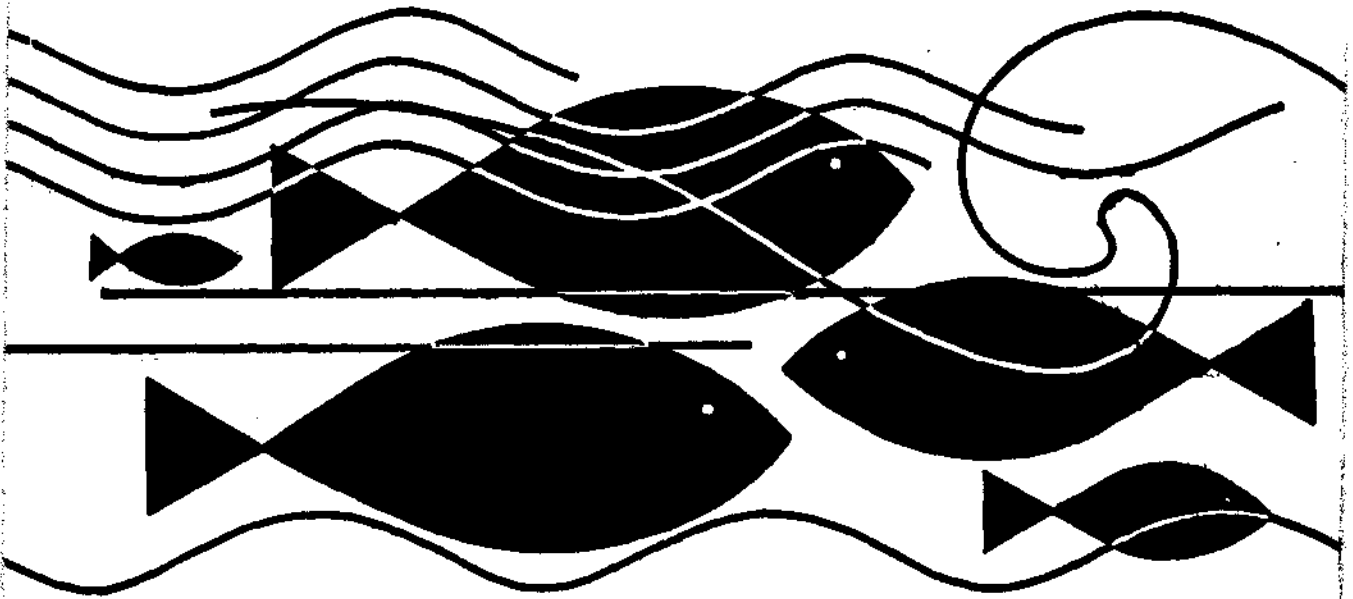


Central Marine Fisheries Research Institute
40
YEARS
1947-1987

Number 37

an
appraisal
of the
marine fisheries
of
maharashtra



Issued in connection with the 40th Anniversary Celebrations of

Central Marine Fisheries Research Institute

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

(Indian Council of Agricultural Research

September 16-18, 1987

**AN APPRAISAL OF THE MARINE FISHERIES
IN MAHARASHTRA**

**M. SRINATH, VARUGHESE JACOB. A. KANAKKAN, P. T. MANI
AND J. P. KARBHARI**

**CMFRI Special Publication
Number 37**



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Limited Circulation



Published by

Dr. P. S. B. R. JAMES
Director
Central Marine Fisheries
Research Institute
P. B. 2704
E. R. G. Road
Cochin-682 031
India

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

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PREFACE

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

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

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

It is with this in view that the data relating to each maritime state for the period 1975-84 are consolidated and processed and presented as a separate Special Publication. This Number gives the appraisal of the marine fisheries of Maharashtra, highlighting the status of the exploited resources and the level of exploitation. It also gives guidelines for increasing the catches by proper development, management and conservation of resources.

