--	--	14	9	17	--	--	25	9787
FOURTH QUARTER																					
1985	12	--	11	--	--	--	--	--	--	--	7	--	--	--	6	28	--	--	--	36	12297
1986	--	--	6	--	--	--	--	--	--	--	5	--	--	--	40	11	12	--	--	26	12816
1987	--	--	7	5	5	--	--	--	--	--	--	--	--	--	15	27	16	--	--	17	7540
1988	--	--	--	--	5	--	--	--	--	--	--	--	--	--	37	15	--	13	--	30	20072
1989	--	--	20	--	--	--	--	--	--	--	--	--	--	--	25	15	13	--	--	27	15280
1990	1	1	29	--	--	--	1	--	1	4	5	--	--	--	21	18	15	--	--	4	13980
1991	--	--	--	--	49	--	--	--	--	--	--	--	--	--	7	23	6	--	--	15	12013
1992	--	--	--	5	--	--	5	9	--	--	--	--	--	--	9	40	8	--	--	24	12233
1993	1	--	35	21	--	1	2	--	--	--	4	1	--	2	10	7	9	--	--	7	18770
1994	--	--	28	--	--	--	7	--	--	--	--	--	--	--	17	19	14	--	--	15	8836
1995	--	--	10	8	--	--	--	--	--	--	--	--	--	--	20	27	18	--	--	17	12841
1996	--	--	13	9	--	--	5	--	--	5	--	--	--	--	23	9	16	--	--	20	12014
1997	--	--	--	19	--	--	--	--	--	--	5	--	--	--	24	6	22	--	--	24	8033

In table 89 quarterwise pelagic and demersal landings by OBN during 1985 to 1992 is given. Contribution of pelagic group of fishes was more in all the quarters when compared to that of demersal group. Maximum landings of pelagic group was noticed during the fourth quarter.

Table 89

Quarterwise Pelagic and Demersal landings of OBN (in t)

Year	I Qr			II Qr			III Qr			IV Qr			Total	
	P	D	Total	P	D	Total	P	D	Total	P	D	Total	P	D
1985	4479	238	4717	3252	186	3438	2249	644	2893	9273	3024	12297	19253	4092
1986	8263	209	8472	7305	1098	8403	2716	1856	4572	11101	1715	12816	29385	4878
1987	2214	589	2803	1732	581	2313	6686	1732	8418	6679	861	7540	17311	3763
1988	1914	1091	3005	3393	116	3509	3941	639	4580	15594	4478	20072	24842	6324
1989	14163	510	14673	5519	1632	7151	17921	3372	21293	13443	1837	15280	51046	7351

Year	I Qr			II Qr			III Qr			IV Qr			Total	
	P	D	Total	P	D	Total	P	D	Total	P	D	Total	P	D
1990	10857	911	11768	10992	2044	13036	11168	5589	16757	13502	478	13980	46519	9022
1991	9206	717	9923	7242	431	7673	5346	1603	6949	11532	481	12013	33326	3232
1992	3850	333	4183	6265	191	6456	3251	1972	5223	9895	2338	12233	23261	4834
1993	5785	794	6579	3292	395	3687	6571	1148	7719	17531	1239	18770	33179	3576
1994	7426	463	7889	9608	1175	10783	5981	1537	7518	8451	385	8836	31466	3560
1995	4438	177	4615	6624	170	6794	7406	702	8108	12470	371	12841	30938	1420
1996	9398	672	10070	18270	864	19134	6785	1931	8716	11224	790	12014	45677	4257
1997	16938	409	17347	12899	735	13634	8423	1364	9787	7572	461	8033	45832	2969

Note: P - Pelagic; D - Demersal

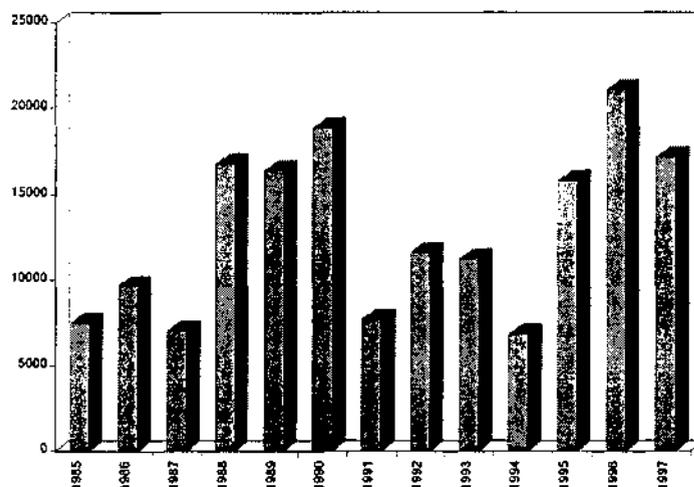
4.2.2.3 OUTBOARD HOOKS & LINE

There are many variations in the dimensions and operations of hook and line depending on the area, species and local traditions. In the context of diminishing returns and escalating fuel prices, line fishing appears attractive. There are many changes in the type of hooks and materials used for line fishing. The snood used in the Malabar is made of cotton twine, the snoods

twine after securing on to the hook is wound back on the snood itself nearly two third of its length, so as to reduce the wear and tear caused due to abrasion by fishes while hauling. In the central part of Kerala (Alleppey) type of the stainless snood is seized by cotton twine in order to reduce the visibility of the steel wire while in water. This type of line is chiefly used for shark

and catfish line fishery. Line fishery for seer fishes is another lucrative one, where instead of cotton twine, coloured multifilament synthetic ropes are used. Achil and Mayak are two variations of hooks and line, a hand line with smaller hooks closely set at the end of the line together with artificial baits; these two types are common in the southern districts of Kerala, they are operated from Catamaran, canoes and plyvallam. The target groups are carangids, tunnies etc.

Fig. 67. Outboard Hooks & line landings (in t)



Year	I Qr			II Qr			III Qr			IV Qr			Total	
	P	D	Total	P	D	Total	P	D	Total	P	D	Total	P	D
1990	10857	911	11768	10992	2044	13036	11168	5589	16757	13502	478	13980	46519	9022
1991	9206	717	9923	7242	431	7673	5346	1603	6949	11532	481	12013	33326	3232
1992	3850	333	4183	6265	191	6456	3251	1972	5223	9895	2338	12233	23261	4834
1993	5785	794	6579	3292	395	3687	6571	1148	7719	17531	1239	18770	33179	3576
1994	7426	463	7889	9608	1175	10783	5981	1537	7518	8451	385	8836	31466	3560
1995	4438	177	4615	6624	170	6794	7406	702	8108	12470	371	12841	30938	1420
1996	9398	672	10070	18270	864	19134	6785	1931	8716	11224	790	12014	45677	4257
1997	16938	409	17347	12899	735	13634	8423	1364	9787	7572	461	8033	45832	2969

Note: P - Pelagic; D - Demersal

4.2.2.3 OUTBOARD HOOKS & LINE

There are many variations in the dimensions and operations of hook and line depending on the area, species and local traditions. In the context of diminishing returns and escalating fuel prices, line fishing appears attractive. There are many changes in the type of hooks and materials used for line fishing. The snood used in the Malabar is made of cotton twine, the snoods

twine after securing on to the hook is wound back on the snood itself nearly two third of its length, so as to reduce the wear and tear caused due to abrasion by fishes while hauling. In the central part of Kerala (Alleppey) type of the stainless snood is seized by cotton twine in order to reduce the visibility of the steel wire while in water. This type of line is chiefly used for shark

and catfish line fishery. Line fishery for seer fishes is another lucrative one, where instead of cotton twine, coloured multifilament synthetic ropes are used. Achil and Mayak are two variations of hooks and line, a hand line with smaller hooks closely set at the end of the line together with artificial baits; these two types are common in the southern districts of Kerala, they are operated from Catamaran, canoes and plyvallam. The target groups are carangids, tunnies etc.

Fig. 87. Outboard Hooks & line landings (in t)

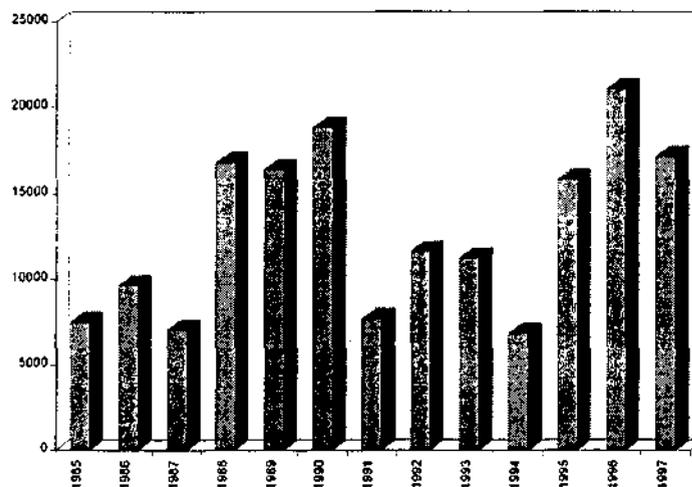
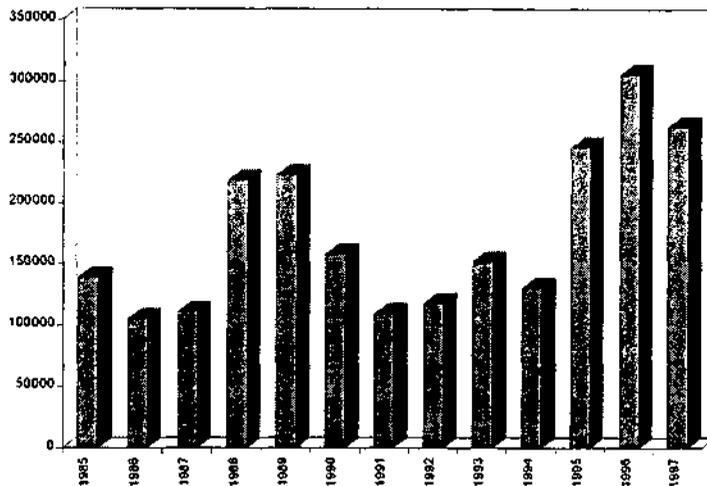


Fig. 68. Outboard Hooks & line Effort (in Unit operation)



Outboard Hooks & Lines (OBHL) started operation from 1984 onwards. During the period 1985 to 1997 OBHL landings in Kerala varied from 6850 in 1994 to 21100 t in 1996 (Table 81 pg. 105, fig. 67). Percentage contribution of this gear to the total landings varied from 1.2 in 1994 to 3.69 in 1996 (Table 48 pg. 59).

