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

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TREND OF THE MAJOR EXPLOITED MARINE FISHERY RESOURCES OF INDIA DURING 1961-'85

M. Srinath
Central Marine Fisheries Research Institute, Cochin - 682 031

ABSTRACT

The annual estimated total marine fish landings in India during 1961-'85 are given. The contributions of the four regions namely North east, South east, South west and North west to the total landings are presented. The trends in the landings of some of the major exploited resources are depicted. Estimates of the potential yields of the major fishery resources are also indicated. Strategies for monitoring and rational exploitation of the fishery resources are also indicated along with the future perspective.

INTRODUCTION

Marine fish landings in India have registered a three fold increase from about 5 lakh tonnes in the early fifties to about 15 lakh tonnes in the eighties. The realisation of the export potential of the marine products especially prawns has resulted in substantial increase of mechanised fishing craft mainly, the small trawlers aiming primarily for exploitation of the prawns. This prawn induced growth has also helped in higher landings of other resources associated with the trawl fishery. Added to this the introduction of purse seiners in the early eighties to exploit the pelagic resources such as oil sardine, mackerel, white bait etc., and motorisation of indigenous craft has helped to certain extent sustain the growth of marine fish landings. But this process has brought in its wake conflicts between the traditional and the mechanised sector. In spite of better capture techniques there are indications, of stagnation in the marine fish landings. The area of exploitation along the coast is mainly restricted to 0.50 m depth and remained so even with the technological changes in the capture techniques. This over intensification of effort to a certain extent might have contributed to the stagnation. This reduced growth rate has prompted the fishery managers and policy makers to look beyond the 50 m depth and advocate deep-sea fishing. At present this venture is still in the infant stage and directed towards exploitation of prawns which have better export value. The analysis of

complex multiger, multi-species nature of Indian marine fisheries is very complicated and demanding. In this paper an attempt is made to study the trends of the major exploited resources. The potential harvestable yield is also indicated. Strategies for monitoring and rational exploitation of the resources are also given. The marine fish landings during 1961-'85 form the data base for the present study covering the period from the initial stage to the present stage of mechanisation.

THE LANDINGS

The marine fish landings in India are estimated by the well planned multistage stratified random sampling scheme. The total landings in the country during 1961-85 are given in Table-1. It is clear from the table that the landings have increased tremendously from 6.4 lakh tonnes in 1962 to 16.3 lakh tonnes in 1984. The period under consideration is classified into 5 groups by considering the average landings during 1961-65, 1966-70, 1971-75, 1976-80 and 1981-85. These groups cover the entire period from the initial stages of mechanisation to the present stage and designated as S1, S2, S3, S4 and S5. The average annual landings during these five stages are as follows:

Stage:	S1	S2	S3	S4	S5
Landings: (Lakh tonnes)	7.35	9.31	12.00	13.31	15.03

The average annual growth rates between the stages are 26.6, 28.9, 10.9 and 12.9 per cent respectively. Thus we see that although landings have increased over the stages, the growth rate has declined. The maximum growth rate between S2 and S3 of 28.9% may be attributed to intensification of mechanisation. This promising growth rate did not sustain over the stages and suffered a decline in the later stages inspite of introduction of purse seiners, motorisation of indigenous craft and increase in the overall effort. This may be attributed to the fact that the area of exploitation remained more or less the same inspite of the technological changes in the capture techniques. For the purpose of this paper, the area of exploitation along the coast has been divided into 4 regions namely, North east (West Bengal and Orissa), South east (Andhra Pradesh, Tamil Nadu and Pondicherry), South West (Kerala, Karnataka and Goa) and North west (Maharashtra and Gujarat). The landings in the Andaman Nicobar Islands and the Lakshadweep have not been considered, as the aforementioned regions contribute more than 99% of the marine fish landings in India. The average annual landings in the regions, during the five stages and their percentage contribution to the country's landings are given below.

