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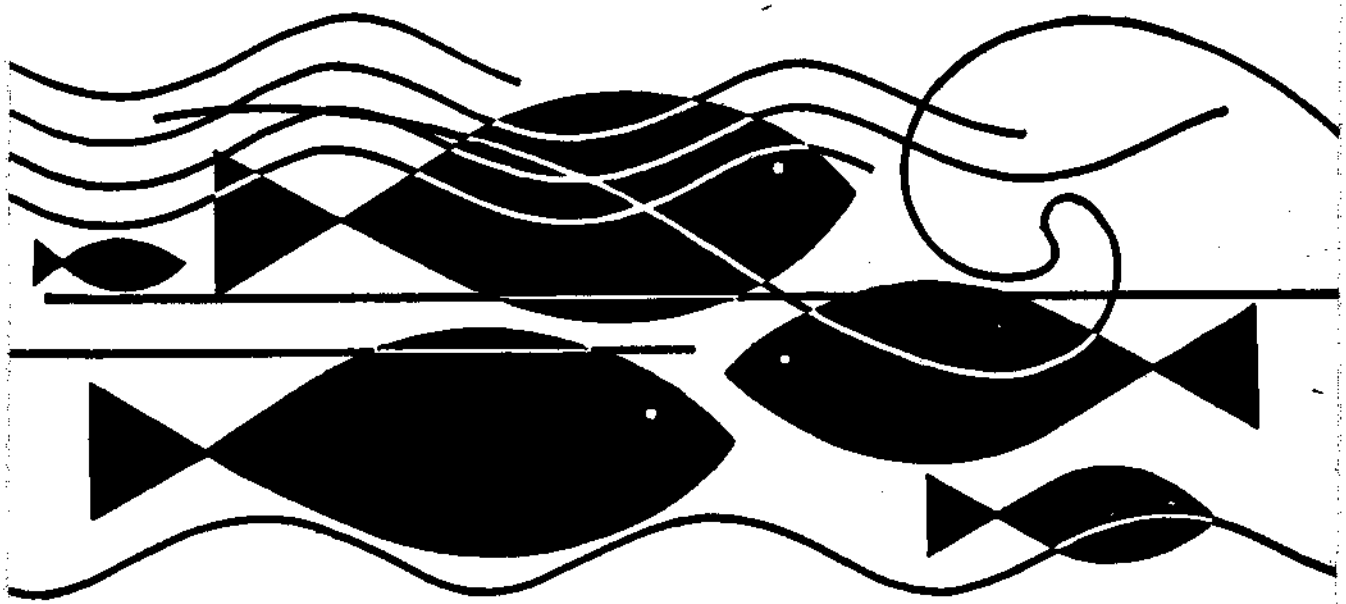

Issued in connection with the 40th Anniversary Celebrations of

Central Marine Fisheries Research Institute
P. B. No. 2704, E. R.G. Road, Cochin 682 031, India
Indian Council of Agricultural Research
September 16-18, 1987

AN APPRAISAL OF THE MARINE FISHERIES OF KARNATAKA & GOA

K. NARAYANA KURUP, G. KRISHNAN KUTTY NAIR, V. P. ANNAM, ABHA KANT, M. R. BEENA AND LATHA KAMBADKAR

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Dr. P. S. B. R. JAMES
Director
Central Marine Fisheries
Research Institute
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E. R. G. Road
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India

Cover drawing by Shri K. K. Sankaran
Artist
CMFRI, Cochin

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- Landing centres of Karnataka
- Landing centres of Goa

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PREFACE

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

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

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

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

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P. S. B. R. James
Director

AN APPRAISAL OF THE MARINE FISHERIES OF KARNATAKA AND GOA

K. Narayana Kurup, G. Krishnan Kutty Nair, V. P. Annam, Abha Kant, M. R. Beena and Latha KambadKar

INTRODUCTION

Karnataka, on the west coast, plays an important role in the fisheries development of India and has a prominent place in the country's fisheries map. It has a shelf area of 25000 Sq. Km. and a coastline of 270 Km, about 1/22 of the country's coastline. The State's contribution to the total marine fish production in the country is of the order of 9.0%. The State has two coastal districts, namely Dakshin Kannada and Uttar Kannada. The lengths of coastline of both the districts are almost the same. Many rivers such as the Nethravathi, the Saravathi and the Kali flow into the Arabian sea and render the inshore area rich in nutrients.

Although fishing has been a traditional occupation of the inhabitants on this coastal belt since time immemorial no concerted effort was made to expand this traditional area of activity into a real industry or to exploit the resources fully until the early sixties. Nevertheless, over the last two decades several technological innovations in fishing have been implemented resulting in the improvement of marine fish production and in the growth of industry, the mechanized craft and gear slowly and steadily replacing the traditional non-mechanized ones. The rampani is a classical example of on erstwhile widely prevalent traditional gear that has suffered a set back in the face of mechanization. Introduced in Goa a century ago, rampani had soon won the acceptance almost at once in

Karnataka and Goa and had been the most important gear here ever since till the more efficient purse seines replaced them. The purse seine, first introduced in Goa and then in Karnataka in 1977, has grown tremendously in number and Karnataka now has the distinction of operating the maximum number of purse seines in the country, closely followed by Goa.

The fishing season in Karnataka-Goa begins in September and extends up to May. Important fisheries are oil sardine, mackerel, catfishes, croakers, seer fishes and penaeid prawns. Types of craft commonly used by traditional fishermen are rampani boats, dugout canoes and out-rigger boats. Popular gear used by artisanal fishermen include rampani, small shore seines, gillnets, drift nets and hooks and lines. Mechanized craft include purse seiners, trawlers and gill netters.

Marine fish production in Karnataka over the last two decades has shown wide fluctuations, trend often determined by two pelagic species, oil sardine (*Sardinella longiceps*) and mackerel (*Rastrelliger Kanagurta*). Fishing is mostly confined to near shore area leaving most of the 9700 Sq. Km. of inshore area underexploited.

Characteristics of marine fisheries in Goa are in many a way similar to those of Karnataka. Goa State, contiguous to Karnataka in the west coast, has a coastline of 153 km and a shelf area of about 10000 Sq. Km Goa's contribution to the total marine fish production in the country is of the order of 2%. It has the distinction of introducing the non-mechanized gear rampani and the mechanized purse seine. both of which still continue to be the dominant gear in operation in the respective areas. Major resources in Goa are oil sardine, mackerel, other sardines, penaeid prawns and croakers. Marine fisheries in Goa over the last decade has shown an increasing trend.

During this period, the fisheries in Karnataka and Goa have undergone changes both qualitatively and quantitatively. The inshore waters of both these have been heavily exploited and the marine fish production now appears to be almost stabilized. An attempt is made here to make an appraisal of fishery resources currently exploited in these two regions. The discussion is largely based on the data collected by Central Marine Fisheries Research Institute through a multi-stage stratified sample survey.

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MEANS OF PRODUCTION

For planning developmental programmes in fisheries sector the means of production such as the number of fishermen involved, fishing equipments and fishlanding facilities are an essential prerequisite. The census carried out by this Institute in 1980, as a national programme, gives us these details, of which those pertaining to Karnataka are given in this chapter.

Fishing Villages and Landing Centres

In Karnataka there are 147 fishing villages and 105 fishlanding centres distributed in the two coastal districts, namely Dakshin Kannada and Uttar Kannada, the former comprising 77 villages and 55 landing centres and the latter 70 villages and 50 landing centres.

Population

There are about 15,600 fishermen households in Karnataka State, 58% of them in Dakshin Kannada district and the remaining in Uttar Kannada district. Out of the marine fishermen population of 1 13 lakh, about 71,000 (63%) are in Dakshin Kannada district and the remaining 37% in Uttar Kannada. The adult population, which forms the major component of productive labour, accounts for 60% of the total population, of which 29% are males and 31% females. Adult males account for 29% of the population in both the districts but proportions of adult females and children differ.

Table 1. *Districtwise distribution of fishing villages and fishermen population in Karnataka (Ref. Year 1980)*

Sl. No	Item	Districts		Total
		Dakshin Kannada	Uttar Kannada	
1.	Fishing villages	77	70	147
2.	Landing centres	55	50	105
3.	Fishermen household	8992	6646	15638
4.	Fishermen population:			
a)	Male	20544	12171	32715
b)	Female	23070	11818	34888
c)	Children	27214	18076	45290
	Total	70828	42065	112893

Educational status: 25% of the fishermen population have received education, 19% primary level, 5% secondary level and 1% above secondary. The percentage of population who received education at primary level is 19 in both districts; while 6% of the population in Dakshin Kannada district received education at Secondary level it is only 3% in Uttar Kannada district.

In Dakshin Kannada district, the adult females form 33% but in Uttar Kannada it is 28% only. The children account for 38% of population in Dakshin Kannada and in Uttar Kannada children constitute 43% of the population.

Fishermen engaged in actual fishing: Twenty-two percent of the fishermen in the State are engaged in actual fishing activities; 16% full time, 5% part time, 1% occasional. In Dakshin Kannada district 20% are engaged in actual fishing; 13% full time, 6% part time and 1% occasional. In Uttar Kannada 19% are engaged in full time fishing, 4% part time and 2% occasional.

Table 2. *Districtwise distribution of fishermen engaged in fishing*

Fishermen engaged in actual fishing	Districts		Total
	Dakshin Kannada	Uttar Kannada	
a) Full time	9502	8162	17664
b) Part time	4014	1544	5558
c) Occasional	975	808	1783
Total	14491	10514	25005

Fishing Craft

The fishing craft in Karnataka comprise mechanized and non-mechanized types. As per the census there are about 2000 mechanized boats in the state, consisting of trawlers, purse seiners, gill netters and others. The number of trawlers is in the order of 1500 and that of purse seiners in the order of 300. Census reveals that more than 800 trawlers and 170 purse seiners are owned by fishermen of the state. 56% of such trawlers are in Dakshin Kannada district. The mechanized craft include 29 gill netters.

Among the non-mechanized craft dugout canoes dominate, forming 64% of the total non-mechanized craft, and are evenly distributed in both districts. However, the plank-built conoes are found mainly in Uttar Kannada district while the number of plank-built canoes in Dakshin Kannada is insignificant. Out of about 6900 non-mechanized units in the state 4670, which account for 67% of the total, are found in Uttar Kannada.

Fishing Gear

Out of 24,000 non-mechanized gear in Karnataka State 27% are drift/gill nets. Drift/gill nets dominate in Uttar Kannada district. Out of about 6600 nets in the state about 5400 are in Uttar Kannada district. This forms about 36% of the total non-mechanized nets in Uttar Kannada district. Shore seins other than rampans account for 16% of the total non-mechanized nets in the State. Out of about 3900 shore seins nearly 3000 belong to Dakshin Kannada district. Out of the total 1500 hooks & lines in the State, 1200 belong to Uttar Kannada district while only 300 are in Dakshin Kannada. Similarly out

Table 3. *Fishing craft and gear in Karnataka*

Sl. No.	Item	Dakshin Kannada	Uttar Kannada	Total
1.	Fishing crafts			
a)	Mechanized			
	Trawlers	454	354	808
	Purse seiners	110	63	173
	Gill netters	16	7	23
	Carrier boats	65	2	67
	Others	2	5	7
	TOTAL	647	431	1,078
b)	Non-mechanized			
	Dug out canoes	2,225	2,229	4,454
	Plank built boats	11	1,736	1,747
	Catamarans	4	19	23
	Others	29	689	718
	TOTAL	2,269	4,673	6,942
2.	Fishing Gears			
	Trawlnets	945	843	1,788
	Purse seines	121	67	188
	Fixed bag net	84	857	941
	Boat seines	1	22	23
	Drift/gill net	1,130	5,441	6,571
	Hooks and lines	300	1,207	1,507
	Rampans	24	62	86
	Shore seines	2,990	934	3,924
	Others	4,470	6,455	10,925

of about 940 fixed bag nets, 91% belong to Uttar Kannada; out of 86 rampans 62 belong to Uttar Kannada district while only 24 belong to Dakshin Kannada.

While major component of non-mechanized nets belong to Uttar Kannada district major component of mechanized nets belong to Dakshin Kannada district. Out of an estimated 3400 trawl nets, 1800 belong to Dakshin Kannada and the remaining to Uttar Kannada district. Similarly, out of an estimated 350 purse seines about 225 belong to Dakshin Kannada while nearly 125 belong to Uttar Kannada district.

Infrastructure Facilities

There are 27 freezing plants in the state with a capacity of 112.84 tonnes which is about 7.6% of the total freezing capacity available in the country. Nine canning plants available in the state have a total capacity of 38 tonnes which form 15.2% of the total capacity available in the country. Fifteen ice plants available in the state have a total capacity of 212 tonnes which account for 11.1% of the total capacity available in the country. There are 5 fish meal plants with a total capacity of 150 tonnes forming 25.4% of the total capacity available in the country. Thirtyone cold storages available in the state have a total capacity of 2612 tonnes accounting for 7.3% of the total capacity available in the country.

MARINE FISH PRODUCTION IN KARNATAKA

Marine fish production in Karnataka during the 10 year period 1975-'84 was characterised by wide fluctuations (see Appendix). The trend of total marine fish landings in the state was determined by the landings of two prominent pelagic species, oil sardine (*Sardinella longiceps*) and mackerel (*Rastrelliger kanagurta*) which showed wide fluctuations in their landings. During the period mentioned above, the landings in the state varied between minimum of 87,000 tonnes in 1975 and a maximum of 155,000 tonnes in 1982. The landings which was 97,000 tonnes in 1977 increased tremendously to 153000 tonnes in 1978 accounting for an increase of 57%. But the landings reduced to 126000 tonnes in the succeeding year. The landings was of the order of 154,000 in 1981 and in 1982 but again reduced to 112000 tonnes in 1983 and showed an increase of about 14% in 1984 when the landings increased to 127000 tonnes.

During this period, percentage contribution of Karnataka to the total marine fish production in the country also showed fluctuations. It varied between 6.2% of 1975 to 11.1% of 1981. (Table 4). This percentage which was 7.7 in 1977 increased to 10.9 in 1978 and remained stabilised around 10% till 1982 with a maximum of 11.1% in 1981. As for the succeeding two years, this percentage reduced to 7.2 in 1983 but increased marginally to 7.8 in 1984.

Table. 4 *Estimated marine fish landings (in tonnes)*

Year	India	Karnataka	Percentage contribution of Karnataka
1975	1422693	87494	6.2
1976	1352855	95283	7.0
1977	1259782	97152	7.7
1978	1403607	152860	10.9
1979	1388380	126384	9.1
1980	1249837	115322	9.2
1981	1378457	153349	11.1
1982	1420624	154836	10.9
1983	1548475	111598	7.2
1984	1630678	126996	7.8

Table-5 *Estimated marine fish landings in Karnataka by mechanized and non-mechanized units during 1980-1984. (figures in tonnes)*

Name of fish	1980			1981			1982			1983			1984		
	Mecha nized	Non-me- chanized	Total	Mecha- nized	Non-me- chanised	Total	Mecha- nized	Non-me- chanized	Total	Mecha- nized	Non-me- chanized	Total	Mecha- nized	Non-Me- chanized	Total
Oil sardine	39642	3085	42727	60906	4708	65614	51931	3195	55126	21404	297	21701	35446	877	36323
Mackerel	14797	4837	19634	15547	4219	19766	4697	814	5511	2055	127	2182	12129	208	12337
Stolephorus	5588	33	5621	5780	179	5959	12328	20	12348	10395	557	10952	11431	49	11480
Bombay Duck	9	6	15	—	—	—	—	1	1	2	9	11	2	—	2
Croakers	2477	1023	3500	990	1305	2295	1149	1177	2326	3369	698	4067	1350	655	2005
Perches	768	301	1069	382	17	399	381	137	518	4319	109	4428	2077	164	2241
Pomfrets	511	185	696	52	367	419	1795	1281	3076	1160	695	1855	1052	725	1777
Tunnies	928	24	952	2388	129	2517	1227	1041	2268	1111	684	1795	857	256	1113
Penaeid prawns	2961	137	3098	3392	730	4122	7378	320	7698	7575	308	7883	5134	377	5511
Non penaeid prawns	6	122	128	4	—	4	—	—	—	—	—	—	—	—	—
Others	27152	10730	37882	40077	12177	52254	52836	13128	65964	45463	11261	56724	44331	9876	54207
Total	94839	20483	115322	129518	23831	153349	133722	21114	154836	96853	14745	111598	113809	13187	126996

The annual average landings in the state during 1975-79 was about 112000 tonnes which increased to 132,000 tonnes during 1980-'84 showing an annual average rate of increase of about 3%.

Oil sardine, other sardines, mackerel and *stolephorus* spp together constituted more than 50% on an average of the total landings in the state. The pelagic group of fishes accounted for 69.1% while demersal group for 30.9%. Mechanized units contributed to 85.9% of the total landings in the state while the contribution from non-mechanized units was 14.1%. The average annual contribution from Dakshin Kannada district during 80-84 was about 95000 tonnes and accounted for 71.5% of the total landings in the state.

Table. 6 gives the percentage contribution of important varieties of fish to the total fish landings in Karnataka.

Table-6. *Percentage contribution of important varieties of fish in Karnataka during 1975-'84*

	1975	76	77	78	79	80	81	82	83	84
Elasmobranchs	2.0	1.6	3.3	1.3	2.0	2.5	2.7	3.2	3.6	1.3
Cat fishes	3.7	4.5	5.3	1.8	7.9	4.7	4 9	6.6	6.5	2.9
Oil sardine	60.2	43.5	32.1	30.6	26.3	37.1	42.8	35.6	19.4	28.6
Other sardines	0.9	0.7	0.2	1.7	3.8	3.6	3.5	2.0	5.5	4.3
Stolephorus spp.	0.01	0.1	0.2	0.3	1.4	4.9	3.9	7.4	9.8	9.0
Croakers	2.1	3.4	2.8	1.1	1.9	3.0	1.5	1.5	3.6	1.6
Ribbon fishes	0.3	0.6	0.2	0.3	0.9	1.3	0.2	0.7	2.0	0.6
Carangids	1.1	0.8	1.3	0.2	0.9	4.2	2.3	1.7	3.9	5.9
Silver bellies	1.4	4.3	1.7	2.8	1.2	4.1	1.1	1.6	6.3	2.6
Pomfrets	0.2	0.5	0.3	1.3	0.2	0.6	0.3	2.0	1.7	1.4
Mackerel	14.3	23.6	27.0	33.2	31.7	17.0	12.9	3.6	2.0	9.7
Seer fishes	0.9	1.4	1.9	1.0	1.3	1.7	1.5	4.4	3.7	3.9
Tunnies	0.2	0.6	0 6	0.4	1.4	0.8	1 6	1.5	1.6	0.9
Penaeid prawns	3.5	2.7	3.4	5.5	3.7	2.7	2.7	5.0	7.1	4.3
Others	9.2	11.7	19.7	18.5	15.5	11.8	18 1	23.2	23.3	23.0
Total	100	100	100	100	100	100	100	100	100	100

From table 5 it could be seen that oil sardine was consistently the most dominant species in the state followed by mackerel. In the later years *stolephorus* spp also emerged as a dominant variety of fish in the state.

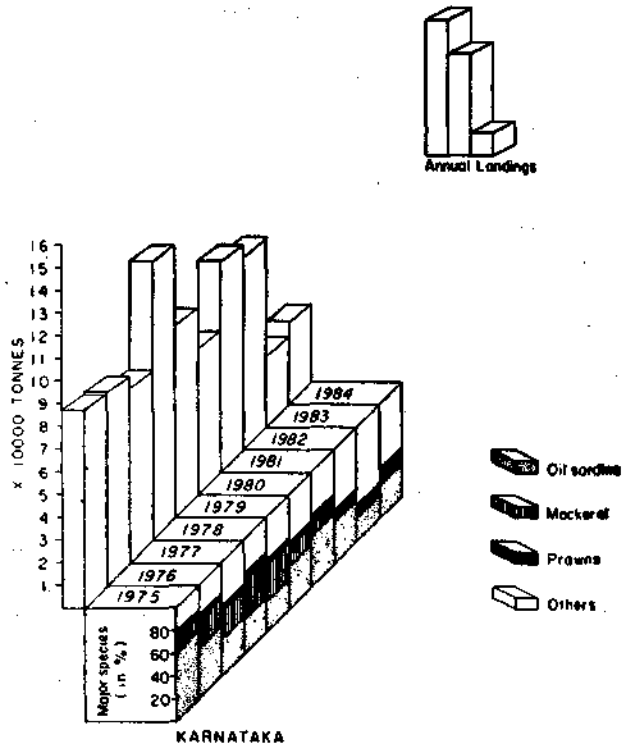


Fig. 1. Landings of major species in Karnataka during 1975-84.

Pelagic Group of Fishes

The pelagic group consists of wolf herring, oil sardine, other sardines, hilsa shad, other shads, anchovies, other clupeoids, bombayduck, half beaks and full beaks, flying fishes, ribbon fishes, carangids mackerel, seer fishes, tunnies, bill fishes, barracudas, mullets and unicorn cod and other miscellaneous varieties. During the period under discussion, landings of this group varied over years with a maximum of 123,000 tonnes in 1978 and a minimum of 60,000 tonnes in 1983. However, percentage contribution of this group to the total landings in the state was maximum (81.1%) in 1975 and reduced to 69.4% in 1984. In 1978 when the pelagic species landed maximum of 123,000 tonnes, it accounted for 80.4% of the total landings.

Among the pelagic group of fishes, dominant species was oil sardine of which the percentage contribution to the pelagic group varied ranging from 74.3% in 1975 to 36.3% in 1983. Table (7) gives the percentage contribution of important varieties to the average landings of pelagic species for 1975-79 and 1980-84.

Table-7 *Percentage contribution (% of average landings)*

	1975-79	1980-84
Oil sardine	46.7	48.4
Other sardines	2.0	5.3
Stolephorus spp.	0.5	10.1
Ribbon fishes	0.6	4.2
Carangids	1.0	5.0
Mackerel	34.6	13.0
Seer fishes	1.6	4.4
Tunnies	0.9	1.9
Others	12.1	7.7
Total	100	100

Percentage contribution of average annual landings of oil sardine increased marginally from 46.7 in 1975-79 to 48.4 in 1980-84. The contribution of mackerel during the period showed very high fluctuations. It formed 41.2% of the total landings of this group in 1978 while it reduced to a very low 3.6% in 1983. However it showed improvement in 84, when the percentage contribution rose to 14. The contribution of average annual landings of mackerel reduced significantly to 13.0% in 1980-84 from 34.6% in 1975-79. *Stolephorus* spp of which the contribution was insignificant in the early years showed tremendous improvement and its proportion increased to 13% in 1984. From 0.5% of 1975-79, its average annual contribution increased to 10.1% in 1980-'84. A trend similar to that of *Stolephorus* spp is seen in the case of other sardines. Against 1.1% of 1975, it accounted for 10.2% of the landings of pelagic species in 1983 but reduced to 6.2% in 1984. Against 2% of 1975-'79, it accounted for 5.3% in 1980-'84 period in the average annual landings of pelagic group. Similar increasing trend in the percentage contribution is seen in the case of carangids, ribbon fishes and seer fishes with maximum percentage contribution in the year 1983. Percentage contribution of average annual landings of carangids increased from 1.0 in 1975-'79 to 5.0 in 1980-'84, that of seer fishes from 1.6 to 4.4 and that of ribbon fishes from 0.6 to 4.2.

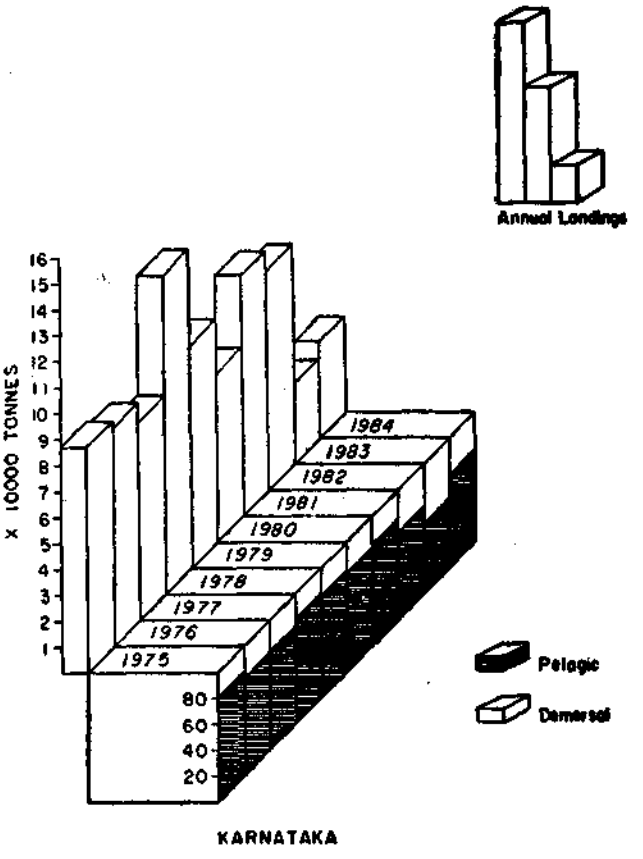


Fig 2. Landings of pelagic and demersal groups in Karnataka during 1975-84.

Demersal Group of fishes

Demersal group consists of elasmobranchs, eels, catfishes, lizard fishes, perches, goat fishes, thread fins, croakers, silver bellies, big jawed jumper, pomfrets, flat fishes, prawns, lobsters, crabs, stomatopods and cephalopods and other miscellaneous varieties. Karnataka coast is rich in all these varieties but the dominant among them are catfishes, penaeid prawns, elasmobranchs croakers, silverbellies and pomfrets.

Landings by demersal group varied between 17000 tonnes in 1975 to 52000 tonnes in 1983 and showed an increasing trend during the period under discussion It increased to 51,000 tonnes in 1982 from 35,000 tonnes in 1981, remained at the same order of abundance in 1983 and reduced to 39,000 tonnes in 1984.

Table-10 *Districtwise estimated marine fish landings in Karnataka during 1980–84 (figures in tonnes)*

Name of fish	1980			1981			1982			1983			1984		
	South canara	North canara	Total	South canara	North canara	Total	South canara	North canara	Total	South canara	North canara	Total	South canara	North canara	Total
Oil sardine	38449	4278	42727	53978	11636	65614	47716	7410	55126	17640	4061	21701	30236	6087	36323
Mackerel	16765	2869	19634	15878	3888	19766	4586	925	5511	1476	706	2182	11260	1077	12337
Stolephorus	5556	65	5621	5647	312	5959	10562	1786	12348	9769	1183	10952	10433	1047	11480
Bombay Duck	—	15	15	—	—	—	—	1	1	—	11	11	—	2	2
Croakers	730	2770	3500	846	1449	2295	1460	866	2326	2297	1770	4067	1048	957	2005
Perches	347	722	1069	13	386	399	93	425	518	2561	1867	4428	1143	1098	2241
Pomfrets	332	364	696	75	344	419	1973	1103	3076	1640	215	1855	1173	604	1777
Tunnies	766	186	952	2153	364	2517	950	1318	2268	1132	663	1795	656	457	1113
Penaeid prawns	1797	1301	3098	2806	1316	4122	4862	2836	7698	3712	4171	7883	2650	2861	5511
Non penaeid prawns	80	48	128	—	4	4	—	—	—	—	—	—	—	—	—
Others	20396	17486	37882	35035	17219	52254	35784	30180	65964	33998	22726	56724	30689	23518	54207
Total	85218	30104	115322	116431	36918	153349	107986	46850	154836	74225	37373	111598	89288	37708	126996

Table-11 *Percentage contributions of the two districts to total landings of pelagic group in Karnataka during 1980-'84.*

Year	Dakshin Kannada	Uttar Kannada
1980	80.4	19.6
1981	81.3	18.7
1982	75.9	24.1
1983	75.9	24.1
1984	77.1	22.9

Table-12 *Contributions (%) of Dakshin and Uttar Kannada districts to the landings of demersal group.*

Year	Dakshin Kannada	Uttar Kannada
1980	53.7	46.3
1981	57.7	42.3
1982	57.3	42.7
1983	55.7	44 3
1984	54.9	45.1

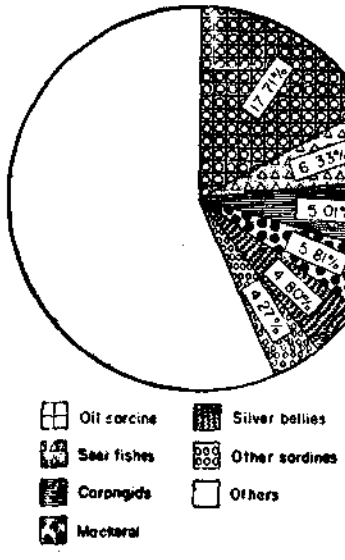


Fig. 3. Contribution of important varieties to the total marine fish landings in Karnataka State.

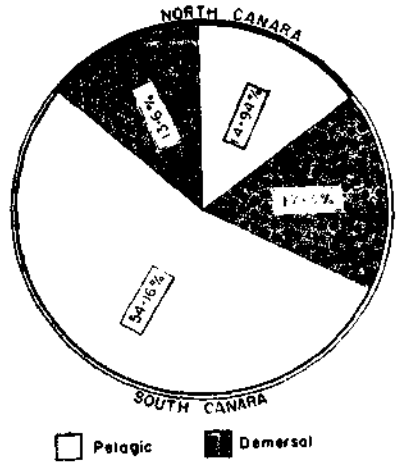


Fig. 4. Contribution of districtwise landings of pelagic and demersal groups in Karnataka.