OBHL effort in terms of unit operation varied from 105000 in 1986 to 306000 in 1996 (fig. 68). CPUE of this gear varied from 52 kg in 1994 to 119 kg in 1990 (fig. 69). Quarterwise catch, effort and CPUE of OBHL during 1985 to 1997 is given in table 90.

Fig. 69. Outboard Hooks & line CPUE (in kg)

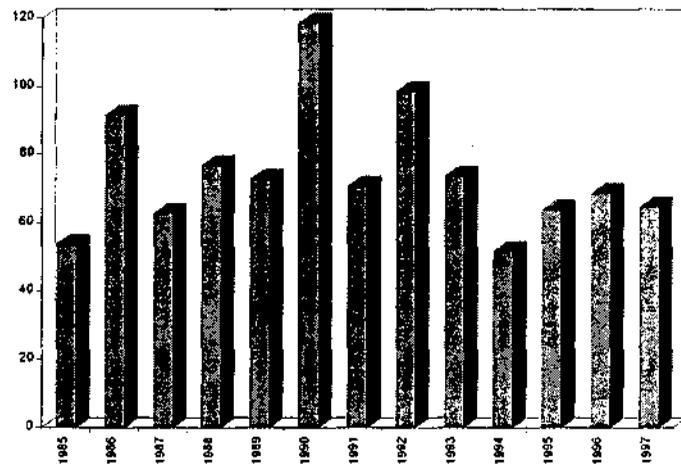


Table 90

Quarterwise Catch, Effort and CPUE of OBHL

Year	I Qr			II Qr			III Qr			IV Qr		
	Catch	Effort	CPUE	Catch	Effort	CPUE	Catch	Effort	CPUE	Catch	Effort	CPUE
1985	1604	36700	44	825	17200	48	1299	21200	61	3759	64300	58
1986	851	26300	32	476	13600	35	4553	23400	195	3821	41700	92
1987	860	25200	34	566	18200	31	2988	30700	97	2640	37600	70
1988	2509	33300	75	1899	27300	70	4734	34100	139	7661	124200	62
1989	3893	67600	58	1780	37100	48	3345	44400	75	7409	74800	99
1990	2659	44289	60	3553	27646	129	8561	47501	180	4115	38615	107
1991	2696	38696	70	2354	27475	86	725	12159	60	1945	30996	63
1992	2529	38800	65	793	16300	49	511	10000	51	7841	52900	148
1993	2349	48115	49	4540	30567	149	1384	21288	65	3015	52174	58
1994	2716	52560	52	799	14664	54	1741	31450	55	1594	31671	50
1995	1061	21000	51	2267	35000	65	4926	72000	68	7583	116000	65
1996	6683	93000	72	6175	76000	81	2876	36000	80	5306	100000	54
1997	5095	63000	81	3962	67000	59	2313	42000	55	5800	89000	65

Note: Catch in tonnes; Effort in units operation; CPUE in kg.

It can be seen that catch per unit effort was more during the third quarter except '89,'91 and '92.

Percentage contribution of OBHL in the landings of major group of fishes is given in table 91.

Table 91

Percentage contribution of OBHL in the landings of major group of fishes

Groups	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
Elasmobranchs	23	2.2	9.3	7.2	26.1	19.7	3.1	19.5	2.5	4.8	7	5.9	2	3.7
Cat fishes	21.2	21.9	58.8	19	40.2	--	15.2	24.7	3.2	7.4	27.2	22.4	21	30.7
Lizard fishes	1.9	--	0.2	0.4	0.3	--	0.2	--	0.1	0.2	--	0.05	0.19	0.1
Perches	0.7	1.2	0.5	1.6	5.2	--	2.1	1.1	8.9	1.3	1.4	1.3	2.12	5.4
Ribbon fishes	--	4.1	15.9	2.2	--	--	--	--	0.8	0.1	1	-	2.4	1
Carangids	14	22	0.8	11.7	5.5	--	6.2	1.2	14.6	2.7	2.6	5.7	11	10
Mackerel	3.2	2.1	0.4	1.7	2.2	--	6.5	1.7	2.6	0.2	0.3	0.94	1.5	1.5
Seer fish	2.1	1.2	0.3	4.5	20.8	17.3	1	4.2	3.6	7.3	3.5	9.3	14.4	21.1
Tunnies	5	11.2	5.9	16.6	24.1	--	21	29.5	57.5	46.4	15.7	24.2	42.5	36.2
Cephalopods	3.4	2.4	1.1	0.3	0.6	--	0.8	0.4	2.2	1.4	1.2	9.9	3.6	0.64

Elasmobranchs, catfishes, carangids, seerfishes, tunnies and cephalopods were the major group of fishes for which OBHL has contributed considerably. Percentage contribution of OBHL in the landings of elasmobranchs varied from 2.2 pct in '85 to 26.1 pct in '88, in the case of catfish it was 3.2 pct in '92 and 58.8 pct in '86. In fact OBHL is a major gear for catfish. Contribution of catfishes in landings of this gear was observed in first, third and fourth quarters in most of the years (Table 92). OBHL's contribution in the landings of carangids ranged from 0.8 pct in '86 to 22 pct in '85, while it was 0.3 pct in '86 and 20.8 pct in '86 in the case of seer fishes. Landings of tunnies by OBHL ranged from 5 pct in '84 to 57.5 pct in '92. Ever since the introduction of OB motors at the southern part of Kerala hooks and line fishery for cephalopods from the off shore waters became very lucrative. Contribution of this gear varied from 0.3 pct in '87 to 9.9 pct in '85.

Quarterwise species composition of OBHL is given in table 92.

Table 92

Quarterwise percentage contribution by major group of fishes in OBHL landings

Group /Year	SH	RA	CF	LF	RC	SN	TF	OP	RF	HM	SC	LJ	OTC R	IM	SF	TU	CEP	OTR S	Total (in t)
FIRST QUARTER																			
1985	--	--	17	--	--	--	--	--	--	--	11	--	36	5	--	11	--	20	1604
1986	--	--	21	--	5	--	--	5	--	--	--	--	12	--	--	31	--	26	851
1987	7	--	8	--	16	--	--	--	--	--	--	--	30	--	--	14	--	25	860
1988	7	--	6	--	12	22	--	14	--	--	--	--	--	--	8	12	--	19	2509
1989	--	--	--	--	23	17	--	--	--	--	--	--	14	--	--	13	6	27	3893
1990	--	--	6	--	15	12	--	6	--	--	--	--	--	--	--	47	--	14	2659
1991	--	--	--	--	--	--	--	5	--	--	--	--	18	20	--	26	--	31	2696
1992	--	--	11	--	--	--	--	8	--	--	--	--	19	7	--	38	--	17	2529
1993	4	--	--	--	11	4	1	10	--	2	3	--	16	3	5	31	--	10	2849
1994	5	--	--	--	14	--	10	--	--	--	--	--	19	7	6	25	--	14	2716
1995	--	--	--	--	--	--	--	--	--	20	--	--	--	11	9	24	--	36	1061
1996	--	--	--	--	--	--	--	--	--	--	--	--	33	22	5	25	--	15	6683
1997	--	--	--	--	7	10	--	6	--	--	--	--	--	15	9	20	--	33	5095
SECOND QUARTER																			
1985	--	--	--	--	--	--	--	--	--	--	20	--	24	5	5	34	--	12	825
1986	26	--	9	--	--	--	--	--	--	--	14	--	12	13	--	14	--	12	476
1987	--	--	--	--	--	--	7	--	--	--	13	--	--	5	10	53	--	12	566
1988	21	--	5	--	--	--	--	--	--	--	8	--	--	20	--	35	--	11	1899
1989	--	--	9	--	--	--	5	--	--	--	6	--	8	--	--	58	--	14	1780
1990	--	--	--	--	--	--	--	--	--	--	--	--	--	6	--	78	--	16	3553
1991	10	--	--	--	--	--	--	--	--	--	--	--	--	--	--	75	--	15	2354
1992	20	--	9	--	--	--	--	--	--	--	11	--	--	14	--	30	--	16	793
1993	1	--	1	--	--	--	1	--	--	--	1	1	1	--	4	86	--	4	4540
1994	--	--	8	--	--	--	--	--	--	--	16	--	--	5	--	55	--	16	799
1995	--	--	--	--	--	--	--	--	--	--	5	--	23	13	--	48	--	11	2237
1996	--	--	--	--	--	--	--	--	--	--	14	--	27	5	--	41	--	13	6175
1997	--	--	--	--	--	--	--	--	--	6	7	--	--	7	7	50	--	23	3962
THIRD QUARTER																			
1985	--	--	39	--	--	--	--	--	--	--	24	10	10	--	--	--	--	17	1299
1986	5	--	80	--	--	--	--	--	10	--	--	--	--	--	--	--	--	5	4553
1987	--	--	19	--	--	--	6	--	11	--	--	--	37	--	--	17	--	10	2988
1988	23	--	26	--	--	--	--	--	--	--	--	--	5	5	11	21	--	9	4734
1989	--	16	--	8	--	--	--	--	--	--	13	--	22	--	--	11	--	30	3345
1990	--	--	--	--	--	--	--	--	--	--	20	--	10	57	--	7	--	6	8561
1991	9	25	12	--	--	--	--	--	--	--	--	--	--	7	--	27	--	20	725
1992	--	--	--	--	--	--	--	--	--	--	31	--	12	--	--	--	14	45	511
1993	4	1	1	1	--	--	3	3	--	1	29	3	12	--	--	34	5	3	1384
1994	16	--	--	--	--	--	--	--	9	--	7	--	6	--	--	29	22	11	1741
1995	--	--	--	--	--	--	--	--	--	--	5	--	--	--	--	7	75	13	4926
1996	--	--	--	--	--	--	--	--	15	--	--	15	--	--	--	30	17	23	2876
1997	--	--	--	--	5	--	--	--	8	--	--	20	--	--	--	32	--	35	513

Group Year	SH	RA	CF	LF	RC	SN	TF	OP	RF	HM	SC	LJ	OTC R	IM	SF	TU	CEP	OTR S	Total (in t)
FOURTH QUARTER																			
1985	--	--	9	--	--	--	--	--	28	--	7	--	22	7	--	14	--	13	3759
1986	--	--	32	--	--	--	--	--	37	--	--	--	7	--	--	10	--	14	3821
1987	--	--	9	--	--	--	--	--	--	--	--	--	42	--	6	20	--	23	2640
1988	--	--	32	--	--	--	--	--	--	--	16	--	7	--	17	12	--	16	7661
1989	--	--	--	--	--	--	--	--	--	--	10	--	19	9	17	38	--	7	7409
1990	--	--	6	--	--	--	--	--	--	27	--	--	7	--	--	46	--	14	4115
1991	--	--	9	--	--	--	--	--	--	--	--	--	--	15	--	54	--	22	1945
1992	--	--	--	--	5	--	5	--	--	--	--	--	9	--	--	70	10	1	7841
1993	--	--	--	--	4	--	--	4	--	8	--	--	16	2	7	34	11	14	3015
1994	--	--	--	--	--	--	--	--	--	19	--	--	7	10	8	42	--	14	1594
1995	--	--	--	--	--	--	--	--	--	35	--	--	26	--	5	13	8	13	7583
1996	--	--	--	--	--	--	--	--	--	9	10	--	--	--	6	45	12	18	5366
1997	--	--	--	--	5	--	--	--	--	7	--	--	36	--	--	36	--	16	5800

Quarterwise pelagic and demersal landings by OBHL during 1985-97 is given in table 93. Maximum contribution of pelagic group was noticed during fourth quarter. It varied from 1587 t in 1991 to 6889 t in 1992.