Stagewise average annual landings in the four regions

(Figs in tonnes)

Stage	N.E	S.E.	S.W.	N.W.
S1	10320	182152	319319	219212
%	1.4	24.8	43.4	29.8
S2	22642	225466	437500	233294
%	2.4	24.2	47.0	25.0
S3	25590	304315	523299	344455
%	2.1	25.3	43.6	28.7
S4	47489	339372	476633	485011
%	3.6	25.5	35.8	34.9
S5	68493	384231	512941	526699
%	4.6	25.6	34.1	35.1

(% : denotes per centage contribution of the region to the average all India landings during the stage.

It is obvious from the above table that although the absolute landings have been gradually increasing over the stages, the rate of growth has however, has been declining. It is also seen from the above table that the relative contribution of N. W. regions have increased whereas that of the South east region remained more or less constant. The trends in the landings of the some of major resources are described below.

Elasmobranchs

There is no directed fishery to exploit this group comprising sharks, rays and skates The landings (TABLE 1) ranged from about 29,000 tonnes. in 1967 to about 70,000 tonnes in 1983. Although there has been an increase

TABLE

Estimated landings (in tonnes) of major exploited

Year	Elasmo-branch	Catfish	Oil Sardine	Other Sardines	Anch-ovies	Bombay duck	Per-ches	Croa-kers	Ribbon fish
1961	33554	10928	167884	19764	22103	93844	15377	29917	19515
1962	40761	19327	110299	19551	19168	83933	8958	32439	20586
1963	42997	17567	63647	27173	28672	91670	8797	22570	16452
1964	34890	22729	274333	40398	25179	81342	12563	25197	25891
1965	32054	18915	261863	42770	24377	73894	8544	23673	41921
1966	37469	22572	247214	64643	26679	77363	12138	26032	45124
1967	29401	24290	256324	34980	29237	74882	8337	25458	27463
1968	31028	23748	301446	41740	18355	82407	8810	26142	25586
1969	35442	26903	174249	52467	31436	76276	12865	35041	31722
1980	44048	50631	226997	55220	24400	78443	13913	41903	26984
1971	41348	48858	209261	61283	19516	71508	12993	36903	44690
1972	46237	42443	127568	43629	18699	51570	15247	40159	36225
1973	44917	52642	144395	108523	25394	64345	21513	87682	53106
1974	66054	76196	126676	83921	41507	61138	36837	79261	63028
1975	65230	68689	159240	112117	30744	99614	35232	114535	57330
1976	54605	43540	169262	10000	30069	87075	18162	87581	64542
1977	62216	53504	150130	65724	34033	85236	31799	99887	42407
1978	61621	39231	168078	52838	39054	125481	49312	96379	77795
1979	52843	48817	153971	68351	26588	126044	35657	93018	71349
1980	57862	43745	115744	67053	33684	95505	38541	89360	62690
1981	56009	59390	220126	61980	33383	137790	31325	82686	41669
1982	64316	67664	205294	55496	41824	86476	45026	87247	48875
1983	70046	60764	183706	77010	89267	100950	56141	100755	39071
1984	57757	57415	188832	67594	74951	117742	71241	109852	53085
1985	52804	44500	120587	60773	54514	112454	71813	101078	84403

in the landings compared to the early sixties, at present there are indications of stabilisation in the magnitude of landings. These groups are mainly caught in hooks & lines, Drift/ gill nets and trawl nets. The regionwise and and stagewise elasmobranch landings are given in the following table.

Elasmobranch landings (tonnes)

Stages	N.E	S.E.	S.W	N.W.
S1	272	17,842	8,650	9,903
S2	469	17,641	7,926	8,928
S3	1,022	25,998	11,161	14,342
S4	3,434	23,075	10,616	20,326
S5	2,800	21,614	10,626	24,610

