

MARINE FISH PRODUCTION OF MARITIME STATES OF THE WEST COAST OF INDIA

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ABSTRACT

To highlight the fishery in monsoon, an attempt has been made in this paper to evaluate the impact of monsoon fishing on the exploited marine fish stocks in the west coast of India and the trends in the production of various groups in different seasons discussed.

Except in Kerala where monsoon fishing is intensive due to the Mud Bank fishery and trawling off Sakthikulangara and Kochi, in the rest of the coast fishing activities are not as intensive as in Kerala during monsoon. The major gears used during monsoon are trawls and ring seines in Kerala.

AN OVERVIEW

Prior to eighties monsoon fishing was almost absent on the west coast of India except in Kerala. With the advancements in mechanised fishing and motorisation of country craft, fishing during monsoon was attempted and soon the intensity of fishing started increasing in eighties. Since the monsoon season is considered to be the spawning season for many of the commercially important fish stocks, this development, it is feared may affect the spawning and therefore, recruitment to the fishable stock. The purpose of this paper is to bring out the salient features of monsoon fishing in the west coast and to see whether there is any impact of monsoon fishing on the exploited fish stocks on the basis of data available with the Central Marine Fisheries Research Institute and to identify the gaps in the data base so as to improve the same for obtaining reliable information.

For the purpose of this study the seasons are considered as premonsoon (February to May) monsoon (June to August) and postmonsoon (September to January). This report covers the period from February 1984 to January 1988. The fishery year referred to is from February to January.

During the four year period an average of about 1.1 million tonnes of marine fish was landed annually along the west coast. Kerala accounted for 31% followed by Maharashtra (28%), Gujarat (21%), Karnataka (15%) and Goa (5%). More than 50% of the west coast landings was during postmonsoon

accounting for about 0.62 million tonnes followed by premonsoon with 0.36 million tonnes and monsoon with 0.12 million tonnes. During the postmonsoon period, Maharashtra Coast landed more (31%) followed by Kerala (25%), Gujarat (20%), Karnataka (19%) and Goa (5%). During premonsoon also, Maharashtra contributed more (29%). During this season Gujarat landed (27%) marginally more than Kerala (26%), followed by Karnataka (13%) and Goa (5%). However, during monsoon, Kerala ranked first contributing 77% of the west coast landings followed by Maharashtra (13%), Gujarat (4%), Karnataka (4%) and Goa (2%). The impressive record of Kerala during the monsoon is mainly due to landing in the mud bank fishery and the successful fishery off Sakthikulangara and Kochi (Table 1 - 4).

SALIENT FEATURES OF STATEWISE LANDINGS

Kerala : Better catches of perches, whitebaits and penaeid prawns were noticed during the monsoon. About one third of trawl landings was accounted for during monsoon. Monsoon contribution varied from 5 to 32% of the total annual landings of the State.

Karnataka : Monsoon contribution varied from 1.5 to 4.0% of the total marine fish landings in this State. Penaeid prawns and carangids contributed more during this season. Motorised country craft using *Mattubala* contributed more to the penaeid prawn landings in the State during monsoon.

TABLE 1. *Statewise marine fish landings (tonnes) on the west coast during pre-monsoon period (monthly averages in brackets)*

	Kerala	Karnataka	Goa	Maharashtra	Gujarat	W.coast
1984-85	112356 (28089)	30420 (7605)	15640 (3910)	81120 (20280)	91327 (22832)	330,863 (82716)
1985-86	97369 (24342)	26923 (6731)	21575 (5394)	102808 (25702)	106279 (26570)	354,954 (88739)
1986-87	81571 (20392)	55316 (13829)	20181 (5045)	128050 (32013)	113913 (28478)	399,031 (99757)
1987-88	87218 (21805)	69113 (17278)	21621 (5405)	105861 (26465)	74204 (18551)	358,017 (89504)
Average	94,628	45,443	19,754	104,460	96,431	360,716
Percent	26.2	12.6	5.5	29.0	26.7	100

TABLE 2. *Statewise marine fish landings (tonnes) on the west coast during monsoon 1984-88 (monthly averages in brackets)*

	Kerala	Karnataka	Goa	Maharashtra	Gujarat	W.coast
1984-85	96108 (32036)	2024 (675)	4179 (1393)	14400 (4800)	5440 (1813)	122,151 (40,717)
1985-86	88902 (29634)	5324 (1775)	3157 (1052)	13235 (4412)	6049 (2016)	116,667 (38,889)
1986-87	103263 (34421)	6753 (2251)	3372 (1124)	17666 (5889)	5058 (1686)	136112 (45,371)
1987-88	97492 (32497)	3777 (1259)	796 (265)	17008 (5669)	4718 (1573)	123791 (41,263)
Average	96,441	4,470	2,876	15,577	5,316	124,680
Percent	77.3	3.6	2.3	12.5	4.3	100

TABLE 3. *Statewise marine fish landings (tonnes) on the west coast during postmonsoon 1984-88 (monthly averages in brackets)*

	Kerala	Karnataka	Goa	Maharashtra	Gujarat	W.coast
1984-85	168166 (33633)	90476 (18095)	20567 (4113)	218543 (43709)	145254 (29051)	643,006 (128,601)
1985-86	150807 (30161)	100190 (20038)	24554 (4911)	211093 (42219)	136671 (27334)	623,315 (124,663)
1986-87	185445 (37089)	121457 (24291)	37565 (7513)	169583 (33917)	117481 (23496)	631,531 (126,306)
1987-88	118391 (23678)	160206 (32041)	40847 (8070)	157575 (31515)	106716 (21343)	583,235 (116,647)
Average	155702	118082	30758	189199	126531	620,272
Percent	25.1	19.0	5.0	30.5	20.4	100

Goa : With a declining trend in the marine fish landings during monsoon in this State, contribution varied from 1 to 10% in the State.

Maharashtra : Major contribution came from trawling resulting in better landings of penaeid prawns, Bombay-duck, nonpenaeid prawns and croakers. On an average, monsoon contribution was 5% only to the annual landings.

Gujarat : Mechanised gill netters and nonmotorised country craft contributed considerably during monsoon. Croakers, penaeid prawns and stomatopods were landed in good quantities during monsoon in this State.

From the above it is clear that monsoon fishery varies from State to State and points out to the need for deeper study. Changes in biological factors of the exploited resources, fishing activities and environmental factors have to be studied to draw valid conclusions on the impact of monsoon fishery on the exploited fish stocks of the region. The reports presented below give more details of the current status of the monsoon fishery in different maritime States of the west coast.

KERALA

The marine fish production in Kerala ranged from a minimum of 3.03 lakh tonnes in 1987 to a maximum of 4.9 lakh tonnes in 1988. The monthly average catch during premonsoon was minimum and maximum during postmonsoon season (Table 5), excepting postmonsoon season of 1987. In this year, an unusual fall in the landings during postmonsoon occurred.

TABLE 4. *Statewise total marine fish landings (tonnes) on the west coast during 1984-88 (monthly averages in brackets)*

	Kerala	Karnataka	Goa	Maharashtra	Gujarat	W.coast
1984-85	376630	122920	40386	314063	242021	1,096,020
Feb Jan	(31386)	(10243)	(3365)	(26172)	(20169)	(91,335)
1985-86	337078	132437	49286	327136	248999	1,094,936
Feb Jan	(28090)	(11036)	(4107)	(27261)	(20750)	(91,244)
1986-87	370278	183526	61118	315299	236452	1,166,673
Feb Jan	30857	(15294)	(5093)	(26275)	(19704)	(97,233)
1987-88	303101	233096	62764	280444	185638	1,065,043
Feb Jan	(25258)	(19425)	(5230)	(23370)	(15470)	(88,753)
Average	346,772	167,994	53,388	309,236	228,278	1,105,668
Percent	31.4	15.2	4.8	28.0	20.6	100

TABLE 5. *Seasonwise total marine fish landings in Kerala (tonnes) and monthly averages during 1984-1988*

Year	Premonsoon		monsoon		Postmonsoon	
	Total catch	Av. monthly catch	Total catch	Av. monthly catch	Total catch	Av. monthly catch
1984	112,356	28089	96,108	32036	168,166	33633
1985	97,369	24342	82,902	29634	150,807	30161
1986	81,571	20392	103,263	34421	185,445	37089
1987	87,218	21804	97,492	32497	118,391	23678
1988	93,262	23316	117,157	39052	282,844	56569

The important groups of fishes and crustaceans that were landed during the five year period were oilsardine, whitebaits, perches, croakers, carangids, mackerel, penaeid prawns, other sardines and catfishes.