Shri. M. Srinath, Shri. Varughese Jacob, Shri. A. Kanakkan, Smt. P. T. Mani and Shri. J. P. Karbhari had shown keen interest and spared no effort to analyse the data for the preparation of this report. I have great pleasure to place on record my appreciation of their efforts to bring out this publication. Shri. A. Prosper, Shri. K. Ramdoss Gandhi, Shri. D. G. Jadhav, Shri. M. Shriram, Shri. J. L. Oza, Shri. S. D. Kamble, Shri. Johnny R. Dias, Shri. C. J. Josekutty, Shri. K. B. Waghmare, Shri. Baben N. Khatkar, and Shri. S. S. Sugwekar collected the catch and other details which form the basic data for this report. I deeply appreciate the earnest efforts put in by them to collect these data.

P. S. B. R. James
Director
C. M. F. R. Institute.
Cochin

AN APPRAISAL OF THE MARINE FISHERIES IN MAHARASHTRA

M. Srinath, Verughese Jacob, A. Kanakkan,
P. T. Mani and J. P. Karbhari

INTRODUCTION

Maharashtra with a coast line of 720 km ranks second among the maritime states of India in respect of marine fish landings. There are 153 landing centres situated in the five coastal districts namely, Thane, Greater Bombay, Raigad, Ratnagiri and Sindhudurg. The state, which has a continental shelf of 89,096 square kilometers, offers rich potential for marine fisheries. The areas of potential fishing grounds in 0-50 m depth and 50-200 m depth are 2.55 and 10.48 million hectares respectively. Fishing takes place almost throughout the year except during the monsoon period. Several types of boats, mechanised and non-mechanised, using different gears land their catches. The exploited marine fish landings in the state are estimated by a well-planned multi-stage stratified sampling design followed by the Central Marine Fisheries Research Institute. Bombay duck, non-penaeid prawns, penaeid prawns, croakers, pomfrets, elasmobranchs, perches and ribbonfishes are some of the commercially important groups which form the bulk of landings. From the early sixties the marine fish landings in the state have been steadily progressing mainly owing to the increase in the mechanised fishing. This increase continued up to midseventies and thereafter the landings have more or less stabilised. For formulating suitable management strategies for judicious exploitation of the fish stocks, knowledge of the status of the stocks is essential. In this report an attempt is made to examine the status of the exploited stocks with the help of a time series of fish landing from 1975 to 1984. This account provides information on the marine fishermen population, craft and gears, marine fish landings in the state as a whole, districtwise landings, besides, an assessment of the present level of exploitation, potential yield and future prospects of the fisheries in the state.

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MARINE FISHERMEN POPULATION CRAFTS AND GEARS

During 1982 the Department of Fisheries, Maharashtra government, conducted a census of marine fishermen population, boats and nets. Certain salient details are given below.

Marine Fishermen Population and Occupation: According to the census there are 2.32 lakh fishermen in the state distributed over the five maritime districts, namely, Thane, Greater Bombay, Raigad, Ratnagiri and Sindhudurg, living in 40,500 households. The active fishermen constitute about 20.4% of the total marine fishermen population in the state. Among the districts, Ratnagiri has the highest percent of active fishermen (25%), followed by Raigad (22%), Sindhudurg (22%), Thane (21%) and Greater Bombay (11%). Among the allied fishery activities 15% of the total marine fishermen are engaged in marketing, followed by 7% in processing and 2% in net making.

Craft and Gear: There are 12,485 boats, comprising mechanised boats, plank-built boats and dug-out canoes. Among 4557 mechanised boats, bagnetters constitute 46%, followed by trawl netters (29%), gillnetters (25%) and the rest long liners and others. Out of 2568 plank-built boats 46% are gill netters, 34% are bagnetters, 7% rampanis and the rest are long liners and others. About 43% of 5360 dugout canoes are gill netters, 29% are bag netters and the rest are the long liners, rampanis and others. Among the gears employed, gill nets are 244,390 in number, followed by bagnets (20525), trawl nets (4152) and Rampani (99). There are 7676 hooks and 616842 lines. There are 43470 nets such as cast nets which are in the categories other than given above.