Marine fish resources in India during 1961-85

Carangids	Silver bellies	Pomfret	Mackerel	Seerfish	Tunnies	Penaeid prawns	Non-Penaeid prawns		
26511	15763	16488	34485	1449	7805	39083	23685	94	683569
11859	18104	25678	29103	10941	2297	48251	24884	96	644244
20939	17748	17256	76980	9116	4454	41071	40522	260	655484
29830	28301	19580	23863	11160	5002	63389	31506	463	859582
21072	27147	17892	43095	9436	3698	38085	41415	265	832777
23635	37972	17845	31959	10113	3063	56146	34768	964	890311
27797	43769	27460	29194	9854	3370	62475	31033	521	862631
19584	36385	27798	20785	12759	3309	68346	31586	1517	902948
24560	44038	24176	91837	11516	3445	72133	33964	769	913630
22413	49275	17589	139206	13410	3015	89857	31834	1184	1085607
23428	32510	21000	204575	18339	6032	72109	76734	1505	1161389
30886	32314	19007	108971	21210	5760	78361	85488	1026	980049
29200	48127	22052	79423	19700	5678	136514	66955	1394	1220240
23841	50902	22421	37462	19841	10839	114934	55244	3677	1217797
24238	39813	24987	45947	18897	11285	141713	79038	7889	1422693
31318	42445	37701	65497	20159	19322	114640	76787	10826	1352855
35739	34504	35127	62136	21119	13005	96472	73992	10005	1259782
21476	41777	41434	85233	20779	13893	129204	50652	15931	1403607
33935	55255	40427	71514	29547	26595	113666	63917	15032	1388380
30113	54400	38231	55279	25986	20371	112037	58700	11335	1249837
37345	69449	48728	48660	27553	17803	83539	61430	9548	1378457
40025	72668	49968	28007	33197	20597	110797	51148	15799	1420624
53082	91733	54290	31227	36615	16959	118203	43750	19748	1548475
58813	57122	49979	42648	36615	20354	130051	61961	20964	1630678
54704	52725	32974	61860	34078	31261	121958	67084	31586	1534726

It is observed from the above table that during the initial stages (S1 and S4) the landings were of more or less the same magnitude. Then there was a sudden spurt in the landings during which the process of mechanisation got established in all the regions. After this, in spite of increase in effort, the landings showed a declining trend in the south east region, the major contributor to the elasmosbranch landings in the country. In the south west region the landings seem to be stabilised. However, in the north west region, the landings are showing an increasing trend. In the north east region, no definite trend is discernible.

Catfish

The catfish landings (Table 1) ranged from about 11,000 tonnes in 1961 to about 76,000 tonnes in 1974. The fishery is supported by many species and are caught in variety of gears, namely, drift/gill net, hook & lines, trawls, purseseines, dolnet etc. The region-wise and stage-wise landings are given in the following table.

Landings of catchfish (Tonnes)

Stages	N.E.	S.E.	S W.	N.W.
S1	263	7,329	3,043	6,848
S2	254	8,006	12,034	9,063
S3	1,198	16,753	25,164	14,637
S4	2,051	11,373	17,563	14,764
S5	8,938	8,551	18,006	22,359

In the north east region there were two sudden spurts in the landings, from S2 to S3 and from S4 to S5. In the south east region the spurt in the landings in the third stage did not last long and there was a gradual and inexplicable decline in the landings. In the South west region where the process of mechanisation began much earlier, the spurt in the landing occurred in the second stage itself and the landings in subsequent stage were also higher. After this, there was a sudden fall during S4 and the magnitude of landings remained more or less the same in the fifth stage also. In the north west region there is a gradus increase in the landings.

Oil sardine:

Oil sardine the major component of marine fish landings in India forms a major fishery in the South west region especially in Kerala and Karnataka. At present the fishery is gaining importance in the South east region namely along the Tamil Nadu and Pondicherry coast. The landings during 1961-85 are given in Table-1, The feature of the landings is characterised by its wide and wild fluctuations over the years. The major gears employed for exploitation are the boat seines, gill nets, rampan, shore seines and of late purse seines. With the advent of purse seine, rampans, the major gear along the Karnataka coast were adversely affected. The oil sardine landings in India ranged from 1.1 lakh tonnes in 1962 to 3 lakh tonnes in 1968 and its percentage contribution varied from 8% in 1985 to 33.4% in 1968. The stage wise landings in the south east and south west regions are given below.

Oil sardine landings (tonnes)

Stage	S.E.	S.W.
S1	34	1,73,423
S2	121	2,40,787
S3	211	1,51,355
S4	439	1,50,366
S5	1,878	1,81,042

It is evident from the above table, oil sardine has been gradually gaining importance in the south east region, where as in the South west region the landings exhibited the typical fluctuating nature.