Landings of important groups in different seasons

Of the 112,000 t landed in premonsoon of 1984, about 53% was contributed by oilsardine, 7% by penaeid prawns and 4% by perches (Table 6).

In 1984, though the contribution of perches during premonsoon season was only 4,000 t, during monsoon it increased to 17,900 t. Whitebait landings in the monsoon season formed 18% of the catches of the year. Penaeid prawns contributed to 15% of total catch and oilsardine, the least.

In 1985 also the situation was same as in 1984 in the case of oilsardine, whitebait, perches and penaeid prawn landings. However, there was an unusually high landings of ribbonfish during the monsoon and postmonsoon seasons. Of 97,000 t of total landings during the premonsoon period, 38% was accounted for by oilsardine landings. The penaeid prawns contributed to 10% of the total landings. Whitebait and perches contributed about 4% each during the season. During monsoon period perches contributed about 21% whereas whitebait formed 13% of the total catch. The contribution of penaeid prawns was 11%. As in 1984, the postmonsoon season recorded maximum landings in respect of oilsardine (27%) and whitebait (14%). About 5% of the catch was contributed by penaeid prawn during this season. Thus, oilsardine and whitebait landings were maximum during postmonsoon season whereas perches, penaeid prawns and ribbonfishes during monsoon.

Unlike in earlier years, oilsardine and whitebait landings declined in 1986. However, the landings of carangids increased considerably. Total landings during premonsoon was at 82,000 t, of which 20% was accounted for by oilsardine (4,900 t) followed by penaeid prawns (14%) and mackerel (11%). During the monsoon season, maximum landings were obtained in the case of

TABLE 6. *Landings (tonnes) of major groups of fishes and shellfishes in different seasons in Kerala during 1984-88*

Fishes/Groups	1984			1985			1986			1987			1988		
	PRM	M	PSM	PRM	M	PSM	PRM	M	PSM	PRM	M	PSM	PRM	M	PSM
Sharks	3187	678	2079	1194	360	3511	1021	473	3085	1487	553	1171	1538	1667	1912
Catfishes	2632	3046	4917	882	1233	3087	320	903	7277	162	2070	2359	362	3609	6017
Oilsardine	59987	12309	62609	37106	9415	40854	16291	59	8973	1712	17762	25486	2223	7948	66636
Other sardines	1722	1326	4448	1471	161	1908	2751	1821	4516	4860	554	3915	1195	2067	9671
Whitebaits	2399	16883	21153	3490	11342	21506	4866	7964	14265	3356	2787	10605	5155	15065	25853
Perches	3956	17867	4988	5061	18870	6629	4392	29589	12777	8032	15930	6484	8602	16067	7163
Croakers	2217	3706	3331	3394	2745	2295	1678	1676	9648	2233	3049	2851	1922	1829	5196
Ribbonfishes	784	5903	383	97	13348	11720	635	3941	7298	1021	11844	2390	2810	928	5189
Carangids	5481	2042	5872	3717	1959	7350	3048	19546	49464	7631	5191	9702	7229	9847	31657
Mackerel	3878	1533	6214	5332	2306	10476	9196	1221	11815	2896	2795	3880	4108	13257	27260
Seerfish	816	644	4546	1269	414	7145	483	307	3762	1212	649	3309	1694	615	8063
Tuna	2486	1062	2503	3535	1602	4596	570	511	8395	2237	4029	4234	3294	3123	7127
Penaeid prawns	7689	14572	12974	9881	9968	7443	11500	17575	8175	24887	14576	13132	19539	20346	29309
Cephalopods	637	891	4000	3012	1475	2772	1464	1714	12271	2791	736	3539	4779	2358	8049
Others	15085	13646	28149	17928	13704	13288	23356	15963	23724	22521	14967	25334	28818	18431	43742
Total	112356	96108	168166	97369	88902	150807	81571	103263	185445	88218	97492	118391	93262	117157	282844

PRM = Premonsoon; M = Monsoon; PSM = Postmonsoon.

perches (29%) followed by carangids (19%), penaeid prawns (17%) and whitebaits (8%). The postmonsoon season witnessed a major change in the composition of the catches, in that carangids formed the most dominant group (27%) followed by whitebait (8%), perches 7%, cephalopods (7%) and mackerel (6%). Penaeid prawn landings declined considerably and formed 4% of the season's catch.

During 1987, the catches declined with the estimated landings at 3.03 lakh tonnes. The decline occurred mainly during the postmonsoon season. The most dominant group in premonsoon season was penaeid prawns followed by perches, carangids, other sardines and others. In the monsoon season, oilsardine was most dominant followed by perches, penaeid prawns, ribbonfish and others. In the postmonsoon period, the important groups were oilsardine, penaeid prawns, whitebaits, carangids and others.

During the premonsoon of 1988, the landing was highest. The monsoon season witnessed a clear improvement in the landings of penaeid prawns, perches, whitebaits, mackerel and oilsardine compared to premonsoon. In the postmonsoon, the landings of oilsardine increased and touched the level of 66,700 t. The whitebaite estimate was of the order of 25,900 t.

Thus generally, monsoon witnessed better catches of perches, whitebait and penaeid prawns and the postmonsoon season indicated increased landings of oilsardine, whitebait and carangids. The major composition of the catches during the premonsoon season also were oilsardine, penaeid prawns and perches.

Landing by mechanised and non-mechanised units in different seasons

During 1984, about 69% of the total landings of 3.77 lakh tonnes was accounted for by the mechanised sector, of which 33% was contributed by the inboard craft and 36% by the craft fitted with outboard engines. Major gears operated in inboard engine craft were trawl net, drift/set gill net and purse-seines. In the motorised sector, boat seines, ring seines and drift/gillnet were important and the operation of hooks and lines was restricted in certain areas only. In the non-mechanised sector, boat seines, drift/gill net, shore seine and hook and

line were the major gears operated during these years. About 74% of the landings of inboard craft was by trawl net. The percentage contributions during premonsoon, monsoon and postmonsoon seasons respectively were 30, 26 and 44 of the total landings of 1984.

In 1985, the landings from both inboard and outboard craft, contributed to 75% of the total landings of 3.37 lakh tonnes. Of this, 1.29 lakh tonnes were from the motorised craft. Seasonwise contributions were 29%, 26% and 45% respectively during premonsoon, monsoon and postmonsoon.

In 1986, the contribution of the inboard craft was 36%, whereas, outboard craft contributed 48%, thereby increasing the total share of mechanised sector catch to the tune of 84%. The non-mechanised catch was about 58,000 t (16%). There was increase in the landings during the postmonsoon season of 1986, the percentage being 50. Premonsoon and monsoon seasons' contributions were respectively 22% and 28%. From 1986 onwards the ring seine started operating from the motorised craft and about 13% of the catches (1.8 lakh tonnes) from this sector was accounted by this gear. 63% of the motorised catch was from the boat seines.

Compared to 1986, there was a reduction of 64,000 t in the catch in 1987, by motorised craft. However, a slight increase in the landings of small mechanised fishing vessels was noticed.