Marine Fish Landings

The estimated marine fish landings in the state (in lakh tonnes) during the period 1975 to 1984 are given below:

	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
Landings	2.57	2.94	2.64	2.84	2.93	2.32	2.73	2.53	2.70	3.06

It is observed from the above that there is no discernible trend in marine fish landings in the state, which ranged from 2.32 lakh tonnes in 1980 to 3.06 lakh tonnes in 1984 with an average landings in the ten year period as 2.73 lakh tonnes. The contribution of the state to the all India marine fish landings ranged from 18 to 22% during the period. To explain the seasonality in the marine fish landings, the quarter wise landings of 1975-84 are furnished in the following table.

	I	II	III	IV	Total
1975	66251	41576	28972	119820	256619
1976	64043	106589	43359	79610	293601
1977	88902	78687	27193	69670	264452
1978	51948	56936	30241	145119	284244
1979	85710	75788	31260	100568	293326
1980	65258	53742	15716	97317	231763
1981	79203	69953	15091	108340	272587
1982	62984	70612	26074	93759	253429
1983	77054	51127	24254	117221	269656
1984	76137	36736	43219	150193	306285
Average	71749	64175	28538	108162	272624

From the above figures it is seen that, in general, heavier landings take place during the fourth quarter followed by the first quarter, the third quarter being the least productive one. On an average, during 1975-84 about 66% of the catch in the state was landed during October-March period. The quarterwise, species-wise landings during 1975-84 are given in the Appendix.

Landings of Major Groups of Fishes and Prawns

The landings (in lakh tonnes) of the pelagic and demersal groups of fishes and crustaceans, during 1975-84 are furnished below.

	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
Pelagic	1.038	1.019	0.985	1.151	1.073	1.028	1.268	0.922	0.996	1.209
Demersal	1.528	1.917	1.660	1.691	1.861	1.289	1.458	1.613	1.702	1.854

The average landings of pelagic group during the ten year period is 1.069 lakh tonnes forming about 39.3% of the total landings. Except during 1981, 1982 and 1984 the landings of this group was more or less uniform. The highest pelagic landings of 1.268 lakh tonnes in 1981 was mainly due to record high landings of Bombayduck which was estimated as 82,136 tonnes. In the following year there was a steep fall in the landings of Bombayduck which resulted in decreased landings of pelagic group. On an average during the ten year period, Bombayduck and Ribbonfishes together accounted for 63% of the pelagic landings. The average demersal landings during the ten year period was 1.657 lakh tonnes with a peak during 1976 and the lowest being during 1980.

Bombayduck, non-penaeid prawns, penaeid prawns, croakers, pomfrets and catfishes form the bulk of landings in state, the details of the trend in landings of these are given below.

Bombayduck: *Harpodon nehereus* commonly known as Bombayduck is the quite abundant species in the state especially in the northern region. This sustains the 'dol' net fishery which is the predominant fishery in the region. Dol nets are operated in 9-20 Km from the shore at the depths ranging from 20 to 30m. The Bombayduck landings (in thousand tonnes) during the ten year period are given below along with its percentage contribution to the total marine fish landings in the state.

	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
Landings	51.6	49.5	50.8	68.8	59.7	57.4	82.1	45.2	45.3	58.4
%	20.1	19.2	19.2	24.1	20.3	24.7	30.1	17.8	16.8	19.0

The landings during the ten year period exhibited wide fluctuations ranging from 45,162 tonnes in 1982 to 82,136 tonnes in 1981. The fishery begins immediately after the monsoon around September and extends to March, occasionally to April or May. The peak landings, normally, take place during October-December period. Thane district accounted for 80 to 90% of the landings in the state, followed by Greater Bombay (10-20%), while the other districts contribute only marginal quantities. The contribution of bombayduck in the total landings of the state ranged from 17 to 30% during the ten year period, with a maximum in 1981. This is the major component of pelagic landings, its contribution during the ten year period ranging from 45 to 65%.