Other sardine

This group consists of other *Sardinella* spp. other than the *sardinella longiceps*, the oil sardine. The landings during 1961-85 are presented in the Table 1. Like the oil sardines the landings fluctuated over the years and of late there are indications of declining trend. The landings ranged from about 29,500 tonnes in 1962 to 112,000 tonnes in 1975 and its contribution ranged from 3% in 1962 to 9% in 1973 to the total marine fish landings. As the contribution by the north west region is negligible, the landings in different stages in the other regions are given in the following table.

Landings of the other sardines (tonnes)

Stage	N.E.	S.E.	S.W.
S1	1636	16,615	11,175
S2	2896	31,185	10,766
S3	1644	46,194	31,683
S4	1999	41,321	26,114
S5	4248	46,675	12 139

From the above table we observe that in the order of abundance south east region ranks first followed by the south west and north east regions. In the north east region highest

andings were recorded in the fifth stage, which is also the case with the south east region. In the south west region the average landings have declined after the third stage.

Anchovies

The landings of anchovies comprising *Stolephorus* spp. during 1961-85 (Table-1) ranged from about 18,000 in 1968 to about 89,000 tonnes in 1983, the percentage contribution ranging from 2 to 6. The anchovies are mainly caught in the traditional seine nets and of late very large quantities are caught in the purse seines. They are quite abundant in the south east and the south west regions. They are also available in the other regions but form a negligible proportion. The stage wise landings in the south east and south west regions are given in the following table.

Landings of Anchovies (in tonnes)

Stage	S.E.	S.W.
S1	15,349	7434
S2	15,910	9178
S3	13,661	12,442
S4	18,981	12,779
S5	17,530	39543

The variations in the landings in the south east regions are less over the stages as compared to those in the south west region. In the south west region the landings have gradually increased and experienced a sudden increase in the fifth stage. This can be attributed to good landings by the purse seines.

Bombay duck

The Bomby duck landings in India during the period under study are given in Table-1. This forms an important component in the north west region comprising Maharashtra and Gujarat. This fishery is supported by a single species *Harpodon nehereus* and mainly caught in the dol nets. Like the oil sardine, the bombay duck landings have also shown wide variations over the years. Ranging from about 52,000 tonnes in 1962 to about 138000 tonnes in 1981, in which year Maharashtra recorded all time high landings of about 82,000 tonnes. An interesting pattern in the landings was that the landings in Gujarat were higher than the Maharashtra upto 1972 and from 1973 onwards the latter recorded higher landings till now. It is also observed that the percentage contribution of Bombay duck in the marine fish landings of the Gujarat state which was as high as 65% in the early sixties has gradually declined and now forms only about 20% of the total fish landings in the state. Besides, the north west region, the Bombay duck landings are also recorded in the north east region, though not in such abundance as in the north west region. The stage wise landings in these two regions are presented below.

Landings of Bombay duck (in tonnes)

State	N.E.	N.W.
S1	275	84,100
S2	1,175	76,189
S3	1,662	67,527
S4	1,524	1,01,585
S5	2,248	1,07,816

In the north east region we observe that there is a general increasing trend. In the north west region the landings showed a gradual decline from the first stage to the third stage. This was mainly due to gradual reduction in the landings along the Gujarat coast. In the beginning of the fourth stage the landings in Gujarat improved which along with the continuing increasing trend in Maharashtra landings during this period resulted in higher average landings during the 4th stage. In the 5th stage the landings increased on an average by 6% inspite of record high landings in Maharashtra during 1981.

Perches

This group comprises rock cods, snappers, pig face breams, threadfin breams and other perches. Among these, the threadfin breams and pig face breams dominate the total perch landings. The total landings (Table 1) of this group, in general, have been increasing over the years with a minimum landings of about 8000 tonnes in 1967 to about 72,000 tonnes in 1985. This is mainly caught in trawlnets and other traditional seine nets. But with enhancement of effort by the mechanised sector especially the trawlers the perches formed on important

component of trawler landings. The regionwise, stage wise landings are given below.