About 4.93 lakh tonnes of fish landings were recorded during 1988. The percentage contributions of inboard craft and motorised craft were respectively 43% and 50%. The artisanal sector brought only 7% of the total landings.

It was observed that there was steady increase in the landings of inboard craft contributing to half of the total landings of the State and the landings in the non-mechanised units decreased except in 1988. Thus year after year, the contribution of non-mechanised sector diminished and that of motorised sector increased.

Important gears and their catches in different seasons

Trawl net was the most important gear used in the purely mechanised sector. There was substantial increase in the catches of trawl net over the years (Table 7).

TABLE 7. Total marine fish production by trawl net (tonnes) and that realised during monsoon in Kerala

Year	1984	1985	1986	1987	1988
Total	90,862	98,425	118,020	144,018	202,433
Catch realised during monsoon	36,995	36,936	47,119	36,847	47,759

However, there is no substantial increase in the catches of trawl net during the monsoon season. During 1984, the percentage contribution of monsoon trawl to the total catch was about 41%, but there was no increase in the percentage contribution over the years and during 1988 it came down to 24%. The partial ban on trawl operations during the season might have resulted in the decreased production. However, over the years, an increase in the trawl catch was noticed during the postmonsoon season and during 1988 about 41% trawl catch was attributed to this season.

The drift/gill net forms the next important gear under the mechanised sector. The percentage contribution of gillnet catches to the total mechanised catches varied from 10% (12,900 t) in 1984 to 4% (8,400 t) in 1988. The maximum catch was obtained in the gear during postmonsoon season.

Boat seine was the foremost gear operated in the motorised sector. During 1984, the catches by the boat seine was to the tune of 103,000 t and upto 1986 almost the same trend prevailed. In 1987, the contribution of catches from this gear declined to 48,000 t. The reduction in the catches during 1987 was mainly attributed to the lesser contribution by this gear. However, during 1988, boat seine catches increased to 91,000 t. Nevertheless it was seen that most of the boat seines were gradually replaced by ring seines. Among the seasons, postmonsoon

season contributed about half of the boat seine catches all the years.

Ring seine came into existence by the middle of 1986 and soon spread rapidly through out the coast. In 1987, about 30,000 t were accounted by this gear and by 1988, it increased to 88,000 t. About 79% of the ring seine catch was realised during the postmonsoon season.

The contribution from the non-mechanised sector diminished year after year and during 1988 only 7% of the total 4.93 lakh tonnes was accounted for by the non-mechanised sector. Boat seine, drift/gillnet, shore seine and hook and line were the major gears used.

Catch/Unit of major gears in different seasons

Table 8 shows catch/unit effort obtained in trawl unit drift/gillnet, boat seine and ring seine in different seasons.

The catch/unit of effort of trawl unit in different seasons showed much variation. In the premonsoon season it varied between 177 kg and 215 kg, whereas, during monsoon it ranged from 473 kg to 728 kg. Postmonsoon season had a slight edge over the premonsoon season. Monsoon season clearly indicated the abundance of resources, especially that of demersal fishes and crustaceans. Compared to premonsoon season, the catch/unit during monsoon was three times, except in 1988.

The data on C/E of drift/gillnet showed that monsoon season was again the best season, the resources being more abundant as compared to the other two seasons. During postmonsoon, catch rate of drift/gillnet operation on an average was on the higher side, indicating the availability of the resources, especially of pelagic groups.

TABLE 8. Catch/unit of effort (Kg) by trawl net, drift/gill net (mech.), boat seine and ring seine in different seasons in Kerala during 1984-88

Year	Trawl net			Drift/gill net (Mech.)			Boat seine			Ring seine		
	PRM	M	PSM	PRM	M	PSM	PRM	M	PSM	PRM	M	PSM
1984	195	563	279	103	176	154	290	298	428	-	-	-
1985	207	622	175	115	164	216	722	316	457	-	-	-
1986	177	728	244	100	118	161	257	265	517	-	247	624
1987	215	605	189	66	250	99	162	239	425	248	649	330
1988	210	473	192	107	196	109	196	310	699	101	456	782

PRM = Premonsoon; M = Monsoon; PSM = Postmonsoon.

The catch per unit of boat seine in the monsoon did not show much variation over the years. Premonsoon season also did not indicate much variation over the years, except in 1985, when an unusually high catch per unit (722 kg) was recorded. The landings of oilsardine was very high during this season. Among the seasons, postmonsoon realised better catch rate ranging between 425 kg (1987) and 699 kg (1988) in this gear.

The catch per unit of ring seine indicated that during the postmonsoon and monsoon seasons better catches were available, the premonsoon being the lean period. The minimum (330 kg) catch per unit was observed during 1987 postmonsoon season which was an unusual phenomenon; otherwise postmonsoon season recorded better catch rate, maximum being 782 kg.

REMARKS

The annual estimated landings varied from 3.9 lakh tonnes to 4.5 lakh tonnes during 1985 to 1988, if the unusually low level catches during 1987 was excluded. The catches from the mechanised sector (including motorised craft) increased year after year and in 1988 its contribution rose to 93% of the annual estimate. The increase in the estimated landings could be attributed mainly to two gears, ring seine and trawl net. The catches from ring seines increased from 23,000 t in 1986 to 88,000 t in 1988. It could also be seen that the contribution of the postmonsoon was high, primarily due to the pelagic groups of fishes.

Generally monsoon season witnessed better catches from perches, whitebaits and penaeid prawns and postmonsoon indicated increased landings of oilsardine, whitebaits and carangids. The major composition in the landings of premonsoon season were oilsardine, penaeid prawns and perches.

The increased landing was primarily noticed in the traditional craft, fitted with motors, operating ring seines and marginally in the craft with inboard engine operating trawl net.

Most of the motorised boats operating boat seine were replaced by ring seine and it had spread almost the entire coast. The landings from the purely traditional sector (non-motorised) diminished year after year.

The differential catch per unit in the seasons indicate that the availability of resources is more during monsoon, especially for demersal fishes and crustaceans. However, catch per unit of operation of ring seine and boat seine indicate that the pelagic resources are abundant during postmonsoon season.

With the limitations of the data available for the assessment of the fishery resources of the different seasons, it appears that there is further scope for augmenting the catch during monsoon and postmonsoon seasons especially in the motorised sector provided the area of operation is widened. However, caution has to be exercised while increasing the number and to decrease the mesh size of the ring seine so as to sustain the resources. Continuous monitoring the resources data is of prime importance as innovations are introduced in the gears and more and more units are put into operation.

KARNATAKA

The marine fish landings in Karnataka ranged from 1.32 lakh tonnes in 1985 to 2.33 lakh tonnes in 1987, the annual average production being 1.5 lakh tonnes (Table 9).

Oilsardine, carangids, mackerel, whitebaits, penaeid prawns and stomatopods formed the major groups in the landings. The oilsardine catches fluctuated between 18,000 t in 1986 and 52,000 t in 1987 and a slight increasing trend was observed, though in 1988 it recorded 44,000 t with an average annual landings of 38,000 t. An improvement in the landings of carangids was observed during the period, the average catch being

TABLE 9. Important groups of fishes and prawns exploited in the marine fishery of Karnataka during 1985-88 (in tonnes)

	1985	1986	1987	1988	Average
Sharks	1349	2031	1522	2026	1732
Catfishes	1433	8802	2412	8766	5353
Oilsardine	36708	18174	51539	44130	37638
Whitebaits	6292	13048	7771	17401	11128
Carangids	9989	28282	24864	23053	21547
Indian mackerel	25139	20794	26213	22952	23774
Penaeid prawns	4335	5601	9624	8332	6973
Stomatopods	11224	19010	45713	24146	25023
Others	35968	67784	63438	54692	55470
Total	132437	183526	233096	205498	150938

22,000 t. However, the landings of mackerel did not indicate any upward trend, the average production being 24,000 t. Whitebaite catch recorded a slight improvement, but in 1987, an unusually low estimate of 8,000 t was recorded. Similarly, the landings of penaeid prawns also showed a slight improvement from 4,300 t of 1985 to 8,300 t in 1988 with an average catch of 7,000 t. Of late, the catches of stomatopods, primarily obtained through trawl net indicated an upward trend.