Non-penaeid prawns: Among the crustaceans, non-penaeid prawns are the predominant group mainly contributed by *Acetes spp.*, followed by *Palaemon spp* and *Hippolytina spp.* The main fishing gear employed is the fixed bag net locally known as 'dol' and 'Bokshi'. The peak landings take place during April-May and October-November periods. The landings (thousand tonnes) of non-penaeid prawns for the ten year period 1975-84 are given below along with their percentage composition in the total landings of the state.

	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
Landings	69.01	63.70	66.98	44.26	56.21	47.31	52.85	40.81	32.13	39.23
%	25.8	24.8	25.3	15.5	19.1	20.4	19.3	16.1	11.9	12.9

It is observed from above that the landings of non-penaeid prawns and the percentage contribution to total landings, in general, have declined over the period. The landings decreased from about 69,000 tonnes in 1975 to about 39,200 tonnes in 1984. This was mainly due to the declining trend in the Thane district. More than 95% of the landings in the state was accounted by Thane, Greater Bombay and Ratnagiri Districts out of which the first two districts alone accounted for more than 70%.

Penaeid prawns : Penaeid prawns are being exploited intensively all along the coast supporting the trawl and dol net fisheries. The exploitation is mainly concentrated in the depth range of 15-60 m and multiple species support the fishery. The more dominant and common ones are *Parapenaeopsis stylifera*, *Parapenaeopsis hardwickii*, *Parapenaeopsis sculptilis*, *Metapenaeus affinis*, *Metapenaeus monoceros* and *Solenocera crassicornis*. The landings of the penaeid prawns (thousand tonnes) along with their percentage contribution to the state marine fish landings for the ten year period are furnished below.

	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
Landings	24.65	40.77	26.68	41.09	45.64	23.43	21.72	33.91	36.03	43.93
%	9.6	15.9	10.1	14.4	15.5	10.1	7.9	13.4	13.3	14.3

Unlike the non-penaeid prawns, we observe from the above that there is no discernible trend over the ten year period. But the interesting feature of the landings was that the ten year period could be split in two groups one from 1975-79 and the other from 1980-84. In the first five year period the landings showed an increasing trend upto 1979 followed by a steep fall in 1980 thereafter the fishery improved showing a gradual progression in the landings upto 1984. On an average during the ten year period they accounted for 12.4% of the total landings in the state and 37% of the crustacean landings. Greater Bombay district ranked first in respect of landings followed by Ratnagiri, Raigad and Thane. The increasing trend in the landings of penaeid prawns during 1980-84 was mainly due to increased landings in Greater Bombay District. But in the Thane District there was a general declining trend during the same period.

Croakers : The landings of croakers in the state are mainly composed of *Otolithus spp* though many other species such as *Johanius* etc are also caught. The landings (thousand tonnes) of croakers during the ten year period along with the percentage contribution are given below.

	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
Landings	20.58	19.78	17.09	17.20	21.37	13.96	17.47	15.93	18.27	22.59
%	8.0	7.7	6.5	7.3	6.0	6.4	6.3	6.8	7.4	6.8

The percentage contribution of croakers to the total marine fish landings in the state did not exhibit much variation lying close to the ten year average of 6.8%. However, there is an increasing trend in the landings from 1980 to 1984. The districts of Greater Bombay and Ratnagiri together accounted for about 79% of croaker landings in the state, with Greater Bombay alone accounting for 49%. During 1980-84, a steady increasing trend was observed in the landings in Ratnagiri and Raigad Districts, where as in Thane the landings declined.

Pomfrets: The landings of pomfrets (thousand tonnes) one of the most important commercially exploited fishes, along with the percentage contribution for the period are:

	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
Landings	8.35	17.98	17.30	13.05	14.94	10.08	17.14	16.84	22.52	19.19
%	3.2	7.0	6.5	4.6	5.1	4.3	6.3	6.6	8.3	6.3

The landings did not show any trend in the ten year period and seemed to be more or less stable during 1976-84 except during 1978-80. On an average during the ten year period it accounted for 5.8% of the total marine fish landings in the state. Among the pomfrets, the silver pomfrets accounted for more than 80% of the landings followed by black pomfrets. The contribution of chinese pomfrets was negligible. The peak fishing season is from October to December and sometimes heavier landings take place during January-February period also. About two third of the pomfret landings in the state was accounted by the Thane district followed by Greater Bombay, Ratnagiri and Raigad.