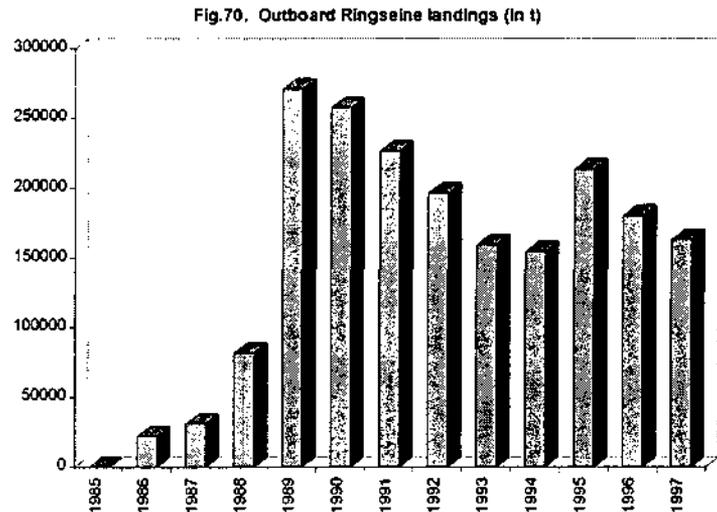
Table 93

Quarterwise Pelagic and Demersal landings by OBHL (in t)

Year	I Qr			II Qr			III Qr			IV Qr			Total	
	P	D	Total	P	D	Total	P	D	Total	P	D	Total	P	D
1985	1119	485	1604	787	38	825	683	616	1299	3008	751	3759	5597	1890
1986	522	329	851	300	176	476	528	4025	4553	2294	1527	3821	3644	6057
1987	537	323	860	487	79	566	2160	828	2988	2220	420	2640	5404	1650
1988	814	1695	2509	1365	534	1899	2295	2439	4734	6205	1456	7661	4474	4668
1989	1794	2099	3893	1336	444	1780	1712	1633	3345	6045	1364	7409	8539	4738
1990	1536	1123	2659	3243	310	3553	8242	319	8561	3535	580	4115	16556	2332
1991	2010	686	2696	2072	282	2354	329	396	725	1587	358	1945	5998	1722
1992	1779	730	2529	548	245	793	399	112	511	6889	952	7841	9635	2039
1993	1552	797	2349	4305	235	4540	1117	267	1384	2402	613	3015	9376	1912
1994	1692	1024	2716	692	107	799	1052	689	1741	1470	124	1594	4906	1944
1995	871	190	1061	2142	125	2267	1075	3851	4926	6451	1132	7583	10539	5298
1996	6141	542	6683	5635	540	6175	2098	778	2876	4282	1084	5366	18156	2944
1997	3645	1460	5095	3660	302	3962	1750	363	2113	5041	759	5800	14096	2874

Note: P - Pelagic; D - Demersal.

Outboard ringseine operation started in Kerala during third quarter of 1986. Ring seine is a mini purse seine mainly operated with plank built canoes. The gear is 18-22 mm mesh of nylon knotless webbing mainly used to catch sardines and mackerel. 12 mm mesh size ring seine (chooda vala) is used to target small species like white baits and operate in shallow waters. The overall length of this gear ranges from 150 m to 800 m with a depth range from 30 m to 90 m. Thangu valloms of 70 feet long with a crew size of 35 operated with two 25 horse power engine are being currently used for ring seine operation.



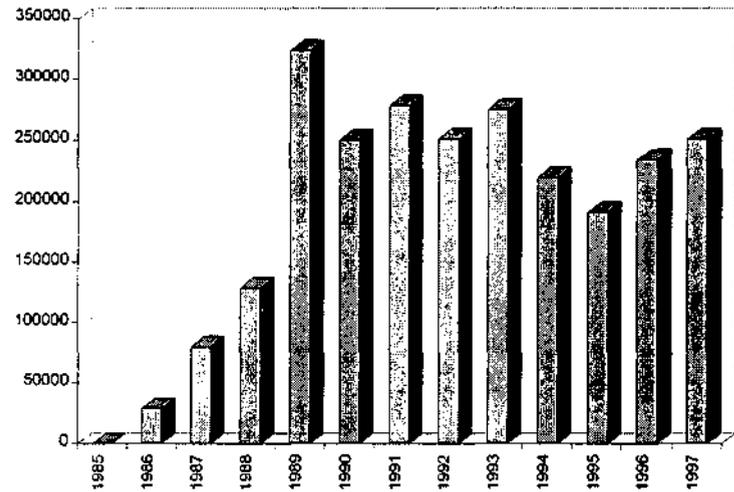
With the introduction of ring seine, two major artisanal gears "Kolli vala" Boat seine operated by two dugout canoes and "Thanguvala" or "Koruvala" (encircling net used with plank canoes) became obsolete.

With the ring seine replacing the traditional Koruvala, the scale of operation has substantially increased. The size of the Thanguvallom has been continuously increasing in order to accommodate larger gear. The Ring seine belt between Neendakara and Fort Cochin has shifted to two boat operation, one of which a smaller Thanguvallom, accompanies the larger one as a carrier boat, mainly used to ferry the catch to the shore. Northern Ernakulam, Trichur and Malappuram districts have shifted their dugout Kollivala combination to Thanguvallom ring seine combination. They have also adopted the carrier boat system for ring seine operation. On the other hand Malappuram boat seines which got converted to ring seine only in the last couple of years adopted the single boat system. The dugouts are seasonally engaged in Malappuram as carrier boats. Fishermen of the Kasargod district played an important role in bringing about technological change in northern districts. Almost at the same time the Ernakulam and Alleppey fishermen were experimenting with the ring seine, Kasargod fishermen developed ring seine operation with the dug out canoes in 1986. The ring seine used in Kasargod called the "Rani vala" requires four larger dug outs. Two of them are used for actual fishing operations while the other two are mainly carrier boats. This switching to ring seine took place without substantial new investment. Two of the old Kollivala units came together to form a new Rani Vala unit and bits and pieces of the old Kollivala have gone into the new Rani vala.

Caught between the rapidly enlarging Ring seine belt on the south and Rani vala belt on the north, the Calicut and Cannanore Districts resisted the new technology for a long time and stuck to their Kollivala operation.

Finally the more efficient gear ring seine forced them to also adopt it. The whole of Cannanore district has quickly opted for the Rani vala technology wherein the existing dugouts can be used. Southern part of Calicut district has adopted the Thanguvallom-Ring seine combination while the northern end has gone for the Cannanore way with Ranivala technology. Central area has a mix of both these technologies. At present there are about 2259 ring seines in operation throughout Kerala, out of which 1751 ring seines are used with plank canoes and the remaining with dug out canoes (Anon.'91).

Fig. 71. Outboard Ringseine effort (in unit operation)



During the period 1986-97 the OBRS landings in the state varied from 22498 t in 1986 to 270903 t in 1989. There was tremendous increase in landings by this gear from 1988 onwards (table 81 pg. 105, fig. 70). This increase coincides with the period of partial banning of trawl operation in Kerala. This fluctuation was even reflected in the catch per unit effort also. The percentage contribution of OBRS to the total landings varied from 5.8 in 1986 to 41.8 in 1989 (table 43, pg. 52). OBRS effort in terms of unit operation varied from 29000 in 1986 to 323000 in 1989 (fig. 71). The catch per unit effort varied from 394 kg in 1987 to 1118 kg. in 1995 (fig. 72). Quarterwise catch, effort and CPUE of OBRS is given in table 94.

Fig. 72. Outboard Ringseine CPUE (in kg)

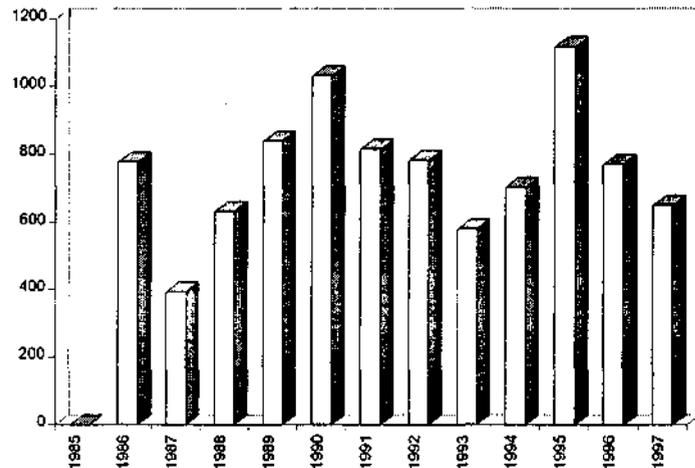


Table 94

Quarterwise Catch, Effort and CPUE of OBRS .

Year	I Qr			II Qr			III Qr			IV Qr		
	Catch	Effort	CPUE	Catch	Effort	CPUE	Catch	Effort	CPUE	Catch	Effort	CPUE
1986	--	--	--	--	--	--	3793	7330	520	18705	21700	862
1987	3948	20900	189	2147	8400	256	21816	36800	593	3647	14100	259
1988	677	4700	144	7769	25600	303	25599	41500	617	47841	57900	826
1989	18655	37000	504	50890	84400	603	86635	77800	1114	114723	123800	927
1990	27767	29500	941	33217	79100	420	94752	85400	1110	102117	73900	1382
1991	59659	140000	407	37943	49200	771	87646	93300	940	41082	71632	574
1992	27853	40700	684	11785	13500	873	109072	116800	934	47706	80000	596
1993	6814	17125	398	37804	64203	589	79182	140278	564	35972	53375	674
1994	2425	11487	211	22095	52445	412	102310	113475	902	27789	42257	658
1995	3325	8600	386	17421	28000	622	109861	86000	1277	82895	68000	1219
1996	8497	16000	531	16134	27000	598	88370	110000	803	67431	79000	853
1997	38712	48000	806	20877	38000	549	58005	91000	638	45681	73000	626

Note: Catch in tonnes; Effort in unit operation; CPUE in kg.