Here again it might be noted that there was only marginal fluctuation over years in respect of both the districts. The percentage contributions of the two districts varied widely in respect of pelagic group of which average annual contributions were 78.4% and 21.6% from Dakshin and Uttar Kannada districts respectively but in the case of demersal group the difference in the percentage contributions of the two districts did not differ much.

Landings by Mechanized Craft

Landings by mechanized vessels increased tremendously during the period under discussion. The landings increased from about 10,000 tonnes in 1975 to 56,000t in 1977 and then had a steep increase to about 123,000 tonnes in 1978 and afterwards stabilized to the order of 100,000 tonnes. The percentage contribution of landings by mechanized vessels had been steadily increasing; from 11.2% of 1975 it rose to 89.6% in 1984 (Table-13).

Table-13 *Percentage contribution of landings by mechanized/non-mechanized craft*

Year	Mechanized	Non-mechanized
1975	11.2	88.8
1976	17.7	82.3
1977	57.5	42.5
1978	80.2	19.8
1979	79.4	20.6
1980	82.2	17.8
1981	84.5	15.5
1982	86.6	13.4
1983	86.8	13.2
1984	89.6	10.4

In the beginning of the period under discussion, the proportion of landings by mechanized units to the total landings was very low. But it gained momentum in the year 1977 and 1978 and by end of the period '80-'84, it got stabilized. The annual average landings of 61,000 tonnes in the period '75-'79 increased to 114,000 in 1980-'84 resulting in the percentage contribution increasing from 54.6% in 1975-'79 to 85.9% in 1980-'84.

Landings by mechanized craft from Dakshin Kannada district accounted for 77.3% on an average with annual landings of about 88,000 tonnes. The landings increased from 82,000 tonnes in1980 to 104,000 tonnes in 1981 and remained at the

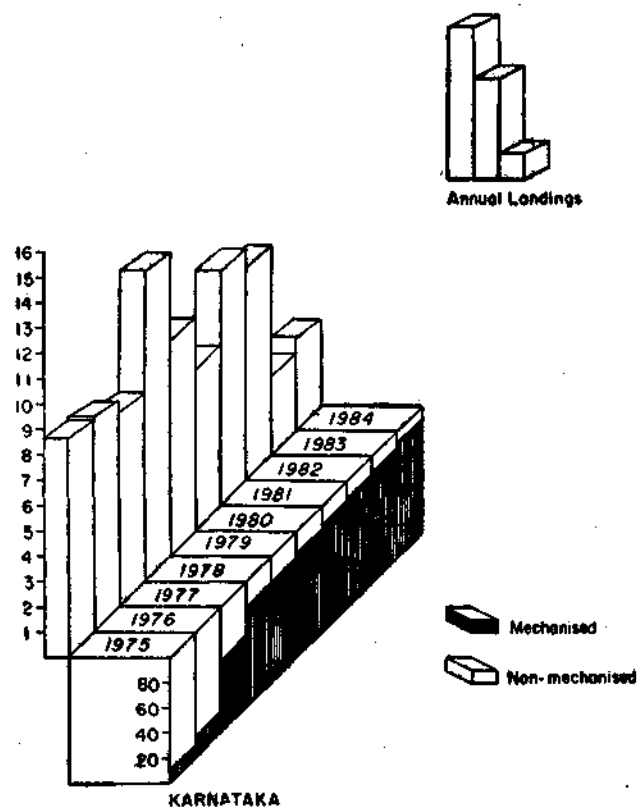


Fig. 5. Mechanized and non-mechanized landings in Karnataka during 1975-'84

same level in 1982 but showed steep decrease in 1983 to 65,000. However, it increased to 85,000 t in 1984. The contribution from Uttar Kannada district to the total landings by mechanized craft accounted for 22.7% with an average annual landings of about 26,000 tonnes. This increased steadily from 13,000 t in 1980 to 32,000t in 1983 but showed a marginal decrease in 1984. The percentage contribution of Dakshin Kannada to this landings ranged from 86.6 of 1980 to 67.3 of 1983. This percentage contribution from Uttar Kannada district increased from 13.4 in 1980 to 32.7 in 1983 and then reduced to 24.9% in 1984. (Table-14).

Table-14. *Districtwise percentage contribution to total mechanized landings in the State*

Year	Dakshin Kannada	Uttar Kannada
1980	86.6	13.4
1981	80.1	19.9
1982	77.0	23.0
1983	67.3	32.7
1984	75.1	24.9

Purse seine dominated in the mechanized fishing in the state followed by trawl net. Drift/set gill nets and hooks and lines also were in vogue in the state. The landings by purse seines contributed on an average 77700 t annually during the five year period 1980-'84 This constituted 68.3% of the average annual landings by whole of the mechanized units during the period under discussion. (Table-15).

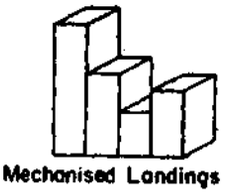
Table-15. *Percentage contributions of Purse seine and Trawl net to the total landings by mechanized fishing*

Year	Purse seine	Trawl net	Others
1980	80.3	19.4	0.3
1981	73.7	25.1	1.2
1982	63.9	33.4	2.7
1983	54.8	40.2	5.0
1984	68.9	29.3	1.8

The landings of trawl net contributed on an average 33600 tonnes, accounting for 29.5% of the landings by mechanized craft. Drift/set gill net with mechanized propulsion landed on an average 2100 tonnes accounting for 1.9% of the landings by mechanized units. Hooks and lines contributed just 0.3% on an average annually.

Among the major varieties of fish that were caught by mechanized units in Karnataka, oil sardine dominated with an average annual landings of 42,000 tonnes which constituted about 36.8% of the landings by mechanized vessels. It increased from 40,000 tonnes in 1980 to 61,000 tonnes in 1981. 1983 witnessed minimum landings of 21,000 tonnes but the landings of oil sardine increased to 35000 tonnes in 1984. Its percentage contribution to the total landings by mechanized vessels touched a maximum of 47% in 1981 and a minimum of 22.1% in 1983.

Other sardines accounted for 4% of the total landings by mechanized vessels with an average annual landings of 4600 tonnes. *Stolephorus* spp with an annual average landings of 9100 tonnes contributed 8%. The landings of *Stolephorus* spp by mechanized craft touched a maximum of 12300 tonnes in 1982. Its percentage contribution was minimum in 1981 (4.5%) and touched maximum (10.7%) in 1984. 3.5% of landings by mechanized craft was accounted for by carangids of which the annual landings was about 2,000 tonnes on an average during the period '80-'84. Silverbellies contributed 2.9% with an average annual landings of 3300 tonnes. Mackerel, which contributed 8.7% of the total landings by mechanized vessels with an average annual landings of about 9800t during the period, manifested wide fluctuation during the period with a maximum of about 16,000 tonnes in 1981 and a minimum of 21,00 tonnes in 1983. Penaeid



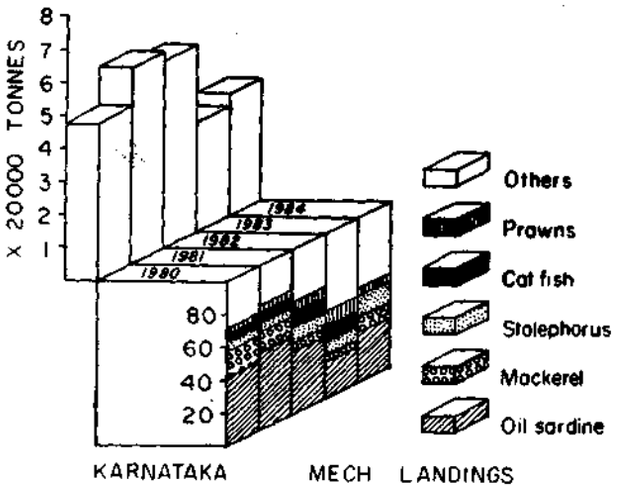


Fig. 6. Specieswise mechanized landings in Karnataka during 1980-'84.

prawns with an average annual landings of 5300 tonnes accounted for 4.6% of the total landings. Stomatopods with an average annual landings of 7400 tonnes accounted for 6.5% (Table-16).

Table-16 *Landings by mechanized vessels in Karnataka*

	Average landings (tonnes) during 1980-'84	Percentage
Oil sardine	41866	36.8
Mackerel	9845	8.7
Carangids	3929	3.5
Stolephorus	9104	8.0
Silverbellies	3304	2.9
Penaeid prawns	5288	4.6
Stomatopods	7398	6 5
Others	33014	29.0
Total	113748	100

Table. 18. *Quarterly landings in percentage to the total annual landings of marine fish in Karnataka.*

	1975	'76	'77	'78	'79	'80	'81	'82	'83	'84
Ist quarter (January to March)	26.5	56.5	19.3	20.6	24.5	26.8	28.1	34.0	23.1	21.1
II Quarter (April to June)	4.8	12.0	10.3	10.2	15.3	10.6	10.6	17.6	20.4	11 0
III Quarter (July to September)	3.5	5.1	8.9	23.7	10.3	16.4	12.5	12.4	16.2	29.8
IV Quarter (October to December)	65.2	26.4	61.5	45.5	49.9	46.2	48.8	36.0	40.3	38.1

Table. 19. *Average quarterly landings during 1980–'84 in the maritime districts of Karnataka (figures in tonnes)*

District	January to March	April to June	July to September	October to December	Total
Uttar Kannada	11617 (32.4%)	6375 (34.5%)	5383 (23.8%)	14415 (26.0%)	37790
Dakshin Kannada	24261 (67.6%)	12083 (65.5%)	17260 (76.2%)	41026 (74.0%)	94630
Total	35878	18458	22643	55441	132420

Maximum contribution to the marine fish landings in Dakshin Kannada district came during October to December period which was of the order of 41,000 tonnes forming 43.4% of the average annual landings in the district. The landings during January to March accounted for 25.6% of the annual landings in the district, that during April to June accounted for 12.8% and that during July to September for 18.2%. In Uttar Kannada district the landings during the quarter October to December accounted for 38.2% of the average annual landings while the percentage contributions during the quarters January to March, April to June and July to September were 30.7, 16.9 and 14.2 respectively of the annual landings in the district.

All of the important varieties of fish in the state were caught during all seasons but with varying magnitudes. Comparing the periods 1975-'79 and

1980-'84, it could be observed that the landings of oil sardine during the first quarter of the year remained at the same level of the order of 13,000 tonnes though its percentage contribution to the total landings during the first quarter showed a marginal decline from 43.3% in 1975-'79 to 37.2% in 1980-'84. The landings of mackerel, during first quarter which was, on an average, of the order of 4,000 tonnes in 1975-'79, reduced to the order of 2,000 tonnes in 1980-84; the percentage contribution of this fish to the total landings during the quarter January to March reduced from 13 4 in 1975-'79 to 6.4 in 1980-'84. The landings of prawns in the first quarter reduced from 2000 tonnes in 1975-'79 to 1,800 tonnes in 1980-'84 with a corresponding reduction of 1.6% in its contribution to the total landings during the quarter as the percentage contribution reduced from 6.6 to 5.0. A significant improvement could be observed in the landings of *Stolephorus* spp which increased to about 1,000 tonnes in the latter period from less than 200 tonnes of the former accounting for 3% of the total first quarter landings against 0 6% of the former period.

During the period 1975-'79, mackerel was the dominant variety of fish in the second quarter (April to June) with an average landings of the order of 2,000 tonnes which accounted for 17.6% of the total landings. This was followed by catfishes (11.3%), oil sardine (10.3%) and prawns (9.7%). However in the latter period 1980.'84, during second quarter, oil sardine emerged the dominant variety with an average landings of about 3,100 tonnes accounting for 16.1% of the total landings. This was followed by prawns (8.3%) with an average landings of 1,500 tonnes and catfishes (6.5%) with an average landings of 1,200 tonnes. The percentage contribution of *Stolephorus* spp increased considerably in second quarter also; from 0.1% of the former period it increased to 5.2% of the latter period.

During the former period (1975-'79) the mackerel dominated in third quarter with an average landings of 4,800 tonnes which accounted for 36.4% of the total landings. This was followed by oil sardine (22.1%) with an average landings of 2,900 tonnes. Prawns accounted for 5.3% with an average landings of 700 tonnes. But in the latter period (1980-'84) oil sardine dominated the fishery with an average landings of 7,000 tonnes (31.0%) followed by mackerel (5,100 tonnes) accounting for 22.5%. Prawns with an average landings of 1,400 tonnes contributed 6.1% of the total landings during the quarter July to September during 1980-'84.

Oil sardine with an average landings of 23,000 tonnes dominated contributing 42.2% to the fishery in the fourth quarter (October to December) in the former period 1975-'79. This was followed by mackerel which contributed 35.0% to the landings in the fourth quarter with an average landings of the order

of 19,000 tonnes. Catfishes also supported the fishery substantially by contributing 4.8% with an average landings of about 2,600 tonnes. In the latter period 1980-'84, oil sardine continued to dominate the fishery with an average landings of 21,000 tonnes (37.8%) showing a marginal reduction over that of the former period. The landings of mackerel sustained a steep decrease in the landings which reduced to a meagre 3,600 tonnes accounting for just 6.6%. A significant phenomenon observed during the latter period was the considerable increase in the landings of *Stolephorus* spp. which coutributed 12.3% of the total landings in the fourth quarter with an average landings of 6,800 tonnes. The landings of prawns showed a marginal increase, on an a verage, resulting the percentage contribution increasing from 0.9% to 1.7%.

Table 20. *Average quarterly landings (in tonnes) of important fishes in Karnataka during 1980-'84.*

Name of fish	Quarter I	II	III	IV	Total
Elasmobranchs	1157	591	608	1170	3526
	(3.2)	(3.1)	(2.7)	(2.1)	
Catfishes	1837	1192	870	2922	6821
	(5.1)	(6.5)	(3.8)	(5.3)	
Oil sardine	13353	2967	7021	20957	44298
	(37.2)	(16.1)	(31.0)	(37.8)	
Other sardines	922	826	483	2599	4830
	(2.6)	(4.5)	(2.1)	(4.7)	
Stolephorus Spp.	1051	959	452	6810	9272
	(2.9)	(5.2)	(2.0)	(12.3)	
Mackerel	2282	890	5084	3630	11886
	(6.4)	(4.8)	(22.5)	(6.5)	
Prawns	1799	1527	1389	947	5662
	(5.0)	(8.3)	(6.1)	(1.7)	
Others	13477	9506	6736	16406	46125
	(37.6)	(51.5)	(29.8)	(29.6)	
Total	35878	18458	22643	55441	132420

During the period 1980-'84, on an average, 41.9% of the landings of elasmobranchs in the first quarter was contributed by Dakshin Kannada district and the rest by Uttar Kannada district. In the second quarter the landings of elasmobranchs in Dakshin Kannada accounted for just 9.0% only. However in the third quarter, the trend was reversed with 74.8% coming from Dakshin Kannada. But in the fourth quarter the contribution from Dakshin Kannada reduced to 42.6%.

Throughout the year Dakshin Kannada district dominated in the fishery of catfishes with higher percentage contributions-62% in first quarter, 73.7% in second quarter 78.2% in third quarter and 77.1% in fourth quarter Major contribution to the landings of oil sardine and *Stolephorus* Spp. came from Dakshin Kannada district in all four quarters. The percentage contribution to the quarterly landings of oil sardine from Dakshin Kannada district were, 77.4 in first quarter, 84.9 in second quarter 92.9 in third quarter and 87.0 in fourth quarter. Dakshin Kannada district accounted for 91.4% of the landings of *Stolephorus* Spp. in first quarter, 88.3% in second quarter, 88.9% in third quarter and 90 8% in fourth quarter. Similarly, mackerel was most dominant in the southern part of the state the percentage contributions from Dakshin Kannada district to the average quarterly landings being 85.9 in first quarter, 88.9 in second quarter, 87.5 in third quarter and 77.0 in fourth quarter. The percentage contribution to the landings of pomfrets was more from the Uttar Kannada district during the first half of the year but in the latter half the trend was reversed, the percentage contribution from Dakshin Kannada district being 47.9 in first quarter, 20.2 in second quarter 89.0 in third quarter and 62.9 in fourth quarter. The fishery of seerfishes was dominant in the Dakshin Kannada only during first quarter with a contribution of 68·6% but during second, third and fourth quarters the contributions from this district were 7.5%, 30 9% and 38.9% respectively. Except in fourth quarter, the prawns was found dominant in the Dakshin Kannada district than in Uttar Kannada district, the contribution from the former to the average landings for the four quarters being 64.8%, 55.5%, 55.2% and 40.7%.

Marine Fish Landings by Important Gear

Landings by two prominent gear, purse seines and trawlnets accounted for about 84% of the total marine fish landings in the state. The landings by purse seines was of the order of 77,700 tonnes forming 58.7% of the total landings and that by trawlnets was about 33,600 tonnes accounting for 25.3%, on an average, of the total landings. These two, together, account for 97.8% of the total landings by mechanized craft. Among the non-mechanized fishing gear, the landings from rampani was about 4,300 tonnes in 1980 but reduced to about 800 tonnes in 1984.

Purse seines: Landings by purse seines fluctuated around 78,000 tonnes during the period 1980-'84. From 76,000 tonnes in 1980, it rose to a maximum of 95,000 tonnes in 1981 but showed a decrease of about 10,000 tonnes in 1982 and then further by 32,000 tonnes in 1983 when the landings touched a minimum of 53,000 tonnes. However, the landings by purse seines increased to 78,000 tonnes in 1984. Oil sardine with an average annual landings of about 40,700 tonnes was the most dominant variety accounting for 52.3% of the landings by purse seines. The landings of this variety by purse seines increased from about 40,000 tonnes in

1980 to a maximum of 57,000 tonnes in 1981, but registered a marginal decrease in 1982 and then reduced to a minimum of about 21,000 tonnes in 1983. However it showed an increase of about 14,000 tonnes in 1984. The landings of mackerel from purse seines which was about 15,000 tonnes in 1980 and 1981 reduced to a minimum of 2,000 tonnes in 1983 but showed an increase of about 8,000 tonnes in 1984. The landings of *Stolephorus* spp. increased from 5,600 tonnes in 1980 to about 12,300 tonnes in 1982 and thereafter maintained comparatively high landings in the succeeding years.

The percentage contribution of dominant varieties of fish from purse seines are given in the table-21.

Tunnies with an average landings of about 1,100 tonnes formed 1.4% of the landings by purse seines and carangids registered an average annual landings of 3,000 tonnes from purse seines. Other sardines with an average annual landings of 4,400 tonnes from purse seines touched a maximum of 5,900 tonnes in 1983 and a minimum of 2,600 tonnes in 1982. Landings of catfishes by purse seines increased from about 2,500 tonnes in 1980 to 7,100 tonnes in 1982 but decreased to 1,800 tonnes in 1984 with an average annual landings of about 4,100 tonnes accounting for 5.2% of the total landings by purse seines.

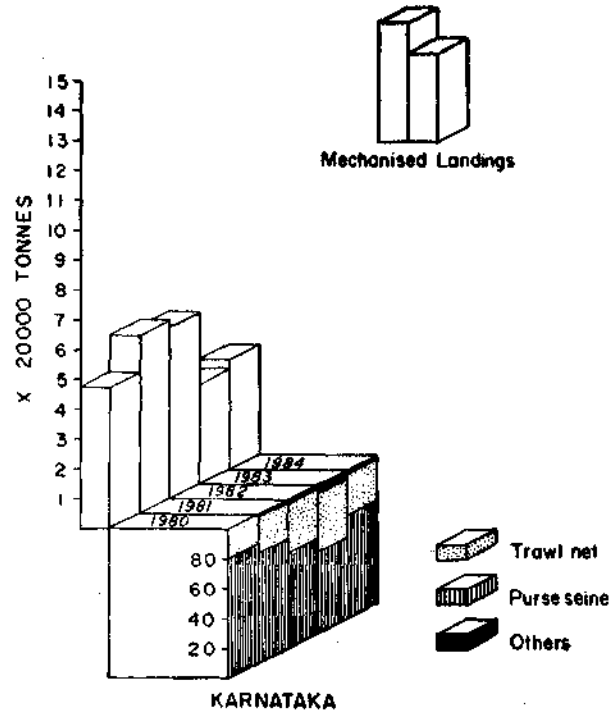


Fig. 10. Mechanized gearwise landings in Karnataka during 1980-'84

Table-21. *Percentage contribution of important fishes from purse seines during 1980-1984.*

Name of fish	1980	1981	1982	1983	1984	Average
Oil sardine	52.1	59.3	59.3	40.1	44.8	52.3
Mackerel	19.4	16.2	5.1	3.9	15.4	12.5
Stolephorus spp.	7.3	6.0	14.4	18.9	14.4	11.6
Others	21.2	18.5	21.2	37.1	25.4	23 6

Trawlnet: The landings by trawl net in Karnataka during the period 1980-'84 fluctuated around 34,000 tonnes annually with a minimum of 18,000 tonnes in 1980 and a maximum of about 45,000 tonnes in 1982. The landings which showed an annual increase of about 12,000 tonnes from 1980 to 1982 showed subsequently an annual decrease of about 6,000 tonnes.

Among the commercially important varieties, penaeid prawns with an average annual landings of about 4,900 tonnes accounted for 14.5% of the total landings by trawlnets. The landings of prawns by trawlers increased considerably from a minimum of 2,300 tonnes in 1980 to 6,700 tonnes in 1982 and then to a maximum of 7,000 tonnes in 1983 but declined to 5,000 tonnes in 1984.

Table 22. *Percentage contribution of important fishes to the landings by trawlnet during 1980-'84.*

Name of fish	1980	1981	1982	1983	1984	Average
Penaeid prawns	12.5	10.0	14.9	18.0	15.1	14.5
Catfishes	5.8	2.0	1.5	6.7	1.7	3.3
Croakers	12.2	2.6	2.0	5.8	3.9	4.5
Silverbellies	5.8	1.9	2.6	8.7	5.0	4.7
Soles	3.2	1.3	3.0	5.9	18.0	6.3
Stomatopods	4.1	26.9	22.2	19.7	29.5	22.0
Others	56.4	55.3	53.8	35.2	26.8	44.7

Catfishes with an average landings of 1,100 tonnes accounted for 3.3% of the landings by trawlnets. Its landings decreased from about 1,100 tonnes in 1980 to 600 tonnes in 1981 but subsequently steadily increased and attained a maximum of 5,600 tonnes in 1984. Among the perches landed by trawlnets, threadfin breams increased from 200 tonnes in 1981 to 3,800 tonnes in 1983 but reduced to 1,400 tonnes in the subsequent year. Ribbonfishes with an average landings of about 800 tonnes accounted for 2.3% of the landings by trawlnets and fluctuated between 110 tonnes of 1982 to 1,300 tonnes of 1980.

Soles from 400 tonnes in 1981 steadily increased and touched a maximum of 6,000 tonnes in 1984 when it accounted for 18.3% of the landings by trawlnet. Stomatopods constituted 22% of the landings by trawlnets with an average annual landings of 7,400 tonnes and since 1981 fluctuated around 9,000 tonnes.

Dakshin Kannada contributed about 58.2% of the total landings by trawl nets with an average annual landings of about 19,500 tonnes. This fluctuated between a minimum of 11,800 tonnes in 1980 and a maximum of 27,200 tonnes in 1982. The landings by trawlnets in Uttar Kannada district with an annual average of about 14,000 tonnes accounted for 41.8% of the total trawlnets' landings in the state and this fluctuated between a minimum of 6,700 tonnes in 1980 and a maximum of 20,100 tonnes in 1983.

Among the non-mechanized gear, operation of rampaninet, which in earlier years was a prominent one, showed a slimming trend in the latter years. The landings by Rampani reduced from 4,300 tonnes of 1980 to just 800 tonnes in 1984.

Driftset gill nets contributed a major share of the landings by indigenous gear in Karnataka. With the introduction of purse seines, the rampani operation reduced markedly, so to say, in 1983 the contribution from rampani to the total landings by indigenous gear was only 0.8%. The landings by drift/set gill nets accounted for 58.8% of the total landings by non-mechanized fishing. During 1980–84, its percentage contribution varied from 43.3 in 1981 to 78.7 in 1982. Annual landings fluctuated around 11,000 tonnes with the minimum of 8,100 tonnnes in 1983 and the maximum of 16,600 tonnes in 1982. The landings of rampani showed a consistent decreasing trend till 1983. It decreased from 4,300 tonnes in 1980 to 100 tonnes in 1983 but improved in 1984 when the landings was 800 tonnes. Among other prominement gear were yendi (shore seine) and hooks and lines. Yendi contributed average annual landings of 1,300 tonnes during 1980-84, accounting for 7.2% of the total landings by non-mechanized fishing. The landings by yendi fluctuated during this period heavily with the

Table 23. *Landings of pelagic and a demersal groups in Karnataka (figures in tonnes)*

Year	Pelagic	Demersal	Total
1975	70943	16551	87494
1976	73206	22077	95283
1977	73864	23288	97152
1978	122945	29915	152860
1979	97889	28495	126384
1980	87290	28032	115322
1981	118545	34804	153349
1982	103773	51063	154836
1983	59840	51758	111598
1984	88096	38900	126996

Table 24. *Landings by mechanized and non-mechanized Units in Karnataka (figures in tonnes)*

Year	Mechanized	Non-mechanized	Total
1975	9777	77717	87494
1976	16871	78412	95283
1977	55869	41283	97152
1978	122579	30281	152860
1979	100336	26048	126384
1980	94839	20483	115322
1981	129567	23782	153349
1982	133722	21114	154836
1983	96853	14745	111598
1984	113809	13187	126996

minimum 400 tonnes in 1982 and the maximum 3,100 tonnes in 1983. The landings of hooks and lines also fluctuated during the period with the minimum of 400 tonnes in 1984 and the maximum of 1,800 tonnes in 1981 registering an average annual landings of 1,200 tonnes accounting for 6.2% of the total landings by non-mechanized fishing. Others including cast nets contributed on, an average, 16.7% of the landings by non-mechanized units.

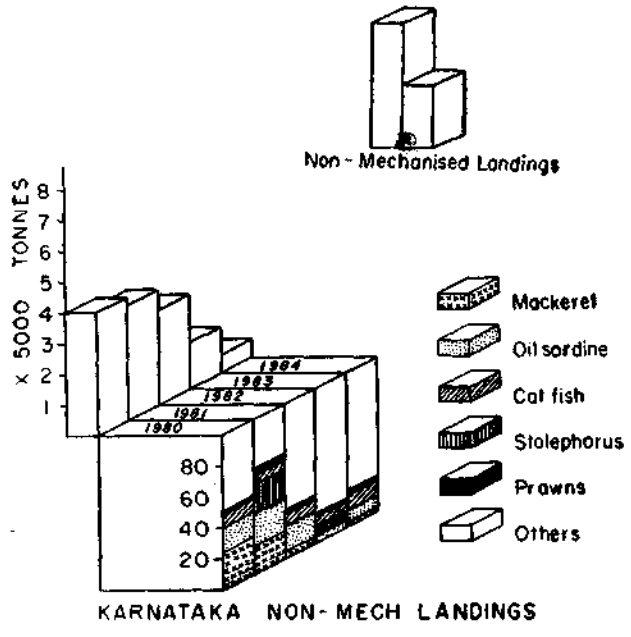


Fig. 11. Specieswise non-mechanized landings in Karnataka during 1980-'84.

Drift/set gill nets and hooks and lines with mechanization for propulsion were also in vogue in Karnataka state. Drift/set gill nets contributed, on an average 2,100 tonnes accounting for 1.9% of the total landings by mechanized vessels and hooks and lines contributed just 0.3%. Both these were more popular in Dakshin Kannada.

Landings at Major Fishing Centres

Fishing activities in Karnataka were heavily concentrated at a few major fishing centres like Mangalore Bunder, Malpe, Ganguli Bunder, Bhatkal, Tadri and Karwar. The landings from these centres alone accounted for about 73% of the total marine fish landings in the state.

Table. 25. *Average landings (in tonnes) at important fishing centres in Karnataka*

Centres	Average landings during 1981–'84	Percentage contribution to the state landings
Mangalore Bunder	41230	30.2
Malpe	24780	18.1
Ganguli Bunder	12677	9.3
Bhatkal	2932	2.1
Tadri	6397	4.7
Karwar	11682	8.5
Total	99698	72.9

Besides, Kasargod another important centre contributed 5.1% of the state's total landings with annual average landings of 6,800 tonnes.

Mangalore: Mangalore Bunder was the most active fishing centre in Karnataka which alone contributed to the order of 30% of the marine fish landings in the state with an average annual landings of 41,200 tonnes. The landings at this centre touched a maximum of 53,100 tonnes in 1982 but sustained a steep decrease to a minimum of 29,100 tonnes in 1983. However, it registered an increase of about 7,000 tonnes in the subsequent year.