Seasonal changes

The important groups of fishes that landed in 1985, were constituted by oilsardine, mackerel, carangids, whitebaite and sharks. Among crustaceans, penaeid prawns and stomatopods formed the major share. During premonsoon of 1985, whitebaite, oilsardine, carangids, shark and catfishes landed in good quantities. However, during monsoon season oilsardine, mackerel and penaeid prawns landed only at a lesser magnitude. The postmonsoon season witnessed good catches of oilsardine, mackerel, carangids, whitebaite, penaeid prawns, stomatopods, sharks and catfishes (Table 10). A similar trend was observed in 1986 also; during premonsoon major contributors were

oilsardine, whitebaite, mackerel, carangids, penaeid prawns, stomatopods, sharks and catfishes. In 1986, both premonsoon and postmonsoon seasons witnessed good catches of oilsardine, mackerel and whitebaite. Penaeid prawns and stomatopods were also available during these two seasons. However, during monsoon only penaeid prawns were available, but no stomatopods recorded (Table 11).

In 1987, oilsardine was available in all the seasons, whereas whitebait was mainly recorded during premonsoon. Mackerel was primarily available during postmonsoon season. Certain carangid groups were found in all the three seasons (Table 12).

The composition of the landings of major groups in the different seasons in 1988 also indicated a similar trend in the production (Table 13).

Catch per unit of mechanised units

During premonsoon, major gears operated were purse-seines, trawl nets and drift/gillnets (Table 14). Premonsoon was the lean period among

TABLE 10. Gearwise and seasonwise contribution (tonnes) of major exploited resources in Karnataka during 1985

Fish groups	Premonsoon					Monsoon					Postmonsoon					
	PS	TR	DN	NM	Total	PS	TR	DN	NM	Total	PS	TR	DN	HL	MN	Total
Shark	47	58	22	461	588	-	-	3	111	114	36	19	223	-	369	647
Catfishes	77	133	7	101	318	-	-	1	6	7	721	91	139	-	157	1108
Oilsardine	4269	1	-	8	4278	150	-	-	-	150	31099	423	758	-	-	32280
Whitebaite	3264	229	-	-	3493	-	-	-	4	4	4594	200	-	-	1	4795
Horse mackerel	-	2	-	1	3	-	-	-	-	-	540	-	1	-	19	560
Scads	-	-	-	-	-	-	-	-	-	-	683	1	-	-	25	709
Leather jackets	3	-	-	-	3	-	-	-	-	-	44	-	636	-	610	1290
Other carangids	360	95	-	145	600	-	-	-	105	105	5948	626	14	-	131	6719
Indian Mackerel	1321	2	-	95	1418	679	-	100	2964	3743	19894	1	17	-	66	19978
Penaeid prawns	56	2760	-	6	2822	-	190	2	62	254	1	1256	-	-	2	1259
Stomatopods	-	5334	-	1	5335	-	-	-	16	16	-	5863	-	-	10	5873
Others	1466	5303	3	1293	8065	-	16	26	889	931	11842	6770	490	3	5867	24972
Total	10863	13917	32	2111	26923	829	206	132	4157	5324	75402	15250	2278	3	7257	100190
Effort in units operation	14258	75764	496	92387		271	752	4290	60105		26066	67233	15164	217	153406	

PS = Purse-seine; TR = Trawl net; DN = Drift/gill net; NM = Non mechanized.

TABLE 11. Gearwise and seasonwise contribution (tonnes) of major exploited resources in Karnataka during 1986

Fish groups	Premonsoon					Monsoon					Postmonsoon					
	PS	TR	DN	NM	Total	PS	TR	MTBL	NM	Total	PS	TR	DN	MTBL	NM	Total
Sharks	38	78	731	459	1314	-	-	-	91	91	21	48	430	-	127	626
Catfishes	760	477	114	124	1475	-	-	-	17	17	6936	151	173	-	50	7310
Oilsardine	11009	1	-	57	11067	44	1	1	4	49	6884	-	1	15	158	7058
Whitebaits	5674	107	-	6	5787	-	-	-	15	15	7099	118	-	-	29	7246
Horse mackerel	-	1	-	62	63	-	-	-	-	-	1533	-	-	9	31	1573
Scads	-	1	-	2	3	-	-	-	-	-	10160	-	-	-	-	10160
Leather jackets	7	4	-	-	11	-	-	-	23	23	111	-	51	-	20	182
Other carangids	273	1095	2	82	1452	2	13	3	66	84	13056	1417	79	2	177	14731
Indian Mackerel	411	1	6	130	551	-	1	2	41	44	19838	1	73	-	287	20199
Penaeid prawns	106	3347	-	-	3453	108	77	28	338	551	28	1520	-	-	49	1597
Stomatopods	-	10342	-	18	10360	-	-	-	-	-	8	8616	-	-	26	8650
Others	2664	15638	122	1356	19780	1791	590	339	3159	5879	17045	17913	1600	87	5400	42125
Total	20942	31095	983	2296	55316	1945	682	372	3754	6753	82719	29784	2487	113	6354	121457
Effort in units operation	13174	105192	9297	89460	217123	791	3346	4	74958		22924	70243	25518	746	115030	234461

PS = Purse-seine; TR = Trawl net; DN = Drift/gill net; NM = Non mechanized; MTBL = *Mattubala*.

the seasons. On an average, the catch rate obtained by purse-seiner was 1591 kg, by trawl net 350 kg and drift/gill net 63 kg. Over the years, there was an increasing trend in respect of purse-seine and trawl net landings, suggesting the availability of the resources. However, catch per unit of drift/gill net in 1988 was the minimum (17 kg).

In the monsoon season, there was a reduction of CPUE of purse-seine over the years. In 1985 it was 3059 kg, but it reduced to 1810 kg in 1988. The average CPUE of purse-seine worked out to 2104 kg during this period. However, catch per unit of trawl net indicated an increasing trend, though in 1987 it recorded 61 kg, the average CPUE

TABLE 12. Gearwise and seasonwise contribution (tonnes) of major exploited resources in Karnataka during 1987

Fish groups	Premonsoon						Monsoon						Postmonsoon						
	PS	TR	DN	HL	NM	Total	PS	TR	DN	MTBL	NM	Total	PS	TR	DN	HL	MTBL	NM	Total
Sharks	-	138	248	1	108	495	-	-	-	-	60	60	294	205	269	19	-	180	967
Catfishes	33	223	17	-	29	302	-	2	-	-	13	15	1250	337	177	1	-	330	2095
Oilsardine	5408	-	35	-	27	5478	15	-	283	204	502	43537	6	-	-	-	436	1588	45567
Whitebaits	2731	209	-	-	-	2940	-	1	-	-	15	16	4211	591	1	-	-	12	4815
Horse mackerel	-	-	-	-	-	-	-	-	-	-	5	5	2404	-	10	-	-	20	2434
Scads	-	31	-	-	-	31	-	-	-	-	-	2250	47	-	-	-	-	-	2297
Leather jackets	197	3	8	-	1	209	-	-	-	-	-	113	-	68	1	-	15	197	
Other carangids	2302	3324	7	-	144	5777	11	18	-	19	81	129	10326	3278	47	3	87	44	13785
Indian mackerel	268	47	8	-	12	335	1	-	-	58	43	100	202	21839	26	50	-	8753	25676
Penaeid prawns	68	3158	-	-	13	3239	-	198	-	1	488	687	261	5435	-	-	-	2	5698
Stomatopods	5	25336	-	-	1	25342	-	-	-	-	1	1	-	20369	-	-	-	1	20370
Others	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	13952	53676	570	1	914	69113	38	528	79	382	2750	3777	96995	51669	2776	44	606	8116	160206
Effort in units operation	9152	127988	8926	96	45240		35	8720	504	1217	69854		36016	177474	36805	216	680	70106	

PS = Purse-seine; TR = Trawl net; DN = Drift/gill net; HL = Hook & Line; NM = Non mechanized; MTBL = *Mattubala*.