Maximum catch observed was in the third quarter followed by fourth quarter in most of the years. There was an increasing trend in third quarter landings of OBRS over these years. Similar trend was also observed in the case of effort during third quarter over these years.

Percentage contribution of OBRS in the landings of various groups of fishes is given in Table 95.

Table 95

Percentage contribution of OBRS in the landings of major group of fishes

Groups	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
Elasmobranchs	--	--	--	2.7	0.5	3.5	0.2	1.2	1.5	1.3	1.7	2.1
Cat fishes	3.1	16.2	7	24.6	2.9	2.6	--	0.3	3	3.6	9.7	-
Oil Sardine	5.8	34.6	51	69.1	71.6	86.7	24.8	74.7	60	78	70.7	70.3
Other Sardines	6.9	17	47.3	74.4	77.4	76.9	6.5	57.7	63	82	48.2	62.2
White baits	21.5	--	8.4	48	46.4	1.4	15.5	51.8	52.4	68	60.6	30.8
Perches	0.6	--	2.2	1.8	1.6	5	0.7	5.3	31	2.8	0.9	1.4
Croakers	1	4.1	3.1	20.3	17.6	3.7	1.6	13.8	16.8	13	38.6	0.4
Ribbon fishes	--	--	--	--	0.2	0.6	--	0.4	0.2	2	0.03	0.07
Carangids	15.5	14.2	27.1	27	41.1	62	24.4	23.1	27.7	66.2	20	25
Silver bellies	--	0.6	2.8	13.3	7.2	11.3	0.1	13	22	15.2	11.4	7
Big jawed jumper	0.5	--	2.6	6.2	10.5	--	--	10.8	2.8	17.8	5	2.7
Mackerel	4.6	28.9	47	72.4	64.5	67.7	10.3	69	80	71.7	66.2	64.3
Seer fishes	--	4.3	--	1.1	1.1	0.5	--	4.5	2.5	0.5	0.1	12
Tunnies	--	2.4	1.8	23.6	36.4	1.4	1.5	0.7	36.2	1.3	0.06	1.9
Flat fishes	--	--	0.5	8.2	4.1	0.7	1.4	3	--	0.3	3.5	0.04
P Prawns	0.4	4.4	1.8	27.3	14.5	12	2.7	17.1	7.1	10.6	22.3	7
Cephalopods	--	--	--	0.6	0.8	1.1	--	0.1	0.1	0.03	0.1	-

Oil sardine, other sardines, white baits, carangids, mackerel and P. prawns were the major group fishes landed by this gear. Contribution of this gear in the landings of oil sardine varied from 5.8 pct in '86 to 86.7 pct in '91. There is increasing trend in the contribution of this gear to the landings of this fish over the years. Contribution of oil sardine in the landings of OBRS was observed throughout the year. Maximum contribution was observed during the first quarter followed by third quarter (Table 96). During the first and second quarter of '90, '91 and '92 more than 65 pct of the landings by OBRS was oil sardine. In the case of other sardines the share of this gear varied from 6.9 pct in '86 to 82 pct in '95. Other sardines occurred mostly during fourth quarter of 1986 to '97. White baits landings varied from 1.4 pct in '91 to 68 pct in '95. Maximum of 66.2 pct contribution of this gear in the landings of carangids was observed during '95 and the minimum was 14.2 pct in '97. The share of OBRS in the landings of mackerel ranged between 4.6 pct in '86 and 72.4 pct in '89 and in the case of penaeid prawns it ranged from 0.4 pct in '86 to 27.3 pct in '89. Mackerel was available in OBRS throughout the year. In effect the abundance of pelagics was determined by the contribution of OBRS. In fact during '89 to '97 this gear contributed more than 60 pct of the landings of oil sardine, other sardines and mackerel.

Quarterwise percentage contribution of different species in OBRS landings is given in table 96.

Table 96

Quarterwise percentage contribution of OBRS in the landings of major group of fishes

Group	CF	OS	OSS	WB	OC	OP	HM	SC	OTCR	IM	TU	MUL	PP	OTRS	Total (t)
FIRST QUARTER															
1987	--	14	6	--	10	20	--	--	--	29	--	--	15	6	3948
1988	--	49	--	--	--	--	--	--	--	51	--	--	--	--	677
1989	--	81	--	--	--	--	--	--	--	13	--	--	--	6	18655
1990	--	85	--	--	--	--	--	--	--	5	--	--	10	--	27767
1991	--	66	22	--	--	--	--	--	--	9	--	--	--	3	59659
1992	--	77	5	7	--	--	--	--	--	7	--	--	--	4	27853
1993	--	52	5	26	3	3	--	--	4	1	--	--	3	3	6814
1994	--	7	5	28	--	5	7	--	--	22	--	--	15	--	2425
1995	--	9	--	--	8	14	--	--	9	17	--	--	21	11	3325
1996	--	47	--	8	--	--	--	--	--	30	--	--	7	8	8497
1997	--	63	--	--	--	--	--	8	--	23	--	--	--	6	38712
SECOND QUARTER															
1987	--	17	12	--	--	--	--	--	--	23	--	--	44	4	2147
1988	--	--	--	--	--	--	--	--	--	83	--	--	--	17	7769
1989	--	19	--	35	--	--	--	--	--	8	--	--	25	13	50890
1990	--	74	--	--	--	--	--	--	--	9	--	--	9	8	33217
1991	--	85	--	--	6	--	--	--	--	--	--	--	--	9	37943
1992	--	69	--	--	6	--	--	--	--	15	--	--	--	10	11785
1993	--	30	1	27	2	3	1	--	2	25	--	--	6	3	37804

Group	CF	OS	OSS	WB	OC	OP	HM	SC	OTCR	IM	TU	MUL	PP	OTRS	Total (t)
1994	--	--	--	23	9	7	--	--	--	31	--	--	13	17	22095
1995	--	--	--	43	5	--	--	--	--	30	--	--	14	8	17421
1996	--	7	--	11	22	--	--	--	--	44	--	--	8	8	16134
1997	--	53	--	8	--	--	--	--	--	25	--	--	--	14	20877
THIRD QUARTER															
1986	7	--	--	--	6	6	--	51	15	7	--	5	--	9	3793
1987	--	55	--	--	8	--	--	--	5	6	--	--	--	26	21816
1988	--	35	--	13	--	--	--	8	13	17	--	--	--	14	25599
1989	--	65	--	--	5	--	--	7	--	15	--	--	--	8	86635
1990	--	44	--	8	--	--	6	17	--	15	--	--	--	10	94752
1991	--	13	--	--	8	--	--	39	--	24	--	--	5	11	87646
1992	--	6	5	18	8	--	--	37	--	12	--	--	--	14	109072
1993	--	17	1	10	8	3	--	5	2	31	--	--	7	6	79182
1994	--	--	--	10	--	--	--	14	--	61	5	--	--	10	102310
1995	--	--	--	8	--	--	--	56	--	22	--	--	--	14	109861
1996	--	9	--	7	6	--	--	7	--	54	--	--	9	8	88370
1997	--	20	--	6	--	--	--	6	--	48	--	--	6	--	58065
FOURTH QUARTER															
1986	--	13	--	30	--	--	--	33	12	--	--	--	--	12	18705
1987	--	68	17	--	--	--	--	--	5	--	--	--	7	3	3647
1988	--	45	13	--	--	--	7	--	7	20	--	--	--	8	47841
1989	--	44	7	--	--	--	--	5	--	33	--	--	--	11	114723
1990	--	38	9	5	--	--	--	--	--	32	11	--	--	5	102117
1991	--	23	10	--	6	--	--	29	--	22	--	--	--	10	41082
1992	--	27	14	19	5	--	--	13	--	7	--	--	--	15	47706
1993	--	26	33	15	1	--	--	3	--	19	--	--	1	2	35972
1994	--	--	34	--	--	--	--	--	--	56	--	--	--	10	27789
1995	--	8	44	11	--	--	--	--	--	32	--	--	--	5	82895
1996	--	13	--	15	8	--	--	6	--	41	--	--	--	17	67431
1997	--	42	19	6	5	--	--	--	--	24	--	--	--	4	45681

Table 97 gives quarterwise pelagic and demersal landings by OBRS during 1986-97. Abundance of pelagic group of fishes was more in OBRS landings. Maximum contribution of pelagic group was observed during fourth quarter followed by third except in 1987 '91 and '92.

Table 97

Quarterwise Pelagic and Demersal landings by OBRS (in t)

Year	I Qr			II Qr			III Qr			IV Qr			Total	
	P	D	Total	P	D	Total	P	D	Total	P	D	Total	P	D
1986	--	--	--	--	--	--	3245	548	3793	18374	331	18705	21619	879
1987	2544	1404	3948	1191	956	2147	19434	2382	21816	3359	288	3647	26528	5030
1988	677	--	677	7525	244	7769	23768	1831	25599	46312	1529	47841	78282	3604
1989	18418	237	18655	34749	16141	50890	82377	4258	86635	113108	1615	114723	248652	22251
1990	24956	2811	27767	29127	4090	33217	90581	4171	94752	101833	284	102117	246497	11356
1991	58673	986	59659	36580	1363	37943	80664	6982	87646	38700	2382	41082	214617	11713
1992	27235	618	27853	11223	562	11785	99757	9315	109072	43852	3854	47706	182067	14349
1993	6284	530	6814	33455	4349	37804	68919	10263	79182	34975	997	35972	143633	16139
1994	1780	645	2425	16708	5387	22095	96644	5666	102310	27045	744	27789	142177	12442
1995	1979	1346	3325	14523	2898	17421	105743	4118	109861	82499	396	82895	204744	8758
1996	7692	805	8497	14563	1569	16132	76394	11976	88370	60408	7023	67431	159057	21373
1997	37912	800	38712	20357	520	20877	53227	4838	58065	45010	671	45681	156506	6829

Note: P - Pelagic, D - Demersal.

4.2.2.5 OUTBOARD TRAWLNET

Hornel (1938) observed that scant regard is given to fishing techniques for capture of demersal fishes by the artisanal fishermen and their attention is entirely upon the capture of shoaling fishes. With the advent of motorisation of traditional craft, many a fishing techniques of industrial fisheries were adopted by the traditional fishermen. One of the techniques is trawling with outboard engine fitted in country craft. The trawl nets generally used are 12.7 m two seam trawl net designed for operation from 8.4 m dugout canoes with 11 horse power out board engines.