Among the commercially important varieties of fish that were landed at this centre, oil sardine ranked first with an average landings of 20,100 tonnes accounting for about 49% of the total landings; the entire landings of oil sardine coming from purse seiners. The landings of oil sardine occurred mainly in the period October to March with an average landings of 9,500 tonnes in the quarter October to December and 5,400 tonnes in January to March. Landings of oil sardine at Mangalore showed fluctuations around 20,100 tonnes with a minimum of about 9,100 tonnes in 1983 and a maximum of 30,700 tonnes in 1982. *Stolephorus* spp with an average annual landings of 3,400 tonnes accounted for 8.2% of the total landings at the centre. Contribution from gear other than purse seines to the landings of *stolephorus* spp was quite negligible. The landings of *Stolephorus* spp at Mangalore centre showed an increasing trend during the period 1980 to '84 with the landings from purse seines increasing from 2,300 tonnes in 1981 to 4,100 tonnes in 1984. It was observed that about 85% of the annual landings of *Stolephorus* spp landed in the period October to December.

Mackerel with landings of the order of 3,000 tonnes annually accounted for more than 7% of the total landings at the centre and was landed entirely by purse seiners. The landings of mackerel reduced from 4,000 tonnes in 1981 to about 1,000 tonnes in 1983 but again recovered in 1984 when the landings was 3,900 tonnes. Maximum landings of mackerel occurred in the third quarter of the year (July to September) with an average of 1,500 tonnes followed by the subsequent quarter (October to December) with an average of 1,100 tonnes.

Catfishes formed about 7% of the landings at Mangalore with an average landings of 2,800 tonnes annually. During '81 and '82 the entire landings of catfishes came from purse seiners and in subsequent years also purse seiners contributed heavily to the landings. From 4,000 tonnes in 1981, it increased to 4,700 tonnes in 1982 but thereafter reduced to about 600 tonnes in 1984. Prawns with an average annual landings of about 1,500 tonnes constituted 3.6% of the landings at Mangalore centre and was mainly contributed by trawlers which landed about 1,200 tonnes annually, majority of the landings taking place during January to June. About 4.7% of the landings at Mangalore was constituted of by stomatopods with an average annual landings of 1,900 tonnes, entire landings being by trawlers. More than 50% of the landings of stomatopods occurred during January to March.

Landings by purse seines constituted 80% of the total marine fish landings at Mangalore. The landings by purse seines at Mangalore during the period 1981-'84 fluctuated around 33,000 tonnes with a maximum of 44,000 tonnes in 1982 and a minimum of 19,000 tonnes in 1983. This was constituted mainly of oil sardine with an average annual landings of 20,100 tonnes (60.9%), *Stolephorus* spp with 3,400 tonnes (10.2%), mackerel with 3,000 tonnes (9.2%), carangids (2.4%) and other sardines (2.3%). Among these, only *Stolephorus* spp showed an increasing trend while all others fluctuated heavily from year to year.

Landings by trawlnets constituted more than 19% of the total marine fish landings at this centre. This landings fluctuated between a minimum of 6,200 tonnes in 1981 and a maximum of 9,900 tonnes in 1983 with an average annual landings of 8,000 tonnes. This comprised mainly, prawns with an average of 1,200 tonnes and stomatopods with 1,900 tonnes. The landings of prawns from trawlnets was a minimum of about 700 tonnes in 1981 and a maximum of 1,600 tonnes in 1982.

Besides these two, drift/gill nets with mechanized propulsion also had been operated at Mangalore since 1983 though the contribution to the total landings compared to the former two was negligible. In 1983 and 1984, the landings from this was around 300 tonnes each, major component of landings being seerfishes. Pelagic group accounted for 77.6% of the total landings at the centre. The landings of this group fluctuated around 32,000 tonnes with a minimum of 18,100 tonnes in 1983 and a maximum of 41,900 tonnes in 1982 The landings of demersal group fluctuated around 9,200 tonnes during 1981-'84.

Table-26. *Estimated landings of important species at Mangalore during 1981-84 (Figures in tonnes)*

Name of fish	1981					1982					1983					1984				
	I	II	III	IV	Total	I	II	III	IV	Total	I	II	III	IV	Total	I	II	III	IV	Total
Oil sardine	2593	660	1621	21489	26363	14634	3175	4698	8153	30660	2371	1633	2913	2148	9065	1979	979	5394	6102	14454
Mackerel	651	337	1700	1272	3960	8	464	1060	1662	3194	—	22	15	1011	1048	6	99	3234	572	3911
Stolephorus	65	26	745	1480	2316	364	240	38	2482	3124	13	52	—	3960	4025	273	224	—	3630	4127
Bombayduck	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Croakers	1	47	—	6	54	—	1	3	93	97	272	176	26	351	825	151	103	—	50	304
Perches	—	—	—	—	—	—	—	—	—	—	589	800	—	323	1712	461	212	—	161	834
Pomfrets	—	—	—	—	—	—	11	104	1	116	92	15	1	19	127	45	4	—	34	83
Tunnies	192	45	177	1537	1951	5	307	118	14	444	16	8	—	71	95	32	2	—	21	55
Penaeid prawns	270	286	8	231	795	409	341	745	569	2064	680	660	559	68	1967	600	366	—	216	1182
Non penaeid prawns	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Others	2447	1804	570	6500	11321	3378	6337	852	2792	13359	3286	2765	464	3704	10219	3165	1543	62	6302	11072
Total	6219	3205	4821	32515	46760	18798	10876	7618	15765	53058	7319	6131	3978	11655	29083	6712	3532	8690	17088	36022

Table-27 *Estimated landings (in tonnes) of important species at Malpe during 1981-84*

Name of fish	1981					1982					1983					1984				
	I	II	III	IV	Total	I	II	III	IV	Total	I	II	III	IV	Total	I	II	III	IV	Total
Oil sardine	676	992	467	11032	13167	2314	1017	2201	4206	9738	353	99	2934	832	4218	992	752	5613	6213	13570
Mackerel	684	97	1502	1166	3449	—	161	—	60	221	—	3	102	208	313	221	611	5362	508	6702
Stolephorus	391	94	247	1728	2460	258	569	163	600	1590	35	910	123	764	1832	480	345	—	2902	3727
Bombayduck	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Croakers	—	—	—	—	—	—	—	79	—	79	49	114	57	692	912	58	78	25	23	184
Perches	—	—	—	—	—	—	—	—	—	—	198	227	—	76	501	140	53	—	9	202
Pomfrets	—	—	—	—	—	—	—	797	—	797	11	7	87	45	150	21	8	—	121	150
Tunnies	46	10	66	80	202	24	45	77	—	146	7	13	217	8	245	31	14	96	75	216
Penaeid prawns	206	270	9	120	605	187	150	342	204	883	206	374	45	52	677	201	310	350	32	893
Non-penaeid prawns	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Others	1597	1406	626	2250	5879	2210	1418	335	1154	5117	1562	1429	1313	5587	9891	1517	1255	4856	2774	10402
Total	3600	2869	2917	16376	25762	4993	3360	3994	6224	18571	2421	3176	4878	8264	18739	3661	3426	16302	12657	36046

Table 28. *Estimated landings of important species at Ganguli Bunder during 1981-84 (in tonnes)*

Name of fish	1981					1982					1983					1984				
	I	II	III	IV	Total	I	II	III	IV	Total	I	II	III	IV	Total	I	II	III	IV	Total
Oil sardine	1161	148	4	3322	4635	263	—	200	993	1456	1594	490	29	1592	3705	648	426	285	466	1825
Mackerel	1792	700	309	416	3217	23	141	—	38	202	—	—	2	33	35	65	205	24	215	509
Stolephorus	189	44	657	139	1029	745	379	—	1203	2327	659	965	—	634	2258	665	329	192	1300	2486
Bombayduck	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Croakers	—	—	—	4	4	—	—	2	—	2	19	24	18	35	96	57	61	12	48	178
Perches	—	—	—	—	—	—	—	—	—	—	24	8	—	1	33	21	3	—	49	73
Pomfrets	—	—	—	—	—	—	—	152	—	152	1	—	34	—	35	—	2	—	65	67
Tunnies	—	—	—	—	—	4	—	—	—	4	—	—	1	30	31	215	—	16	15	246
Penaeid prawns	300	108	2	95	505	268	107	1	95	471	143	115	30	22	310	182	84	46	95	407
Non-penaeid prawns	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Others	2671	1534	939	3403	8547	3183	1677	342	2700	7902	696	406	528	1860	3490	1635	515	517	1804	4471
Total	6113	2534	1911	7379	17937	4486	2304	697	5029	12516	3136	2008	642	4207	9993	3488	1625	1092	4057	10262

Table-29. *Estimated landings (in tonnes) of important species at Bhatkal during 1981-84*

Name of fish	1981					1982					1983					1984				
	I	II	III	IV	Total	I	II	III	IV	Total	I	II	III	IV	Total	I	II	III	IV	Total
Oil sardine	592	81	6	535	1214	276	13	90	38	417	163	62	—	444	669	563	174	167	290	1194
Mackerel	53	28	—	44	125	19	23	11	1	54	—	—	350	116	466	11	200	34	37	282
Stolephorus	—	—	—	—	—	—	—	—	5	5	—	4	53	287	344	136	13	30	136	315
Bombayduck	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Croakers	—	—	—	—	—	—	1	5	1	7	21	9	23	10	63	31	9	19	47	106
Perches	—	—	—	—	—	—	—	—	—	—	5	15	—	4	24	20	22	—	70	112
Pomfrets	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Tunnies	—	—	—	—	—	—	—	8	59	67	—	—	—	—	—	6	—	—	38	44
Penaeid prawns	—	—	—	—	—	—	—	—	—	—	51	35	32	16	134	76	48	46	35	205
Non-penaeid prawns	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Others	109	46	332	337	824	78	81	7	150	316	207	175	26	1611	2019	1225	385	257	856	2723
Total	754	155	338	916	2163	373	118	121	254	866	447	300	484	2488	3719	2068	851	553	1509	4981

Table-31. *Estimated landings (in tonnes) of important species at Karwar during 1981-84*

Name of fish	1981					1982					1983					1984				
	I	II	III	IV	Total	I	II	III	IV	Total	I	II	III	IV	Total	I	II	III	IV	Total
Oil sardine	1964	481	37	1646	4128	1766	141	319	1221	3447	174	232	7	1511	1924	1809	298	7	933	3047
Mackerel	37	51	580	260	928	15	173	2	42	232	—	7	36	111	154	2	21	36	124	183
Stolephorus	—	2	4	71	77	8	—	—	113	121	26	102	24	123	275	23	27	24	39	113
Bombayduck	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Croakers	110	60	17	84	271	—	3	25	6	34	90	74	115	53	332	43	38	115	79	275
Perches	16	125	3	—	144	1	—	13	—	14	76	175	1	45	297	131	78	1	43	253
Pomfrets	25	7	—	17	49	44	100	7	480	631	12	8	16	43	79	28	3	16	2	49
Tunnies	—	—	6	27	33	3	13	15	150	181	—	—	115	2	117	—	—	3	114	117
Penaeid prawns	144	295	23	137	599	287	102	121	222	732	366	207	372	192	1137	139	134	371	44	689
Non-penaeid prawns	—	—	—	4	4	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Others	1676	2047	114	1361	5198	5540	3226	501	1959	11226	1935	1370	484	1562	5351	1683	986	594	1023	4286
Total	3972	3068	784	3607	11431	7664	3758	1003	4193	16618	2679	2175	1170	3642	9666	3858	1585	1168	2401	9012

Malpe: During 1981-'84, Malpe registered an annual average landings of 24,800 tonnes constituting 18.1% of the total marine fish landings in the state. The landings at this centre decreased from 26,000 tonnes in 1981 to about 19,000 tonnes in 1982 and remained at the same level in 1983 but registered a steep increase to 36,000 tonnes in 1984.

Pelagic fishes formed about 77% of the total landings and demersal fishes about 23%. Pelagic group fluctuated between 11,300 tonnes of 1983 and 28,700 of 1984 with an annual average of 19,100 tonnes. Demersal group varied between 3,700 tonnes of 1981 and 7,300 of 1984 with an annual average of 5,400 tonnes.

Among the commercially important varieties, oil sardine ranked first contributing 41.1% of the total landings, entire landings coming from purse seines This fluctuated around 10,200 tonnes with a minimum landings of 4,200 tonnes in 1983 and a maximum of 13,600 tonnes in 1984, about 55% of the landings occurring in the quarter October to December. Mackerel constituted 10.8% of the landings, purse seine being the sole gear landing it. Wide fluctuations were observed in its landings which touched a minimum of just 200 tonnes in 1982 from 3,400 tonnes of 1981 but revived in 1984 with an annual landings of 6,700 tonnes. Major landings of this fish occurred in the quarter July to September followed by the subsequent quarter October to December. *Stolephorus* spp with an average annual landings of 2,400 tonnes contributed 9.7% to the total landings, purse seines accounting for over 98% of the landings of this fish. The landings of *Stolephorus* spp at this centre from purse seines decreased from 2,500 tonnes of 1981 to 1,600 tonnes in 1,982 and increased in the subsequent years and in 1984 touched the maximum of 3,700 tonnes. About 63% of the landings occurred in the last quarter October to December of the year. Carangids accounted for 4.1% of the landings at this centre with an annual average of about 1,000 tonnes, contribution from purse seines alone being of the order of 95%. Landings of carangids by purse seines showed an increasing trend since 1982. Stomatopods, which accounted for 6.3% of the landings, was wholly contributed by trawlers. 3.1% of the landings at Malpe was accounted for by prawns. Out of an annual average of about 800 tonnes of prawns 700 tonnes was contributed by trawlnets.

Almost the entire landings at Malpe came from purse seines and trawlnets, the contribution from other gear available, viz, gill nets being less than 0.5% of the total landings. The landings by purse seines fluctuated around 19,500 tonnes with a minimum annual landings of 13,100 tonnes in 1983 and a maximum of 30,300 tonnes in 1984. Oil sardine, the major component, accounted for 52.2% of the landings by purse seines with an annual average landings of 10,200 tonnes. Landings of oil sardine was a minimum of 4,200 tonnes

in 1983 but regis tered a steep increase to 13,600 tonnes in 1984, the maximum during the period 1981-'84. This was followed by mackerel which remained very poor throughout in the landings with average annual landings of just 2,700 tonnes (13.7%). The landings of mackerel in 1982 and 1983 were very low at 200 tonnes and 300 tonnes respectively but showed improvement in 1984 when the landings was 6,700 tonnes. *Stolephorus* spp accounted for 12.1% of the landings by purse seines. This fluctuated between a minimum of 1,600 tonnes of 1982 and a maximum of 3,700 tonnes of 1984 with an average annual landings of 2,400 tonnes. These were followed by carangids which accounted for 5% of the landings with an average annual landings of about 100 tonnes.

The landings by trawlnets at this centre showed an increasing trend during the period 1981-'84 with a minimum of 4,700 tonnes in 1981 and a maximum of 5,600 tonnes in 1984. Penaeid prawns constituted 13.4% of the landings by trawl nets which showed an increasing trend during the period 1981-'84, from about 500 tonnes of 81 to about 900 tonnes of 1984. The landings of stomatopods fluctuated around 1,500 tonnes forming 30% of the total landings from trawlnets.

Ganguli Bunder

Another important landing centre in Dakshin Kannada district is Ganguli Bunder where about 9.3% of the total landings in the state take place. The landings at this centre fluctuated around 12,700 tonnes during 1981-'84 with a minimum landings of about 10,000 tonnes in 1983 and a maximum of 18,000 tonnes in 1981. Among the commercially important varieties of fish, oil sardine with an average annual landings of 2,900 tonnes accounted for 22.9% of the total landings at this centre, the entire landings of oil sardine being realized through purse seines. The landings of oil sardine from purse seines at this centre showed wide fluctuations during the period 1981-'84. From 4,600 tonnes of 1981 it reduced to just about 1,500 tonnes in 1982 but recovered in 1983 when the landings rose to 3,700 tonnes. However in 1984 it again decreased sharply to about 1,800 tonnes. Peak landings of oil sardine occurred in the last quarter October to December of the year. *Stolephorus* spp with an average annual landings of about 2,000 tonnes constituted 16% of the total landings at the centre, almost entire landings being from purse seines. The landings of *Stolephorus* spp rose from about 1,000 tonnes in 1981 to 2,300 tonnes in 1982 and remained almost at the same level in the subsequent years with insignificant fluctuations. The last quarter (October to December) contributed the maximum landings followed by first quarter (January to March). Other sardines accounted for 10.9% of total landings at the centre with an average annual landings of about 1,400 tonnes, entire landings being from purse seines. The landings of other sardines at this centre fluctated widely with a maximum of 2,800 tonnes in 1981 and a minimum of 400 tonnes in 1983. Mackerel with an average

annual landings of about 1,000 tonnes contributed 7.8% of the total landings at the centre, the landings coming entirely through purse seines. Mackerel, in its landings at this centre, manifested wide fluctuations during the period 1981-'84. From 3,200 tonnes in 1981 it reduced to 200 tonnes in 1982 and in 1983 it further reduced to quite insignificant quantity but showed marginal recovery in 1984 with an annual landings of about 500 tonnes. Among other varieties-cat fishes accounted for 4.5% with an average annual landings of about 600 tonnes, penaeid prawns for 3.3% with an annual landings of about 400 tonnes on an average and silverbellies for 3.1% of the total landings.

About 77.3% of the total landings was accounted for by pelagic group and the rest by demersal group. The pelagic group fluctuated about an average of 9,800 tonnes during 1981-'84 with a maximum of 16,300 tonnes in 1981 and a minimum of 6,700 tonnes in 1983. Demersal group fluctuated during the period around 2,900 tonnes with a minimum of 1,600 tonnes in 1981 and a maximum of 3,500 tonnes in 1984.

The major gear that operated at this base were purse seines and trawlnets which together contributed 99.4% of the landings, purse seines 68.4% and trawlnets 31%. The landings of purse seines at this centre during 1981-'84 fluctuated around 8,700 tonnes. From 12,600 tonnes in 1981 it decreased to 7,000 tonnes in 1982. The landings which increased to 8,000 tonnes in 1983 again decreased to 7,000 tonnes in 1984. Among the major varieties of fish landed by purse seines, oil sardine accounted for 33.5% followed by *Stolephorus* spp (23.3%). Other sardines accounted for 15.9% and mackerel 11.4%. Out of these, oil sardine, other sardines and *Stolephorus* spp landed maximum in the fourth quarter (October to December) of the year and mackerel registered maximum landings in the first quarter (January to March).

The landings by trawlnets showed fluctuation around 3,900 tonnes. This landings which was of the order of 5,400 tonnes in 1981 and 1982 reduced considerably to 1,700 tonnes in 1983 but increased to 3,100 tonnes in 1984. Among the commercially important varieties, prawns constituted 10.6% of the landings and stomatopods accounted for 13.4%.

Bhatkal: The landings at Bhatkal accounted for 2.1% of the total landings in the state. The landings at this centre also varied from year to year around an annual average of 2,900 tonnes. The percentage contribution of this centre to the total landings in the state showed a similar trend as the total landings at this centre, both showing considerable decrease in 1982 from those of 1981 and subsequently maintaining an increasing trend; when the landings increased, to about 5,000 tonnes in 1984, percentage contribution of this centre to the total landings in the state rose to 3.9 in 1984 from 3.3 of 1983.

The pelagic group of fishes accounted for 71.2% of the total fish landings at the centre, contribution from demersal group being 28.8%. The pelagic group with an average annual landings of about 2,100 tonnes decreased from 2,100 tonnes of 1981 to just about 800 tonnes in 1982 but subsequently increased consistently and was a maximum of 3,300 tonnes in 1984. Demersal group which landed in insignificant quantities in 1981 and 1982 caught up in 1983 with an annual landings of about 1,600 tonnes and showed further marginal increase in the year 1984.

Among the major fisheries, oil sardine accounted for 29.8% of the total landings. Oil sardine recorded an annual landings of about 900 tonnes, purse seine being the sole gear contributing to its landings. From 1,200 tonnes of 1981 it reduced to just about 400 tonnes in 1982 and showed a marginal increase in the succeeding year and then increased to about 1,200 tonnes in 1984. Oil sardine was followed by other sardines which contributed 17.8% of the total landings with an average annual landings of about 500 tonnes. Silverbellies (9.2%), mackerel (7.9%), carangids (6.9%) and *Stolephorus* spp (5.7%) were among major varieties that landed at this centre.

Purse seines contributed 80.1% of the landings at this centre with an annual average of about 2,300 tonnes. From about 2,200 tonnes of 1981 it reduced to just about 900 tonnes in 1982 but in the subsequent year increased to about 3,200 tonnes and remained at the same level in the succeeding year 1984. Among the major fisheries, oil sardine accounted for 37.2% of the landings by purse seines followed by mackerel (9.8%), carangids (8.2%) and *Stolephorus* spp (7.0%). The landings by trawlnets rose from about 500 tonnes in 1983 to about 1,700 tonnes in 1984. In the landings by trawlnets, prawns increased from just about 200 tonnes in 1983 to about 800 tonnes in 1984.

Tadri: The landings at Tadri contributed 4.7% of the total landings in the state. From 8,000 tonnes of 1981, it decreased to 5,800 tonnes in 1982 but showed a marginal increase to 6,400 tonnes in 1983. However the landings again decreased to 5,300 tonnes in 1984.

Pelagic group of fishes constituted 50.4% of the total landings and demersal group 49.6%. Pelagic group over the years 1981 to '84 manifested a decreasing trend; from 6,100 tonnes of 1984 it sustained a steep decrease in 1982 with annual landings of about 2,700 tonnes. It remained at the order of 2,000 tonnes in the subsequent years 1983 and 1984. Demersal group, on the other hand, fluctuated during '81-'84 around 3,200 tonnes. From 2,000 tonnes of 1981 it increased to 3,100 tonnes in 1982 and then to about 4,400 tonnes in 1983. But it sustained a decrease in the year 1984 when the annual landings was about 3,300 tonnes.

Among the major fisheries at the centre, oil sardine accounted for 25.5% of the total landings, main contribution (about 99%) being from purse seines. The landings of oil sardine from this gear decreased from about 4,000 tonnes in 1981 to about 1,500 tonnes in 1982 and further reduced to 400 tonnes in 1983 and showed a marginal increase in 1984 with landings of 500 tonnes. Prawns constituted 9.2% of the landings at this centre and about 95% of the landings of prawns was contributed by trawlnets. The landings of prawns by trawlnets fluctuated around 600 tonnes, with a minimum of 300 tonnes in 1981 and a maximum of 700 tonnes in 1982. This was followed by mackerel of which the landings decreased from 1,700 tonnes of 1981 to practically insignificant quantity in 1982 and 1983. But this showed recovery in the year 1984 with annual landings of about 500 tonnes. Among other important fisheries silverbellies accounted for 7.1%, catfishes 5.6% and other sardines 3.2%. Stomatopods with an average annual landings of the order of 600 tonnes accounted for 10.7% of the total landings at the centre.

Among the nets that operated at the centre, purse seines and trawlnets together accounted for 94.5% of the total landings at the centre.

Purse seine with an average annual landings of 2,900 tonnes accounted for 45.2% of the total landings while trawlnets with an average annual landings of 3,400 tonnes accounted for 49.3%. Among the major fisheries landed by purse seines, oil sardine accounted for 55.7%, followed by mackerel (19.2%), other sardines (7.0%) and *Stolephorus* spp (4.3%). Among these, *Stolephorus* spp landed in good quantities in the years 1983 and 1984. Among the important fishes landed by trawlnets penaeid prawns accounted for 16.4% followed by silver bellies (12.1%), catfishes (6.1%) and croakers (4%). Stomatopods with an average annual landings of 600 tonnes accounted for 18.5% of the landings by trawlnets.

Karwar: The landings realized annually on an average at Karwar was 11,700 tonnes which accounted for 8.5% of the the total production in the state. The landings at this centre increased from 11,400 tonnes of 1981 to 16,700 tonnes in 1982 but sustained a reduction of about 7,000 tonnes in the subsequent year and reduced still by Simillar quantity in the year 1984 when the annual landings was 9,000 tonnes.

The pelagic group of fishes constituted 51.8% of the total landings at the centre while the complement of demersal group was 48.2%. Pelagic group of fishes fluctuated around 6,100 tonnes with a maximum of 7,600 tonnes in 1982 and a minimum landings of 4,800 tonnes in 1983.

The landings of demersal group increased to a maximum of 9,000 tonnes in 1982 from 5,000 tonnes of 1981. But in the subsequent year the landings reduced to 4,900 tonnes and further decreased to 3,600 tonnes in 1984.

Oil sardine dominated among the important varieties in the landings at this centre. It contributed 26.9% of the total landings at this centre registering an average annual landings of about 3,100 tonnes, major contribution of this fish being from purse seines. The landings of oil sardine from purse seines at this centre showed wide fluctuations during the period 1981-'84. From 4,100 tonnes of 1981 it reduced to 3400 tonnes in 1982 and sustained a further reduction by about 1,500 tonnes in the subsequent year when the annual landings was 1,900 tonnes. However in 1984, it revived to 3,000 tonnes. The quarter January to March recorded maximum landings of this fish followed by the quarter October to December. Penaeid prawns ranked second in the order of abundance of commercially important varieties. Penaeid prawns with an average annual landings of 800 tonnes accounted for 6.8% of the total landings at the centre.

The landings of prawns at this centre from trawlnets accounted for 97% of the total landings of prawns. This landings which was 1,100 tonnes in 1983 remained around 600 tonnes in the remaining years. Among other major varieties, other sardines contributed 6% with an annual average landings of 700 tonnes, silverbellies 4.1%, catfishes 3.4% and mackerel 3.2%. Stomatopods with an annual average landings of 2,100 tonnes accounted for 17.7% of the landings at this centre.

Major gear that operated at this centre were purse seines and trawlnets which together accounted for 99% of the total landings at the centre. Purse seines with average annual landings of 5,800 tonnes accounted for 50% while the trawlnets with 5,700 tonnes for 49% of the total landings. Oil sardine with an average annual landings of 3,100 tonnes accounted for 53.6% of the landings of purse seines followed by other sardines (700 tonnes; 12.0%), mackerel (400 tonnes; 6%) and carangids (200 tonnes; 4.1%).

Among the major fisheries from trawlnets, prawns landed about 800 tonnes annually accounting for 13.4% of the total landings by trawlnets, and stomatopods with an annual average landings of 2,100 tonnes constituted 36% of the landings.

Effort and Catch per Unit Effort

Purse Seines: Effort put in by purse seines was very low in 1977, the year in which purse seine was first introducted on commercial scale in Karnataka. Effort in terms of number of operations made was only in the order of 5,000 in 1977 but it increased to about 19,000 in 1978. The year 1979 witnessed a further increase of effort of 7,000 trips when the total effort increased to 26,000. However there was a reduction of 6,000 trips in the effort put in the year 1980. A sudden

spurt was observed in 1981 and subsequently in 1982 when the maximum effort of about 55,000 trips were made. But the trend was reversed in 1983 when it reduced by about 16,000 operations but showed an increase of about 7,000 trips in 1984. The catch, effort and catch per unit effort realized by purse seines from 1980 to '84 are given in table 32.

In the early years of the introduction of purse seines, there was marked response to the increased effort in the landings and this was maintained more or less upto 1981 when the maximum landings of 95,000 tonnes was recorded. In 1979, though there was an increase of effort by 38% the landings by purse seine decreased by a marginal 8%. In 1980, when the effort decreased by 24%, the

Table 32. *Catch, effort and catch per unit effort realized by purse seines*

	1980	1981	1982	1983	1984
C	76.13	95.47	85.40	53.06	78.46
E	19.54	31.12	54.58	38.76	45.32
CPUE	3895	3068	1565	1369	1731

C–Catch in '000 tonnes; E-Effort in '000 operations
CPUE-Catch per unit operation in kg

landings did not show appreciable change over that of preceding year the decrease in landings was only by a marginal 0.7%. In spite of the increase in the effort in 1979, the reduction in the landings was mainly due to the non availability of oil sardine of which the catch per unit effort reduced from 2,239 kg of 1978 to 985 kg of 1979. Similarly despite the decrease in the effort by24% in 1980 the landings did not show appreciable reduction mainly due to an increase in the catch per unit effort of oil sardine which increased to 2,028 kg in 1980. The year 1981 witnessed an increase of effort by 59% while the landings increased by only 25%. This was mainly due to the reduction in the CPUE of oil sardine and mackerel which reduced so 1,818 kg and 496 kg in 1981 from 20,28 kg and 756 kg of 1980 respectively. The effort which was a maximum in 1982 recorded an increase of about 75% over that of preceding year but the landings registered a decrease of 10.5%. This sudden increase in the effort might be the consequence of good landings in the preceding year but resulted in a very low catch per unit effort of 1,565 kg compared to 3,068 kg of 1981. The main contributing factor was the poor catch per unit effort of oil sardine which went down drastically from 1,818 kg of 1981 to 927 kg in 1982 and also that of mackerel which reduced from 496 kg of 1981 to just 80 kg in 1982. In 1983 both effort and landings reduced; the former by 29% and the latter by 38%. Reduction in the

landings was contributed mainly by the reduction in the catch per unit effort of oil sardine which reduced by 41%. In 1984 both effort and landings registered considerable increase; former by 17% and the latter by 48%. This increase in the landings was the consequence of the increase in the catch per unit effort which increased from 1,369 kg of '83 to 1,731 kg accounting for an increase of 26%. The main factor contributing to this was an increase in the catch per unit effort of oil sardine to the order of 41% over that of preceding year. Also, there was considerable increase in the catch per unit effort of mackerel though it remained still poor when compared to that during late seventies.