Landings of perches (in tonnes)

Stage	N. E.	S. E.	S. W.	N. W.
S1	74	6,588	1,172	2,929
S2	19	6,943	2,406	1,736
S3	103	9,364	10,685	3,985
S4	198	10,556	17,133	6,355
S5	934	20,777	20,643	11,740

It is seen from the above table that there is a good improvement in the landings over the stages. In the south west region the sudden spurt in the landings in the third stage coincided with intensification and concentration of mechanised effort. After this, the landings gradually increased over the stages. The south west region which ranked second to the south east region in respect of landings upto the second stage has become the major contributor from the third stage onwards. The general increasing trend was also noticed in the other regions also. This is among the few marine fishery resources showing an increasing trend in all the regions.

Croakers

There has been a substantial increase in the landings (Table 1) from the early fifties to the mid seventies after which the landings seem to be stablized till the mid eighties. The minimum landings were about 22,000 tonnes in 1963 and the maximum was about 114,000 tonnes in 1975. The major gears are trawl and gill nets. The region wise landings over the five stages are given below.

Landings of Croakers (in tonnes)

Stage	N.E.	S.E.	S.W.	N.W.
S1	721	9,380	5,008	11,797
S2	1,269	12,569	5,585	11,373
S3	2,535	17,847	12,405	38,921
S4	4,398	24,747	13,723	50,376
S5	11,448	22,717	10,761	51,126

In the northwest region, the landings suddenly shot up during the third stage. This sudden increase was due to heavy landings along the Gujarat coast. The landings along this coast which were about 4000 tonnes in 1972 rose to about 40,000 tonnes in 1973. This group which showed a promising trend upto the fourth stage could not sustain its increasing trend and seemed to have more or less stabilised in all the regions except in the north east region.

Ribbonfish

Compared to the early sixties, the magnitude of the landings (Table-1) have considerably increased but later on began fluctuating during the late seventies and early eighties. The landings ranged from about 16,000 tonnes in 1963 to about 84,000 tonnes in 1985, the highest during the twenty five year period. The main gears in which they are caught are the boat seines and shore seines. They are also caught in the dol nets, trawl and gill nets. As the north east region does not contribute significantly to the landings, the catches in the other regions over the stages are given below, these three together accounting for more than 95% of the ribbon fish landings in the country,

Ribbon fish landings (tonnes)

Stage	S,E,	S,W,	N,W,
S1	15,060	4202	4891
S2	15,590	8,567	6,575
S3	19,393	19,878	10,793
S4	26,142	17,124	19,627
S5	15,266	12,244	22,546

During the first two stages more than half of the ribbonfish landings in the country was accounted by the south east region. After this the landings in this region began fluctuating. In the South west region, the third stage recorded higher landings and thereafter the landings started to decline. However, unlike these two regions, the north west region has witnessed a steady increase in the landings and during the fifth stage it out-scored the other two regions.

Carangids

This group comprises horse mackerel, scads, leather jackets and the other carangids. The landings (Table-1) ranged from about 20,000 tonnes in 1968 to about 59,000 tonnes

in 1984, It's percentage contribution to the all India marine fish landings ranged from 2 to 4, The landings of this group in general, have shown an increasing trend over the period under study, Bulk of the landings in India are accounted by the south east, south west and north west regions, The landings during the five stages are given below,

Carangids landings (tonnes)

Stage	S.E,	S,W,	N,W.
S1	13,824	6,652	1,383
S2	12,524	7,100	3'370
S3	12,437	11,121	2,984
S4	12,517	13533	3451
S5	20655	18,346	7,480

In the south east region, the landing were of the same magnitude during the first four stages and improved in the fifth stage, A similar trend was observed in the north west region also, However, in the south west region the landings have been gradually increasing, This was mainly due to increased landings in Kerala, Karnataka and Goa in the early eighties,