Fig. 73. Outboard Trawl-net landings (in t)

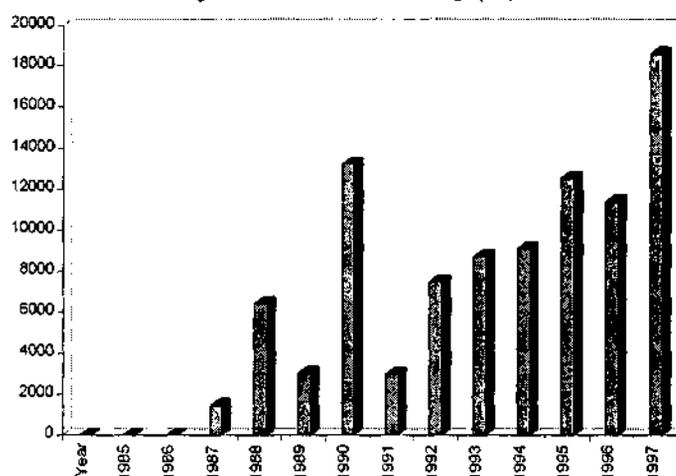


Table 97

Quarterwise Pelagic and Demersal landings by OBRS (in t)

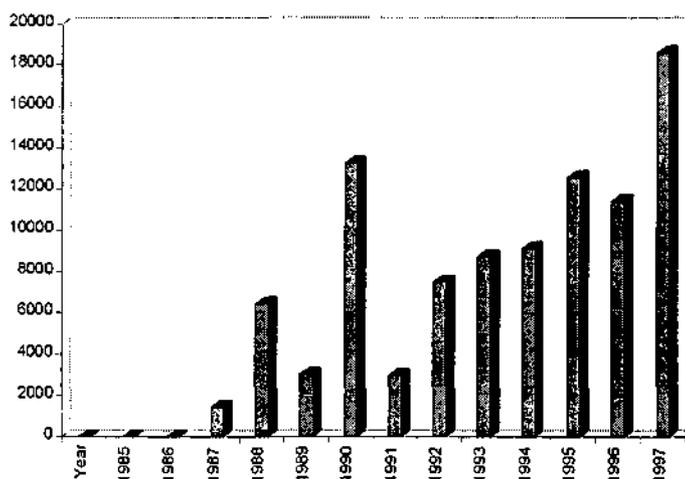
Year	I Qr			II Qr			III Qr			IV Qr			Total	
	P	D	Total	P	D	Total	P	D	Total	P	D	Total	P	D
1986	--	--	--	--	--	--	3245	548	3793	18374	331	18705	21619	879
1987	2544	1404	3948	1191	956	2147	19434	2382	21816	3359	288	3647	26528	5030
1988	677	--	677	7525	244	7769	23768	1831	25599	46312	1529	47841	78282	3604
1989	18418	237	18655	34749	16141	50890	82377	4258	86635	113108	1615	114723	248652	22251
1990	24956	2811	27767	29127	4090	33217	90581	4171	94752	101833	284	102117	246497	11356
1991	58673	986	59659	36580	1363	37943	80664	6982	87646	38700	2382	41082	214617	11713
1992	27235	618	27853	11223	562	11785	99757	9315	109072	43852	3854	47706	182067	14349
1993	6284	530	6814	33455	4349	37804	68919	10263	79182	34975	997	35972	143633	16139
1994	1780	645	2425	16708	5387	22095	96644	5666	102310	27045	744	27789	142177	12442
1995	1979	1346	3325	14523	2898	17421	105743	4118	109861	82499	396	82895	204744	8758
1996	7692	805	8497	14563	1569	16132	76394	11976	88370	60408	7023	67431	159057	21373
1997	37912	800	38712	20357	520	20877	53227	4838	58065	45010	671	45681	156506	6829

Note: P - Pelagic, D - Demersal.

4.2.2.5 OUTBOARD TRAWLNET

Hornel (1938) observed that scant regard is given to fishing techniques for capture of demersal fishes by the artisanal fishermen and their attention is entirely upon the capture of shoaling fishes. With the advent of motorisation of traditional craft, many a fishing techniques of industrial fisheries were adopted by the traditional fishermen. One of the techniques is trawling with outboard engine fitted in country craft. The trawl nets generally used are 12.7 m two seam trawl net designed for operation from 8.4 m dugout canoes with 11 horse power out board engines.

Fig. 73. Outboard Trawl-net landings (in t)



Out board trawl net (OBTN) operation started in Kerala in 1987. The mini trawling is another post motorisation innovation. It is being used in pockets in the whole of Kerala except for the belt South of Neendakara. In the central zone it is essentially the operation of those who have lost out in the upward spiral of the ring seine unit size. The entire operation is based on using obsolete craft and second hand engines. In the northern region the mini trawl nets are used in some areas as a diversification by the dugout canoe-gill net groups who are loosing out to the ring seine.

Even though this technology is being used just for survival it appears to be spreading its operation throughout Kerala. At present there are about 1648 motorised minitrawlers in operation (Anon 91).

Fig. 74. Outboard Trawnet Effort (in unit operation)

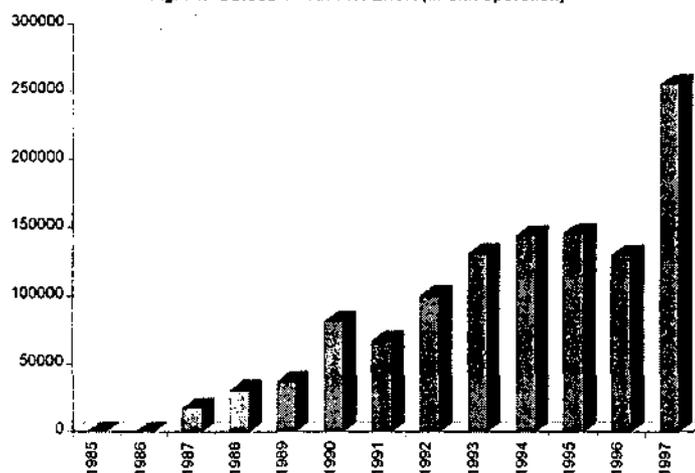
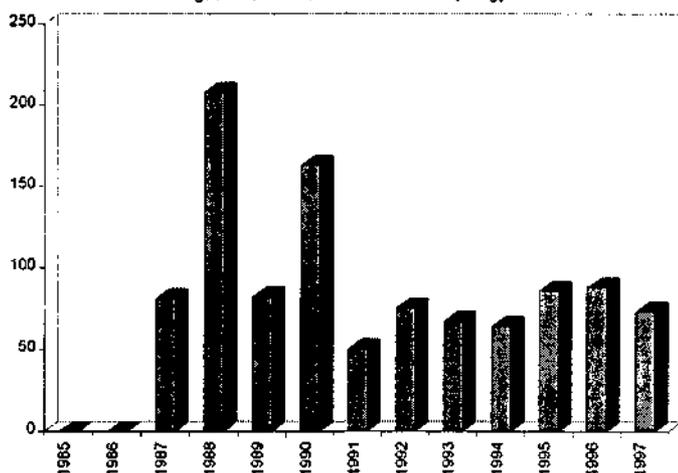


Fig. 75. Outboard Trawnet CPUE (in kg)



During the period 1987-97, OBTN landings in the state varied from 1454 t in 1987 to 18600 t in 1997 (table 72 pg. 96, fig. 73). OBTN efforts in terms of unit operation varied from 18000 in 1987 to 256000 in 1997 (fig. 74). Catch per unit effort varied from 50 kg. in 1991 to 208 kg. in 1988 (fig. 75). The percentage contribution of OBTN to the total landing varied from 0.4 pct in 1987 to 3.23 pct in 1997 (Table 48, pg. 59).

Table 98

Percentage contribution of OBTN in the landings of major group of fishes

Groups	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
Elasmobranchs	--	--	--	0.5	--	--	0.1	0.05	0.17	0.47	0.9
Lizard fishes	--	--	--	0.4	--	--	-	--	--	--	-
Perches	0.1	--	1.6	5.3	--	--	-	--	--	0.01	0.1
Croakers	--	7.2	1.4	1.9	0.9	1.5	0.8	1.6	2.5	2	5.7
Ribbon fishes	--	--	--	0.5	--	--	-	--	2.6	--	-
Carangids	--	--	0.1	0.6	--	0.2	-	--	0.2	0.36	0.1
Silver bellies	--	1	--	1.3	0.2	--	0.1	--	6.5	1.9	0.06

Groups	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
Big jawed jumper	--	--	--	1	--	--	0.1	--	0.17	0.2	0.05
Mackerel	--	--	--	0.2	--	--	-	--	0.02	0.01	0.03
Flat fishes	8.4	5	3	7.5	4.6	37	18.9	--	24	29.1	24.7
P Prawns	0.5	7	1.3	7	3	36	8.1	4.5	14.8	7.2	10.6
Cephalopods	--	--	0.7	4.6	--	--	-	0.4	0.18	0.01	-

Percentage contribution of OBTN in the landings of major group of fishes is given in table 98. Landings of croakers varied from 0.9 pct in '91 to 7.2 pct in '88. In the case of flat fishes it was 3 pct in '89 and 37 pct in '92. Contribution of this gear in the landings of penaeid prawns varied from 0.5 pct in '87 to 36 pct in '92 while in the share of cephalopods it was 0.7 pct in '89 and 4.6 pct in '90.

Quarterwise catch, effort and CPUE is given in table 99.

Table 99

Quarterwise Catch, Effort and CPUE of OBTN

Year	I Qr			II Qr			III Qr			IV Qr		
	Catch	Effort	CPUE	Catch	Effort	CPUE	Catch	Effort	CPUE	Catch	Effort	CPUE
1987	55	1600	34	164	4600	36	--	--	--	1235	12500	99
1988	--	--	--	74	3700	20	2391	9000	266	4005	18000	223
1989	463	8800	53	714	11000	65	7	300	23	1843	16000	115
1990	7182	31000	232	4759	29000	164	76	900	84	1239	21000	51
1991	1110	21000	53	779	15000	52	479	5000	96	645	26000	25
1992	4741	59400	80	2040	28000	73	136	3800	36	598	9100	66
1993	362	7481	48	1174	26809	45	2530	28711	88	4603	66707	69
1994	1972	38131	52	484	13027	37	2400	37666	64	4313	55275	78
1995	1914	52000	37	1527	29000	53	6934	31000	224	2209	33000	67
1996	2929	36000	81	2071	28000	74	3435	20000	172	2993	44000	68
1997	5343	73000	73	3281	53000	62	1601	15000	107	8375	114000	74

Note: Catch in tonnes; Effort in unit operation; CPUE in kg.

Maximum catch was observed during the fourth quarter. Effort also was maximum during fourth quarter. Catch per unit effort in the fourth quarter varied from 25 kg. in 1991 to 223 kg. in 1988. Quarterwise percentage contribution of different groups in OBTN is given in table 100.