Catch per unit effort realized by purse seine showed a clear decreasing trend during the years of its operation. From 4 to 4.5 tonnes of 1977-1978, with the introduction of more number of purse seines, it reduced to 3 to 4 tonnes in the years 1979 to '81. But the enormous pressure exerted in 1982 reduced it to just 1.4 to 1.6 tonnes in the subsequent years. Oil sardine had been the mainstay in the fishery realized by purse seines and the whole performance of purse seine operations was dependent on the availability of this single fish though to a large extent it was supplemented by mackerel in the early years of the purse seine operations. With the introduction of purse seine in the state the landingg of *Stolephorus* spp considerably increased and had been showing an increasins trend. The catch per unit of effort of *Stolephorus* spp ranged between 185 kg of 1981 and 286 kg of 1980.

Table 33. *Catch per unit effort of important varieties realized by purse seines (figures in kgs)*

	1980	1981	1982	1983	1984
Catfishes	126	184	131	82	39
Oil sardine	2028	1818	927	549	776
Other sardines	182	151	48	153	116
Stolephorus spp	286	185	225	259	249
Carangids	200	79	31	48	108
Mackerel	756	496	80	53	267
Tunnies	47	74	17	15	17
Others	174	55	85	124	126
Total	3895	3068	1565	1369	1731

The catch per unit effort realized in respect of catfishes touched a very low 39 kg in 1984 compared to 184 kg of 1981. Catch per unit effort of other sardines fluctuated during the period 1980-'84 with a minimum of 48 kg in 1982 and a

maximum of 182 kg in 1980. The catch per unit effort of tunnies was consi_ derably good only in the year 1981 when it was 74 kg and in the subsequent years it had been as low as 15 to 17 kgs.

Effort had been increasing in Dakshin Kannada district consistently till 1982 and that in Uttar Kannada district till 1983. In Dakshin Kannada district from 18,000 trips in 1980, the effort increased to about 48,000 in 1982 but in 1983, it sustained a reduction of about 19,000 trips, the effort expended being only 28,000 trips. However this registered an increase in 1984 when the effort went upto 35,000. Good landings in 1981 with a catch per unit effort of 3,031 kg would have given impetus for the increased effort in 1982 but the low catch per unit effort (1·557 kg) realized in 1982 would have propelled the withdrawal of effort in 1983 in Dakshin Kannada district. However in 1984 a marginal increase in the catch per unit effort also was observed in Dakshin Kannada district matching with the increased effort.

Table 34. *Catch, effort and CPUE in respect of purse seine*

		1980	1981	1982	1983	1984
Dakshin Kannada						
	C	70.20	81.48	74.04	42.36	65.59
	E	18.00	26.89	47.55	26.16	35.12
	CPUE	3900	3031	1557	1504	1868
Uttar Kannada						
	C	5.93	13.99	11.37	10.70	12.87
	E	1.54	4.24	7.02	10.60	10.20
	CPUE	3844	3303	1618	1010	1262

C – Catch in '000 tonnes; E - effort in '000 operations CPUE–Catch per unit effort in kg.

The catch per unit effort realized in Dakshin Kannada district had been consistently decreasing till 1983. When the effort increased by 49% in 1981 compared to that of 1980, CPUE registered a decrease of 22% and the same trend continued in 1983 also; when the effort increased by a considerably high 77%, the CPUE reduced by a significant 49%. However, there was a significant reduction in effort in 1983 by 41% but resulted in only a marginal decrease of 3% in CPUE. But in 1984 both effort and CPUE increased; former by 25% and latter by 24%.

In Uttar Kannada district, CPUE had been consistently decreasing till 1983 but showed improvement in 1984. On an average, till 1983 effort had been

increasing by 3,000 trips but in 1984 it showed a marginal decrease of 400 trips. In 1980, the CPUE in Uttar Kannada matched well with that of Dakshin Kannada and in 1981 it was about 9% more than that of Dakshin Kannada and it remained 4% more in 1982 also but in 1983 and 1984 the trend was reversed. As in the Dakshin Kannada, significant reduction in CPUE was observed in 1982 in Uttar Kannada when it reduced by 51% from that of 1981. The catch per unit effort realized in 1983 was the lowest observed in both the districts over the years 1980 to 1984. In 1984, however, though effort registered a marginal decrease, a 25% increase was observed in CPUE in Uttar Kannada. In both the years 1983 and 1984, the CPUE realized in Uttar Kannada district was about two third of that in Dakshin Kannada district.

Trawlnet: During the period 1980-'84, the effort put in in terms of number of operations (trips) of units showed an increasing trend in respect of trawlnet. This increased from about 67,000 in 1980 to 118,000 in 1981 and then registered a steep increase to 192,000 in 1982 resulting in an average annual increase of 71%. This resulted in an average annual increase of 56% in the landings by trawl nets the landings increased from 18,000 tonnes of 1980 to about 45,000 tonnes in 1982. In 1983 though effort increased by 11%, the landings showed a decrease of 13% and in 1984 both effort and landings decreased, former by 23% and latter by 14%.

Catch per unit effort had been steadily decreasing from 1980 till 1983 but in 1984 it improved marginally. From 281 kg of 1980, CPUE reduced to 183 kg of 1983.

Table 35. *Catch per unit effort of important varieties realized by trawlnet (in kg)*

	1980	1981	1982	1983	1984
Elasmobranchs	16	4	2	2	2
Catfishes	16	5	4	12	3
Croakers	34	7	5	11	8
Silverbellies	16	5	6	16	10
Soles	9	3	7	11	36
Penaeid prawns	35	28	35	33	31
Stomatopods	11	74	52	36	60
Others	144	148	122	62	53
Total	281	274	233	183	203

Penaeid prawns had been the mainstay among commercially important varieties in the resources realized by trawlnets and showed a more or less steady catch per unit effort which varied only with in the range 28 to 35 kg during the period under discussion. Other important varieties like elasmobranchs, catfishes, croakers and silverbellies showed sudden and steep decrease in the catch per unit effort in 1981 from that of 1980 but the year 1981 witnessed a very high catch per unit effort of stomatopods (74 kg) which remained very high in the subsequent years also. The catch per unit effort of catfishes, croakers and silverbellies though very low in 1981 and 1982 showed signs of recovery in 1983. The catch per unit effort of soles though very low in the years 1980-'83, was as high as 36 kg in 1984 when the total landings also was a substantial 6,000 tonnes from trawlnet.

Table 36. *Catch, effort and CPUE in respect of trawlnet*

		1980	1981	1982	1983	1984
Dakshin Kannada						
	C	11.75	21.98	27.17	18.85	17.79
	E	47.72	90.43	126.62	121.59	86.96
	CPUE	245	243	215	155	207
Uttar Kannada						
	C	6.69	10.49	17.48	20.10	15.38
	E	17.92	27.87	65.23	90.82	77.60
	CPUE	373	376	268	221	198
Total						
	C	18.44	32.47	44.65	38.95	33.35
	E	65.64	118.30	191.85	212.41	164.56
	CPUE	281	274	233	183	203

C - landings in '000 tonnes, E-Effort in '000 operations
CPUE - Catch per unit effort (in kg)

Catch per unit effort realized by trawl net had been very high in Uttar Kannada district compared to that of Dakshin Kannada district till 1983. In 1980-'81, when it was about 240 kg in Dakshin Kannada, it was of the order of 370 kg in Uttar Kannada district This might be due to the fact that by this time, Dakshin Kannada district had almost reached saturation with respect to trawlers while intensity was much less in the Uttar Kannada district. However by 1984, the catch per unit realized in both the districts was very much comparable showing thereby that the

increase in the effort in the Uttar Kannada had been very fast in the latter years. In Dakshin Kannada district, the effort increased by 89% in 1981 compared to that of 1980 and consequently the catch also increased, by 87%, thereby showing no significant change in the catch per unit effort. Similarly, a 55% increase in effort in Uttar Kannada during 1981 resulted in an increase of 57% of landings, the catch per unit effort making no appreciable change. But in 1982 in Dakshin Kannada district an increase of effort of 40% resulted in an increase in the landings only of 24% reducing catch per unit effort from 243 kg of 1981 to 215 kg in 1982. During the same period, effort in Uttar Kannada district increased by 134% but the landings increased only by 67% and this had been the consequence of a reduction of 29% in the catch per unit effort. In the year 1983, the effort in Dakshin Kannada district showed a marginal decrease of 4% but the landings registered a decrease by 31% as a result of reduction of the catch per unit effort by about 28%. In Uttar Kannada district both the effort and landings increased during 1983 compared to that of 1982; former by 39% and the latter by 15%; the reduction in the proportion of increase in landings over that of effort being due to the decrease in the catch per unit effort in the order of 18%. In 1984 catch per unit effort increased in Dakshin Kannada by 34% and in Uttar Kannada it decreased by 10%. But in both the districts, landings as well as effort decreased from that of preceding year. In Dakshin Kannada the effort decreased by 22% while the landings reduced by only 5% and in Uttar Kannada, the reductions in effort and the landings were 15% and 23% respectively.

Gill nets: Gill nets became popular in Karnataka in 1983. Total landings by gillnetters at important landing centres like Mangalore, Malpe, Ganguli, Bhatkal, Tadri and Karwar, in 1984 showed a decrease by 22.5% from about 1,000 tonnes of 1983, while the effort in terms of operations showed an increase of 15%. The catch per unit effort considerably decreased in 1984 from 127 kg of 1983 to 86 kg of 1984, mainly due to reduction in the catch per unit effort of elasmobranchs by 59% and that of seerfishes by 16%.

Catch per unit effort by gillnetters showed steep decrease in both the districts. In Dakshin Kannada from 135 kg of 1983, it reduced to 88 kg in '84 and in Uttar Kannada the CPUE reduced from 103 kg of 1983 to 77 kg in 1984. In Dakshin Kannada, the reduction was mainly the consequence of the fall in the CPUE of elasmobranchs by about 64% and that of seerfishes by 13%. In Uttar Kannada also, the reduction in CPUE was the result of fall in the catch rate of seerfishes by 41%.

Discussion

Karnataka state contributed to the order of 9% to the total marine fish landings in the country. Productivity of Karnataka is much better than the average when we observe that this contribution has come from a coastal length

which is a little less than one twentieth almost of the total coastal length of the country. The continental shelf area of Karnataka (about 25000 sq.km) is only one sixteenth of the total shelf area of the country but the production per hectare from the shelf area of Karnataka is 52 kg which is 49% above the average production in India per hectare from shelf area.

During the period 1975 to '84, the marine fish landings in Karnataka manifested promising features of quantitative improvement though the annual landings was characterized by wide fluctuations because the trend of fisheries in Karnataka had been mainly determined by two major pelagic resources, oil sardine and mackerel, which fluctuated widely over years. During this period both pelagic resources and demersal resources had increased in general. Proportion of demersal resources became markedly better in the latter part of the period. There was significant reduction in the proportion of pelagic resources in the year 1983 when the landings of oil sardine touched a very low 22,000 tonnes and the landings of mackerel was the lowest ever recorded in Karnataka.

Commercial introduction of small trawlers in Karnataka in the early seventies gave a fillip to the production. The proportion of landings by mechanized craft increased from just 16% of 1971 to 53% in 1972 and qualitatively, demersal resources showed remarkable increase in the landings; elasmobranchs by 78%, catfishes by 139%, croakers by 61% and penaeid prawns by 82%, but subsequently the proportion of landings by mechanized craft reduced to 11% in 1975. But the facade suddenly changed in the year 1977 with the introduction of purse seiners and the contribution from mechanized craft increased from just 18% of 1976 to about 90% in 1984.

Commercially important varieties of fish like elasmobranchs, catfishes, croakers, seerfishes, pomfrets, *Stolephorus* spp,tunnies and penaeid prawns showed comparatively better landings during latter half of 10 year period 1975-'84. The landings of oil sardine fluctuated during the period and the landings of mackerel during the latter half was very poor. *Stolephorus* spp, catfishes, seerfishes,tunnies carangids and elasmobranchs appeared to be promising fisheries with potentiality of further increase in the landings. The percentage contribution of these varieties to the total landings also registered increase from that of first half 1975-'79. The percentage contribution of *Stolephorus* spp increased from just 0.4% of the first half to 7.0% in the latter half 1980-'84, about 97% of the landings being from the purse seiners and this phenomenal increase in the landings of *Stolephorus* spp could be attributed to the introduction of purse seiners in the state. Seerfishes registered increase in its percentage contributions to the total landings from 1.3% of 1975-'79 to 3.0% of 1980-'84 and similarly tunnies increased from 0.7% to 1.3% and carangids from 0.8% to 3.5%. Even though there was a spurt in the landings of mackerel in the year 1978 and maintained high in the subsequent year, failed considerably in the following years touching the lowest production in

1983. Oil sardine though fluctuated, yielded good landings upto 1982 but failed in following two years. This spurt noticed in the landings of mackerel and oil sardine might be attributed partly to introduction of purse seiners.

The landings in all the four quarters of the year showed increase uniformly in 80-84 over that of 75–79. Significant increase of 72% could be observed during the quarter July to September while it was just 13% in the first quarter January to March. In the remaining two quarters increase in the landings was of the order of 50%. Maximum landings of major resources occurred in the fourth quarter October to December followed by the quarter January to March.

Generally penaeid prawns occurred maximum in the first quarter (January to March). Elasmobranchs, cat fishes and croakers also landed during the first quarter in quantities comparable to the landings during fourth quarter. The landings in Dakshin Kannada district in all the seasons were nearly the double of that in Uttar Kannada district. In both the districts maximum landings occurred in the last quarter but minimum landings occurred in Dakshin Kannada in second quarter whereas it was in third quarter in Uttar Kannada. Landings of elasmobranchs, croakers, and seerfishes were found to be more in Uttar Kannada district while Dakshin Kannada contributed more to the landings of other important varieties like catfishes, oil sardine, other sardines, *Stolephorus* spp, carangids, silverbellies, mackerel, pomfrets and tunnies and also of prawns. Even though annual landings of elasmobranchs was more in Uttar Kannada, this district contributed only 25% of the landings in the third quarter while 75% of the landings in the third quarter came from Dakshin Kannada. Similarly in respect of landings of croakers, 54% of the landings in second quarter and 53% in the third quarter was contributed by Dakshin Kannada district. In all the seasons, the percentage contribution of the landings of ribbonfishes by Uttar Kannada was higher than that of Dakshin Kannada district. Percentage contribution of landings of seerfishes was higher in Dakshin Kannada only in first quarter (69%) Two thirds of the landings of other sardines in the state was contributed by Dakshin Kannada district though about 52% of the landings in the first quarter was contributed by Uttar Kannada. In respect of landings of carangids Dakshin Kannada dominated in the first and third quarters while Uttar Kannada in second and fourth quarters. The contribution to the landings of silverbellies from Uttar Kannada accounted for 86% in the first quarter but in the remaining quarters the Dakshin Kannada dominated in its landings. Similarly in the case of pomfrets, the contribution from Uttar Kannada was more in first and second quarters but in the remaining quarters Dakshin Kannada witnessed higher landings.

In the landings of Dakshin Kannada district component of the pelagic group of fishes constituted 76% and complemented by the demersal group to the

tune of 24% while the pelagic and demersal groups accounted for 52 and 48% of the landings in Uttar Kannada district. While there was wide difference in the proportions of pelagic and demersal groups in Dakshin Kannada, in Uttar Kannada district both groups were evenly distributed in the landings. Similarly, the contribution from Uttar Kannada to the pelagic resources in the state was about 22% while 78% was accounted for by Dakshin Kannada district. But in respect of demersal resources, the contribution from Dakshin Kannada and Uttar Kannada were 56% and 44% the difference being negligible when compared to the difference in the percentage contributions towards pelagic resources.

Major contribution to the landings by mechanized vessels was provided by Dakshin Kannada district (77%) while the landings in Uttar Kannada accounted only for 23% of the total landings of this category. But in respect of landings by non-mechanized traditional units, the trend was reversed with 64% coming from Uttar Kannada and 36% from Dakshin Kannada district indicating thereby that traditional units had been more vigorously operated in the northern part of the state compared to that in southern part while more intensive fishing by mechanized craft had been in the southern district. During the period 1980-'84, landings by triditional units in the northern district had been quite encouraging.

Landings realized by purse seiners accounted for 68% of the total landings by mechanized craft and that by trawlers for about 30%. The contribution from gill netters and liners had been very small and scanty. However, Gillnetters had been operating from all important harbours since 1983 and the production also had been encouraging. The catch rate realized by purse seiner had been decreasing and the landings also seem to have stabilized and further increase would result in very low catch rate rendering operation not economically viable. Since oil sardine and mackerel, the two target fisheries had exhibited annual fluctuations in their landings, nothing emerged out of the anlysis to cast pesimism on their future availability. *Stolephorus* spp however, showed scope for increasing production. Catch rate realised by trawler also had been decreasing generally during the period 1980-'84. Catch rate of penaeid prawns realized by trawler remained more or less steady during the period but that of elasmobranchs and croakers reduced significantly during the period. The complementing factor had been increased landings of stomatopods which remained very high in the landings since 1981. Catch rate of trawler had been comparatively high in the northern district but both had been showing a decreasing trend. The relatively high catch rate in the Uttar Kannada district of 1980 and '81 indicated that the intensity of operation was not that high in Uttar Kannada district compared to that in south.

The gradual disappearance of rampani. onetime most popular and effective tackle, had been conspicious in Karnataka with the onset of purse seiners. The landings by rampani reduced significantly from about 9,000 tonnes of 1979 to just about 1,000 tonnes in 1984, both catch and effort decreasing proportionally.

Gillnetters became popular in Karnataka since 1983 and were mainly concentrated at important landing centres like, Mangalore, Malpe, Karwar, Tadri and Ganguli Bunder.

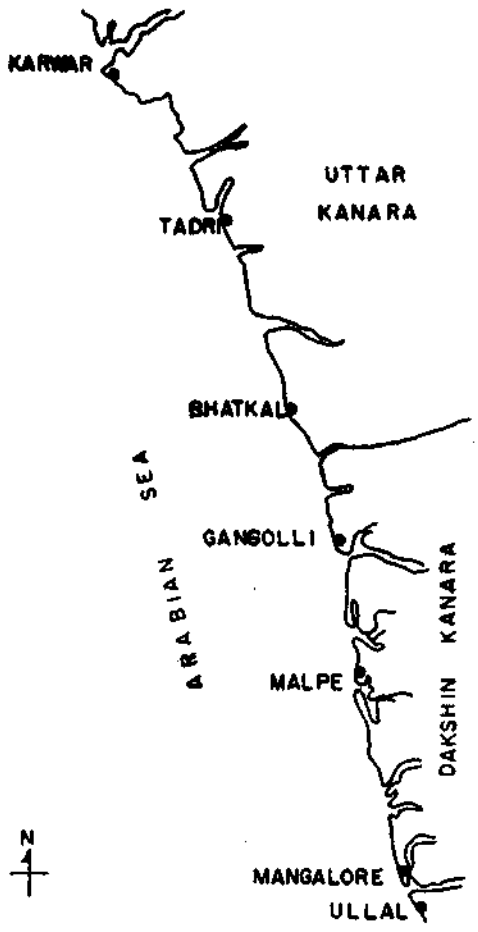
About 73% of the total marine fish landings in Karnataka is accounted for by the landings at the important landing centres namely Mangalore, Malpe, Ganguli, Bhatkal, Tadri and Karwar. Mangalore alone contributed more than 30% of the total landings in the state and Malpe about 18%.

Karnataka had been a promising region in the matter of fisheries development in the country. The state in the past had pioneered many novel introduction in the fishing technology. Rampani which was introduced a century ago by a Portughese priest in Goa was immediately adopted for commercial operation by Karnataka fishermen and it remained by far the most important indigenous gear which accounted for about 60% of the total fish caught in the state. Historically it has been in operation since the latter part of the nineteenth century. It was introduced by Fr. Rampani, a Portughese priest and there were 160 Rampani nets in the state in 1976. Rampani is a shore seine of exceptionally large size and is made by lacing together 150-200 pieces each measuring 10 to 12 m long. Breadth varies from 2 to 7 m and is narrower at the extremities. The head rope is buoyed with wooden or plastic floats and the foot rope weighted with stones or metal balls at regular intervals. The net requires about 80-100 persons fer operation. When a shoal of fish is sighted near the shore one end of the net is held at the shore by a group of fishermen and the Rampani boat is steered in a semi circular path releasing the net and the boat brings back the other end of the net to the shore encircling the shoal. The net is slowly dragged bringing the catch ashore or the shoal is kept impounded and fish caught in stages depending on the demand and market trend.

In Karnataka, first attempt at trawling was made by the Japanese trawler M. S. Kaiko Maru in 1961 and from 1963-67, vessels of Indo-Norwegean project conducted systematic exploration of fishing ground and this was followed by a spurt in the mechanized fishing activity in the state. Initially, these vessels fished in the area beyond 10-15 km from the shore away from the fishing range of traditional fishermen but soon shifted to shallow waters which promised good catches.

Two decades ago some pioneering work in purse seining was initiated under Indo-Norwegian Project. But commercial purse seining started only in 1977 with the introduction of 120 purse seiners. The number steadily increased and was in the order of 300 by 1980. Purse seine is an encircling gear. As soon as a shoal of fish is located, the net from the mechanized vessel is quickly released to form a wall of webbing around the shoal. The bottom of the net is pulled together to hold the catch in an artificial pond of webbing which is gradually made smaller and finally drawn aboard. The catch is often transported to shore through carrier boats. Usually 26 persons are employed in a purse seine.

Large no. of mechanised fishing craft in Karnataka had its impact on the traditional fishing units. Both the trawlers and purse seiners have affected the operation of indigenous gear like gillnets and rampanis. Trawlers used to fish in area upto depth of 10 m where gill nets and other local traditional units used to operate. The area of operation of purse seines was not that of rampani. The operation of rampani is shore based while purse seines negotiate distant waters. However in both the cases major fisheries used to be oil sardine and mackerel and the purse seines encircles the incoming shoals preventing them from moving towards the shore thus depriving the shore based units of chances of catching these resources. Consequently the share of the catches by rampani had been decreasing which have forced the withdrawal of operation of rampani considerably and seriously affecting the economic conditions of fishermen engaged in rampani fishing. In the years 1982, '83 and '84, the catches of oil sardine and mackerel in the rampani landings had been practically insignificant and the number of operations also has reduced significantly. A study conducted by the Institute on the comparative economics of fishing by purse seiners and rampani it was revealed that in Dakshin Kannada the value of fish caught by purse seines increased from 151.36 lakh rupees of first half of 1978 to 195.89 lakh rupees in the first half of 1979. But the returns from rampani reduced significantly from 78.76 lakh rupees of first half of 1978 to 3.92 lakh rupees of first half of 1979. (since 1980, the landings by rampani has been very poor in the state). But in Uttar Kannada district the returns from rampani showed an increase since the number of purse seines was very less compared to the heavy concentration in the Dakshin Kannada district (Jacob et. al, 1979).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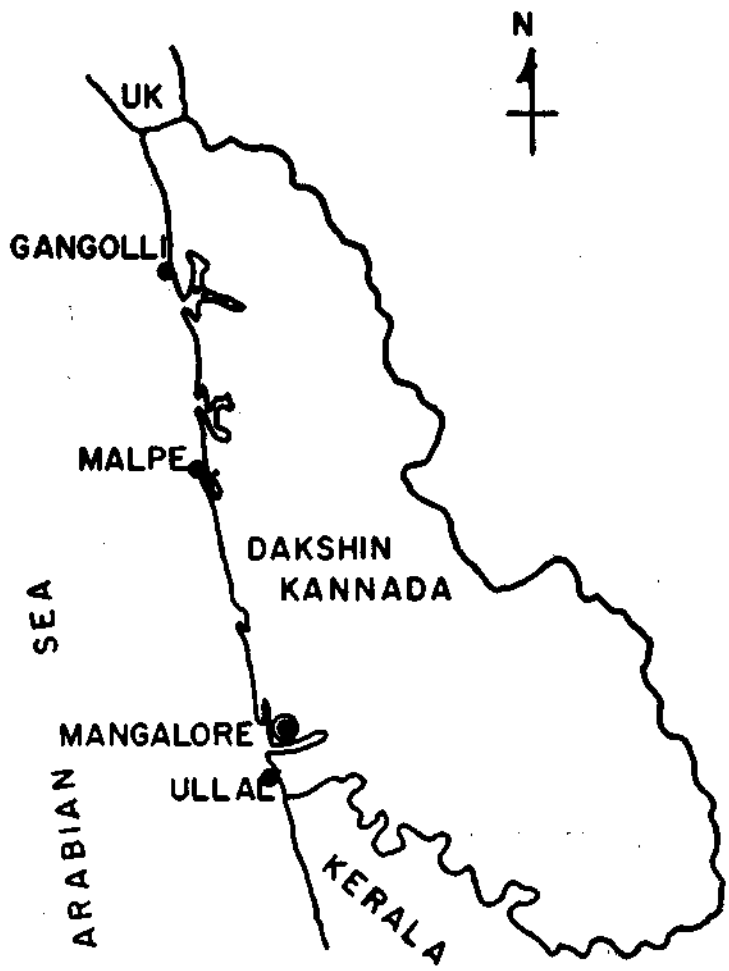
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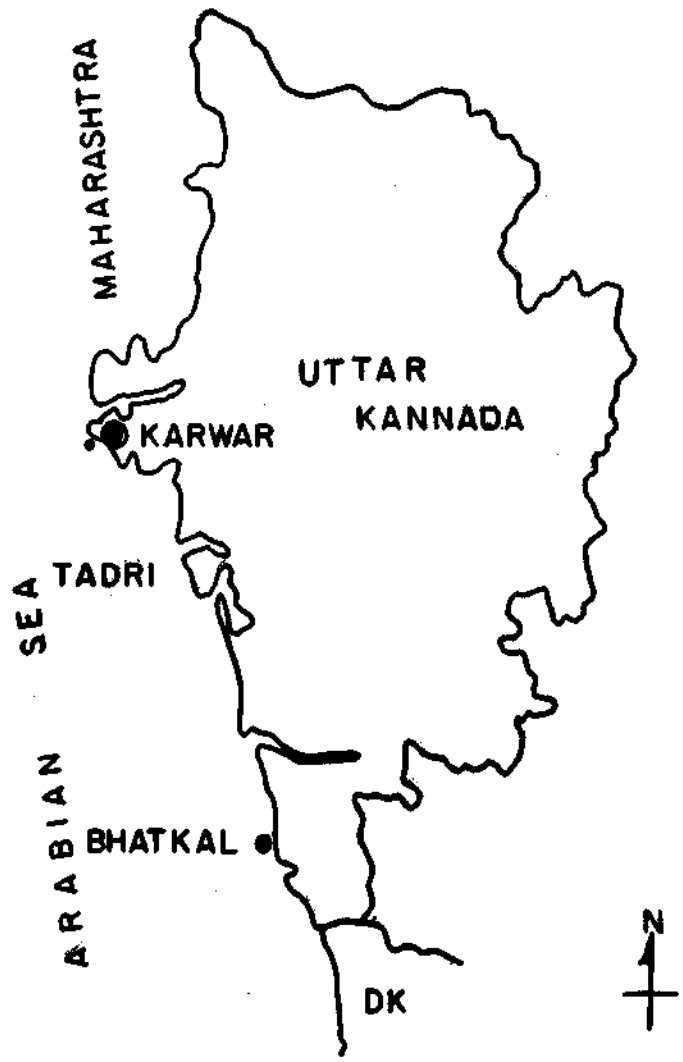
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Fishing Villages, Landing Centres and Fishermen Population

As per the census carried out in 1980, there are 47 fishing villages and 46 fish landing centres in Goa State. 19,000 fishermen livein 3,380 households with an average family size of 5. 9. The proportion of adult male population to adult female population is 1 07 to 1.00, adults constituting 65% and children 35% of the population. 38% of the population are actively engaged in fishing occupation, 30% being, engaged full time, 5% part time and 3% occasional.

Table 37 *Marine Fishing villages and fishermen population in Goa (Source; Mar. Fish. Infor. Serv* T&E *Ser; No. 30)*

No. of fishing villages	47
No. of landing Centres	46
No of fishermen house holds	3380
Fishermen Population	
Male	6429
Female	5991
Children	6812
TOTAL	19232
Educational Status	
Primary	4302
Secondary	1793
Above Secondary	210
TOTAL	6305
Fishermen engaged in actual fishing	
Full time	3678
Part-time	651
Occasional	336
TOTAL	4665

Fishing Craft and Gear:

The mechanized fishing fleet in Goa, as per census of 1980, consists 494 trawlers, 274 gillnetters, 66 purse seiners and 74 others. 231 trawlers, 39

purse seiners and 46 gillnetters are owned by fishermen. Non-mechanized craft are comprised of 1054 dugout canoes, 1006 plank built boats and 6 others. Gear used by mechanized craft consist 654 trawlnets and 69 purseseines (estimated). Drift/set gillnets constitute 51% of the 4,500 indigenous gear, prominent among others being rampani (101 numbers) other shore seines (259 nos.) and boat seines (109nos.)