TABLE 13. Gearwise and seasonwise contribution (tonnes) of major exploited resources in Karnataka during 1988

Fish groups	Premonsoon						Monsoon						Postmonsoon								
	PS	TR	DN	HL	NM	Total	PS	TR	DN	OBMB	NM	Total	TR	PS	MGN	MHL	OBRN	OBMB	OBCN	NM	Total
Sharks	-	259	85	12	180	536	-	8	-	-	62	70	222	61	474	562	-	1	9	91	1420
Catfishes	204	1343	27	-	97	1671	-	26	-	-	-	26	2695	3831	498	19	-	11	-	15	7069
Oilsardine	20155	28	-	-	607	20790	-	-	-	-	-	-	4	22053	2	-	-	817	-	464	23340
Whitebaits	8369	977	-	-	3	9349	-	7	-	3	329	339	721	6973	-	-	-	9	-	10	7713
Horse mackerel	120	23	-	-	31	174	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Scads	-	172	-	-	-	172	7	60	-	-	65	132	-	-	-	-	-	-	-	-	-
Leather jackets	5	15	24	3	-	47	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Other carangids	1606	2544	26	3	84	4263	-	-	-	-	-	-	4075	14002	68	9	-	62	4	45	18265
Indian mackerel	423	346	8	-	155	932	485	-	2	-	319	806	260	19306	623	-	1	514	22	488	21214
Penaid prawns	269	2667	-	-	-	2936	66	1091	-	856	118	2131	3210	48	2	-	-	-	-	5	3265
Stomatopods	-	13508	-	-	5	13513	-	-	-	-	3	3	10627	1	-	-	-	-	-	2	10630
Others	-	-	-	-	-	-	119	486	44	75	906	1630	12204	12214	2946	29	15	738	48	1344	29538
TOTAL	32154	43477	320	56	1900	77907	677	1678	46	934	1802	5157	34018	78489	4613	619	16	2152	83	2464	122454
Effort in units operation	12926	86696	18360	3268	53409	374	7279	461	1293	37152			108248	3960	49406	1460	13	5493	2905	79256	

PS = Purse-seine; DN = Drift/gill net; NM = Non-mechanized; OBRN = Outboard *ranibala*; TR = Trawl net; HL = Hooks & line; OBMB = Outboard *mattubala*;
 OBCN = Outboard gill net; MGN = Mechanised gill net; MHL = Mechanised hook & line.

being 193 kg. The landings by drift/gill net also showed an upward trend (Table 14). A remarkable phenomenon noticed during the monsoon season was the operation of *Mattu bala* and over the years, an increasing trend in the operation and catch per unit was noticed. During 1986 monsoon it recorded a CPUE of 360 kg and it rose to 722 kg in 1988, though a slight reduction was noticed in 1987. The average CPUE of *Mattu bala* was 465 kg.

Of the different seasons, postmonsoon season (Table 14) contributed to the maximum production as well as catch per unit. However, over the years, CPUE of purse seine was showing a slightly decreasing trend; during 1988 it recorded 1982 kg, whereas the average CPUE was 2794 kg. The CPUE of trawl net was found almost established around 314 kg, suggesting caution on further increase of effort input by these units. There was an increase in the operation of hook and line during the season and in 1988, it recorded a CPUE of 423 kg, though the average CPUE was 160 kg. There are indications that these units operate in deeper waters and stay back more time in the sea. The *Mattu bala* operation was also on the increase, but catch per unit did not depict a clear trend.

REMARKS

During the eighties, marine fisheries in Karnataka made new strides and showed promising trends both in quantity and quality. The operation of purse seine on a commercial basis in 1977 saw the landings increasing again. It could be observed that introduction of trawlers improved the landings of demersal resources and the operation of purse-seines gave a fillip to the production of pelagic resources. '*Mattu bala*' introduced in 1986 is becoming popular, especially during monsoon, when it brings in penaeid prawns.

The major groups of fishes and prawns that landed during 1985 - 1988 were oilsardine, mackerel, carangids, whitebaits, penaeid prawns, stomatopods, sharks and catfishes. The increasing trend in the landings was primarily noticed in the case of oilsardine, carangids and stomatopods. The major groups that landed during premonsoon period was oilsardine, mackerel, whitebaits and sharks and during monsoon penaeid prawns. Oilsardine and carangids landed in all the seasons in 1987 and resulted in the maximum production of 2.33 lakh tonnes. Postmonsoon season generally brought oilsardine, mackerel, carangids, whitebaits, penaeid prawns, stomatopods and sharks. The composition of the landings of major groups over different years indicated more or less similar trends. The average monthly contribution of postmonsoon season was comparatively better than premonsoon.

The major gears used in the mechanised sector were purse seine, trawl net, drift/gill net and hook and line. The purse seine landings were the important contributor to the total production in some years it touched 66% of the total production. The minimum percentage contribution of purse-seine was observed in 1987 (48%). Generally, purse-seine catches almost determines the level of production of the State. The next important gear operated along the coast was trawl net and its share in some years touched 45% of the total production. However, the contribution of this gear was to the tune of 39% of the total production in 1988. The drift/gill net contributed only 2% of the total estimates and the major component of the catches were sharks and catfishes. The drift/gill net operation had not improved over the years.

In the recent years the trawlers were seen operating in areas beyond conventional limits,

TABLE 14. Catch per unit (Kg) of mechanised units operated in different seasons in Karnataka during 1985-1988

Year	Premonsoon			Monsoon				Postmonsoon				
	PS	TR	DN	PS	TR	DN	MB	PS	TR	DN	H&L	MB
1985	762	184	65	3059	274	31	-	2893	227	150	14	-
1986	1590	296	106	2459	204	-	360	3608	424	98	-	151
1987	1524	419	64	1086	61	157	313	2693	291	75	203	891
1988	2488	501	17	1810	231	100	722	1982	314	93	423	392
Average	1591	350	63	2104	193	72	465	2794	314	104	160	478

PS = Pure-seine; TR = Trawl net; DN = Drift/gill net; H&L = Hooks & line; MB = *Mattu bala*

often their voyages extending to two days and more. For this purpose, small trawlers are remodelled with extra investments. Trawling is thus shifting gradually towards a capital intensive enterprise.

The motorisation of the country craft was seen picking up momentum for the operation of *mattu bala*, *rani bala* and gill nets. These units undertaking diversified fishing made it possible to tap the additional resources.

The near shore areas of Karnataka have been heavily exploited. Though marginal increase can be expected from the presently exploited area, the present situation does not warrant any further addition of purse-seines or trawlers as the catch rate is not that high. However, there is good scope for further expansion of drift/gill net fisheries along the coast.

GOA

Goa, with a coastline of 153 km and a continental shelf area of 10,000 Sq. km contributed 3.6% of the total marine fish landings in India during 1984-88. In the fisheries development of the west coast, Goa had played a prominent role by introducing new fishing methods. *Rampani* was introduced first in Goa in nineteenth century and of late introduction of purse-seining on a commercial scale was first effected in Goa. *Yendi* (shore seine) and gill net are the prominent among the indigenous gear operated in Goa and these together contribute nearly 90% of the landings by non-mechanised units. Trawl net, purse-seine, gill net

and hooks and lines are the mechanised gears commonly operating in Goa.