Table 100

Quarterwise Percentage contribution of OBTN in the landings of major group of fishes

Group	FIRST QUARTER										SECOND QUARTER										
	1987	89	90	91	92	93	94	95	96	97	87	88	89	90	91	92	93	94	95	96	97
ELA	2	--	--	--	--	1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TF	--	2	10	--	--	7	--	--	--	--	--	--	2	6	--	--	--	--	--	--	--
OP	4	2	29	--	--	--	--	--	--	1	--	3	11	--	--	--	--	--	--	--	--
CR	7	3	--	4	--	3	--	--	--	3	--	2	--	2	--	1	--	--	--	--	--
CAR	--	--	--	--	--	3	--	--	--	3	--	--	--	--	--	--	--	--	--	9	--
SB	4	--	--	--	--	2	--	--	--	--	8	--	--	--	--	--	--	--	--	--	--
FF	11	46	8	21	43	24	28	--	31	29	25	7	48	8	26	26	32	17	12	37	27
PP	51	22	22	54	29	42	34	49	22	25	49	76	30	18	47	47	61	42	55	29	37
LJ	--	--	--	--	--	--	--	--	--	--	--	--	7	--	--	--	--	--	--	--	--
STO	18	11	8	8	17	1	29	24	40	35	3	9	6	18	6	15	--	28	18	14	26
CEP	--	--	11	--	--	1	--	--	--	--	--	--	7	--	--	--	--	--	--	--	--
CAB	--	--	--	--	--	4	--	--	--	--	--	1	--	--	--	2	--	--	--	--	5
OTRS	3	14	12	13	11	12	9	27	7	11	16	--	8	25	19	12	4	3	15	11	5
Total																					
Catch	55	463	7182	1110	4741	362	1972	1914	2929	5343	164	74	714	4759	779	2040	1244	484	1527	2071	3281

Table 100. Contd..

Group	THIRD QUARTER										FOURTH QUARTER										
	88	89	90	91	92	93	94	95	96	97	87	88	89	90	91	92	93	94	95	96	97
ELA	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TF	--	--	--	--	--	--	--	--	--	--	--	--	40	--	--	--	--	--	--	--	--
OP	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
CR	13	--	--	3	6	--	7	--	6	8	--	8	8	5	--	--	--	--	--	--	--
CAR	--	--	--	--	--	3	--	--	--	--	--	--	5	--	--	--	--	--	--	--	--
SB	1	--	5	--	--	--	--	--	--	--	--	1	--	--	--	--	--	--	--	--	--
FF	8	--	--	25	--	38	30	20	51	--	65	11	3	20	18	39	53	35	49	34	30
PP	74	43	68	70	57	52	48	59	26	72	16	73	21	55	77	53	36	28	24	40	28
LJ	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
STO	3	14	--	--	--	--	--	--	--	--	11	5	--	12	--	--	4	30	17	18	33
CEP	--	--	--	--	--	--	6	--	--	--	--	--	9	--	--	--	--	--	--	--	--
CAB	--	--	--	--	--	--	--	--	--	--	6	--	--	--	--	--	1	--	--	--	--
OTRS	1	43	27	2	37	7	10	21	17	20	2	2	14	8	5	8	6	17	10	8	9
Total																					
Catch	2391	7	76	479	136	2530	2400	6934	3435	1601	1235	4005	1843	1239	645	598	4603	4313	2209	2993	8375

Croakers, soles, penaeid prawns and stomatopods are the major groups landed by this gear. Contribution of croakers varied from 2 pct in the second quarter of 1989 to 13 pct in third quarter of 1988. Soles were available almost throughout the year. Maximum of 65 pct of the OBTN landings was observed during the fourth quarter of 1987 by this fish. Penaeid prawns were the most important group landed by this gear throughout these

years. Percentage contribution of the groups varied from 16 pct in the fourth quarter of 1987 to 77 pct in the fourth quarter of 1991.

Stomatopods:

Stomatopods were available in OBTN landings in most of the years during 1987-97. Its contribution varied from 3 pct in the second quarter of 1987 to 18 pct in the second quarter of 1990. Table 101 gives quarterwise pelagic and demersal landings by OBTN in Kerala during 1987-97. OBTN is mainly meant for harvesting the demersal group of fishes. Maximum contribution of demersal group was noticed during fourth quarter of these years. It varied from 598 t in 1992 to 8375 t in 1997.

Table 101

Quarterwise Pelagic and Demersal landings by OBTN (in t)

Year	I Qr			II Qr			III Qr			IV Qr			Total	
	P	D	Total	P	D	Total	P	D	Total	P	D	Total	P	D
1987	--	55	55	7	157	164	--	--	--	--	1235	1235	7	1447
1988	--	--	--	--	74	74	--	2391	2391	--	4005	4005	--	6490
1989	--	463	463	--	714	714	--	7	7	110	1733	1843	110	2917
1990	--	7182	7182	381	4378	4759	--	76	76	--	1239	1239	381	12875
1991	--	1110	1110	--	779	779	--	479	479	--	645	645	--	10168
1992	44	4697	4741	10	2030	2040	35	101	136	--	598	598	89	7426
1993	44	318	362	6	1238	1244	125	2405	2530	134	4469	4603	309	8430
1994	--	1972	1972	5	479	484	10	2390	2400	110	4203	4313	125	9044
1995	21	1893	1914	3	1524	1527	753	6181	6934	60	2149	2209	837	11747
1996	--	2929	2929	205	1866	2071	507	2928	3435	15	2978	2993	727	10701
1997	65	5278	5343	26	3255	3281	199	1402	1601	45	8330	8375	335	18265

Note: P - Pelagic; D - Demersal.

5. DISCUSSION

Marine fishing using artisanal tackle is an age old tradition in Kerala. Mechanization was experimented in the late fifties. The early sixties witnessed the shift from cotton to nylon nets. Commercial purse seining started in the late seventies and the large scale motorization of country craft started in the early eighties.

About two third of the marine fish landings in Kerala was by artisanal sector till 1979. Due to large scale motorization area of fishing ground has been extended.

During the last 48 year period ie, 1950-97. the annual marine fish landings in the state varied from 105457 t in 1955 to 662890 t in 1990. There was a steady increase in the marine fish landings of the state. After the large scale introduction of OBRS the marine fish landings always crossed 4.7 lakh t. The estimated catchable potential yield of Kerala

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	P	D	Total	P	D	Total	P	D	Total	P	D	Total	P	D
1987	--	55	55	7	157	164	--	--	--	--	1235	1235	7	1447
1988	--	--	--	--	74	74	--	2391	2391	--	4005	4005	--	6490
1989	--	463	463	--	714	714	--	7	7	110	1733	1843	110	2917
1990	--	7182	7182	381	4378	4759	--	76	76	--	1239	1239	381	12875
1991	--	1110	1110	--	779	779	--	479	479	--	645	645	--	10168
1992	44	4697	4741	10	2030	2040	35	101	136	--	598	598	89	7426
1993	44	318	362	6	1238	1244	125	2405	2530	134	4469	4603	309	8430
1994	--	1972	1972	5	479	484	10	2390	2400	110	4203	4313	125	9044
1995	21	1893	1914	3	1524	1527	753	6181	6934	60	2149	2209	837	11747
1996	--	2929	2929	205	1866	2071	507	2928	3435	15	2978	2993	727	10701
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During the last 48 year period ie, 1950-97. the annual marine fish landings in the state varied from 105457 t in 1955 to 662890 t in 1990. There was a steady increase in the marine fish landings of the state. After the large scale introduction of OBRS the marine fish landings always crossed 4.7 lakh t. The estimated catchable potential yield of Kerala

is 5.99 lakh t. When ever a new gear was introduced, there used to be an upward trend in the landings of pelagic group of fishes. Among the pelagic resources the dominant ones are oil sardine, mackerel, other sardines, white baits, seer fishes, tunnies, carangids and ribbon fishes. The contribution of oil sardine varied from 1554 t in 1994 to 247048 t in 1968 with a declining trend over the years. During the period 1984-87, OBBS was the major gear for this fish and there after it was OBRS. Maximum landings of oil sardine was noticed during fourth quarter. Of late role of non-motorised sector in the landings of oil sardine became insignificant.

Mackerel landings in the state varied from 3599 t in 1968 to 128411 t in 1996. More than 54 pct of the mackerel landings in the state during 1989-97 was by OBRS. During this period, contribution of non-mechanized gears in the landings of this fish is negligible. Generally maximum landings of mackerel was noticed during fourth quarter.

White bait landings in Kerala varied from 2718 t in 1965 to 55042 t in 1983. OBBS and OBRS were the main contributors to the landings of this group. After the introduction of OBRS during 1986, there was an increasing trend in the landings of other sardines in Kerala. More than 50 pct of the other sardine landings was by OBRS during 1989-97. There was an increasing trend in the landings of carangids during the period 1986-97. At present TN and OBRS are the two major gears for this group. Maximum landings were observed during the third quarter. There was an increasing trend in the landings of tunnies from 1974 onwards. Gears operated with the help of OB engines were the major tackles for this group of fishes during the later half of eighties. Contribution by mechanized gill net was showing a declining trend. The main contributors in the landings of seer fishes were MGN and OBGN. Of late, OBGN is assuming the major role in the harvest of seer fish. Production of ribbon fish varied from 169 t in 1964 to 30192 t in 1974. There were wide fluctuations in the landings of this fish over the years. Maximum landings was observed during the third quarter. During monsoon period this fish was available in OBBS at Trivandrum region along with white baits. NMBS was the major gear employed for fishing ribbon fishes during 1984-87, but OBBS has taken its place in the latter years. Landings of demersal group of fishes varied from 23418 t in 1953 to 278012 t in 1994. Large scale introduction of trawlers in the 1970's and extended grounds of fishing resulted in augmenting the production of this group. Among the demersal group of fishes the dominant ones are elasmobranchs, cat fishes, perches, croakers, lizard fishes, silver bellies, big jawed jumper, soles, goat fishes, penaeid prawns and cephalopods. Contribution of catfishes varied from 192 t in 1997 to 33526 t in 1974. During 1991 more than 50pct of the catfish landings was by trawl net. The near shore trawling in pre-monsoon period damaged new recruitment of catfishes by removing the juveniles and sub adults from the feeding grounds. There is an increasing trend in the landings of perches from 1973 onwards. Maximum occurrence was observed during 1984-97. Increased landings of perches can be attributed to large scale introduction of trawlers and change of fishing grounds. It is observed that more 80pct of perch landings during 1984-97 was by trawlers, major component being nemipterids. In the case of croakers more than 50pct was landed by trawlers in the above period except 1986. There was an increasing trend in the landings of lizard fishes from

1970 onwards. Trawlers landed more than 94pct of the lizard fishes during 1984-97. TN, MGN and OBGN are the major gears which contributed substantially to the elasmobranchs landings in Kerala during 1984-97. Maximum landings was noticed during the fourth quarter. There was a sharp increase in the landings of flat fishes during 1982-97, due to increased operation of trawlers, which is the main gear for this group of fishes. The major gears which contributed to the landings of big-jawed jumper during 1984-97 were TN, OBBS, OBGN and NMGN. Trawling has an adverse effect on the stock of this fish. There is drastic reduction in the landings of silver bellies. The main gear for this group was the trawls. During 1984-85, NMGN was the major gear for goat fish landings in Kerala. Subsequently trawl net became the major gear. There was an upward trend in the landings of this group over the years. This increase could be due to the extended area of operation by trawlers beyond the conventional limits. Penaeid prawn landings in Kerala varied from 12798 t in 1960 to 84770 t in 1973. Peak landings was noticed during 1972-76 and in 1986-94. In all the years more than 66pct of landings was by trawlers. Till 1986, OBBS was second to trawl nets and after 1988, OBRS has taken the place of OBBS. There was a marked increase in the landings of cephalopods from 1977 onwards. The rate of increase in the cephalopods landings was maximum during the period 1986-97. Trawl was the major gear for this group over the years.