Table 38 *Marine fishing craft and gear in Goa*
(*Source*: *Mar. Fish. Infor. Serv T&E Ser; No. 30*)

Fishing Craft	
Mechanized	
Trawlers	494
Purse Seiners	66
Gill netters	274
Others	74
TOTAL	908
Non-mechanized	
Dug out canoes	1054
Plank built boats	1006
Others	6
TOTAL	2066
Fishing Gear	
Trawlnets	655*
Purse seines	69*
Fixed bagnets	73
Boat seines	109
Drift/gillnets	2293
Hooks and lines	127
Rampani	101
Shore seines	259
Others	1597

*Estimated.

Infrastructural Facilities:

There are 12 freezing plants in Goa with a capacity of 45 tonnes. 7 Canning factories are available in the State having a capacity of 33.5 tonnes. Other facilities include 9 cold storages with a capacity of 560 tonnes and 2 ice plants having a capacity of 19 tonnes (Source: Hand book of Fisheries Statistics, Govt of India).

MARINE FISH LANDINGS IN GOA

Marine fish landings in Goa during the ten year period 1975-84 was characterized by yearly fluctuations. It varied between the minimum of 24,500 tonnes of 1980 and 38,500 tonnes of 1984. Though no definite increasing trend could be discerned for the period, average annual landings during 1980-84 was 33,800 tonnes which registered an increase of 20% over the average annual landings during 1975-79. The landings registered an increase of 20% in 1976 from 29,200 tonnes of 1975 but it reduced by 29% in the subsequent year. In the following four years the annual landings fluctuated marginally around 25,400 tonnes. But the landings recorded a steep increase of 10,000 tonnes in the year 1981 from 24,500 tonnes of 1980 and remained high in the subsequent years though showed marginal fluctuations around annual average landings of 36,200 tonnes during 1981-84.

The landings in Goa constituted 2.3% of the total marine fish landings in the country. The contribution in percentage of Goa to the marine fish landings in the country varied in the range 1.8-2.6 during the ten year period 1975-84. The estimated landings in Goa and percentage contribution to all India landings are given in table 39.

Table 39. *Estimated landings in Goa and percentage contribution of Goa to the all India landings.*

	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
Estimated landings in Goa (in tonnes)	29170	34968	24731	27111	25388	24490	34498	34041	37688	38505
Percentage contribution	2.1	2.6	2.0	1.9	1.8	2.0	2.5	2.4	2.4	2.4

Oil sardine, other sardines, catfishes, croakers whitebaits, mackerel and penaeid prawns dominated the fishery resources which together constituted 52%, on an average, during 1980-84. Pelagic group of fishes constituted 43% of the total landings in the state while the demersal group complemented 57% during 1980-84. Mechanized fleet contributed 84% to the total landings and non-mechanized units 16%. Landings during the major fishing season October to March contributed 69% to the annual production in the state.

Landings of Pelagic and Demersal Groups;

Landings of pelagic and demersal fishes including crustaceans are given in table 40.

Table 40. *Landings (1000 tonnes)*

	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
Pelagic	20.7	22.7	15.8	15.9	15.8	12 0	18.3	15.7	12.5	13.9
(%)	71.1	65.1	63.7	58.8	62.4	49.2	53.0	46.2	33.2	56.6
Demersal	8.4	12.2	9.0	11.2	9.6	12.4	16.2	18.3	25.2	24.6
(%)	28.9	34.9	36.3	41.2	37.6	50.8	47.0	53.8	66.8	43.4

A decreasing trend was discernible in the landings of pelagic resources in Goa during 1975-84 and an increasing trend in the landings of demersal resources. The percentage contributions of these groups to the total annual landings also exhibited similar trends. Landings of pelagic group ranged between 20,700 tonnes of 1975 and 12,000 tonnes of 1980 and that of demersal group ranged from 8,400 tonnes of 1975 to 24,600 tonnes of 1984.

The percentage contributions of important varieties to the landings of pelagic group during 80-84 are given below:-

Table 41. *Percentage contribution of important varieties.*

	1980	1981	1982	1983	1984
Oil Sardine	20	42	35	44	12
Other sardines	15	13	6	5	18
Ribbonfishes	9	4	7	8	3
Carangids	10	4	9	8	14
Mackerel	20	22	17	2	19
Others	26	15	26	33	34

It could be seen that oil sardine dominated the group with an average annual contribution of 31% followed by mackerel (16%), other sardines(11%)and carangids (5%).

The percentage contributions of important varieties to the landings of demersal group are furnished below:-

Table. 42 *Percentage contribution of Important varieties*

	1980	1981	1982	1983	1984
Elasmobranchs	7	6	3	3	3
Catfishes	9	14	11	6	5
Perches	2	7	5	6	7
Croakers	12	10	13	11	7
White baits	14	13	6	5	7
P. Prawns	15	14	19	31	20
Stomatopods	11	13	19	11	19
Others	30	23	24	27	32

Among the fishes and crustaceans belonging to demersal group, penaeid prawns constituted 21% of the landings of this group followed by stomatopods (11%), croakers (8%) and catfishes (8%).

Landings of Major Varities of Fish:

Oil sardine:

Among the commercially important varieties of fish, Oil sardine contributed on an average 13.4% of the total marine fish landings in Goa during 1980-84 with an annual landings of 4,500 tonnes. The landings fluctuated heavily during the ten year period 1975-84 ranging from 800 tonnes of 1977 to 7,600 tonnes of 1981. Mechanized craft contributed 65% of the landings of this species and the complement of 35% came from non-mechanized craft. Purse seine yielded on an average, 2,900 tonnes and this accounted for 98% of the landings of this fish by mechanized gear. Landings of oil sardine by purse seines showed fluctuation around 2,900 tonnes during 1980-84 with the minimum of 1,000 tonnes in 1984 and the maximum of 6,700 tonnes in 1981. Rampani contributed, on an average, 1,500 tonnes of oil sardine which formed 77% of the landings by non-mechanized units. During 1980-84, the landings of oil sardine by rampani fluctuated around 1,500 tonnes with the maximum landings of 3,500 tonnes in 1983 and the minimum of 500 tonnes in 1984. Main season for oil sardine fishery was October to March. During 1980-84, 83% of the landnigs took place in the period October to March whereas rest of the year accounted only for 17% of the landings. During 1975-79 only 62% of the landings occurred in the period October to March whereas 38% of the landings occurred in the monsoon season.

Table 43. *Percentage contributions of important varieties to the total marine fish landings in Goa during 1975-84*

	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
Elasmobranchs	2.0	3.0	2.5	3.2	5.0	3.7	3.0	1.8	1.8	1.9
Catfishes	4.7	2.4	3.7	5.0	3.3	4.7	6.4	5.7	4.0	3.3
Oil sardine	25.8	4.0	3.3	5.2	11.9	9.7	22.1	16.2	14.7	4.4
Other sardines	13.4	31.7	16.4	19.0	9.7	7.3	6.7	2.8	1.8	6.3
Thryssa spp.	0.4	0.8	1.2	4.8	3.6	3.2	1.7	6.3	2.7	3.8
Perches	0.2	0.9	2.0	2.9	0.8	1.1	3.4	2.7	4.0	4.3
Croakers	10.5	7.6	11.2	12.0	5.9	6.3	4.7	6.8	7.2	4.4
Ribbonfishes	1.2	3.2	1.8	1.9	2.2	4.5	2.0	3.0	2.8	1.2
Carangids	3.7	2.6	4.9	7.0	6.6	4.7	2.1	4.2	2.8	5.2
Silverbellies	2.1	2.6	1.9	2.6	3.5	7.1	6.0	3.0	3.6	4.3
Pomfrets	0.4	0.3	1.2	1.4	0.5	1.1	0.4	1.1	0.9	1.0
Mackerel	23.2	18.4	31.0	12.4	17.3	10.0	11.4	7.7	0.6	7.0
Seerfishes	0.8	1.4	0.9	2.5	4.3	3.0	1.9	1.9	1.9	1.0
Penaeid prawns	6.0	13.3	5.8	6.1	6.3	7.6	6.5	10.3	20.6	12.6
Crabs & Stomatopods	0.8	2.8	2.6	0.1	2.1	5.4	6.3	10.3	7.1	12.0
Cephalopods	0.3	0.4	0.7	0.5	0.7	0.9	0.3	0.5	1.1	1.1
Others	4.5	4.6	8.9	13.4	16.3	19.7	15.1	15.7	22.4	26.2

Meckerel:

Meckerel contributed 7.0% to the annual average marine fish landings in Goa during 1980-84. This percentage contribution showed considerable decrease from 20.3 of 1975-79. Average annual landings of mackerel reduced from 5,700 tonnes of 1975-79 to 2,400 tonnes in 1980-84. The landings of mackerel during the ten year period 1975-84 showed a decreasing trend. During the above period, landings of mackerel was the maximum in 1977 when it was 7,700 tonnes and reduced to just 200 tonnes in 1983, but showed signs of recovery in 1984 when the landings increased to 2,700 tonnes. The mechanized craft accounted for 65% of the landings of mackerel and was complemented by indigenous units to the extent

of 35%. Almost the entire landings by mechanized units was contributed by purse seines; the contribution from other units being veritably negligible. Indigenous units contributed annually to the order of 800 tonnes during 1980-84; rampani accounting for 94% of this landings. As for the seasonality of the landings of mackerel, the period October to March accounted for 71% of the landings and 25% was accounted for by the landings during July to September.

Other sardines:

Other sardines constituted 4.8% of the average annual marine fish landings in the state during 1980-84. The percentage contribution of this variety of fish was considerably low in 1980-84 compared to 18.9 of 1975-79. Annual landings of other sardines was remarkably very high in 1976 (11,100 tonnes). Otherwise the landings fluctuated between 5,200 tonnes of 1978 and 700 tonnes of 1983. The percentage contribution of other sardines to the total landings in the state showed a decreasing trend from 1976 to 1983 with maximum of 31.7% in 1976 and minimum 1.8% in 1983. However it increased to 6.3% in 1984 During 1980-84, the landings was comparatively at a low level; ranging from 700 tonnes of 83 to 2,400 tonnes of 1984 with an average annual landings of 1,600 tonnes. Mechanized units contributed about 1,300 tonnes and formed 77% of the landings; almost the entire landings being contributed by purse seines. Contribution from indigenous gear accounted for 23% of the total landings of other sardines. The peak season for fishery was October to March which, on an average, accounted for 81% of the annual landings during 1980-84. This decreased marginally from 88% of the corresponding period during 1975-79.

Carangids:

Carangids formed 3.7% of the total marine fish landings in Goa annually during 1980-84. During the ten year period 1975-84, the landings of carangids and its percentage contribution to the total landings in the state fluctuated widely without exhibiting any discernible trend. The landings varied in the range 700 to 2,000 tonnes in the ten year period. The average annual landings during 1980-84 (1,300 tonnes) showed a marginal decline of 7% over that during 1975-1979. 75% of the landings of carangids was contributed by mechanized units; purse seines accounting for 48% and trawlnets 22%. Major landings of this group took place during the quarter October to December followed by the quarter January to March which together constituted 72% of the average annual landings during 1980-84.

Thryssa spp.

Among the clupeids, Thryssa spp. dominated in the landings forming 3.5% of the total fish landings in Goa during 1980-84. During the ten year period the

landings showed an increasing trend though its percentage contribution to the total landings in the state did not show any regular trend. The average annual landings doubled in 1980-84 to 1,200 tonnes from the annual average landings of 600 tonnes in 1975-79. However, its percentage contribution fluctuated during the ten year period from 0.4 of 1975 to 6.3 in 1982. Mechanized units contributed 74% of the landings; purse seines accounting for 40% and trawlnets for 33%. *Thryssa* spp.was available throughout the year in the landings. However, the maximum landings on an average, took place in the quarter July to September and landings during this quarter accounted for 59% of the annual landings.

Ribbonfishes:

Ribbonfishes contributed 2.6% to the marine fish landings in Goa. Both the landings and the percentage contribution of the ribbonfishes fluctuated over years without showing any definite trend. Annual landings of ribbonfishes varied, ranging from 400 tonnes to 1,100 tonnes, minimum occurring in 1975 and maximum in 1976. During 1980-84, ribbonfishes yielded an average annual landings of 900 tonnes. 95% of the landings of ribbonfishes was accounted for by the mechanized units, trawlers contributing 95%. Peak season for its fishery was the quarter January to March, followed by April to June. Landings during July to December accounted only for 7% of the annual landings.

Elasmobranchs:

Elasmobranchs accounted for 2.3% of the total landings in the state. During the ten year period 1975-84, the landings of this group fluctuated between 600 tonnes of 1975 and 1,300 tonnes of 1979. Average annual landings during 1980-84 showed a decline by about 10% over about 900 tonnes of 1975-79. The percentage contribution of this fishery to the total landings varied between 2 to 5 in 1975-79 period but was comparatively lower in 1980-84 when it varied between 3.7 of 1980 to 1.8 of 1982-83. The contribution by mechanized craft to the landings of elasmobranchs fluctuated marginally around 600 tonnes during 1980-84. The percentage contribution of mechanized units varied between 64 of 1981 to 95 of 1984 with an average of 77. Trawlnets and gillnets contributed evenly to the landings of this fish. The contribution by trawlnets increased from 28% in 1980 to 61% in 1982 and sustained a steep reduction in 1983 to 27% but increased to 45% in 1984. Contribution from gill nets decreased from 40% of 1980 to 18% in 1982 but showed a steep increase to 52% in 1983 and then reduced to 42% in the subsequent year. Landings by non-mechanized units varied during 1980-84 around 200 tonnes annually contributing 23% of the total landings of this group.

Catfishes:

Catfishes constituted 4.8% of the annual landings in Goa during 1980-84 with an average annual landings of 1,600 tonnes against 3.8% during 1975-79 when the average annual landings was 1,100 tonnes. Its percentage contribution to the total marine fish landings in Goa varied between 2.4 of 1976 and 6.4 of 1981. Annual landings was least in 1979 (800 tonnes) and was maximum (2,200 tonnes) in 1981 coinciding with the maximum percentage contribution to the total landings during the period 1975-84. The contribution from mechanized craft to the landings of catfishes maintained an increasing trend during 1980-84. From 76% in 1980, this increased to 98% in 1984. Landings by trawlnets yielded, on an average, 72% and this increased from 49% of 1980 to 85% in 1982 but in 1983 it decreased to 70% but again increased to 96% in 1984. Drift/set gillnets yielded, on an average, 200 tonnes (15%). The contribution from this gear decreased from 26% in 1980 to 8% in 1982 and increased to 25% in 1983 but showed steep decline to 1% in the subsequent year. The landings by indigenous gear showed a consistently decreasing trend and the corresponding percentage contribution steadily decreased from 24% of 1980 to 2% of 1984. Peak season for catfish fishery was October to December followed by January to March. 73% of the landings took place during these two quarters.

Perches:

Landings of perches showed an increasing trend during the ten year period 1975-84. Landings accounted for 1.3% of the total landings in the state annually during 1975-79 and this percentage contribution increased to 3.2 anaually during 1980-84 with a corresponding increase in the average annual landings from about 400 tonnes of the former period to 1,100 tonnes of the latter. From less than 300 tonnes in 1980, the landings increased considerably to 1,200 tonnes in 1981 and though marginally declined in 1982, the landings recovered in subsequent years and was 1,600 tonnes in 1984. The gear that contributed mainly to the landings of perches was trawlnet which, on an average, accounted for 84% of the total landings of this group. The total percentage contribution of 92% was further complemented by purseseines. Landings by trawlnets constituted 88% in 1980 but this proportion decreased to 64 in 1981 but increased in subsequent years and it was 94 in 1984. In 1983 almost the entire landings was contributed by mechanized craft. Peak season for the perches fishery was the quarter January to March followed by the quarter October to December.

Silverbellies:

The landings of silverbellies showed an increasing trend during the ten year period 1975-84. From 1980 onwards a sudden upward shift was noticed in the landings of silverbellies. The annual average landings increased from 700 tonnes

in 1975-79 to 1,600 tonnes in 1980-84. Landings which remained less than 900 tonnes till 1979 steeply increased to 1,700 tonnes in 1980 and further increased to 2,100 tonnes in 1981 and maintained the level to the order of 1,000 tonnes in the subsequent years. The percentage contribution of silverbellies to the total landings varied between 1.9 and 3.5 during 1975-79 with an average of 2.3 but steeply increased to 7.1 in 1980 , then reduced to 3.0 in 1982 but increased in the subsequent years giving an average of 4.6 during 1980-84. Landings by mechanized units constituted 96% of the total landings of the silverbellies; trawl nets contributing 70% and purse seines 26%. Component of landings by mechanized units constituted 92% of the total landings in 1980 and 99% in 1981 and 1983, 91% in 82 and 97% in '84.

Prawns

Landings of penaeid prawns accounted for 11.9% of the total landings in the state. The landings during the period 1975-'84 did not exhibit any discernible trend though average annual landings increased from 2,200 tonnes of 1975-'79 to the order of 4,000 tonnes in 1960-'84. The landings increased to 4,600 tonnes in 1976 from 1,800 tonnes of 1975 but in the subsequent year it reduced to 1,400 tonnes. But by 1981 it showed recovery and the landings increased to 3,500 tonnes in 1982 and then to 7,700 in 1983, However in 1984 it reduced to about 4,900 tonnes. The percentage contribution of penaeid prawns also showed a similar trend. The contribution increased from 6.0% of 1975 to 13.3% in 1976 and it was at a low level till 1980 but increased to 10.3% in 1982 and to 20.3% in 1983. Landings by mechanized units contributed, on an average, 97% of the total landings of penaeid prawns, 96% being by trawlnets. The contribution by trawlnets ranged between 91% of 1981 to almost 100% in 1983, the contribution from other units being negligible. The contribution by non-mechanized units to the total landings of prawns was negligible, contributing only about 4% annually. Though fishery of prawns was available throughout the year, the quarter January to March witnessed maximum landings, on an average, followed by the quarter April to June.

Landings by Mechanized Craft

Landings by mechanized craft showed increasing trend during the ten year period 1975-'84. From 12,100 tonnes of 1975, it increased to 32,400 tonnes in 1984. The percentage contribution of mechanized landings also showed a similar trend, increasing from 41.4 of 1975 to 89.3 of 1984. During 1980-'84, the landings by mechanized craft accounted for 84% of the total landings in the state.

Among the prominent mechanized units, trawlnets and purseseines together accounted for 95% of the total mechanized landings in the state, trawlnets accounting for 68% and purseseines for 27%. The percentage contribution of important units to total mechanized landings are given in table 44.

Table.44 *Percentage contribution of prominent units to total mechanized landings.*

	1980	1981	1982	1983	1984
Trawl net	59	48	68	83	74
Purse seine	31	48	29	11	21
Others	10	4	3	6	5

Trawl nets: The landings by trawlnets showed an increasing trend during the period 1980-'84. The landings increased by 20% in1981 from 11,900 tonnes of 1980 and then by 25% in 1982 to 17,900 tonnes from 14,200 tonnes of 1981. 1983 witnessed a steep increase of 51% in the landings by trawlnets, over that of previous year, when the landings was 26,800 tonnes. However, in 1984 it decreased marginally to 25,400 tonnes. Penaeid prawns, on an average, constituted 20.3% of the landings by trawlnets. Its percentage contribution to the landings by this gear varied between 14.2 of 1981 to 28.9 of 1983 with an average annual landings of 3,900 tonnes. The landings of penaeid prawns fluctuated between 1,700 tonnes of 1980 and 7,700 tonnes of 1983.

Table.45 *Percentage contributions of major varities to the landings by trawlnets*

	1980	1981	1982	1983	1984
Elasmobranchs	2.1	2.8	2.1	0.7	1.3
Catfishes	4.8	9.5	9.3	4.0	4.8
Perches	2.0	5·3	3.9	5.2	6.1
Croakers	11.5	10 0	11.2	9.7	5.3
Ribbonfishes	8.4	4.5	5.7	3.9	1.8
Silverbellies	11.4	7.4	1.9	4.9	5.5
Flat fishes	10.7	4.8	3.5	3.2	8.1
Penaeid prawns	14.4	14.2	18.9	28.9	18.3
Stomatopods	10.5	15.0	19.7	10.0	18.2
Others	23.2	26.5	28.5	29.5	30.6

Croakers constituted 9.1% of the average annual landings by trawlnets. The landings of croakers increased from 1,400 tonnes of 1980 to 2,600 of 1983 and then reduced to 1,300 tonnes in the subsequent year, about 400 tonnes less than the average annual landings during the period 1980-'84. The percentage contribution of croakers to the total landings by trawlers was the maximum 11.5

in 1980 but reduced to 5.3 in 1984 with an average of 9.1. The landings of catfishes was the minimum (600 tonnes) in 1980 and the maximum (1,600 tonnes) in 1983 with an average annual landings of 1,200 tonnes. The percentage contribution of catfishes to the landings by trawlnets increased from 4.8 in 1980 to 9.5 in 1981 and decreased marginally to 9.3 in 1982. But 1983 and 1984 witnessed steep decline in the percentage contribution to 4.0 and 4.8 respectively. Silverbellies contributed an average of 1,100 tonnes annually through trawlnets. From 1,400 tonnes in 1980 it reduced to 300 tonnes in 1982 but recovered to 1,400 tonnes in 1984. A similar trend was noticed in its percentage contribution which dereased from 11.4 in 1980 to 1.9 in 1982 and then increased to 5.5 in 1984. Flatfishes with an average annual landings of 1,100 tonnes also accounted for 5.7% of the total landings by trawlers. The landings of flatfishes fluctuated heavily during the period 1980-'84. It was 1,300 tonnes in 1980 and 2,100 tonnes in 1984 but in between varied in the range 600 - 900 tonnes. Among other commercially important varieties, perches contributed 4.8% of the landings with an annual average of 900 tonnes and ribbonfishes 4.3% with an average annual landings of 800 tonnes. Stomatopods exhibited an increasing trend in the landings by trawlers. From 1,200 tonnes of 1980 it increased to 4,600 tonnes in 1984 with an average annual contribution of 14.5%.

Purse seines: The landings by purse seines fluctuated during 1980-'84 around an annual average of 7,800 tonnes. This landings increased tremendously in 1981 to 14,100 tonnes from 6,200 tonnes in 1980. However, it fell to 7,600 tonnes in 1982 and further to 3,600 tonnes in 1983 but subsequently increased to 7,300 tonnes in 1984.

Table 46. *Percentage contributions of major varieties to the landings by purse seines*

	1980	1981	1982	1983	1984
Oil sardine	27.4	47.2	43.9	48.7	13.9
Other sardines	21.9	10.7	10.8	12.6	28.0
Thryssa spp	2.3	2.2	24.3	1.9	0.1
Carangids	7.8	1.2	7.5	16.3	16.7
Mackerel	27.6	25.2	0.9	2.7	31.0
Others	13.0	13.5	12.6	17.8	10.3

Oil sardine dominated the resources landed by purse seines though its landings fluctuated heavily during 1980-'84 between 1,000 tonnes in 1984 and 6,700 tonnes in 1981 with an average annual landings of 2,900 tonnes. The

landings in 1981 was very high (6,700 tonnes) whereas in the remaining years it fluctuated between 1,000 tonnes and 3,300 tonnes. Its percentage contribution to the total landings by purse seines was the maximum in 1981 and minimum in 1984, the trend being similar to that of its landings. The landings of mackerel by purse seines also displayed a similar trend. From 1,700 tonnes in 1980 it increased considerably to 3,600 tonnes in 1981 but reduced to about 100 tonnes in 1982 and 1983 showing recovery in 1984 with an annual landings of 2,300 tonnes. Its percentage contribution to the landings by purse seines went down from 27.6 in 1980 and 25.2 in 1981 to 0.9 in 1982 but rose to 31.0 in 1984.Landings of other sardines constituted 16.0% of the purse seine landings. The landings fluctuated around 1,200 tonnes with the minimum of 400 tonnes in 1983 and the maximum of 2,100 tonnes in 1984. Its proportion in the landings by purse seines also varied between 10.7% in 1981 and 28.0% in 1984. Among other major varieties, carangids contributed an annual average landings of 600 tonnes to the landings by purse seines accounting for 7.8% and *Thryssa* spp about 500 tonnes accounting for 6.1%. The landings of *Thryssa* spp was an unusually high 1,800 tonnes in 1981.

Gill nets: Gillnets with mechanized propulsion landed 1,400 tonnes annually which constituted about 5.0% of the total landings by mechanized craft. This landings did not exhibit any discernible trend during 1980-'84 but fluctuated between 700 tonnes in 1982 and 2,000 tonnes in 1983. Seerfishes dominated the resources with an annual average landings of 400 tonnes accounting for 31% of landings by gill nets. This was followed by elasmobranchs which constituted 19.7% with an average annual landings of about 300 tonnes. Catfishes constituted 17.9% annually, on an average, carangids 4.8%, pomfrets 4.4% and tunnies 3.9%. Hooks and lines, though in vogue in Goa, contributed only an insignificant proportion to the total mechanized landings. Gillnets operated by canoes with outboard motors landed about 500 tonnes in 1984.

Landings by Non-mechanizd Craft

Landings by non-mechanized craft showed a decreasing trendduring the ten year period 1975-'84. From 17,100 tonnes in 1975, the annual landings decreased to 4,100 tonnes in 1984 when it accounted for 10.7% of the total landings in the state. Percentage contribution of non-mechanized landings decreased from 58.6 of 1975 to 29 7 in 1976 and during the following four years fluctuated around 28%. But in 1980 the contribution from non-mechanized craft sustained a steep reduction to 10 1% from 31.1% of 1979. Though this landings increased by about 3,000 tonnes in 1982 over 5,000 tonnes of 1981, it decreased in the subsequent years.

Oil sardine dominated the resources landed by non-mechanized units and constituted 29.7% of the total landings by non-mechanized craft. The landings of oil sardine by non-mechanized units accounted for 35% of the total landings of this species in the state. This, however, fluctuated during the five years 1980 to 1984 with the minimum 600 tonnes in 1984 and the maximum 3,500 tonnes in

1983. It formed 14.9% of the landings by non-mechanized fishing in 1980 and this percentage contribution increased to 27.6 in 1982. In 1983 this rose steeply to 66% but reduced to 15% in 1984. Mackerel with an annual average landings of 800 tonnes constituted 15.5% of the non-mechanized landings. During 1980-'84 the landings of mackerel by non-mechanized fishing fluctuated widely with the maximum 2,500 tonnes in 1982 and the minimum 100 tonnes in 1983. Mackerel accounted for 16.3% of the landings by non-mechanized fishing in 1980, 7.5% in 1981 and 31.8% in 1982. In 1983 this percentage reduced to the minimum 2.3 but recovered in 1984 when it was 10.0. Other sardines contributed 7.0% to the landings by non-mechanized units. During the period 1980-84 its landings fluctuated widely with the minimum 100 tonnes in 1983 and the maximum of 700 tonnes in 1984. The percentage contribution of this also was characterized by year to year variation and fluctuated between 1.4 in 1982 and 15.7 in 1981. Among other commercially important varieties, carangids with an average annual landings of 300 tonnes accounted for 5.9% of the landings by non-mechanized units. During 1980-'84, its landings fluctuated in the range 200 to 600 tonnes. Landings of *Thryssa* spp accounted for 5.8% and fluctuated between 200 and 700 tonnes during 1980-'84. Landings of croakers constituted 3.7% and fluctuated over years with an average annual landings of 200 tonnes. Seerfishes and penaeid prawns, each, accounted for for 2.6%, catfishes for 2.7% and pomfrets for 1.5%.

Rampani, yendi (shore seine) and gillnet were the prominent among indigenous gear operated in Goa and these together contributed to 90% of the landings by non-mechanized units. Rampani with an average landings of 3,500 tonnes accounted for 64% of the total non-mechanized landings and gillnet with annual average landings of 1,100 tonnes constituted 20%. The landings by gill net showed a decreasing trend during the period 1980-'84. The landings by rampani fluctuated during the period heavily with the minimum of 1,600 tonnes in 1981 and the maximum of 6,300 tonnes in 1982. Others include drag net, cast net, scoop net and hooks and lines, the contributions of which were insignificant except in 1981 when drag net and hooks and lines landed 400 and 200 tonnes respectively.