Silverbellies

Silverbellies are more abundant in the South east region especially along the Tamil Nadu coast, They are mainly caught in the trawl nets and the seine nets, bulk of the landings beings accounted by the trawl nets, The landings (Table 1) ranged from 16,000 tonnes in 1961 to about 92,000 tonnes in 1983 and it accounted for 2 to 6 % of the total marine fish landings during the period, About 95% of the silver bellies landings are accounted by the south east region and the south west region, The silverbellies landings in these regions during the five stages are given below,

Landings of Silverbellies (in tonnes)

Stage	S.E,	S,W,
S1	12167	8266
S2	26,087	13,828
S3	26,673	13,100
S4	36,237	8,415
S5	56,408	10,422

While the landings in the south west region fluctuated, the landings in the south east region gradually increased over the stages and the contribution of the south east region which was about 56 8% during the first stage increased to 82.1% during the fifth stage.

Pomfrets

The landings of pomfrets (Table-1) ranged from about 16,000 tonnes in 1961 to about 54,000 tonnes in 1983 and it accounted for 2 to 4% of total landings in the country. This group comprises silver, black and chinese of which silver pomfrets dominated the landings. The landings in country over the years have shown general increasing trend. The landings in the four regions over the stages are given below. The main gears employed are dift/grill net and purse seines pomfrets are also caught in trawl and dol nets.

Pomfret landings (tonnes)

Stage	N.E.	S.E.	S.W.	N.W.
S1	243	4,497	27,82	11,819
S2	399	4,273	2,003	16,259
S3	1,124	5,348	2,454	12,959
S4	7,893	3,625	2,687	24,337
S5	6,141	5,948	4,220	30,947

In the north east region, the landings exhibited a sudden spurt during the fourth stage and the there was a decline during the fifth stage. In the south east region the landings were more or less stable. In the south west region the landings were more or less of the same magnitude up to the fourth stage and have suddenly improved during the fifth stage. In the north west region however, there was a steady increase from the third stage.

Mackerel

Mackerel, another important marine fish resource, has shown wide and wild fluctuations (Table-1) ranging from about 21,000 tonnes in 1968 to 2,05,000 tonnes in 1971. It is mainly caught in boat seines, gill nets and of late purse seines accounted for higher landings in south west region especially along the Karnataka and Goa coasts. The south west and south east region account for

more than 95% of the mackerel landings in India. Although Ratnagiri coast of the north west region also recorded landings, its contribution is only marginal. The mackeral landings in the south east and south west regions over the stages are given below:

Mackerel landings (tonnes)

Stage	S.E.	S.W.
S1	4,253	34,369
S2	4,546	45,884
S3	10,393	81,242
S4	9,175	57,266
S5	10,737	29,858

In the south east region the landings have improved after the second stage and remained more or less of the same magnitude during third to fifth stage. However, in the south west region the landings have gradually declined from the third stage. Of late there are indications of good mackerel fishery in the south east region especially along the Andhra coast. In spite of introduction of the purse seines on the south west region especially more so along the Karnataka coast, there has not been any improvement in the landings.

Seerfishes

The landings of seerfish from 1961-85 are presented in the Table 1. They ranged from about 9000 tonnes in 1963 to about 37,000 tonnes in 1984. The species which dominate the landings are *S. commerson, S. guttatus S. lineolatus* and *Acanthocybium* spp. They are caught by gill nets, driftnet and hooks and lines. The regionwise landings over the different stages are given below. More than 95% of the seer fish landings in India is accounted by the south east, south west and north west regions and of these south east dominates the landings.

Seerfish landings (tonnes)

Stage	S.E.	S.W.	N.W.
S1	6,491	2,184	1,481
S2	6,041	2,539	2,405
S3	9,854	4,842	4,140
S4	9,081	6,808	5,980
S5	10,686	10,243	9,277

It is observed from the above table that except in the south east region, in the other regions the landings have been gradually increasing. In the south east region, however, the landings seem to get stabilized from the third stage. The relative contribution of the south east region to the all India seerfish landings has been gradually declining from about 62% during the first stage to about 32% in the fifth stage. Whereas in the other two regions their relative contribution have been gradually increasing.