After motorization of country craft, the contribution from non-mechanized sector which was 65pct in 1981, started declining and its share was only 3.38 pct in 1997. Though OBRS was introduced in 1986, then its contribution was only 5.8pct, it went upto 41.84pct in 1989. Now it is the chief gear for bulk production, even some times surpassing trawlers. After the imposition of partial banning of trawling during monsoon period in 1988-97, there was an increasing trend in the landings of the non-mechanized sector.

Penaeid prawns, stomatopods, threadfin breams, cephalopods, flat fishes, other perches, lizard fishes carangids and croakers were the major groups of fishes landed by trawlers during 1985-97. More than 90pct of the lizard fish landings in Kerala during 1984-97 were by this gear, whereas in the case of perches it was 80pct. The introduction of modified medium trawlers which were deployed in the new fishing grounds brought out good catches of goat fishes.. More than 95pct of the goat fish landings in Kerala during 1987-97 was a result of this kind of operations.

Over the years purse seine operation in Kerala is showing a declining trend. At present there are only 76 purse seiners are in operation. Oil sardine, mackerel, tunnies, carangids and other sardines were the major shoaling pelagic constituents of purse seine landings. Almost all the groups exhibit a declining trend in the contribution of purse seine over the years.

Elasmobranchs, cat fishes, seer fishes and tunnies were the major group of fishes landed by mechanized gillnetters in Kerala during 1984-97. Elasmobranchs, seer fishes and tunnies were landed by this gear throughout the years. It is observed from the catches that tunnies stand as the prime target of this gear.

After the introduction of outboard engine fitted country craft, contribution of non-mechanized sector was fast decreasing. There was an increasing trend in the landings of this sector after imposition of partial ban of trawling during monsoon period. Large scale motorisation of country crafts in Kerala began in early eighties. Out board engines fitted in the country craft are being used for fishing with boat seines and trawl nets. Contribution of motorized sector during 1985-97 varied from 22848 t in 1981 to 400201 t in 1989. From 1989 onwards, more than 40 pct of the marine fish landings in Kerala were by motorized sectors. OB Boat seine operations had began in Kerala during the second half of 1980. There was an increasing trend in the landings of this gear upto 1986. After the introduction of OB-ring seine in 1986 the landings by OB-boat seine started declining. Major group of fishes landed by this gear is oil sardine, it was available in this gear through out the year. There was an increasing trend in catch effort and CPUE of OBGN in all the quarters after the imposition of partial ban of trawling during monsoon season. Except in 1984 and 1988 more than 50 pct of the seer fish landings in Kerala during 1984-97 was by OBGN with a maximum of 80 pct in 1991. As in the case of OBGN there was an increasing trend in catch effort and CPUE of OBHL in all the quarters after 1988.

During the period 1986 to 1997 OBRS landings in the state varied from 22498 t in 1986 to 270903 t in 1989. There was tremendous increase in the landings by this gear from 1988 onwards. This increase coincides with the period of partial banning of trawl net operation in Kerala. The percentage contribution of OBRS to the total landings varied from 5.8 in 1986 to 41.8 in 1989. During the period 1989 to 1997, more than 65 pct each of oil sardine, other sardine and mackerel landings in the state was by this gear.

With the advent of motorisation of traditional crafts many a fishing techniques of industrial fisheries were adopted by the traditional fishermen. One of the techniques is trawling with out board engine fitted in country crafts. OBTN operation started in Kerala in 1987. During the period 1987-97 OBTN landings in the state varied from 1454 t in 1987 to 18600 t in 1997.

Exploratory fishing operations carried out in the inshore deeper waters of Kerala by the Government of India vessels brought to light many potential productive trawling grounds. The survey conducted along Cannanore and Calicut, in the late fifties and early sixties by bull trawling and otter trawling revealed good grounds of threadfin breams (Raguprasad *et.al*, 1963).

Recent surveys by Fishery Survey of India vessels along North Kerala coast revealed rich grounds between 100-200 m depth zone, of nemipterids, lizard fishes, *Priacanthus*, decapterids, cephalopods and crabs. In the 200 - 500 m depth zone black-ruff was the dominant species followed by *Priacanthus*, deep sea prawns, deep sea sharks, *Chlorophthalmus* sp. and deep sea lobsters. These surveys established availability of some potential demersal resources (Vijayakumaran *et al* 1990).

In the grounds off Cochin within a depth zone of 101 -179 m good stock of threadfin breams, *Centropristis* sp., *Emmelichthys* sp., *Priacanthus* sp., and *Parasclopsis* sp. was indicated.

In the Quilon bank especially in the upper continental slope (180 - 450 m) new potential grounds of the following species viz., *Chlorophthalmus* sp., *Chascanopsetta* sp., *Epinula* sp., *Polymixia* sp., *Psenopsis* sp., *Cubiceps* sp., *Aristeus* sp., *Aristeomorpha* sp., *Metapenaeopsis* sp., *Penaeopsis* sp., *Heterocarpus* sp., and *Parapandalus* sp. were discovered. A significant discovery was the location of commercially exploitable stocks of deep sea lobsters on the continental slope. Commercial exploitation was carried in the late eighties and early nineties.

Some amount of midwater trawling conducted by the erstwhile INP vessels revealed the presence of large quantities of file fishes (Balistidae) on the shelf from Calicut to Kayamkulam at 50 - 110 m depth. Crab resource is one of the least exploited one and the investigations revealed a rich ground of crabs along the mud bank region of Kerala.

Trawling in the coastal waters also created several environmental problems and stock recruitment maladies to fisheries sector. The shallow bottom scraping by the trawlers damaged the population of many species along with destruction to bottom dwelling non-edible biota which are the major producers of several plankton groups. In the total trawl production roughly about 1.5pct is composed of juvenile and sub adults of a wide variety of commercially important food fishes of pelagic and demersal habitats and prawns which are discarded. (Indian environmental crisis and responses, 1985).

Kerala has formulated some restrictions on the areas that can be fished by different classes of fishing vessels mainly to avoid conflict between them. The areas are defined in terms of depth. Kerala has also specified legal mesh size for the trawl coded, the minimum allowed mesh size is 35 mm. The cod end mesh size of 35 mm has been scientifically established as the optimum dimensions for a prawn fishery dominated by the two species *P.stylifera* and *M.dobsoni* (James 1992).

The progressive growth of fisheries in Kerala can be divided into three different levels, subsistence, artisanal and small scale. The period upto the sixties can be considered as belonging to the subsistence level. The revolutionary change in the gear material and the slow but vivid attempts towards mechanization gave a fillip to the production in terms of quantity and the real value realized. The demand for shrimp in the export market was another impetuous in the slow process of mechanization and related growth. The seventies belong to the artisanal and the small scale fishery.

In an artisanal state of fishery, that came into existence in Kerala at the end of sixties and continuing, there were no policies that were sensitive to contexts and alternatives. In this context no single analytic frame can be offered where no goals can be ranked. When the resource is considered as common property and the access to it as free the growth takes the form of undefined one and goals became less distinct and hence distant. In a

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developing state like Kerala, three classes of marine resource management which (ade) observed, conservation and distribution. Those three exist simultaneously. In the initial years, the development was oriented towards mechanization and induction of newer technology; these were allowed to become ends in themselves

In the management of marine resources the prime aim was in attaining more production and this has become the end in itself, scant attention was paid in protecting biotic stocks. Conservation enables production to continue. Free access to the marine resource dooms it to over exploitation by fishermen each of whom sees no reason to abstain from catching what might otherwise be caught by his competitor. The introduction of ring seines has created a situation where without giving adequate regard to local settings, over emphasis was given on new technology which has resulted in a piquant scene at least for a short time. Continued exploitation by a particular type of gear will expose the vulnerability of stocks and evermore the greed for resources, so intense will be the competition, which will ultimately render stocks biologically overworked.

So far the unimposed aims were to produce enough fish to satisfy internal demand to meet protein requirement of the low income population and export high value items, thereby achieve profitability, employment, foreign exchange etc. but the priorities have not been ranked.

Kerala, which is having a coastline of 590 km is experiencing one of the highest fishing pressure in the country. There are about 3000 trawlers, 2000 ring seines and thousands of other allied gears competing in a climatically limited area. Pelagics are the main stay of motorised and non-motorised sector but of late trawlers too make forays into the traditional hold of the artisanal sector.

Sudarsan *et al* (1989) recorded the level of exploitation of demersal stocks from the nearshore area within 50m depth in the south west coast as 1.75 lakh t. This exceeds the potential yield estimates for the area and necessitates reduction in the fishing pressure.

If catch per unit effort can be taken as indicator of feasible fishing both in terms of resources and commercial exploitation, cpue did not show much of improvement over the years in spite of the investments made but the unit value realisation in terms of return helps to keep the momentum. A decline in the cpue might reflect not a decrease of fish but an increase of fishing effort also.

The study reveals that the inshore region of Kerala (upto 50m depth) today stands as one of the highest exploited region in the sub continent. Though the traditional fishermen belonging to the artisanal sector could successfully motorize their craft, the extension of area of operation did not widen in tune with the pace and intensity of motorisation. This has lead to competition which is deleterious in effect among the motorised fishing craft and in between motorised and non-motorised sector.