Table. 47 *Landings by indigenous units in Goa during 1980-'84.* (*Figures in tonnes*)

	1980	1981	1982	1983	1984
Rampani	2081	1585	6277	4713	2615
Gill net	2157	2154	1221	400	464
Yendi	92	551	280	28	871
Others	110	695	198	188	151
Total	4440	4985	7976	5329	4101

Table 48 *Landings by mechanized and non-mechanized craft in Goa during 1980-84 (figures in tonnes)*

Name of fish	1980			1981			1982			1983			1984		
	Mech	Non-mech	Total	Mech	Non-mech	Total	Mech	Non-mech	Total	Mech	Non-mech	Total	Mech	Non-mech	Total
Elasmobranchs	665	229	894	673	377	1050	511	111	622	535	134	669	677	36	713
Catfishes	874	277	1151	1986	225	2211	1793	140	1933	1469	53	1522	1246	26	1272
Oil sardine	1706	661	2367	6677	932	7609	3317	2201	5518	2037	3518	5555	1030	645	1675
Other sardines	1369	429	1798	1512	784	2296	854	109	963	461	197	658	2068	373	2441
Thryssa spp.	478	301	779	398	195	593	1921	217	2138	828	193	1021	797	657	1454
Perches	240	29	269	975	208	1183	797	111	908	1485	10	1495	1578	62	1640
Croakers	1392	138	1530	1418	192	1610	1998	300	2298	2645	52	2697	1378	299	1677
Ribbonfishes	1008	81	1089	640	44	684	1018	17	1035	1049	12	1061	461	18	479
Carangids	853	292	1145	531	191	722	797	633	1430	802	234	1036	1755	236	1991
Silver bellies	1591	136	1727	2046	29	2075	923	88	1011	1327	15	1342	1620	49	1669
Pomfrets	172	85	257	84	39	123	233	130	363	184	139	323	374	12	386
Mackerel	1723	723	2446	3567	372	3939	69	2538	2607	98	122	220	2275	409	2684
Seerfishes	618	117	735	462	181	643	272	363	635	689	35	724	358	8	366
Tunnies	346	10	356	88	100	188	5	1	6	25	—	25	150	—	150
Penaeid Prawns	1709	144	1853	2032	205	2237	4056	118	4174	7736	8	7744	4646	207	4853
Crabs & Other crustaceans	1795	138	1933	2552	144	2696	4358	50	4408	3366	33	3399	5719	15	5734
Cephalopods	161	49	210	83	11	94	29	137	166	282	112	394	326	82	408
Others	3350	601	3951	3789	756	4545	3114	712	3826	7341	462	7803	7946	967	8913
Total	20050	4440	24490	29513	4985	34498	26065	7976	34041	32359	5329	37688	34404	4101	38505

Seasonal Landings: The intensity of marine fish landings in Goa did differ over different seasons in a year. The estimated quarterwise-speceswise marine fish landings in Goa during 1975-'84 are given appendix. It could be observed that more than two third of the annual landings occurred in the two quarters October to December and January to March. Table 49 gives the estimated quarterwise marine fish landings in Goa during 1975-'84.

Table. 49. *Quarterwise marine fish landings (in tonnes) in Goa during 1975-'84*

	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
Jan. to March	7393	10786	3610	4753	7025	9137	11659	12126	13959	12897
April to June	6829	5879	2125	2982	2701	1732	5052	5422	9330	6139
July to Sept.	1804	6908	3907	4789	2993	3608	4645	5351	2988	7832
Oct. to Dec.	13144	11395	15089	14587	12669	10013	13142	11142	11411	11637
Total	29170	34968	24731	27111	25388	24490	34498	34041	37688	38505

Landings in the first quarter (January to March) during the ten year period 1975-'84 exhibited an increasing trend but the landings in the remaining quarters did not manifest any significant trend. This was reflected in the average quarterly landings during 1980-'84 compared to that during 1975-79. Average landings during the quarter January to March increased by 5,000 tonnes in 1980-'84 period over that of 7,000 tonnes in 1975-'79 registering an increase of 78%. Though no significant trend could be observed in the landings during second quarter (April to June) and third quarter (July to September), the average landings during these quarters increased marginally during 1980-'84 over that during 1975-'79, the landings in second and third quarters registering an increase of 35% and 20% respectively over 4,100 tonnes in 1975-'79. However, the average landings in the fourth quarter (October to December) registered a decrease of 14% in 1980-'84 over that of 13,400 tonnes in 1975-'79.

In the period 1975-79, other sardines, with an average of 1,700 tonnes (25.4%) dominated the landings during the first quarter. But its landings decreased to 400 tonnes, on an average, during the first quarter in 1980-84 period and accounted only for 3.2%. Oil sardine emerged the most dominant among the commercially important varieties contributing 1,800 tonnes (15.4%) to the landings in the first quarter in 1980-84. The percentage contribution of mackerel to the landings in the first quarter in both 1975-79 and

Table. 50 *Quarterly landings of important groups in Goa. (Figures in tonnes)*

	Average for 1975-'79					Average for 1980-'84				
	IQr	IIQr	IIIQr	IVQr	Total	IQr	IIQr	IIIQr	IVQr	Total
Elasmobranchs	205	300	81	289	875	300	131	76	283	790
Catfishes	488	208	85	283	1064	517	276	157	669	1619
Oil sardine	888	729	345	867	2829	1836	34	722	1953	4545
Other sardines	1706	180	460	2994	5340	387	84	225	935	1631
Thryssa spp	173	101	104	207	585	190	114	710	183	1197
Croakers	394	553	996	700	2643	668	577	262	455	1962
Ribbon-fishes	130	183	20	263	596	410	401	17	42	870
Carangids	400	102	136	717	1355	428	194	158	485	1265
Silverbellies	244	208	95	162	709	463	242	396	464	1565
Mackerel	430	1	498	4801	5730	771	88	600	920	2379
Seerfishes	77	27	165	277	546	50	12	109	450	621
Penaeid prawns	351	614	695	556	2216	1766	982	640	648	4036
Others	1228	897	400	1261	3786	4170	2400	812	3982	11364
Total	6714	4103	4080	13377	28274	11956	5535	4884	11469	33844

1980-84 was 6.4 though the average landings increased from 400 tonnes in 1975-79 to 800 tonnes in 1980–84. Among other important varieties, carangids accounted for 6.0% in the first quarter in 1975-79 but 3.6% in 1980-84 though in both the periods landings was 400 tonnes. Catfishes in both the periods contributed 500 tonnes but constituted 7.3% of the first quarter landings in 1975-79 and 4.3% in 1980–84. Croakers contributed 5.9% of landings in the first quarter in 1975-79 but showed a marginal reduction of 5.6% in 1980-84 but the landings registered an increase of 70% over 400 tonnes in 1980-84. Significant increase could be observed both in the landings and in percentage contribution of penaeid prawns, the landings increased from about 400 tonnes in 1975-79 to 1,800 tonnes and the corresponding percentage contribution from 5.2 to 14.8.

During 1975–79, oil sardine, constituting 17.8%, dominated in the landings in the second quarter but the corresponding percentage contribution in 1980-84 reduced significantly to 0.6%. Among other important varieties, elasmobranchs accounted for 7.3% in the second quarter in 1975-79 and this percentage reduced to 2.5 in 1980-84 with a reduction of about 200 tonnes in the landings from 300 tonnes in 1975–79. The percentage contributions of catfishes in both the periods

were almost the same, 5.1 in 1975-79 and 5.0 in 1980-84, though there was a marginal increase in the landings. The landings of croakers registered a marginal increase of 4% in 1980-84 but the percentage contribution reduced from 13.5 to 10.4. The penaeid prawns registered increase in landings and in its percentage contribution. From 600 tonnes the landings increased to about 1,000 tonnes increasing its percentage contribution to second quarter's landings from 15.0 to 17.2.

In the third quarter, in the period 1975-79, the croakers which accounted for 24.4%, was the prominent group but its contribution reduced to 5.4% in 1980-84. Oil sardine which constituted only 8.5% in 1975-79 emerged the most dominant species accounting for 14.8% in 1980-84. Mackerel, though showed a marginal increase in the landings by about 20%, did not show any appreciable change in its percentage contributions which were 12.2 and 12.3 in 1975-79 and in 1980-84 respectively. Among other important groups, other sardines registered a decrease in its percentage contribution from 11.3 in 1975-79 to 4.6 with a landings of 200 tonnes in 1980-84. Penaeid prawns showed a reduction of about 8.0% from 700 tonnes in 1975-79 and consequently reducing its percentage contribution from 17.0 to 13.0

In 1975-79, during fourth quarter, on an average, mackerel was the most dominant group which accounted for 35.9% of the landings in that quarter. This was followed by other sardines (22.4%), oil sardine (6.5%), carangids (5.4%), croakers (5.2%) and penaeid prawns (4.2%). In 1980-84 oil sardine with a percentage contribution of 17.0 emerged the most dominent species relegating mackerel to third position after other sardines. Its landings showed tremendous improvement; it increased from 900 tonnes in 1975-79 to 2,000 tonnes in 1980-84. Average landings of mackerel reduced significantly from 400 tonnes in 1975-79 to 900 tonnes in 1980-84 Other sardines also, similarly, decreased from 3,000 tonnes to 900 tonnes. The landings of carangids reduced from 700 tonnes in 1975-79 to about 500 tonnes in 1980-84 with consequent reduction of its percentage contribution from 5.4 to 4.2. Similarly, the percentage contribution of croakers decreased from 5.2 to 4.0. Penaeid prawns showed a marginal increase in its landings by about 15% from about 600 tonnes and its percentage contribution increased from 4.2 in 1975-79 to 5.7 in 1980-84. The landings of stomatopods, though insignificant in the earlier years, started appearing in good quantities from 1978 onwards and by 1980 commercial quantities of this variety could be observed in the landings. In the first quarter during 1980-84, stomatopods accounted for 10% of the total landings with an average landings of 1,200 tonnes. From 800 tonnes in the first quarter 1980, the landings of stomatopods increased to 1,600 tonnes in the first quarter of 1984. It accounted for 5.8% of the landings in the second quarter during 1980-84 with an average landings of 300 tonnes. However, the landings of stomatopods was practically insignificant during the third quarter. It accounted for 11.5% of the total landings in

the fourth quarter during 1980-84 with an average landings of 1,300 tonnes. Landings of this group increased from about 500 tonnes of 1980, 1981 to 2,200 tonnes in 1982 but decreased to 1,300 tonnes in the fourth quarter in 1983 and subsequently increased to 2,000 tonnes in the fourth quarter of 1984.

Effort and Catch per Unit Effort

Fishing effort (number of operations of fishing units) exhibited a trend almost similar to the total fish landings. 1981 witnessed a tremendous increase in the effort input which resulted in proportional increase in the landings. When effort increased by 42% from 125,000 operations in 1980 to 178,000 in 1981, the landings registered an increase of 41% from 24,500 tonnes to 34,500 tonnes. However during 1981 to 1984, the effort showed only marginal

Table 51. *Catch and effort of mechanized and non-mechanized units in Goa during 1980-84.*

	1980	1981	1982	1983	1984
Mechanized					
Trawlnet					
a.	11863	14229	17761	26753	25373
b.	42954	61188	69229	98219	80505
Purse seine					
a.	6217	14113	7611	3568	7322
b.	4184	12977	7333	5821	7311
Others					
a.	1970	1171	693	2038	1709
b.	6781	6315	8786	23754	38005
Total (Mechanized)					
a.	20050	29513	26065	32359	34404
b.	53919	80480	85348	127794	125821
Non-mechanized					
a.	4440	4985	7976	5329	4101
b.	71120	97215	69862	21690	39763
Grand total					
a.	24490	34498	34041	37688	38505
b.	125039	177695	155210	149484	165584

a– Catch in tonnes

b– Effort in number of operations.

fluctuations, the maximum in 1981 being just 19% more than the minimum of 150000 operations in 1983. In 1982, both catch and effort decreased from those in 1981, former by a marginal 1% and latter by 13%. In 1983 catch and effort showed reverse trends in that when the effort decreased by about 6000 operations (4%), the landings increased by 11%. However, in 1984 both catch and effort increased, former by 2% and latter by 11%.

Trawlnet; Both the landings and the effort of trawlnet had been increasing steadily from 1980 till 1983 but in 1984 both registered marginal decrease. The effort expended recorded an increase of 42% in 1981 from 43000 in 1980 but this resulted in an increase of only 20% in the landings of trawlnet with the result the catch per unit effort (CPUE) reduced from 276 Kg in 1980 to 233 Kg in 1981. Among the major varieties, CPUE of catfishes, perches and stomatopods showed increase in 1981 whereas CPUE of croakers, silverbellies, flatfishes and penaeid prawns declined considerably during 1981 compared to 1980. It might be noted that even though the landings of croakers, penaeid prawns and stomatopods increased, their CPUE registered decrease in 1981. 1982 witnessed increased effort and also increase in CPUE and thereby the landings. When the effort increased by 13% from 61000 in 1981 to 69000 in 1982, the landings showed an increase of 25% resulting in an increase of 10% in the CPUE which increased to 257 Kg. Among the important varieties, catfishes, croakers, penaeid prawns and stomatopods registered increase both in catch and in CPUE. The CPUE of catfishes increased by 9% and landings increased by 23%. Croakers registered an increase of 26% in CPUE and 41% in the landings. The CPUE of penaeid prawns increased from 33 kg in 1981 to 48 Kg in 1982 showing an increase of 36% and similarly stomatopos from 35 kg to 51 kg registering an increase of 46%. Silverbellies on the other hand showed decrease both in landings and in CPUE, CPUE reducing from 17kg in 1981 to 5kg in 1982. In 1983, the landings of trawlnet increased by 50% over that in 1981 against an increase of 41% of effort in 1983 resulting in an increase in the CPUE of trawlnet by 6% from 257 kg in 1982. Among commercially important varieties, penaeid prawns registered a substantial increase of 31kg in the CPUE compared to that in 1982 registering an increase of 63% and this resulted in the tremendous increase in the landings of penaeid prawns by 87%. Stomatopods, however, registered a decrease of 24 kg (47%) from 51 kg in 1982 and this resulted in the reduction in the landings by 24%. Croakers recorded an increase of 30% in the landings but showed a marginal reduction of 3 kg (10%) in CPUE. Catfishes registered decrease in both landings and CPUE, 35% in the landings and 54% in the CPUE. CPUE of trawlnet further increased to 315 kg in 1984 from 272 kg of 1983, though, the total landings registered a marginal decrease of 5% and this reduction in the landings could be attributed to reduction in the CPUE realized in respect of croakers and penaeid prawns. The CPUE of former reduced by 9 kg (35%) and resulted in the decrease of landings by 52%. The CPUE of penaeid prawns decreased by 21 kg (27%) and

Table 52 *Catch and catch per unit effort of major varieties realized by trawlnet.*

	1980	1981	1982	1983	1984
Elasmobranchs					
a.	247	396	378	179	324
b.	6	6	5	2	4
Catfishes					
a.	564	1345	1648	1070	1216
b.	13	22	24	11	15
Perches					
a.	237	757	692	1390	1542
b.	6	12	10	14	19
Croakers					
a.	1369	1418	1996	2601	1344
b.	32	23	29	26	17
Ribbonfishes					
a.	993	637	1011	1032	456
b.	23	10	15	11	6
Silverbellies					
a.	1352	1051	341	1303	1391
b.	31	17	5	13	17
Flatfishes					
a.	1266	679	617	864	2055
b.	29	11	9	8	26
Penaeid prawns					
a.	1708	2025	3348	7729	4634
b.	40	33	48	79	58
Stomatopods					
a.	1244	2129	3504	2662	4629
b.	29	35	51	27	57
Others					
a.	2883	3792	4226	7923	7782
b.	67	64	61	81	96
Total					
a.	11863	14229	17761	26753	25373
b.	276	233	257	272	315

a— Catch in tonnes b— CPUE in kg.

this resulted in the decrease of 60% of its landings by trawlnet. However, the stomatopods registered an increase of 30 kg in the CPUE in 1984 compared to 27 kg of 1983. Among other important varieties, flatfishes showed substantial improvement in CPUE which increased from 8 kg in 1983 to 26 kg in 1984. Similarly silverbellies showed increase in the CPUE by 4 kg, perches by 5 kg and catfishes by 4 kg.

Thus, the CPUE of trawlnet showed an increasing trend since 1981. Though no definite trend could be observed in the CPUE of any important variety, croakers, penaeid prawns and stomatopods maintained moderately high catch rates.

Purse seine: The landings and the effort of purse seine exhibited similar trends during 1980-84. Both catch and effort showed a steep increase in the year 1981 compared to those in 1980. The landings of purse seine increased to 14,100 tonnes in 1981 from 6,200 tonnes in 1980 and the corresponding effort increased from 4000 operations in 1980 to 13000 operations in 1981. But in 1982, the catch and the effort declined considerably, former by 6,500 tonnes and the latter by about 6000 operations. In 1983 the catch decreased considerably by about 53% while the effort decreased only 21%. However both catch and effort showed increase in 1984 and recovered to the level of 1982. The CPUE of purse seine. on the other hand, showed a decreasing trend till 1983 but in 1984, it recovered.

Table 51. *Catch and catch per unit effort realized by major varieties by purse seine*

	1980	1981	1982	1983	1984
Oil sardine					
a.	1706	6663	3317	1739	1021
b.	408	513	452	299	140
Other sardines					
a.	1362	1511	824	448	2052
b.	326	116	112	77	281
Thryssa					
a.	141	315	1848	71	10
b.	34	24	252	12	1
Carangids					
a.	485	164	569	581	1220
b.	116	13	78	100	167
Mackerel					
a.	1716	3558	67	98	2269
b.	410	274	9	17	310
Others					
a.	807	1902	986	631	750
b.	192	148	135	108	103
Total					
a.	6217	14113	7611	3568	7322
b.	1486	1088	1038	613	1002

a — Catch in tonnes b — CPUE in kg

The oil sardine recorded a three fold increase in 1981 in its landings over that in 1980. The CPUE of oil sardine also showed an increase of 26% over 408 Kg in 1980. Other sardines though increased by a margin of 11% from 1,400 tonnes in 1980, the CPUE registered a steep fall to 116 Kg from 376 Kg in 1980. Similarly, the landings of mackerel increased in 1981 to two fold of that in 1980 but its CPUE registered a steep reduction of 33% from 410 Kg of 1980. Among other important groups, carangids registered a steep reduction in the CPUE in 1981 when it was only 13 Kg against 116 Kg in 1980. In 1982 the CPUE of purse seines registered a marginal decrease by 5% but the landings of purse seine suffered a reduction of 46%. The main contributing factor for this reduced landings had been the reduction in the CPUE of mackerel which registered a steep decrease from 274 Kg in 1981 to 9 Kg in 1982. Among other groups, CPUE of oil sardine decreased by 12% and the catch reduced to half of the landings in 1981. *Thryssa* spp, showed increase both in catch and CPUE, former increased by 1,500 tonnes and the latter by 228 Kg from 24 Kg in 1981. Similar trend could be observed in respect of carangids which showed an increase of 400 tonnes in the landings and a five fold increase of CPUE from 13 Kg in 1980. In 1983 both the catch and CPUE decreased in respect of purse seine operations in Goa. The landings decreased from 7,600 tonnes to 3,600 tonnes registering a decrease of 53% and the CPUE from 1088 Kg to 613 Kg showing a reduction of 41%. The CPUE of oil sardine and other sardines reduced by 34% and 31% respectively. The CPUE of *Thryssa* spp. showed a steep decrease from 252 Kg in 1982 to 12 Kg in 1983. Mackerel and carangids, however. showed increase in the CPUE, former increased from 9 Kg in 1982 to 17 Kg in 1983 and the latter from 78 Kg to 100 Kg. In 1984, the landings and the CPUE of purse seine recorded increase over those in 1983. When the landings increased to more than double of that in 1983, the CPUE registered an increase of 63% over 613 kg of 1983. Among the major varieties, oil sardine suffered decrease both in landings and in CPUE, the landings decreasing by 41% from 1,700 tonnes in 1983 and CPUE reducing to 140 kg from 299 kg in 1983. But the CPUE of other sardines, carangids and mackerel increased in 1984 by 204 kg, 67 kg and 293 kg respectively.

Drift/set gill nets: The effort and the landings decreased in the year 1981, the landing from 1,800 tonnes in 1980 to 1,200 tonnes in 1981 and the effort from 6,600 operations in 1980 to 6,300 operations in 1981 showing reductions of 35% and 4% respectively. The catch per unit effort decreased from 276 kg in 1980 to 186 kg in 1981. The decreasing trend continued in respect of landings and CPUE in 1982 but the effort showed an increase of 39%over that in 1981.Landings reduced to 700 tonnes showing a reduction of 59% and CPUE decreased to 79 kg registering a decrease of58%. Year 1983 witnessed tremendous increase in the effort and sub-

stantial increase in the landings but the increase in the CPUE was only marginal The effort increased from 8,800 operations in 1982 to 23,800 oparations in 1983 and the landings from 700 tonnes to 2,000 tonnes. But the CPUE increased only by 7kg registering an increase of only 9%. In 1984, the effort showed a marginal reduction of 3% but the landings reduced to 1,200 tonnes registering a decrease of 41% and consequently CPUE showed a reduction of 40% from 86 kg of 1983.

Non-mechanized Units : 65% of the landings by non-mechanized fishing was contributed by rampani. Its effort and the catch showed similar trends till 1983. From 3,000 operations in 1980, the effort showed a reduction of 15% to 2,600 in 1981 but in 1982 it showed a steep increase to 5,600 operations with consequent increase in the landings from 1,600 tonnes in 1981 to 6,300 tonnes in 1982. However, in 1983 both the landings and the effort reduced, former by 25% and the latter by 41%. In 1984, when the landings decreased to 2,600 tonnes from 4,700 tonnes in 1983, the effort showed an increase of 68% from 3,300 operations in 1983 to 5,'00 operations in 1984. The effort input in respect of drift/set gill nets increased marginally by 4% over about 62,000 operations in 1980 but the landings showed practically no change from 2,200 tonnes of 1980. In the subsequent year the effort registered a steep reduction by 41% when the effort reduced to 38,000 operations with a consequent reduction of landings by 43% with marginal decrease in the CPUE. The CPUE reduced from 35kg in 1980 to 34 kg in 1981 and further to 33 kg in 1982. In 1983 the effort was the minimum, in the period, of 14,000 operations but the CPUE remained at the same level as that in the preceding year because of the reduction in the landings by about 800 tonnes from 1,200 tonnes of 1982. But in 1984, the effort input registered an increase of 49% with no appreciable change in the landings by this gear and consequently the CPUE reduced by a significant 11 kg to 22 kg in 1984. The landings, effort and the CPUE of yendi (shore seine) fluctuated heavily during the period 1980-84. The effort was the minimum 600 operations in 1980 and the maximum 4,100 in 1982. The catch per operation of yendi increased to 354 kg in 1981 over 149 kg in 1980 but sharply reduced in the subsequent years and was only 36 kg in 1983. However, in 1984, the CPUE increased considerably to 214 kg.

Discussion

Discussion: Goa, with a coastline of 153 km and a continental shelf area of 10,000 sq. km. contributed 2.3% of the total marine fish landings in India during 1980-'84. In the fisheries development of the west coast, Goa had played a prominent role by introducing new fishing methods. Rampani was inttoduced first in Goa in the nineteenth century and of late introduction of purseseining on a commercial scale was first effected in Goa.

Total marine fish landings in Goa during the period 1975-'84 did not exhibit any discernible trend. However, compared to the earlier half of the period the latter half witnessed structural changes in the landings. Even though no definite trend could be observed, compared to the five year period 1975-'79, the average annual landings in Goa during 1980-'84 witnessed an increase of 20% and this change was better pronounced during the four year period 1981-'84. This increase could be attributed to the better landings of oil sardine and penaeid prawns, among the commercially important varities, which showed increase by 61% and 82% respectively and, to a large extent, contributed by the tremendous increase in the landings of stomatopods. Qualitatively and structurally the landings have undergone changes during the ten year period. Mackerel which was the most dominant variety, contributed 20.3% of the total landings in 1975-'79 but it was relegated to a very low ranking in 1980-'84 when its average annual contribution was only 4.8%. Similarly other sardines which formed 10% of the total landings in 1975-'79 contributed 4.8% during 1980-'84. Croakers which formed 9.3% in the earlier half reduced in its percentage contribution to 5.8 during the latter half. Among other commercially important varieties, *Thryssa* spp exhibited an increasing trend during the ten year period ($r=0.71$, $p < 0.05$) and its contribution also increased from 2.1 in 1975-'79 to 3.5 in 1980-'84 Silverbellies showed an increasing trend during the ten year period ($r=0.69$, $p < 0.05$) and its percentage contribution also increased from 2.5 in 1975-'79 to 4.6 in 1980-'84. Conspicuous increase could be observed in the annual landings of penaeid prawns in the period 1980-'84 over that in 1975-'79. The landings of penaeid prawns increased by 82% in the latter half over that in the former half an showed and increasing trend during the ten year period ($r=0.85$, $p < .01$). Stomatopods showed remarkable increase in the landings in the latter half (1980-'84) and showed an increasing trend since 1978 ($r=0.96$, $p < .01$). The groups which showed increasing trend except *Thryssa* spp were mainly landed by trawl nets, and that would imply trawlnets were to a large extent responsible for the improvement in the landings in the state and the role of purse seines in increasing the landings is not felt very much in the latter period. This was further substantiated by the clear increasing trend observed in the landings of demersal group ($r=0.89$ $p < 0.01$) and similarly the decreasing trend exhibited by the pelagic group ($r = -0.7$, $p < .05$). The percentage contributions of the demersal and pelagic groups showed trends similar to their landings ($r = \pm 0.79$, $p < 0.01$).

Similarly, an increasing trend was observed in the landings by mechanized fishing ($r=0.84$, $p < 0.01$) and a decreasing trend in the landings by non-mechanized fishing ($r = -0.75$, $p < 0.05$). However no defininite trend was discernible in the landings of purse seines but the landings of trawlnets, during the period

1980-'84, exhibited an increasing trend ($r = 0.94$, $p < 0.05$. Among the four quarters of a year, during the ten year period, the landings in the first quarter showed a conspicuous increasing trend ($r=0.71$ $p < .05$) mainly due to the increase in the landings of penaeid prawns. Among the major resources only penaeid prawns showed a clear increasing trend in its landings in the first qaarter($r = 0.80$, $p < .01$). The landings of croakers in the first quarter had been increasing upto 1983 but in 1984 it showed a downward deflection. Similarly silverbellies showed an increasing trend in its landings during first quarter but for the year 1982 when the landings was very low. The landings of stomatopods, similarly, showed an increasing trend since 1980. ($r = 0.92$, $p < .05$).

The effort input in respect of trawlnets also exhibited an increasing trend during 1980-'84 though no definite trend could be observed in the CPUE. The effort in respect of purse seines fluctuated during the period without showing any trend. The CPUE, on the other hand, showed, a decreasing trend till 1983 though improved in 1984. The landings of drift/set gill nets (with mechanized craft) did not show any trend but the effort had been consistently increasing and in 1983 it showed a sudden spurt with consequent increase in the landings. Though in 1984 the effort remained at the same level, the landings reduced considerably over that in 1983 with a reduction in CPUE establishing thereby a decreasing trend in the CPUE. Among the indigenous gear, the landings, effort and CPUE of rampani did not exhibit any trend. In 1982 the effort in the operation of rampani increased considerably from that in the previous year which resulted in substantial increase in the landings. But in the same year the operations of drift/set gill nets went down considerably with consequent reduction in its landings. The CPUE in respect of rampani had been increasing up to 1982 and then started decreasing. The CPUE from gillnets had been almost steady till 1983 but in 1984 its CPUE went down considerably.

Foregoing discussion would reveal that there is scope of increased landings from trawlnets in Goa while the landings from purse seines, gill nets and non-mechanized gear do not indicate any scope of further increase. Some of the demersal resources like perches, croakers and silverbellies offer scope of improvement. It could be observed that penaeid prawns would continue to be the mainstay with scope of improved landings among the commercially important resources from trawlers. The landings of stomatopods also would follow the pattern of penaeid prawns and further, scope of improving the landings of these resources during the latter part of the fishing season October to March remains bright. Among the pelagic resources only *Thryssa* spp, *Stolephorus* spp and carangids offer scope of improvement though oil sardine, other sardines and mackerel would continue to be the mainstay in the landings.

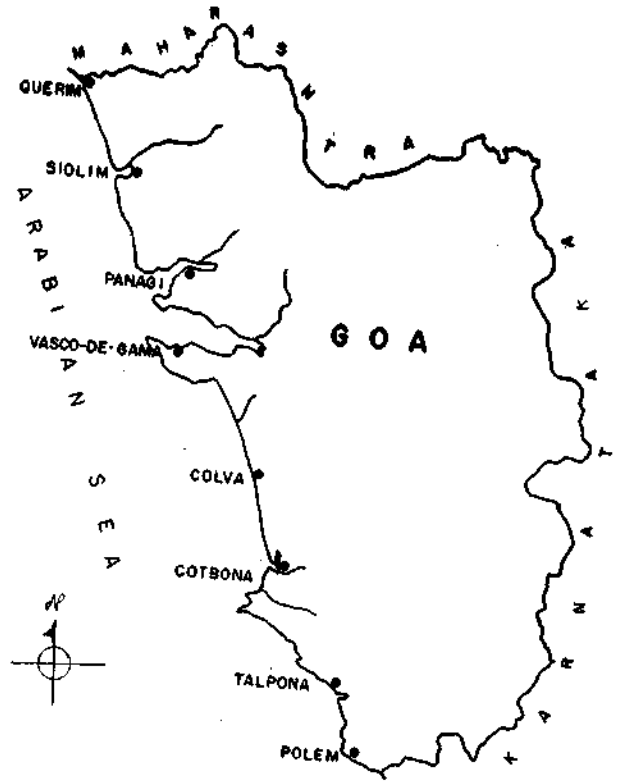

Fig 12. Map of Goa

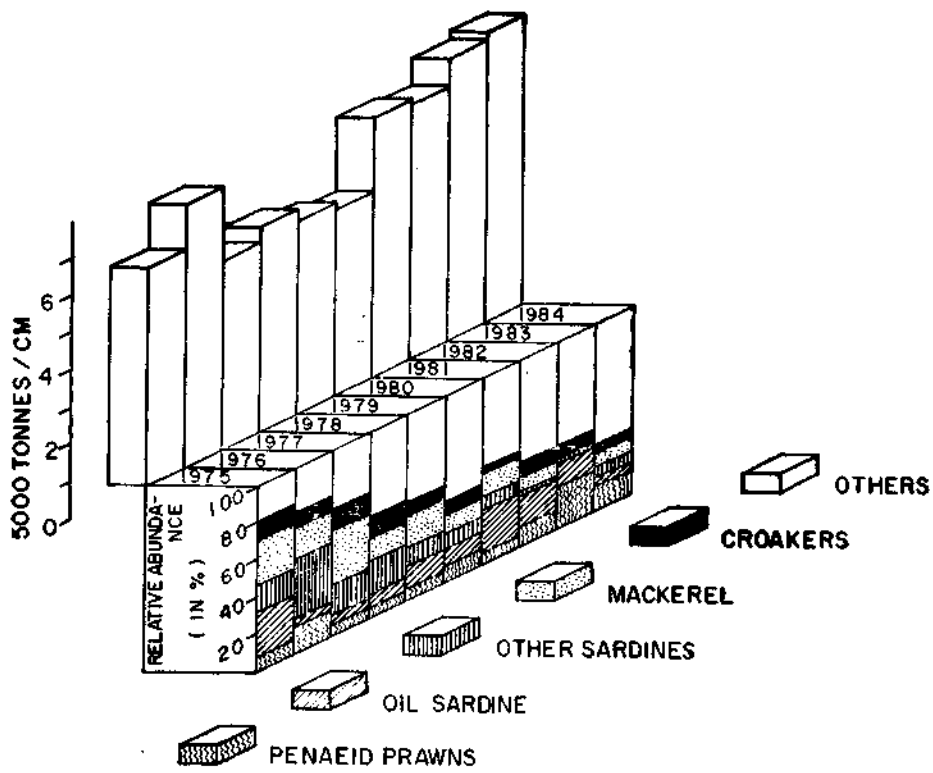

Fig 13. Estimated marine fish landings in Goa and the contributions of major varieties.