Tuna

The landings of the tuna (Table 1) ranged from about 2000 tonnes in 1962 to about 31,000 tonnes in 1985. In general, the landings have shown an increasing trend. In all the regions the coastal species such as *Euthynnus affinis· Auxis* spp. dominate the landings although the oceanic species *Katsuwonus pelamis* and *Thunnus* spp. are also represented to a little extent in the landings. The north east region contributes only marginal quantities to the total tuna landings in India. The landings in the other regions over the five stages are given below

Tuna landings (tonnes)

Stage	S.E.	S.W.	N.W.
S1	1,785	2,227	210
S2	1,168	1,406	352
S3	1,621	4,504	655
S4	3,349	11,629	1,679
S5	3,573	9,164	5,052

The common gear employed in all these regions is the drift/gill net and in the south west region purse seines also land good quantities of tuna. The sudden increase in the landings from the third stage, in south west may be attributed to increase in the effort of mechanised gill netters and the purse seiners. The increase in south east region may be attributed to the higher landings along the Tamil Nadu coast especially in the Tuticorin area where seasonal tuna fishery with mechanised gill netters gained importance.

Penaeid prawns

This group is by far most important and sought after marine fishery resource, because

of its high export value. It sustains the trawl fishery and comprises many species. The landings of this group are given in Table 1. From this, it is observed that there are indications of stabilisation of the landings. The landings ranged from about 29,000 tonnes in 1961 to about 142,000 tonnes in 1976. Its contribution to the country's total landings ranged from 5.7% in 1961 to 11.2% in 1974 Perhaps this is the only variety of marine fish resources towards which there is a directed fishery and it gained considerable importance from the early seventies. The landings over the stages in the four regions are given below.

Penaeid prawn landings (tonnes)

Stage	N.E.	S.E.	S.W.	N.W.
S1	2,403	6,119	25,824	11,439
S2	5,825	11,019	35,600	17,799
S3	2,138	14,475	66,054	26,041
S4	2,411	17,727	47,020	45,798
S5	2,772	22,752	38,493	48,826

The prawn landings were maximum in the south west region upto the fourth stage, At the third stage the landings were high in south west region and later on there was a gradual decline in spite of increased effort, However in the south east region and the north west region the landings are an average increased over the stages, In the north west region the rate of increase has considerably declined giving indications of plateu in the landings, The north east region, is the only region where the landings on an average except during the second stage have remained more or less the same, This is due to the fact that the number of trawler operations are less compared to the other regions,

Non penaeid prawns

The Annual landings (Table-1) ranged from about 24,000 tonnes in 1961 to about 85,000 tonnesin 1972. They are mainly caught in dol nets. They are quite abundant in the north west region mainly along the Maharashtra coast. They are also available in the south east region especially along the Andhra coast. There are indications of decline in the landings and this is mainly due to declined landings in the Maharashtra coast. The north west region and the south east region together account for about 98% of the country's non penaeid prawn landings. The stage wise landings are given in the following table.

Non-penaeid prawn landings (in tonnes)

Stage	S.E.	N.W.
S1	965	31,406
S2	1,623	30,924
S3	1,978	68,809
S4	3,864	59,608
S5	3,510	50,681

It is evident from the above table that during the initial stages of mechanisation the landings in the north west region were more or less of same order, During the third stage when the mechanisation was intensified, the landings increased, After this inspite of of increase in the mechanisation the landings did not respond positively to the increased effort, This phenomenon in the north west region is mainly due to reduction in the coastal district of Thane in Maharashtra, In the south east however the landings increased upto the fourth stage and got stabilized in the fifth stage,

Cephalopods

This group comprises squids, cuttle fish and octopus. The landings of this group (Table-1) ranged from a meagre 90 tonnes in 1961 to about 32,000 tonnes in 1985. Initially these were either discarded or not recorded. But of late because of the export value they were retained on board and hence the landings seem to show increasing trend. They are mainly caught in the trawls and hooks and lines. The south west and north west region account far more than 75 % of the cephalopod landings in the country. The region wise landings over the stages are given below.