A unique phenomenon popularly called 'Chakara' - mud bank fishery is found only in Kerala. The indigenous fishing during south west monsoon starts along with the onset of monsoon. The motorised and non-motorised sector engage fully themselves in this period. The fishing ground usually will be within 6 km and within a depth range of 10m. Prior to the introduction of ring seines, boat seines were having the prime position but of late ring seines have almost replaced boat seines. There was no concerted effort to exploit the deep sea resources, yet there were sporadic attempts, continuous and economically viable attempt is essential to establish the feasibility.

Prior to the introduction of out board motors and there after traditional sector was concentrating on the exploitation of pelagics with conventional gears like boat seine, gill nets etc. but the introduction of ring seine for bulk fishing in the same area created unhealthy competition within the traditional sector itself and also among the ring seine operators. Of course, this has resulted in a boost in production but the question is how long the spurt in production will last. When the spurt in production stabilised or when the resources start showing a declining trend the situation can lead to chaos. The result is some gained and some lost and the hunt for the same target groups increases deprivation among some sectors which ultimately lead to discontent.

Though there is escalation of fish prices, introduction of new units in all sectors needs economic viability in the light of the inter gear competition for the conventional fish groups. This would also ensure the least possibility of labour displacement and sustainability of yield.

In such a situation, what are the possibilities for increasing the productivity - will limiting fishing technology help increase in productivity ; what are the prerequisites of healthy state of biomass, effects of gear limitation or excluding certain gear over space and time. Such a situation warrants technology suitable and sensitive to the situation, so to say appropriate technology.

6. CONCLUSION

- (1) Annual marine fish landings of Kerala show heavy fluctuation over the years and there is an upward swing after getting lesser landings during previous year.
- (2) After large scale introduction of ring seine the annual marine fish landings always crossed 4.7 lakh t .
- (3) Whenever a new gear is introduced in the state there used to be an upward trend in the landings of pelagic group of fishes.
- (4) Of late, OB boat seine is replaced by OB ring seine in the oil sardine fishery.

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- (4) Of late, OB boat seine is replaced by OB ring seine in the oil sardine fishery.

- (5) Prior to the introduction of ring seine, gill nets and purse seines were the main contributor in mackerel fishery, now ring seines have totally replaced other gears especially purse seine.
- (6) There is a marked improvement in the landings of whitebaits since 1982 coinciding with motorisation of indigenous craft.
- (7) Till 1987 landings of other sardines were in a stagnating stage, from 1988 onwards it shows an upward trend mainly due to ring seine operations.
- (8) Carangids show an increasing trend from 1986 onwards partially due to extended area of operation of trawlers and introduction of ring seines.
- (9) In the case of tunnies purse seine ceased to be a contributor. OB gill net and OB hook and line have taken its place.
- (10) There is a marginal increase in the landings of seer fishes during latter half of eighties. OB gill net is the main contributor.
- (11) The landing pattern of ribbon fishes and whitebaits showed an inverse relationship. During south-west monsoon boat seine operations bring good harvest of ribbon fishes.
- (12) Cat fish is caught mainly by trawlers, OB hooks and lines and OBGN. Landings from purse seine is negligible. There is a declining trend over the years in the production of catfish.
- (13) Maximum occurrence of Perches was observed during 1984-97. Trawl continue to be the main contributor. The increase in perch production is mainly due to the extended area of operation and effort put in by trawlers.
- (14) Production of croakers continue to be in a steady state in spite of the increase in effort by trawlers. Trawlers continue to be the main gear.
- (15) Coinciding with increased number of trawler operations landings of lizard fish also show an upward trend. More than 95% of lizard fish is landed by trawlers.
- (16) The landings of elasmobranchs show a steady state. Trawlers, OBHL and OBGN are the main gears. At a few centres long lines also land large sized sharks, seasonally.
- (17) There is a sharp increase in the landings of flat fishes from 1980 onwards. Trawl net is the main gear for this fish.

- (18) There is a declining trend in the landings of big jawed jumper from 1973 onwards. TN, OBGN and NMGN are the main gears. Trawl catch consist mainly of sub adults.
- (19) Landing of Silver bellies show a decreasing trend from 1975 onwards. TN, OBRS and NMSS are the main gears.
- (20) There is a steep increase in the landings of goat fish from 1988 onwards. Trawl is the major gear.
- (21) There is a marked increase in the landings of Cephalopods from 1986 onwards. When trawls aim on Cephalopods at hitherto unexploited grounds goat fishes form the bye catch.
- (22) There is an increasing trend in the landings of Penaeid prawns over the years. Trawl net is the main gear; till 1988 OBBS was next important gear from artisanal sector and thereafter it was replaced OBRS.
- (23) Till 1982 more than 50% of the marine fish landing came from non-motorized traditional sector. After motorisation of indigenous craft share of this sector went down drastically, while contribution from motorised sector went up to 61% . This shift did not bringforth any labour replacement. At present OBRS and trawl are most important gears in bulk fishery.
- (24) Though there is not much of variation in effort, landings from trawl show an upward trend.
- (25) During monsoon trawlers land good quantity of Penaeid prawns, Nemipterids and lizard fishes.
- (26) In 1984 catfishes, lizard fishes, perches, croakers, silver billies, flat fishes, penaeid prawns and cephalopods were the major components of trawl landings whereas in 1991 they were elasmobranchs, cat fishes, white baits, lizard fishes, perches goat fishes, croakers, ribbon fishes, silver bellies, big jawed jumper, flat fishes, Penaeid prawns and cephalopods.
- (27) Of late, landing of pelagics by trawlers show an upward trend.
- (28) Overall performance of Purse seiners over the years present a dismal picture. The contribution of purse seiners was 5% in 1984 and it declined to 0.1 % in 1988.
- (29) During 1984 mechanized gill net contributed more than 26% of elasmobranchs, cat fishes, seer fishes and Tunnies, but it went down to less than 6% in 1991. The declining trend is reflected over the years.

- (30) The mechanized hook and line shows a declining trend over the years. MHL is the main gear for Kalava fishing and for large sized sharks.
- (31) Non-mechanized gill show a decreasing trend over the years. Other sardines, goat fishes, carangids, big jawed jumper, mackerel and tunnies were the major components in 1984. When other gears entered the scene NM gill net lost its importance.
- (32) At present substantial contribution of big jawed jumper comes from non-mechanized gill net.
- (33) The contribution of non-mechanized boat seine was 18% in 1984 and it went down to 0.4% in 1989. This is mainly due to the introduction of motorised country craft.
- (34) In 1984 non-mechanized shore seine landed 45% of ribbon fishes produced in Kerala, now it is negligible.
- (35) When motorisation picked up momentum, contribution from OB boat seine reached 34% in 1984 but it drastically went down to 2.63% in 1995. This is due to introduction of ring seines during this period.
- (36) Contribution of OB gill net shows an upward trend. This is mainly due to the lesser effort put in by MGN, introduction of new gear and craft material and motorisation.
- (37) At present OB hook and lines land nearly 25% of cat fishes and tunnies.
- (38) Contribution of OB Ring seine was 6% of the total landings in 1986, now it is almost 40%. This is the main gear for bulk fishery.
- (39) Introduction of OB trawl net was an offshoot of motorisation. At present contribution from this gear is only 3%. The operational limit is 10 m.
- (40) Fishing pressure is high in Kerala and it often touches the potential estimates.
- (41) Introduction of OB Ring seines and remodelling of trawlers brought a steep increase in investment in fisheries of Kerala.
- (42) There is escalation officious prices, though it is beneficial to the industry it may deny cheap animal protein to the low income section of population.
- (43) Ring seines exploit mainly pelagics while trawlers concentrate on demersals, whether exploitation by one type of gear will have any harmful effect on biotic stocks is to be studied especially in the light of mesh size currently in use.

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Abbreviations:

ALP	Alleppey
AN	Anchovy net
AV	Ayila vala
AVV	Avoli vala
BAR	Barracudas
BJ	Big jawed jumper
BSGN	Bottom Set Gill Net
CA	Canoe
CAB	Crabs
CAR	Carangids
CAT	Catamaran
CEP	Cephalopods
CF	Cat fish
CHV	Chittan vala
CLT	Calicut
CMV	Chemmeen vala
CNR	Cannanore
COT	Cotton
CR	Croakers
CV	Chala vala
D	Demersal
DGN	Drift Gill Net
DN	Drift net
DO	Depth of Operation
DV	Disco vala
EDV	Eadakettu vala
EE	English equivalent
EKM	Ernakulam
ELA	Elasmobranchs
EV	Echa vala
FC	Flat fishes
FF	Fishery craft
GF	Goat fish
GNR	Gillnetter
HB	Half beaks & full beaks
HM	Horse mackerel
IM	Indian mackerel
KAS	Kasargode
KGV	Kengoose vala
KNV	Kantha vala

KV	Kacha vala
LBN	Lobster net
LF	Lizard fishes
LJ	Leather jacket
LN	Local name
M	Motorised
MAL	Malappuram
MGN	Mechanized gill net
MHL	Mechanized Hooks & lines
MKV	Mathi kettu vala
MLV	Malan vala
MN	Mackerel net
MS	Mesh size
MU	Material used
MUL	Mullet
MUN	Mullet net
MV	Mathi vala
NM	Non-motorised
NMBS	Non-motorised boat seine
NMGN	Non-motorised gill net
NMHL	Non-mechanized Hooks & line
NMSS	Non-motorised shore seine
NV	Noo vala
OBBS	Out board boat seine
OBGN	Out board gill net
OBHL	Out board hooks & line
OBRs	Out board ring seine
OBTN	Out board trawl net
OC	Other clupeids
OP	Other perches
OS	Oil sardine
OSS	Other sardines
OTCR	Other carangids
OTRS	Others
OV	Ozhukku vala
P	Pelagic
PAV	Pachi vala
PF	Pig face bream
PLV	Ply vallom
PN	Pomfret net
POM	Pomfret
PP	Penaeid prawn
PRN	Prawn net
PS	Purse seine
PV	Pattu vala

QLN
RA
RC
RF
RN
RV
S
SAN
SB
SC
SF
SGN
SH
SHGN
SM
SN
STO
SV
TCR
TDV
TF
TL
TO
TOT
TRN
TU
TV
TVM
TY
VV
WB
WH
WSN

Quilon
Rays
Rock cods
Ribbon fishes
Ray net
Real vala
Season
Sardine net
Silver bellies
Scads
Seer fishes
Set gill net
Shooks
Shark gill net
Synthetic material
Snappers
Stomatopods
Sravu vala
Trichur
Thirandi vala
Thread fin breams
Total length
Type of operation
Total
Trammel net
Tunnies
Thathu vala
Trivandrum
Thryssa
Veluri vala
Whitebaits
Wolf herring
White sardine net