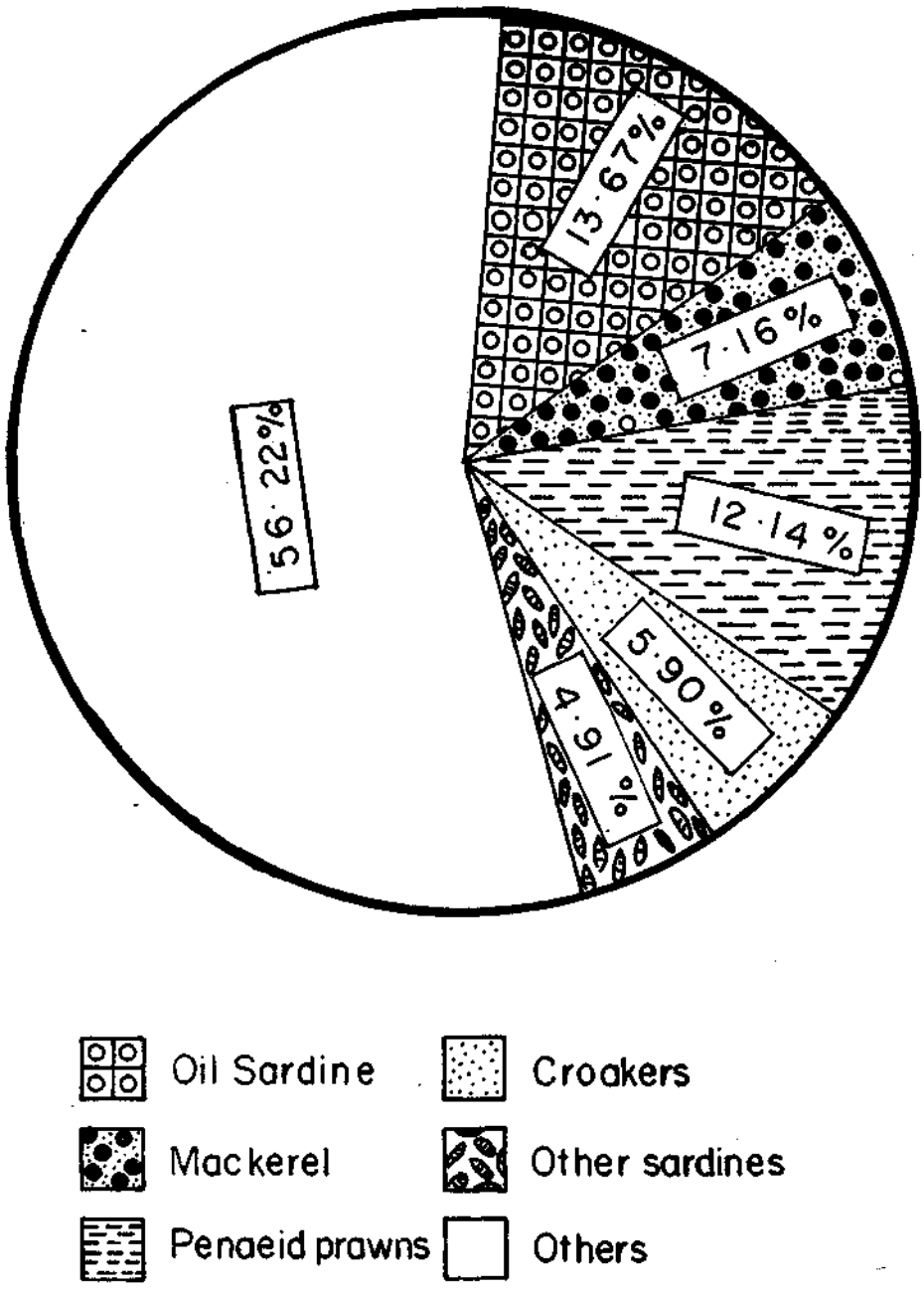

Fig 14. Contributions of important varieties to the total marine fish landings in Goa (base : landings during 1980–'84)

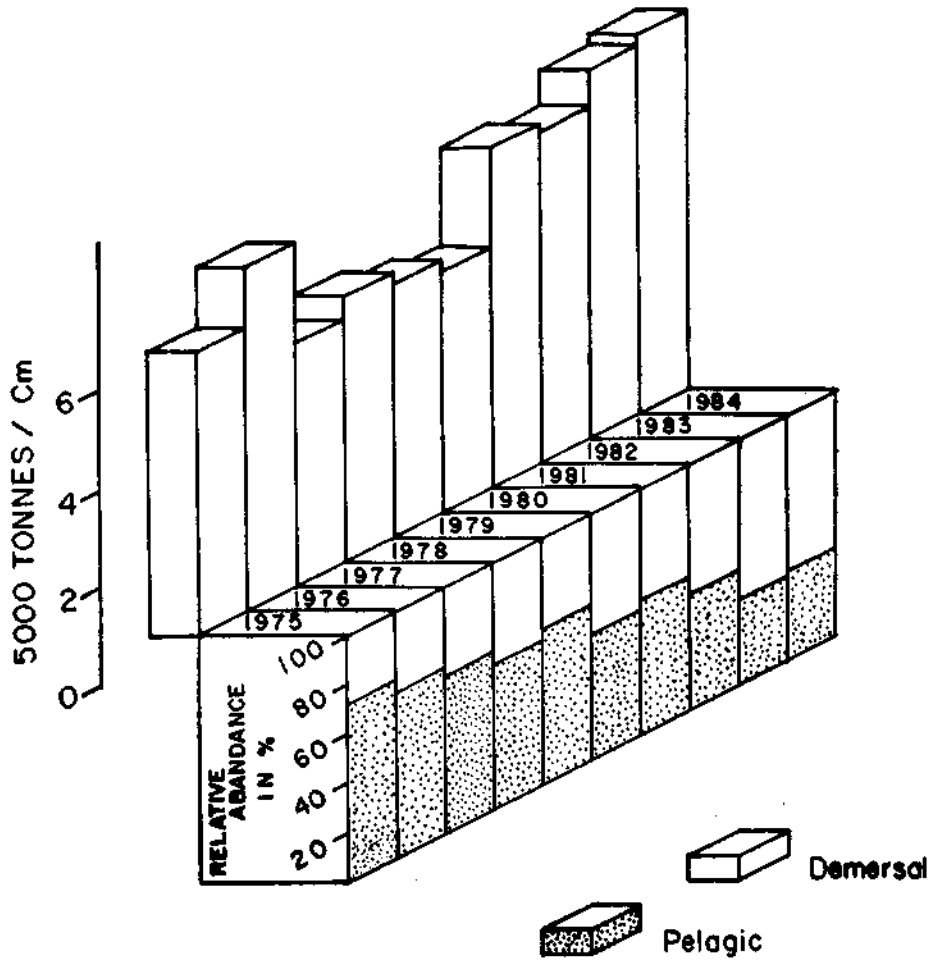

Fig 15. Landings of pelagic and demersal groups in Goa during 1975–'84.

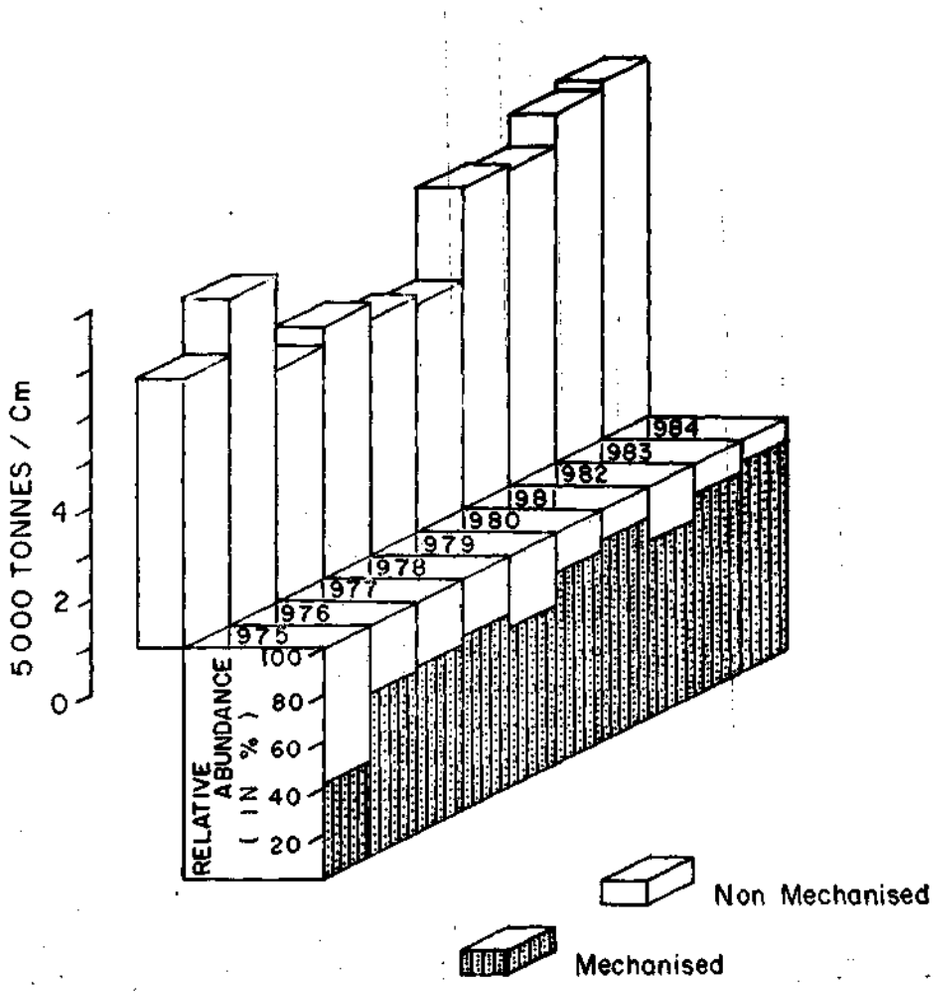

Fig 16. Landings by mechanized and non-mechanized units in Goa during 1975-'84.

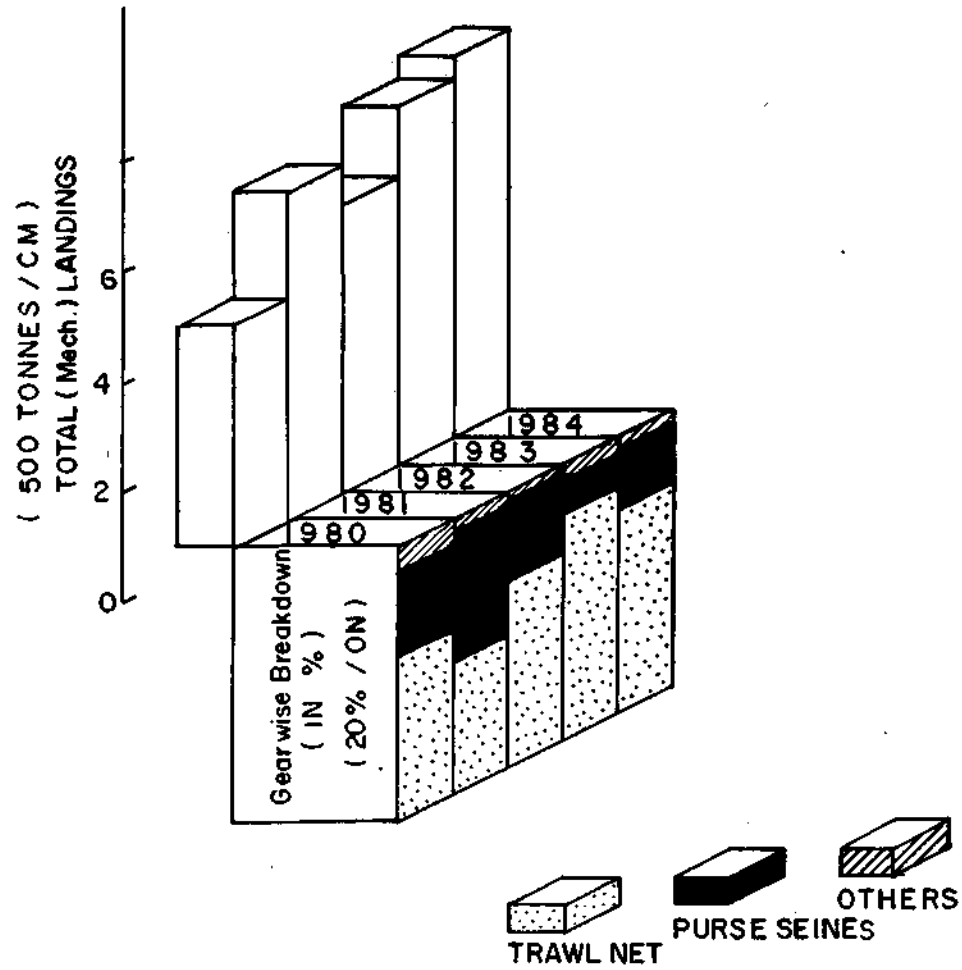

Fig 17. Gearwise contributions of landings by mechanized units in Goa during 1980-'84.

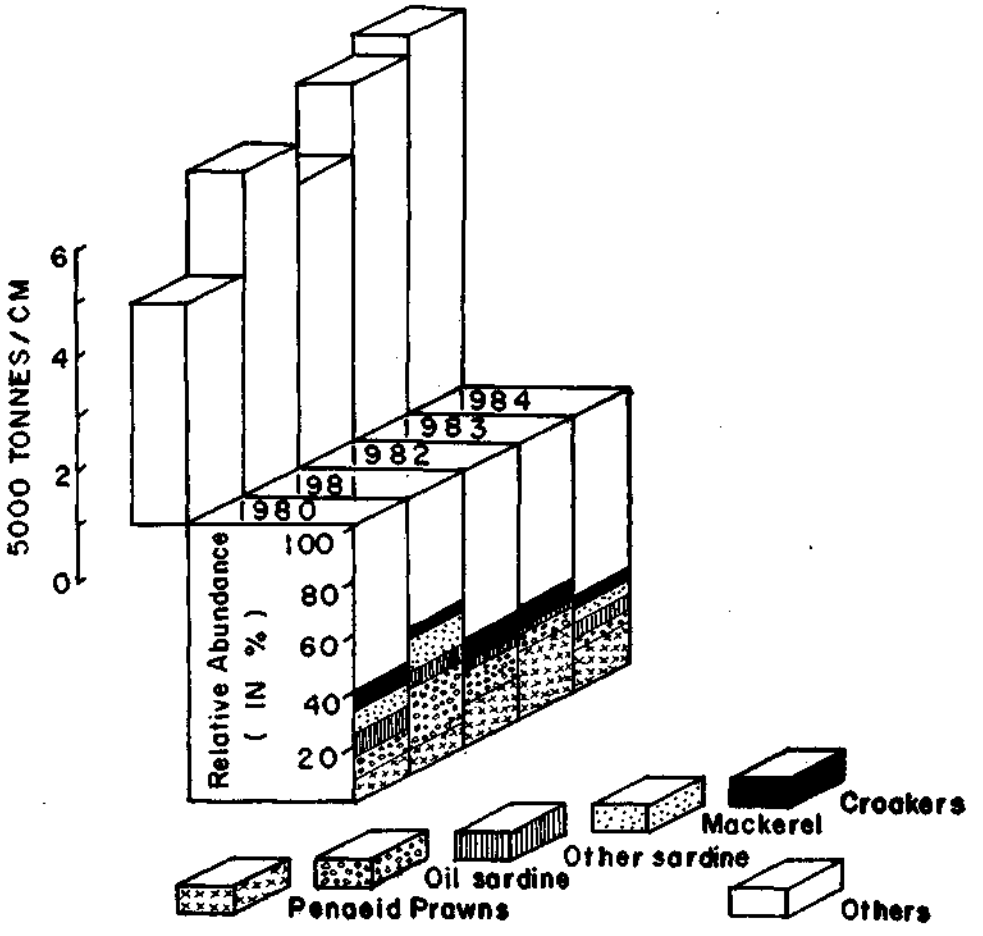

Fig 18. Contributions of major groups to the total landings by mechanized units.

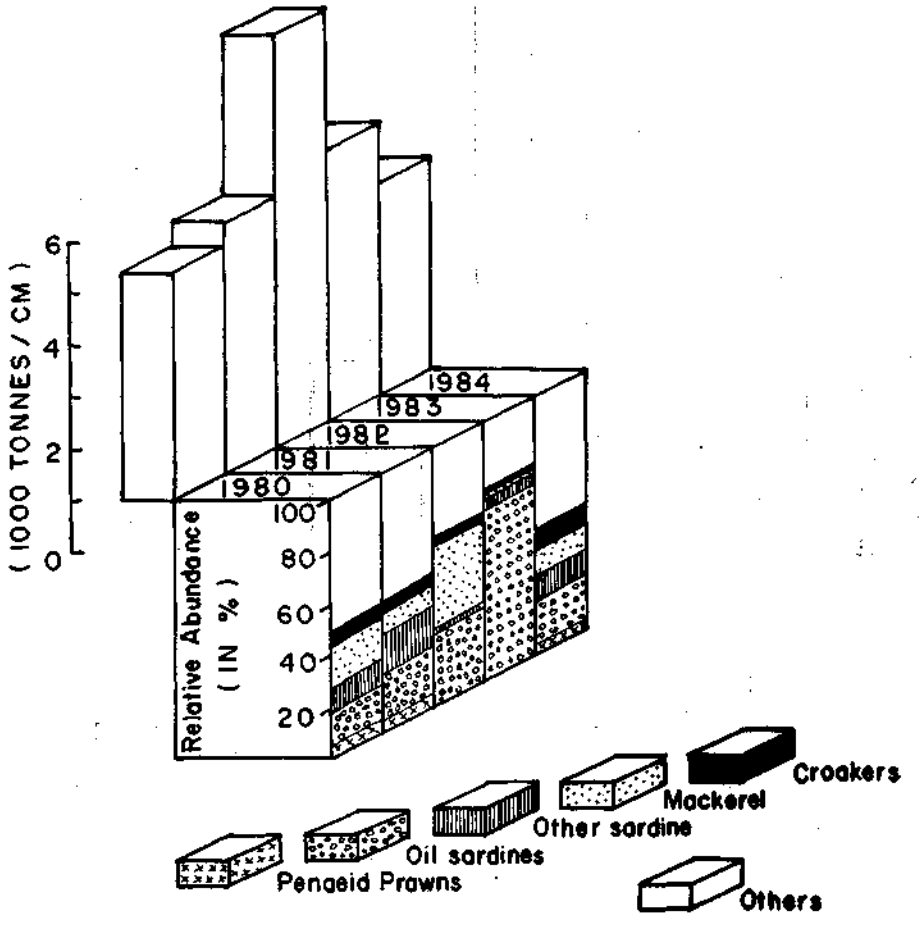

Fig 19. Contributions of major groups to the total landings by non-mechanized units.

FUTURE PROSPECTS

Marine fish production in Karnataka has in recent years stabilized around 1.3 lakh tonnes. Fishing has been heavily concentrated in the nearshore area leaving much of the inshore area within 50 m depth zone underexploited and the area beyond this relatively unexploited. The marine fish production in Karnataka has been sustained mainly by two pelagic species, oil sardine and mackerel and the success or failure of these two determine the trend of production in the state. But these two have been characterized by wide fluctuations over years.

During the period 1975-84, marine fish production in Karnataka has indicated promising features of quantitative improvement. Though the landings of oil sardine and mackerel were characterized by fluctuations the landings of other sardines, *Stolephorus* spp and carangids have shown potentiality of improvement in the landings.

Exploratory surveys carried out by the Governmental agencies have thrown light on the availability of non-conventional fishery resources in the shelf area. It has been reported that many resources in the inshore area and beyond are underexploited and similarly many resources in deeper area are still unexploited. (*Proc. Seminar on potential Marine Fishery Resources* 1986, C.M.F.R.I, Cochin) Surveys have revealed that among underexploited rosources *Nemipterus* spp is available in the depth zone 50-100 m with almost the same intensity as in the inshore area of 0-50 m depth and is abundant at a higher rate in 100-200 m depth zone. This resource forms only 1.1% of the total marine fish landings in Karnataka. Lizardfishes form only 0.5% of the total landings but there exists great potentiality of harvesting this resource once fishing is extended to 100-200m. Catfishes contribute only 5.0% of the total landings in the state and is most abundantly occurring in the inshore area upto a depth of 50 m. However this resource is available upto 200 m. Cephalopods accounts only for 0.3% of the marine fish production in the state. But this also has good potentiality of being harvested from the area in 50-200 m depth zone.

Among other underexploited resources, anchovies is most abundant in 25-50 m depth zone, carangids in 0-50 m depth range, and ribbonfishes in 20-50 m. Among unexploited resources *Priacanthus* spp has indicated high rate of production in the depth zone 100-200 m. Similarly *psenus indicus* is another deepwater resource which has shown a very high potentiality in 100-200 m depth zone. Deep sea prawns and lobsters in the depth range 300-400 m have indicated potentiality of harvest.

At present the marine fish production in the state is stabilized around 1.3 lakh tonnes. *Stolephorus* spp and carangids have shown increasing trends and are expected to yield more from the presently exploited area itself. However much would depend on exploiting underexploited resources within 50 m depth zone and the unexploited resources beyond. Definite indications of large stocks of oil sardine, mackerel, anchovies and carangids in the depth zone 25-75 m have been brought to light in recent surveys. Resources like tuna, pelagic sharks and squids are available abundantly in oceanic regions.

Maximum Expected Yield

Estimates of potential yield from continental shelf area of the country were made by many researchers. These estimates were based on primary productivity studies and also the catch rate realized from different regions (Jones & Bannerji 1973, George et.al 1977, Prasad et. al 1970, Prasad and Nair, 1973, Silas et. al 1976) These estimates vary in the range 2 to 8 million tonnes and in respect of Karnataka these vary in the range 1-5 lakh tonnes. Jones & Bannerji arrived at estimated potential yield of 1.4 lakh tonnes from Karnataka-Goa regions. However, the present total yield from this region has already increased to about 1.75 lakh tonnes.

From the inshore area, where the fishing is heavily concentrated a yield at the rate of 17 tonnes per sq. km is realized in Karnataka. Following George et al, 1977, considering the present catch rate, an estimate of potential yield from the shelf area could be obtained as 2.8 lakh tonnes. However the information available on the production of resources in the shelf area beyond 50 m depth being scanty, this estimate cannot be relied upon.

Gulland (1969) regards potential yield as the greatest average annual yield that can be taken over a period or under average environmental non-fishery induced conditions with any pattern of fishing (Mannual of Methods of Fish Stock Assessment, Part I). In a multispecies fishery where there exists interaction among species and employmant of diverse patterns of fishing it is a hard task to obtain a realistic estimate of the potential yield. However an attempt is made to estimate the maximum expected yield based on the present rate of production and this would serve a conservative estimate for all practical purposes on a short term basis. This is so particularly in respect of Karnataka and Goa where a few groups are exhibiting, currently, increasing trend. Estimates of maximum expected yield for Karnataka and Goa are obtained as follows.

Estimates of proportions of different groups in the total maximum expected yield is given by the percentage contributions of these groups in the current yield. For the present study percentage contributions to the average annual landings

during the ten years 1975-84 are taken as these estimates. Assuming that these proportions will be maintained, the gretest yields of these groups realized during the same period would generate estimates of maximum expected yield. These estimates are further averaged out to give a single estimate of the maximum expected yield.

Thus if p_i is the estimate of proportion of ith species and g_i its greatest yield realized, then an estimate of maximum expected yield y_i from ith species is giveen by

$$y_i = gi/pi \text{ and}$$

from these a single estimate can be obtained as $Y = \frac{1}{n} \sum_{i=1}^{n} y_i$ where n is the number of species/groups used. In respect of Karnataka, groups used are elasmobranchs, catfishes, sardines, scombroids, silverbellies, croakers, crustaceans and others and an estimate of maximum expected yieid is obtained as 219,974 tonnes (say 2.2 lakh tonnes). In respect of Goa the groups used are sardines, carangids, silverbellies, scombroids, crustaceans and others and the estimate is 53,512 tonnes (say 54,000 tonnes). Care has been shown to use only those groups which give consistent results. For example, the species which show either a clear increasing or decreasing trend is likely to end up with estimates which are biased.

Thus for the following analysis, 2.2 lakh tonnes and 54,000 tonnes are taken as the estimated maximum expected yield from Karnataka and Goa from the currently exploited area.

Table: 54 *Maximum Expected yield in Karnataka (in tonnes)*

	Dakshin Kannada	Uttar Kannada	Total
Purse seiners	111,000	18,000	129,000
Trawlers	33,000	23,000	56,000
Other mechanized units	2,500	1,500	4,000
Total mechanized	146,500	42,500	189,000
Non-mechanized	11,000	20,000	31,000
Grand total	157,500	62,500	220,000

As stated earlier, the catch per unit effort realized by purse seines has been showing a decreasing trend since 1980. The purse seines realized a catch per unit effort of 4,000 kg in 1980 against an effort of about 20,000 operations but the effort increased steeply in the subsequent years and was about 55,000 trips

in 1982 which realized a catch per unit effort of 1,565 kg. This warrants a close look into the ways of controlling the fishing effort. It could be seen from the trend of catch and CPUE that for a sustained fishery the CPUE should not be increased more than 2,530 kg. Even at this rate, the effort required to realize the maximum expected yield of 129,000 would be 51,000 operations which is 7% less than the effort put in the year 1982. Further, the CPUE realized during 1979, '80 and '81, on an average, in respect of purse seines was 3,315 kg and this rate of return can be assured if the effort is maintained at about 39,000 operations which would be about 20% less than the maximum effort already put in in the year 1982. It would therefore appear that there is little scope of increasing effort in the case of purse seines.

The catch per unit effort realized by trawlnet also has been showiag a decreasing trend since 1980. The CPUE decreased from 281 kg of 1980 to 183 kg in 1983 when the effort expended was the maximum 212,000 operations. Unlike purse seines, CPUE realized by trawlnets differed in the two districts, Uttar Kannada yielding a higher catch rate. But CPUE from Uttar Kannada had been showing a clear decreasing trend and by 1984, this reduced to the level in Dakshin Kannada. Inspite of this reduction in the CPUE, the effort had been increasing till 1983. It could be observed that even when the CPUE had been increasing, the CPUE realized in respect of prawns had been steady. Also, from 1981 onwards a qualitative change could be observed in the landings of trawlnets. Elasmobranchs, catfishes and croakers registered sudden decrease in the CPUE in 1981 but never recovered to the level of 1980. Considering the present trend it would follow that the yield can be increased to the maximum expected 56,000 tonnes and this would be, to a large extent, through the increased landings of stomatopods. Increase in the landings can be expected from soles and threadfin breams. Prawns would continue to yield at the current rate. It could be observed that the catch rate reduced by 28% in 1984 compared to that in 1980. Maximum expected 56,000 tonnes can be realized with an effort 5% less than the effort expended in 1982 at a catch rate equivalent to the average for 1980 and 81 when the operations of trawlers was tending to be stabilized. Hence considering the present effort and catch rate it could be surmised that there is no scope of any increase in the fishing effort.

Landings from units with mechanized propulsion by inboard engines is likely to be increased to 4,000 tonnes. The data available for the present analysis are not sufficient to make any conclusion regarding the effort pattern for this type of fishing since this is relatively a recent development. However, the possibility of increased landings of catfishes, seerfishes and tunnies cannot be rejected.