Stage	S.W.	N.W.
S1	152	33
S2	508	121
S3	1,408	511
S4	5,192	5,459
S5	4,943	10,093

In both the regions, the landings improved considerably. However in the south west region the landings seem to get stabilized with more or less the same magnitude during the fourth and the fifth stage. In the north west region however there is gradual increase and this region has outscored the south west region from the fourth stage onwards, This increasing trend is also reflected in the all India cephalopod landings.

Potential yield

The foregoing sections have given an idea of the present exploition pattern of some of the major fishery resources currently exploited in the four regions In this section potential yield that could be obtained from the regions are indicated. These estimates pertain mostly to the 0-50 m depth zone and do not include the island territories.

Many attempts have been made in the past to assess the potential yield from the Indian waters. These estimates ranged from 2 million tonnes to 8.5 million tonnes per annum. (Subrahmanyam 1959, Panikker, 1966, Prasad *et al.*, 1970, Cushing 1977, Gulland, 1971 Jones and Banerji 1973, Prasad and Nair 1973, Shomura, 1976, George *et al.*, 1977 and Silas *et al.* 1976). Recently, Alagaraja (1987) has estimated the potential yield of 3 million tonnes from 0-200 m depth of which 2 million tonnes obtainable from the 0-50 m depth. It is assumed that the potential yield is the maximum average yield that could be exploited. In this paper on attempt is made to estimate the potential yield from the average annual yield during the different stages. The average annual landings during the five stages are given below.

Stage	: S1	S2	S3	S4	S5
Landings (lakh tonnes)	: 7.35	9.31	12.00	13.31	15.03

From the trend of the landings over the five stages, it appears that the marine fish landings seem to follow the Gompertz growth formula. The fit of the above data to the Gompertz curve resulted in asymptotic ($C\infty$) value of 20.92 lakh tonnes for the annual landings, which can be taken as an estimate of the potential harvestable yield.

Following the same analysis the potential yields for the four regions are given below.

Region	Potential yield (lakh tonnes)	Remarks
North east	1.20	Data from stages S_3 to S_6 only
South east	5.85	Data from stages S_1 to S_6
South west	6.00	**
North west	6.90	Data from stages S_2-S_6
	19.95	

(** as the data did not follow any growth, pattern, the maximum catch during the 25 year period is taken as an estimate of the potential yield. The above estimates pertain to the 0-50m depth zone oniy.)

The above estimate does not include the Island territories of Lakshadweep and Andaman and Nicobar. As 99% of the landings from the 0-50m depth zone in India is accounted, by the four regions, the potential yield that could be harvested from the 0-50m depth zone in the Indian waters is given by $\frac{100}{99} \times 19.95 = 20.15$ lakh tonnes. This estimate agrees closely with the one obtained above. it is also interesting to note the above estimates agree closely with an estimate of 20-22 lakh tonnes by Alagaraja (*op cit*) and 22.60 lake tonnes by George *et al.* (*Op. cit*).

CONCLUSIONS

From the foregoing the following observations are made. The rate of growth in marine fish landings has decreased and any further increase in effort may not result in higher landings, in the presently exploited area.

Among the four regions, the north east, south east and the north west regions show promise of higher landings.

Among the pelagic resources, anchovies, carangids, ribbonfish and coastal tunas promise higher yields if suitable modifications in the capture techniques are made. The trend of cat fish landings indicate the potentials of the resource along the north east coast and north west coast.

Among the perches, the threadfin breams are the most abundant group having good potential on both the coasts.

The cephalopods which recently have realized higher export value are expected to be harvested in larger quantities especially from the north west and the south west regions.

The potential yield from 0-50 m is estimated to be in the range of 20-21 lakh tonnes. The estimate of potential yield from 51-200 m has been estimated at 10 lakh tonnes (Alagaraja, *op. cit*).

To increase the catches of the larger pelagic fish such as coastal tunas, seerfish, pomfrets etc. from the traditional fishing grounds it is suggested that the currently employed country craft be motorized.

Proper fishing regulatory measures have to be taken to control over-fishing (both biological and economic) by implementing mesh regulations and demarcation of areas of exploitation by the different types of gear.

Adequate infrastructure facilities such as berthing, handling, storage, ice production and marketing need to be developed for the sustained growth of marine fisheries.

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