Trawl net fishery

On an average 55% of total marine fish landings in Goa was by trawlers. Most of the trawl net landings was during premonsoon season and was least in monsoon period except during 1986. Trawl net fishery was very high in postmonsoon season in 1986 (Table 15).

Fishing effort in terms of unit operation was maximum in premonsoon period, except during 1986 and minimum during monsoon period (Table 15). Catch per unit effort was high during premonsoon and postmonsoon periods. It was minimum during monsoon except in 1985.

On an average 88% of trawl net landing during premonsoon period was constituted by demersal fishes. Stomatopods, penaeid prawns, croakers, crabs, catfishes, soles, big-jawed jumper and silverbellies formed the major demersal fishery of Goa during premonsoon period. During monsoon period penaeid prawns and silverbellies constituted the demersal group of fishes. Stomatopods, soles, penaeid prawns and big-jawed jumper accounted for the demersal group of fishes during postmonsoon. During premonsoon period pelagic fishes like ribbonfishes, other carangids and *Thryssa* sp. form the fishery. In monsoon period, the fishery was very poor. *Thryssa* sp., ribbonfishes and other clupeids formed the pelagic fishery during postmonsoon period.

TABLE 15. Effort (units of operation), catch (tonnes), catch per unit effort (kg) of trawlers in different seasons during 1984-88 in Goa (values in brackets are percentage of demersal fish in each season)

	Premonsoon			Monsoon			Postmonsoon		
	E	C	C/E	E	C	C/E	E	C	C/E
1984	35486	13451 (83)	379	17029	2913 (83)	169	36239	11847 (93)	326
1985	56018	17775 (88)	317	2635	1367 (94)	519	16902	6583 (89)	389
1986	34678	17317 (91)	499	6285	1302 (89)	207	70006	26340 (95)	376
1987	59424	17950 (88)	302	2844	279 (90)	98	32828	12430 (92)	378
1988	45089	20813 (89)	461	2530	346 (90)	13	.	.	.

E= effort, C= catch, C/E= catch per unit.

Gillnet fishery

Only 4% of the average marine fish landings was due to mechanised gillnets. Landings during monsoon period was very negligible in quantity (Table 16). Stoppage of gillnetting during monsoon would no way affect the fish landing during monsoon period.

On an average demersal fishes in gillnet landings accounted only 1% during premonsoon and 3% during postmonsoon period.

Among the pelagic group, carangids, lesser sardines, *Scomberomorus guttatus*, *Euthynnus affinis*, billfishes, *S. commersoni* are the major fishes accounted by gillnetters.

Purse-seine fishery

Twenty three percent of the total marine fish landings in Goa during the period (1984-1988) was by purse-seiners. Purse-seine landing was heavy during postmonsoon season and was least during monsoon period (Table 17). Fishing effort in terms of unit operation was maximum during postmonsoon period and minimum during monsoon period (Table 17). Catch per unit effort was more or less same during premonsoon and postmonsoon period and minimum in monsoon period (Table 17).

Hooks and line fishery

Landings and effort showed a decreasing trend during the period of five years (1980-1984)

TABLE 16. Gillnet effort (units), catch (t) and catch per unit effort (kg) during 1984-88 in Goa (percentage of total landings in the season is given in the bracket)

	Premonsoon			Monsoon			Postmonsoon		
	E	C	C/E	E	C	C/E	E	C	C/E
1984	3978	148 (1)	37	4567	35 (1)	8	17523	1019 (5)	58
1985	7009	283 (1)	40	2495	30 (1)	12	29975	2459 (10)	82
1986	22595	589 (3)	26	2910	85 (3)	29	27902	2010 (5)	72
1987	11827	197 (1)	17	463	6 (1)	13	13234	1161 (3)	88
1988	12805	879 (3)	69	398	11 (1)	28	-	-	-

TABLE 17. Purse seine effort (units), catch (t) and catch rates (kg) in different seasons in Goa during 1984-1988 (% of total landings in the season is given in the bracket)

	Premonsoon			Monsoon			Postmonsoon		
	E	C	C/E	E	C	C/E	E	C	C/E
1984	1344	1155 (7)	859	620	236 (6)	381	5192	5622 (27)	1083
1985	1866	2015 (9)	1080	-	-	-	9064	12561 (49)	1386
1986	2994	1735 (9)	579	213	85 (3)	399	11752	3936 (10)	335
1987	5443	2499 (12)	459	769	453 (57)	589	17834	25738 (64)	1443
1988	4982 (24)	7038	1413	264 (52)	426	1613			

except for 1984. The decreasing trend continued in respect of landings and CPUE during 1984-1988 also. On an average 0.6% of the marine fish landings in Goa was by hooks and lines. There was no landings during monsoon in 1984 - 1988. There was no hooks and lines operation during premonsoon period for the years 1984 and 1985. During 1987 there was no hooks and lines operation during the postmonsoon period.

Non-mechanised fishery

Only 9% of the average marine fish landings in Goa was by non-mechanised gears. Most of the non-mechanised landings was during postmonsoon period. *Rampani*, *Yendi* (shore seine) and gillnet were prominent among the indigenous gears operated in Goa.

Fishing effort in terms of unit operation was more or less same during premonsoon and monsoon periods and was maximum during postmonsoon period.

Pelagic fishes constituted the major portion of non-mechanised marine fish landings in Goa during monsoon, premonsoon and postmonsoon periods.

In general, the marine fish landings in Goa during the period 1984-1988 showed increasing trend. Trawl net fishery was prominent in all seasons during the period. Contribution of hooks and lines fishery was not significant. Major contribution from Purse-seine fishery came during the postmonsoon season.

MAHARASHTRA

Total landings

During the four year period (1984-88), the average annual marine fish landings in Maharashtra was 309,000 t, out of which the contribution of postmonsoon season ranked first forming 61.2%, followed by premonsoon period (33.8%) and monsoon period (5.0%) (Table 18).

Gearwise contribution

Data of 1986-88 indicated that the major contribution (97.2%) was by mechanised units. Among the mechanised units 150,000 t per year came from trawls followed by dol nets (105,000 t), gillnets (27,000 t), purse-seine (5,000 t), hooks and lines

TABLE 18. *Seasonwise marine fish landings (tonnes) in Maharashtra during 1984-88 with monthly averages in brackets*

	Premonsoon (Feb.-May)	Monsoon (June-Aug.)	Postmonsoon (Sep.-Jan.)	Total
1984-85	81120 (20280)	14400 (4800)	218543 (43709)	314063
1985-86	102808 (25702)	13235 (4412)	211093 (42219)	327136
1986-87	128050 (32012)	17666 (5889)	169583 (33917)	315299
1987-88	105861 (26465)	17008 (5669)	157575 (31515)	280444
Average	104,460	15,577	189,199	309,236
Percent	33.8 (26,115)	5.0 (5192)	61.2 (37,840)	

(1800 t) and cast nets (140 t). Non-mechanised units put together contributed only 8,300 t to the total annual average of 298,000 t (Table 19).

Mechanised units

Trawls: As mentioned above, maximum contribution of about 150,000 t forming 50.3% to the total marine fish landings was from trawls. During postmonsoon, the landings were maximum with the annual average of 81,000 t forming 54.2% of the average annual trawl landings followed by premonsoon with 58,000 t (38.5%) and monsoon with 11,000 t (7.3%).