The landings by indigenous units is expected to increase to 31,000 tonnes; 11,000 tonnes from Uttar Kannada. Because of the multiplicity of gear and diversity in the fishing methods it is a complex problem to identify the effort level suitable for each type. However, yendi, drift nets and gillnets offer scope of inproving the landings and the operations of rampani has reduced to insignificant proportion. Among the important groups, there are indications to suggest that elasmobranchs, ribbonfishes and seerfishes offer scope of improved landings particularly from Uttar Kannada whereas carangids would improve in its landings in Dakshin Kannada.

Goa

Maximum expected yield from Goa is estimated at 54,000 tonnes which may be taken for short-term planning. The contribution from mechanized fishing would be 45,000 tonnes and 9,000 tonnes from non-mechanized fishing. Compsition of the maximnm expected yield is given below.

Table 55. *Maximum expected yield in Goa (in tonnes)*

Trawinets	...	34,000
Purse seines	...	9,000
Other mechanized gear	...	2,000
Total (mechanized)	...	45,000
Non-mechainzed	...	9,000
Grand total	...	54 000

It could be observed that in Goa state both the effort and the catch in respect of trawlnets had been showing clear increasing trend since 1980 and the indication is that CPUE is also moderately increasing since 1981. The maximum expected yield by trawlnets, being 34,000 tonnes, which is just 27% more than the greatest annual yield obtained so far, could be realized by an additional effort of, interestingly, 27% which would ensure a CPUE of 273 kg, the average CPUE for the five years 1980-84. Additional input of effort can be effected in a phased manner. The expected increase in the landings is likely to be by perches, croakers, silverbellies and stomatopods.

The landings and the effort put in in respect of purse seines were showing fluctuations during the period, the maximum catch realized being in 1981 which was unusually high compared to other years. The effort also was very high during that year. The maximum expected landings by purse seines is only 9,000 tonnes and this does not warrant any increase in the effort from the current

level. The catch per unit effort had been decreasing and was as low as 613kg in 1983. Though, there was this deflexion in the year 1983, the CPUE has been more or less steady in the years 1981-84 at about 1,000 kg. Even at the rate of 1,000 kg, the additional effort required could be about 20% but at the current level of effort at least 20% increase can be expected in the CPUE. Also it could be observed that only *Thrvssa* spp has shown scope of increase among the resources exploited by purse seines. Hence considering the very low catch rate currently realized, and also since increase in the total landings expected is marginal, it is not advisable to increase the fishing effort any more.

The maximum expected yield from the indigenous gear is estimated at 9,000 tonnes which is just 13% more than the maximum yield realized at the current leavel of effort.

Among the indigenous gear, rampani registered good yield in 1982 and 1983 with improved catch per unit effort, though in 1984, against an increased effort, the landings and catch per unit effort went down. However, the indications are that rampani would continue to play a prominent role among indigenous gear in Goa. Among others, drift set gillnets and yendi (shore seine) also would continue to yield steady landings. The resources that show further scope of increase in the landings by non-mechanized gear are *Thryssa* spp and carangids though oil sardine and maekerel would continue to be the main stay.

SUMMARY

During the seventies, marine fisheries in Karnataka made new strides and showed promising features of quantitative improvement and qualitative change. Introduction of small trawlers on a commercial scale gave a fillip to the marine fish production in the early seventies. By mid-seventies, the production showed a trend of getting stabilized around a lower level than that of early seventies. But the onset of purseseining on a commercial scale in 1977 saw the landings again increasing and the level of production remained more or less high till 1982. Introduction of trawlers improved the landings of demersal resources and the operations of purseseines gave an impetus to the production of pelagic resources. It could be observed that elasmobranchs, catfishes and seerfishes offered scope of improved landings. Other sardines, *Stolephorus* spp caragids and stomatopods have shown clear increasing trend and penaeid prawns would continue to give yield at the current level.

The near-shore area of Karnataka has been heavily fished. Though marginal increase can be expected from the presently exploited area the present condition does not warrant any further addition of purseseines or trawlers since the present catch rate is very low. The gillnetting (by inboard engines) is of recent origin and the impact has yet be assessed though the yield from this operation has been encouraging. For an assured yield at a higher level, it is imperative that new areas have to be exploited for which evidence of availabily of non-conventional resources is already known.

Marine fisheries in Goa have many features in common with that of Karnataka State. Oil sardine and mackerel have been the mainstay in the marine fish Landings in Goa. Though the landings in Goa did not exhibit a clear trend, the landings in the latter half of the period 1975-84 was much better than that of the former half. It could be observed that this was mainly due to the increased landings by trawlers and the purseseines did not have much role in increasing the a ndings. Among the resources exploited by purseseines only *Thryssa* spp has shown scope of increase in the landings. However, the landings by trawlnets has shown scope of improvement against an increased effort. The effort can be increased by about 125% but only in a phased manner and additional landings can be expected in respect of perches, whitebaits, croakers and, to a large extent, stomatopods. Penaeid prawns would continue to be the mainstay in the landings. The purseseines do not offer any scops of increasing the effort further. Similarly in the case of gill netters, the increase in the effort during the last two years of the period has been drastic with the conspicuous reduction in the

CPUE. As mentioned earlier the current trend does not indiate any further increase in the landings by gill netters (with inboard engine) Among the indeigenous gear, rampani would continue to play a prominent role. Drift/set gillnets and yendi also would continue to yield steady landings. The resources that offer scope of increase in the landings by non-mechanized gear are *Thryssa* spp and carangids though oil sardine and mackerel would contine to be the mainstay.

In the light of the facts emerging from the foregoing appraisal, following suggestions are made for the management of marine fisheries in Karnataka and Goa.

1. Considering the present catch rate and effort level, there does not seem to be any scope of increasing the fleet strength of purseseiners or the small trawlers.

2. Though the performance of gillnetters with in-board engines has been encouraging, the impact could not be assessed since this is relatively of recent introduction.

3. Uttar Kannada offer scope of increase in the landings by non-mechanized units. This can be further consolidated by encouraging canoes fitted with out-board engines in a phased manner.

4. Resources of anchovies, carangids and other sandines offer scope of improved landings in the presently exploited area. Evidence on the availability of these resources in area of depth range 25-50 m in the south-west coast of India is available. Mid-water trawling can be encouraged to tap these resources which are beyond the reach of artisanal sector.

5. In Goa, considering the present catch rate and effort level, there does not seem to have any scope of increasing the effort in respect of purseseines or gillnetters with in-board engines.

6. An additional effort of 25% can be thought of in respect of small trawlers. This would amount to an addition of about 100 small trawlers which can be introduced in a phased manner in Goa with regular monitoring of impact.

7. Among the pelagic resources, *Thryssa* spp, *Stolephorus* spp and carangids offer scope of improved landings. Among demersal resources, penaeid prawns would continue to give yield at the current rate. To a large extent, the improved landings by trawlers would be made up of stomatopods.

8. Assessment of stocks of commercially exploited resources is beset with a lot of complex situations particularly so in the context of diverse methods of fishing, concentrating in the near shore area. In order to evaluate and monitor the stock position and the fluctuation in the resources, a sound information base covering fishery and non-fishery factors is of paramount necessity.

APPENDIX

QUARTERWISE AND SPECIESWISE CONTRIBUTION OF MARINE

Name of fish	1975					1976				
	I	II	III	IV	Total	I	II	III	IV	Total
1. ELASMOBRANCHS	852	210	384	280	1726	753	215	193	328	1489
2. EELS	—	—	—	81	81	—	—	—	—	—
3. CATFISHES	696	1716	94	716	3222	1823	1410	141	905	4279
4. CLUPEIDS										
a. Wolf herring	158	40	31	183	412	34	5	48	97	184
b. Oil sardine	11150	502	16	41033	52701	35636	746	978	4091	41451
c. Other sardines	1	—	130	644	775	33	202	168	238	641
d. Hilsa shad	1	—	—	—	1	—	—	—	—	—
e. Other shads	—	—	—	10	10	23	—	—	7	30
f. Anchovies										
Stolephorus	—	—	—	10	10	46	3	—	5	54
Thryssa	15	10	202	117	344	84	82	284	450	900
g. Other clupeids	278	21	123	146	568	163	49	123	122	457
5. BOMBAYDUCK	—	—	—	2	2	—	—	4	3	7
6. LIZARDFISHES	—	64	—	11	75	132	19	—	36	187
7. HALFBEAKS & FULLBEAKS	16	—	4	16	36	29	7	18	33	87
8. FLYING FISHES	—	—	—	—	—	—	—	—	—	—
9. PERCHES	314	11	69	333	727	166	5	77	206	454
10. GOATFISHES	—	3	—	—	3	2	122	—	21	145
11. THREADFINS	2	—	—	1	3	—	—	—	—	—
12. CROAKERS	861	148	532	312	1853	1861	691	367	297	3216
13. RIBBONFISHES	115	47	31	26	219	77	253	41	212	583

QUARTERWISE AND SPECIESWISE CONTRIBUTION OF MARINE

Name of fish	1975					1976				
	I	II	III	IV	Total	I	II	III	IV	Total
1. ELASMOBRANCHS	852	210	384	280	1726	753	215	193	328	1489
2. EELS	—	—	—	81	81	—	—	—	—	—
3. CATFISHES	696	1716	94	716	3222	1823	1410	141	905	4279
4. CLUPEIDS										
a. Wolf herring	158	40	31	183	412	34	5	48	97	184
b. Oil sardine	11150	502	16	41033	52701	35636	746	978	4091	41451
c. Other sardines	1	—	130	644	775	33	202	168	238	641
d. Hilsa shad	1	—	—	—	1	—	—	—	—	—
e. Other shads	—	—	—	10	10	23	—	—	7	30
f. Anchovies										
Stolephorus	—	—	—	10	10	46	3	—	5	54
Thryssa	15	10	202	117	344	84	82	284	450	900
g. Other clupeids	278	21	123	146	568	163	49	123	122	457
5. BOMBAYDUCK	—	—	—	2	2	—	—	4	3	7
6. LIZARDFISHES	—	64	—	11	75	132	19	—	36	187
7. HALFBEAKS & FULLBEAKS	16	—	4	16	36	29	7	18	33	87
8. FLYING FISHES	—	—	—	—	—	—	—	—	—	—
9. PERCHES	314	11	69	333	727	166	5	77	206	454
10. GOATFISHES	—	3	—	—	3	2	122	—	21	145
11. THREADFINS	2	—	--	1	3	—	—	—	—	—
12. CROAKERS	861	148	532	312	1853	1861	691	367	297	3216
13. RIBBONFISHES	115	47	31	26	219	77	253	41	212	583

TABLE-1

FISH LANDINGS (IN TONNES) IN KARNATAKA DURING 1975-1979

1977					1978					1979				
I	II	III	IV	Total	I	II	III	IV	Total	I	II	III	VI	Total
916	142	372	1808	3238	535	468	389	659	2051	412	161	774	1184	2531
—	—	3	—	3	3	—	—	5	8	—	—	1	—	1
595	2768	154	1645	5162	675	231	298	1577	2831	756	671	290	8203	9920
151	5	94	467	717	71	30	107	39	247	18	35	125	80	258
4387	425	842	25491	31145	10391	1754	10469	24093	46707	6910	2793	2243	21134	33080
31	20	115	14	180	21	1339	190	1022	2572	1211	2743	108	691	4753
43	—	1	—	44	8	—	—	1	9	2	—	—	8	10
6	—	5	102	113	7	2	16	5	30	26	—	7	19	52
2	—	145	27	174	56	2	30	355	443	775	81	1	864	1721
55	157	381	238	831	16	27	495	381	919	156	55	169	61	441
740	84	187	666	1677	48	46	566	212	872	644	97	98	1439	2278
—	—	4	—	4	2	—	2	—	4	1	—	3	1	5
373	12	—	—	385	1	83	3	5	92	72	83	—	—	155
22	10	18	7	57	13	8	1	19	41	9	—	—	40	49
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
1416	13	60	—	1489	17	100	29	28	174	33	70	22	56	181
19	—	—	—	19	2	4	25	—	31	14	15	—	1	30
—	1	2	—	3	—	3	—	—	3	2	—	—	—	2
948	617	590	607	2762	194	521	732	281	1728	778	265	805	500	2348
70	60	55	52	237	73	111	169	51	404	162	274	626	131	1193

Name of fish	1975					1976				
	I	II	III	IV	Total	I	II	III	IV	Total
14. CARANGIDS										
a. Leather-jackets	5	3	1	46	55	73	—	1	6	80
b Other carangids	339	177	16	409	941	272	155	17	244	688
15. SILVER BELLIES	421	306	44	469	1240	1409	442	147	2088	4086
16. BIG-JAWED JUMPER	80	7	352	56	495	16	7	79	114	216
17. POMFRETS	28	9	3	173	213	71	7	8	352	438
18. INDIAN MACKEREL	1974	147	258	10090	12469	6011	4029	1089	11326	22455
19. SEER FISHES	171	41	75	489	776	310	1	156	874	1341
20 TUNNIES	14	23	—	175	212	30	—	48	498	576
21. BILL FISHES	—	—	—	—	—	—	—	—	—	—
22. BARRACUDAS	1	—	—	13	14	3	—	—	6	9
23. MULLETS	6	—	—	2	8	—	—	—	6	6
24. UNICORN COD	—	—	—	—	—	—	—	—	—	—
25. FLATFISHES										
a. Soles	249	12	9	103	373	86	92	13	446	637
26. CRUSTACEANS										
a. Penaeid prawns	2140	350	267	317	3074	726	1261	351	256	2594
b. Non penaeid prawns	—	—	—	—	—	—	—	—	—	—
b. Lobsters	—	—	2	10	12	—	—	5	3	8
c. Crabs	2377	6	2	155	2540	64	47	15	30	156
27. CEPHALOPODS	151	—	9	15	175	2349	575	1	142	3067
28. MISCELLANEOUS	735	387	392	615	2129	1577	996	519	1670	4762
Total	23150	4240	3046	57058	87494	53859	11421	4891	25112	95283

TABLE-1 (Contd.)

1977					1978					1979				
I	II	III	IV	Total	I	II	III	IV	Total	I	II	III	IV	Total
9	2	5	490	506	4	7	2	—	13	5	1	35	18	59
164	58	27	553	802	177	48	34	44	303	194	114	68	775	1151
828	446	141	216	1631	86	356	3230	569	4241	360	314	332	559	1565
24	16	40	21	101	14	66	80	38	198	90	51	206	86	433
43	15	44	147	249	1313	45	15	584	1957	91	6	24	129	250
497	1271	3229	21217	26214	5358	652	12940	31754	50704	7327	4599	6386	21772	40084
125	8	163	1535	1831	415	35	256	757	1463	393	11	47	1194	1645
—	—	140	482	622	—	32	48	534	614	1	773	6	937	1717
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	3	3	—	—	62	214	276	28	2	1	10	41
—	—	—	—	—	—	—	—	1	1	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
434	141	182	228	985	52	287	1349	132	1820	119	96	286	373	874
1266	637	570	862	3335	3511	2146	2169	596	8422	2710	1492	105	347	4654
—	—	—	—	—	6	—	12	—	18	2	—	—	4	6
1	1	2	—	4	10	23	—	6	39	15	—	—	—	15
52	88	8	59	207	405	5	1	330	741	2282	201	7	250	2740
64	862	1	38	965	37	1282	6	21	1346	48	4	1	15	68
5433	2156	1112	2756	11457	7970	5817	2442	5309	21538	5316	4382	180	2196	12074
18714	10015	8692	59731	97152	31491	15580	36167	69622	152860	30962	19389	12956	63077	126384

QUARTERWISE AND SPECIESWISE CONTRIBUTION OF MARINE FISH

Name of fish	1980					1981				
	I	II	III	IV	Total	I	II	III	IV	Total
1. BLASMOBRANCHS	758	400	316	1436	2910	—	—	—	—	—
a. Sharks	—	—	—	—	—	1798	322	1291	518	3929
b. Skates	—	—	—	—	—	—	—	—	—	—
c. Rays	—	—	—	—	—	90	16	1	29	136
2. EELS	127	1	3	—	131	—	—	—	—	—
3. CATFISHES	1814	207	892	2441	5354	1335	437	541	5190	7503
4. CLUPEIDS										
a. Wolf herring	34	1	56	80	171	38	16	12	52	118
b. Oil sardines	11715	1098	6640	23274	42727	17236	3695	2437	42246	65614
c. Other sardines	900	1800	406	1029	4135	883	802	1199	2444	5328
d. Hilsashad	2	—	6	—	8	—	1	—	—	1
e. Other shads	25	—	—	—	25	279	43	9	—	331
f. Anchovies										
Coilia	—	—	—	—	—	1	—	—	—	1
Setipinna	—	—	—	—	—	—	—	—	—	—
Stolephorus	102	65	29	5425	5621	591	218	1705	3445	5959
Thryssa	161	23	407	259	850	150	14	82	50	296
g. Other clupeids	265	388	127	308	1088	734	39	105	72	950
5. BOMBAYDUCK	—	9	—	6	15	100	230	—	3	333
6. LIZARD FISHES	189	166	—	153	508	65	16	7	60	148
7. HALF BEAKS & FULL BEAKS	59	1	1	119	180	—	—	—	—	—
8. FLYINGFISHES	55	—	—	—	55	—	—	—	—	—
9. PERCHES	61	90	463	455	1069	—	—	—	—	—
a. Rock cods	—	—	—	—	—	—	—	—	10	10
b. Snappers	—	—	—	—	—	53	—	—	—	53
c. Pig-face breams	—	—	—	—	—	—	—	—	1	1
d. Threadfin breams	—	—	—	—	—	35	111	—	110	256
e. Other perches	—	—	—	—	—	31	31	12	5	79
10. GOATFISHES	18	15	—	5	38	—	—	—	—	—
11. THREADFINS	—	—	—	—	—	—	—	—	—	—
12. CROAKERS	1268	401	511	1320	3500	1125	455	569	146	2295
13. RIBBONFISHES	455	555	75	414	1499	47	98	89	1	235
14. CARANGIDS										
a. Horse Mackerel	—	—	—	—	—	18	—	19	962	999
b. Scads	—	—	—	—	—	13	—	—	—	13
c. Leather-jackets	41	1	1	24	67	1	10	7	130	148
d. Other carangids	318	1018	628	2778	4742	775	143	1077	434	2429

TABLE-2

LANDINGS (IN TONNES) IN KARNATAKA DURING 1980-84

1982					1983					1984				
I	II	III	IV	Total	I	II	III	IV	Total	I	II	III	IV	Total
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
1222	875	337	2277	4711	1105	916	550	1230	3801	441	265	469	252	1427
—	—	—	—	—	8	1	—	—	9	32	—	—	—	32
192	41	41	73	347	80	86	11	8	185	60	33	22	27	142
7	—	—	—	7	—	—	—	1	1	1	1	—	—	2
2430	3989	580	3254	10253	2402	1115	885	2871	7273	1205	211	1450	856	3722
74	19	77	224	394	50	28	69	76	223	7	2	432	60	501
24949	4791	8054	17332	55126	5324	2516	6441	7420	21701	7540	2737	11533	14513	36323
845	962	256	1088	3151	555	349	311	4871	6086	1426	215	243	3561	5445
—	6	—	7	13	2	—	—	—	2	—	13	—	2	15
—	42	—	3	45	1	12	—	3	16	1	—	—	—	1
8	2	—	1	11	—	—	—	—	—	9	—	—	—	9
2	—	5	—	7	3	—	1	15	19	—	—	—	—	—
2054	1419	2	8873	12348	794	2083	229	7846	10952	1716	1008	293	8463	11480
61	92	445	336	934	100	167	247	1055	1569	274	98	279	470	1121
41	310	66	186	603	341	269	288	2225	3123	284	265	677	3959	5185
1	—	—	—	1	—	—	11	—	11	2	—	—	—	2
184	26	—	40	250	425	783	—	156	1364	402	124	6	59	591
37	145	1	96	279	7	31	—	59	97	6	20	1	71	98
—	—	—	—	—	—	—	—	—	—	—	—	—	1	1
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	18	—	18	3	1	19	2	25	16	19	—	7	42
—	—	—	—	—	—	58	—	1	59	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	19	19
57	48	1	190	296	1523	2016	5	290	3834	719	344	24	438	1525
59	61	27	57	204	238	62	25	185	510	352	143	10	150	655
1	—	—	—	1	7	10	—	—	17	—	—	—	1	1
3	—	—	—	3	—	—	—	16	16	1	3	6	3	13
485	438	1028	375	2326	935	959	507	1666	4067	737	405	443	420	2005
98	755	71	138	1062	346	611	192	1117	2266	120	248	119	246	733
—	263	112	5	380	—	—	344	89	433	38	22	186	41	287
—	—	—	46	46	—	—	—	24	24	—	—	1067	463	1530
94	6	85	190	375	16	—	1235	126	1377	2	3	1310	131	1446
173	448	110	1134	1865	609	411	231	1275	2526	572	828	393	2479	4272

Name of fish	1980					1981				
	I	II	III	IV	Total	I	II	III	IV	Total
15. SILVERBELLIES	555	2101	540	1517	4713	492	232	171	743	1638
16. BIG-JAWED JUMPER	186	141	203	468	998	237	67	106	105	515
17. POMFRETS	43	197	67	389	696	—	—	—	—	—
a. Black pomfret	—	—	—	—	—	3	12	14	24	53
b. Silver pomfret	—	—	—	—	—	296	30	2	30	358
c. Chinese pomfret	—	—	—	—	—	—	—	7	1	8
18. INDIAN MACKEREL	5189	960	5437	8048	19634	5640	1111	7881	5134	19766
19. SEER FISHES	394	9	466	1072	1941	—	—	—	—	—
a. *S. commersonni*	—	—	—	—	—	279	319	41	598	1237
b. *S. guttatus*	—	—	—	—	—	—	—	19	823	842
c. *S. lineolatus*	—	—	—	—	—	—	—	—	188	188
20. TUNNIES	350	370	38	194	952	—	—	—	—	—
a. *E. affinis*	—	—	—	—	—	240	91	280	1905	2516
b. *Auxis* spp	—	—	—	—	—	—	1	—	—	1
c. *K. pelamis*	—	—	—	—	—	—	—	—	—	—
d. *T. tonggol*	—	—	—	—	—	—	—	—	—	—
Other tunnies	—	—	—	—	—	—	—	—	—	—
21. BILLFISHES	68	1	5	10	84	—	—	3	—	3
22. BARRACUDAS	—	1	8	30	39	62	4	4	5	75
23. MULLETS	—	—	—	—	—	—	—	—	1	1
24. UNICORN COD	—	—	—	—	—	—	—	—	—	—
25. FLATFISHES										
a. Halibut	—	—	—	—	—	—	—	—	—	—
b. Flounders	—	—	—	—	—	—	—	—	—	—
c. Soles	334	165	205	78	782	237	42	52	214	545
26. CRUSTACEANS										
a. Penaeid prawns	1068	646	1050	334	3098	1305	1234	754	829	4122
b. Non penaeid prawns	105	17	4	2	128	—	—	—	4	4
c. Lobsters	110	—	—	—	110	—	—	—	—	—
d. Crabs	1817	380	5	563	2765	295	209	119	27	650
e. Stomatopods	—	—	—	—	—	3030	1708	—	3980	8718
27. CEPHALOPODS	38	11	23	50	122	19	23	—	224	266
28. MISCELLANEOUS	2293	990	266	1018	4567	5552	4445	544	4137	14678
Total	30917	12228	18878	53299	115322	43085	16225	19159	74880	153349

TABLE–2 (Contd.)

1982					1983					1984				
I	II	III	IV	Total	I	II	III	IV	Total	I	II	III	IV	Total
185	731	973	528	2417	1778	1146	603	3497	7024	187	594	2409	165	3355
162	151	284	233	830	377	316	252	187	1132	179	119	309	245	852
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
21	34	825	1099	1979	18	15	790	477	1300	39	9	699	434	1181
110	109	20	838	1077	247	31	21	252	551	299	81	54	109	543
—	—	4	16	20	—	—	4	—	4	—	—	—	53	53
233	1069	2266	1943	5511	26	61	591	1504	2182	323	1248	9246	1520	12337
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
989	18	497	3394	4898	347	28	806	2159	3340	221	26	2216	1686	4149
161	1	137	1625	1924	98	1	382	211	692	115	—	220	436	771
—	—	—	4	4	36	—	—	—	36	1	—	—	—	1
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
48	367	382	1433	2230	23	21	441	871	1356	363	23	245	164	795
—	—	31	—	31	—	—	406	3	409	—	—	30	98	128
—	—	—	—	—	—	—	27	—	27	—	—	—	—	—
—	—	—	—	—	—	—	1	2	3	—	—	1	27	28
—	7	—	—	7	—	—	—	—	—	10	38	15	99	162
—	—	4	43	47	—	—	—	43	43	1	—	4	1	6
2	2	—	62	66	19	11	2	68	100	—	—	2	10	12
—	6	2	—	8	1	8	—	2	11	1	21	16	4	42
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	5	2	—	7	5	3	—	—	8	1	—	—	—	1
—	—	—	—	—	—	—	68	—	68	—	—	—	—	—
435	342	70	526	1373	728	847	83	825	2483	457	351	1495	3729	6032
2496	1302	1821	2079	7698	2530	3068	1713	572	7883	1597	1385	1607	922	5511
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
48	—	—	1	49	—	—	—	—	—	3	—	—	—	3
816	122	13	52	1003	222	290	—	21	533	260	58	1	157	476
6284	3085	3	558	9930	2874	3564	—	1263	7701	6151	2374	—	1313	9838
54	25	2	72	153	845	93	6	35	979	124	106	19	84	333
7577	5082	576	5283	18518	782	742	304	319	2147	565	471	301	425	1762
52698	27196	19228	55714	154836	25830	22729	18101	44938	111598	26860	13911	37852	48373	126996

DISTRICTWISE LANDING CENTRES IN KARNATAKA AND GOA

DAKSHIN KANNADA DISTRICT

1. Talapady
2. Someshwar
3. Ullal
4. Mangalore (Bunder)
5. Bengre
6. Kuduroli
7. Bokapatna
8. Bolur
9. Panambur
10. Baikampady
11. Kulai Chitrapur
12. Hosabettu
13. Suratkal
14. Mukkamitrapatna
15. Sasihithlu
16. Mulki-Hejmadikodi
17. Hejmadi
18. Padubidri
19. Thenka-Yermal
20. Bada-Yermal
21. Bada-Uchila
22. Moolur
23. Kaup-light house
24. Polipu
25. Kaipumjal
26. Mattukoppal
27. Udyawar
28. Kuthupady
29. Kadaikar
30. Kidiyoor
31. Padukerie
32. Malpe
33. Thottam
34. Gujjarbettu-hood
35. Bengre (Hangarkatta)
36. Kodikanyan
37. Kottathattu
38. Manoor
39. Gopadi
40. Bijadi
41. Kundapoorkodi
42. Ganguli Bunder
43. Kharvikeri
44. Trasi
45. Marvante
46. Naunda
47. Gangabailu
48. Kodiyerie
49. Tharapati-paduvari
50. Kesarkodi

TABLE-4 (Contd.)

1982					1983					1984				
I	II	III	IV	Total	I	II	III	IV	Total	I	II	III	IV	Total
—	—	—	—	—	—	61	—	14	75	—	19	344	8	371
—	—	2	—	2	—	—	—	1	1	—	—	—	139	139
—	1	—	59	60	—	—	6	10	16	—	—	—	—	—
415	167	28	758	1368	12	175	67	690	944	992	241	212	36	1481
23	340	648	—	1011	550	387	270	135	1342	693	75	621	280	1669
262	285	23	396	966	325	1162	67	39	1593	301	190	109	186	786
8	—	—	—	8	—	—	—	18	18	23	1	—	16	40
59	—	—	229	288	112	11	1	25	149	2	—	—	111	113
—	66	1	—	67	—	90	40	26	156	27	146	—	33	206
—	—	—	—	—	—	—	—	—	—	6	—	—	21	27
2541	3	18	45	2607	—	124	3	93	220	37	295	1743	609	2684
—	—	—	—	—	2	—	—	—	2	1	—	—	3	4
—	6	3	104	113	—	—	12	245	257	—	—	37	3	40
3	14	16	489	522	—	28	—	437	465	12	6	54	250	322
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	6	6	—	—	—	25	25	—	—	102	48	150
—	—	—	—	—	—	—	—	—	—	—	—	214	—	214
—	26	—	2	28	—	—	—	6	6	—	13	—	11	24
—	45	9	10	64	12	2	—	3	17	—	—	8	85	93
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	17	—	—	17	—	—	—	—	—
—	—	2	—	2	—	—	—	—	—	—	—		—	—
100	151	—	366	617	218	399	12	218	847	152	275	431	1455	2313
1265	770	95	1361	3491	3688	2357	1207	492	7744	1882	800	1490	681	4853
12	—	—	12	24	6	2	—	—	8	4	1	—	1	6
435	344	2	123	904	77	537	—	123	737	668	259	69	109	1105
1049	230	—	2225	3504	1277	79	—	1306	2662	1604	984	—	2041	4629
14	7	20	125	166	66	53	—	291	410	126	14	53	215	408
715	606	221	462	2004	750	834	95	2155	3834	2634	473	286	320	3713
12126	5422	5351	11142	34041	13959	9330	2988	11411	37688	12897	6139	7832	11637	38505