TABLE 19. *Gearwise and seasonwise marine fish landings (tonnes) in Maharashtra (average of 1986-88, values in brackets are percentages)*

Gear	Premonsoon (Feb.-May)	Monsoon (June-Aug.)	Postmonsoon (Sep.-Jan.)	Total
Trawl net	57717 (38.5)	10938 (7.3)	81268 (54.2)	149923
Dol net	48840 (46.3)	3880 (3.7)	52776 (50.0)	105496
Gillnet	7364 (27.2)	1137 (4.2)	18622 (68.6)	27123
Hooks and lines	882 (49.2)	9 (0.5)	900 (50.3)	1791
Purse-seine	427 (8.3)	-	4742 (91.7)	5169
Cast net	-	-	72 (100.0)	72

Dol nets : The contribution from dol nets was the second major component in the total marine fish landings of Maharashtra. It contributed nearly 105,000 t to the total average annual landings forming 35.4%. In this case also postmonsoon landings were maximum (53,000 t; 50.0%) followed by those of premonsoon (49,000 t; 46.3%) and monsoon (3,900 t; 3.7%).

Gill nets : The third major contribution was from gill nets with average annual landings of 27,000 t forming 9.1% to the total landings. Here also the landings during postmonsoon were maximum (18,600 t; 68.6%) followed by those in premonsoon (7,400 t; 27.2%) and monsoon (1100 t; 4.2%).

The contribution from other gears such as purse-seines, hooks and lines and cast nets was about 2.4% only and the trend in their seasonwise contributions remained as in other gear mentioned above.

Non-mechanised units

Under this group comes small bag nets called *Bokshi*, cast nets and others. All these units contributed 2.8% only to the total annual marine fish landings of Maharashtra. The seasonwise trend was the same as found for other gear considered earlier. Maximum contribution was during postmonsoon period with 5,200 t forming 62.7% of the annual landings of non-mechanised units. During premonsoon period the landings were 1700 t (20.8%) and in monsoon the contribution was 1,400 t (16.5%) indicating that when compared to mechanised units, the relative contribution of non-mechanised units was more during monsoon period.

From the foregoing it is clear that during monsoon the operations of trawlers were more than other mechanised units and their contribution to the total landings was also considerable.

Resource-wise contribution

Among the finfish resources, Bombay-duck topped the list contributing about 16.0% to the total marine fish landings in Maharashtra followed by penaeid prawns (14.9%), non-penaeid prawns (14.4%), clupeids (8.3%), croakers (7.5%), ribbonfish (5.1%), pomfrets (4.2%), catfishes (3.9%), cephalopods (3.7%), elasmobranchs (3.4%), carangids (2.0%), perches (2.2%), seerfishes (2.1%), flatfishes (1.7%), eels (0.9%), tunnies (0.6%) and lobsters (0.5%).

Bombay-duck : The landings of Bombay-duck was maximum during postmonsoon season (32,000 t) and minimum during monsoon season (1600 t). During premonsoon season its contributions was 16,000 t (Table 20).

Penaeid prawns : Similar to the seasonal trend of Bombay-duck, this group contributed 29,000 t during postmonsoon season followed by 11,000 t during premonsoon and 6,300 t only during monsoon seasons.

Non-penaeid prawns : The contribution from this group more or less remained the same during postmonsoon (22,000 t) and during premonsoon season (21,300 t). During monsoon period only 1100 t of non-penaeid were landed.

Clupeids : Following the trend of Bombay-duck, this group contributed maximum (16,000 t) during postmonsoon period followed by 8500 t during premonsoon and 1100 t during monsoon seasons.

Croakers : With the same trend as above, maximum contribution of this group was during postmonsoon season with 15,000 t followed by 6800 t during

TABLE 20. Seasonwise contribution (tonnes) of major resources to the marine fish landings of Maharashtra (averages of 1984-1988)

Resource	Premonsoon	Monsoon	Postmonsoon	Total
	(Feb.-May)	(June-Aug.)	(Sep.-Jan.)	
Elasmobranchs	4454	556	5348	10358
Eels	1148	72	1495	2715
Catfishes	4732	597	6675	12004
Clupeids	8477	1096	16053	25626
Bombayduck	16036	1571	31749	49356
Perches	2986	455	3507	6948
Croakers	6815	1096	15252	23163
Ribbonfish	5423	597	9749	15769
Carangids	1444	237	5633	7314
Pomfrets	3402	389	9095	12886
Seerfishes	1542	117	4748	6407
Tunnies	318	43	1525	1886
Flatfish	1826	192	3125	5143
Penaeid prawns	10919	6304	28848	46071
Non-penaeid prawns	21381	1130	22091	44602
Lobster	515	132	914	1561
Cephalopods	2363	99	9065	11527
Others	10686	884	14326	25896

premonsoon and only 600 t during monsoon seasons.

Ribbonfishes : Falling in the same line as croakers, landing of this group was maximum (9700 t) during postmonsoon and only 600 t during monsoon seasons.

Pomfrets : Maximum landings of about 9100 t were recorded during postmonsoon season followed by 3400 t during premonsoon and only 400 t during monsoon seasons.

Catfishes : During postmonsoon and premonsoon seasons the landings of catfishes were 6700 t and 4700 t respectively with a minimum of 600 t during monsoon seasons.

Cephalopods : In this case also maximum landings were in postmonsoon and premonsoon seasons with 9100 t and 4700 t respectively and minimum of 100 t only during the other season.

Elasmobranchs : The contribution of this group during postmonsoon and premonsoon periods was 5300 t and 4500 t respectively showing relatively less variations as in the case of non-penaeid prawns. During monsoon season the landings were low (600 t).

Carangids : Carangids also contributed maximum (5600 t) during postmonsoon season followed by 1400 t and 240 t during premonsoon and monsoon seasons respectively.

Perches : With contribution of 3500 t and 3000 t during postmonsoon and premonsoon seasons and with 460 t during monsoon seasons the trend remained the same for this group also.

Seerfishes : The landings of this group was maximum (4700 t) during postmonsoon season. Only 1500 t and 120 t were landed during premonsoon and monsoon seasons.

Flatfishes : During postmonsoon and premonsoon seasons the landings were 3100 t and 1800 t respectively. During monsoon season the landings were only 200 t.

The other resources that have contributed to less than 1% of the total landings, significant among them being tunnies and lobsters. During post, pre and monsoon seasons the landings of tunnies were about 1500 t, 300 t and 40 t respectively. In the case

of lobsters for these seasons the landings were 900 t, 500 t and 130 t respectively.

The contribution of the rest amounted to 8.4% to the total annual marine fish landings in Maharashtra during 1984-88. In this case also postmonsoon landings were maximum (14,000 t) followed by premonsoon (11,000 t). During monsoon season the landings were very low to the tune of about 900 t only (Table 20).

REMARKS

In the light of the above it is clear that monsoon landings were very much less when compared to the other two seasons. The resources that contributed more than 1000 t during monsoon were penaeid prawns (6300 t), Bombay-duck (1600 t), non-penaeid prawns (1100 t) and croakers (1100 t), indicating that relatively more operations of shrimp trawling were resorted to during this season than other gears. Gearwise analysis also indicated that 11,000 t was contributed by the trawls during monsoon period followed by dol nets with 3900 t and gillnets with 1100 t.

In the overall average annual landings of 309,000 t, contribution during monsoon season was 16,000 t forming 5% only. To answer whether this resource would be available for exploitation in the subsequent period in the event of suspension or absence of monsoon fishing or not, detailed biological and environmental studies are required.

GUJARAT

Marine fisheries is of great significance in Gujarat in view of its rich resources. The State has 1260 km coastline and about 165,000 Sq. km continental shelf area. The prominent fishing gears employed by fishermen in Gujarat are trawls, gillnets, dolnets (bag nets) and other traditional gears. The total marine fish production of the State has fluctuated between 185,638 and 248,999 tonnes during 1984-89 (Table 4).

Trawl net fishery

On an average 49.5% of total marine fish landings in Gujarat was by mechanised trawlers. Most of the trawl net landing was during the postmonsoon season (52.1%). Trawl net fishing was least during the monsoon period forming only 0.4% of total trawl net landings. Fishing effort in

terms of unit operation was maximum in premonsoon period, except during 1985 and minimum during monsoon. Catch per unit effort was more during premonsoon period in all the years other than 1986 and 1987 when compared with other seasons. Catch per unit effort was very low during monsoon period (Table 21).

On an average 76.7% of trawl net landings was constituted by demersal fishes. Croakers, crabs, penaeid prawns, big-jawed jumper, stomatopods, in the order of abundance, formed the major demersal fisheries of Gujarat State during premonsoon and postmonsoon periods by trawls. During monsoon period, the demersal groups such as croakers, penaeid prawns and stomatopods formed the major fisheries. Among the pelagic fishes, ribbonfish, other clupeids, *Coilia*, wolf herring and *Thryssa* in that order, constituted the major fisheries during premonsoon period and *Thryssa*, ribbonfish, other clupeids, *Coilia* and wolf herring during postmonsoon period. Pelagic fishery during monsoon period was contributed mainly by *Coilia*, *Thryssa* and other clupeids.

Gillnet fishery

Nineteen percent of the average marine fish landing in Gujarat during 1984-88 was from mechanised gillnetters. 51% of the gill net landings was during postmonsoon period, 42% during premonsoon period and remaining 7% during monsoon period. The fishing effort in terms of unit operation was maximum during postmonsoon period except during 1986 and minimum during

monsoon. On an average it was only 8.8%. There was not much difference in catch per unit effort from season to season. However, the average catch per unit effort was more during postmonsoon period and least during monsoon period (Table 22).

More than 52% of the average marine fish landings in Gujarat during monsoon period was from mechanised gillnetters. Hence stoppage of gillnetting during monsoon would affect the marine fish landings during monsoon, since there was not much difference in catch per unit effort from season to season, marine fish landing can be increased during monsoon by increasing gillnet operations.

On an average 55% of gillnet landings were constituted by demersal group of fishes, wolf herring, other shads, ribbonfishes, seerfishes and other tunnies, clupeids, horse mackerel and leather-jackets contributed the major pelagic fisheries of Gujarat by gillnetters. Among the demersal fishes, sharks, catfishes, croakers and pomfrets formed the major group in the gill net landings.

Dol net fishery

Twenty three percent of the average marine fish landings in Gujarat was by dol net. Most of the dol net landings was during postmonsoon period (68%), only 0.6% of dol net landings was during monsoon season. Fishing effort in terms of unit operation was maximum during postmonsoon and minimum during monsoon period (3%). The catch per unit effort was minimum during monsoon season. On an average catch per unit effort

TABLE 21. Trawl landings (tonnes), Effort (unit operation) and Catch per Unit Effort (Kg) in different seasons in Gujarat during 1984-1988

	Premonsoon			Monsoon			Postmonsoon		
	Catch	Effort	CPU	Catch	Effort	CPU	Catch	Effort	CPU
1984	58806 (64)*	45143	1302	236 (4)	547	431	57018 (39)	44913	1264
1985	44484 (42)	31757	1401	412 (7)	1582	260	73232 (54)	54217	1351
1986	61977	48806	1270 (54)	206	276	746 (4)	52279	37383	1348 (44)
1987	49423 (67)	47610	1038	764 (16)	1864	408	52972 (44)	44088	1202
1988	36753 (62)	34093	1078	379 (5)	1241	305			

* Percentage of trawl landing in the total landings.

TABLE 22. *Seasonwise gillnet landings (tonnes), Effort (unit operation) and CPU (Kg) in Gujarat during 1984-88*

	Premonsoon			Monsoon			Postmonsoon		
	Catch	Effort	CPU	Catch	Effort	CPU	Catch	Effort	CPU
1984	13639 (15)*	95660	143	2902 (53)	18256	159	23141 (16)	142132	163
1985	29810 (28)	11438	260	3068 (51)	24447	125	30443 (22)	153581	198
1986	15057 (13)	160915	94	3741 (74)	34103	110	20680 (18)	129476	159
1987	15923 (21)	113289	140	2226 (47)	23581	94	16990 (16)	122048	139
1988	12099 (20)	111445	108	2715 (38)	26025	124			

*Percentage of gillnet landing in the total landings.

was more during postmonsoon period. Dol net operation during monsoon season was not economical. Only 7% of the monsoon fish landings was contributed by dol net. 74% of the dol net landings was constituted by pelagic group of fishes. Bombay-duck, *Coilia*, ribbonfish and other clupeids formed the major group of fishes in the dol net landings of Gujarat during this period (Table 23).

Marine fish landings by non-mechanised craft

Only 7% of the average marine fish landings in Gujarat was by non-mechanised gears. Most of the non-mechanised landing was during monsoon period. Fishing effort in terms of unit operation was more during premonsoon period and less during the monsoon season. Generally, the catch per unit effort was low during monsoon period. Even then, non-mechanised gears contributed significantly towards the total marine fish landings in Gujarat during monsoon period (Table 24).

Pelagic fishes constituted the major portion of non-mechanised marine fish landings in Gujarat during premonsoon and postmonsoon periods, whereas demersal fishes dominated the fishery during monsoon period (Table 24).

Apart from the above gears, hooks and lines was also operated during this period in Gujarat, contributing very little towards the total marine fish landings of the State.

REMARKS

Marine fisheries play an important role in the economy of Gujarat. About 23,000 families in the coastal villages are engaged in fishing and allied activities. Trawling is the major fishery in Gujarat, contributing 44.5% of the total marine fish landings of the State. But catch per unit effort is showing a declining trend over the years. It is very low during monsoon season and its contribution to total

TABLE 23. *Seasonwise dol net landings (tonnes), Effort (unit operation) and CPU (Kg) in Gujarat during 1984-1988*

	Premonsoon			Monsoon			Postmonsoon		
	Catch	Effort	CPU	Catch	Effort	CPU	Catch	Effort	CPU
1984	9487 (10)*	21363	444	459 (6)	5445	84	57352 (49)	72213	794
1985	19136 (18)	33082	578	414 (7)	5044	82	14019 (18)	136506	176
1986	33070 (20)	32967	1003	85 (2)	1407	60	34763 (30)	36205	960
1987	4646 (6)	31426	148	321 (7)	2592	124	28406 (27)	83546	340
1988	7738 (13)	33447	231	766 (1)	5552	142			

* Percentage of dol net landings.

TABLE 24. Seasonwise catch (tonnes), effort (unit operation) and CPU (Kg) by nonmechanised craft in Gujarat during 1984-1988

	Premonsoon			Monsoon			Postmonsoon		
	Catch	Effort	CPU	Catch	Effort	CPU	Catch	Effort	CPU
1984	9395 (10)*	235958	40	1841 (34)	118496	15	7725 (5)	140040	53
1985	12849 (10)	209482	62	2155 (36)	111934	20	8474 (6)	254445	33
1986	3430 (3)	182830	10	701 (14)	64434	8	4203 (4)	150037	28
1987	4188 (6)	175299	24	1372 (29)	122505	11	8093 (8)	224920	35
1988	2453 (4)	180604	14	3240 (45)	171437	19			

* Percentage of non-mechanised landings in the total landings.

marine fish landings in Gujarat during monsoon season also is not much.

Major share of monsoon fishery in Gujarat during 1984-88 was by mechanised gillnetters. There was not much difference in catch per unit effort from season to season. By increasing gillnet operation, during monsoon seasons, marine fish landings could be increased during that period.

Contribution of dol net fishery during monsoon season, to the marine fish landings in Gujarat was not much. Catch per unit effort was very low during this period. Hence increasing dol net effort is not of much use to the marine fish landings during monsoon season.

Non-mechanised gears contributed considerably to the marine fish landings during monsoon season in Gujarat. Hence continued operation of non-mechanised gears during monsoon season is of paramount importance to the monsoon fishery of Gujarat.

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