Catfishes: The catfishes are mainly caught in gill nets, trawlnets and hook and lines. *Tachysurus thalassinus*, *T. dussumieri*, *T. sona* and *T. tenuispinis* are some of species that dominate the catfish landings. The catfish are more abundantly available during January-March period. The landings (thousand tonnes) of catfishes along with the percentage contribution to the total marine fish landings of the state are given below.

	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
Landings	8.24	9.52	8.32	11.08	10.43	8.65	11.04	10.92	12.01	13.42
%	3.2	3.7	3.1	3.9	3.5	3.7	4.0	4.3	4.4	4.4

It is observed, in general, that there is an increasing trend over the ten year period both in the landings and the percentage contribution. Greater Bombay and Ratnagiri accounted for bulk of the catfish landings in the state. During 1980-84, they together accounted for 81% of the catfish landings of the state. The average contribution of Thane was 17%.

Mechanised Landings

The total mechanised landings (ten thousand tonnes) in the state during 1975-84 along with non-mechanised landings (ten thousand tonnes) and their percentage contribution to the total marine fish landings are presented in the following table.

<i>Year</i>	<i>Mechanised</i>	<i>Non-Mechanised</i>
1975	14.79 (57.6)	10.87 (43.4)
1976	23.63 (80.5)	5.73 (19.5)
1977	21.30 (80.5)	5.14 (19.5)
1978	24.19 (85.1)	4.23 (14.9)
1979	26.35 (89.8)	2.98 (10.2)
1980	20.45 (88.2)	2.73 (11.8)
1981	24.13 (88.5)	3.13 (11.5)
1982	23.04 (90.9)	2.30 (9.1)
1983	25.26 (93.6)	1.72 (6.4)
1984	28.69 (93.6)	1.94 (6.4)

(Figures in the brackets are the percentage of the landings in the total marine fish landings).

It is clear from the above table that mechanised landings showed tremendous progress over the years whereas the contribution from the non-mechanised sector had gradually been diminishing. The catches by mechanised crafts are mainly from dol nets, trawl nets, gill nets and hooks and lines. Purse seines are also operated along the Ratnagiri coast mainly aimed at pelagic fishes like mackerel and oil sardine. The gear-wise mechanised landings in the state during 1980-84 period are furnished in the next page. The species-wise landings by the mechanised craft from 1980-84 are given in the Appendix.

The contribution of dol nets to the mechanised landings of the state which was 65-70% during 1980 & 81 had declined to about 50% during 1982-84 period. While the contribution from trawl net landings had shown an increase. In spite of the increased catches from trawl nets followed by increase in effort the catch

		1980	1981	1982	1983	1984
Dol net	C	135679	171066	116305	118081	151715
	F	182053	189009	244197	182808	214701
	U	745	905	476	646	707
Trawl net	C	54688	50776	97493	111403	109946
	F	84871	72764	158834	162529	138457
	U	644	698	614	685	794
Gill net	C	13718	18413	16087	22871	23427
	F	62868	50821	73422	165690	165670
	U	218	362	219	138	141
Hook and Lines	C	219	666	520	533	1169
	F	1116	2528	1963	2461	4503
	U	196	263	265	216	260
Others and purse seine	C	—	249	—	—	589
	F	—	521	—	—	264
	U	—	478	—	—	2231

(C = catch in tonnes, F = effort in unit operations; U = catch per unit operation in Kg; others include 'Pag' a type of cast net.)

per unit operation has ranged only from 614 to 794 Kg. The catch rate of dol net had shown, however, fluctuations over the years. This can be attributed to the fluctuations in the landings of Bombayduck which forms the dominant component of the dol nets along with non-penaeid prawns. Although the gill net catches had shown a steady increase from 1980 to 1984 with corresponding increase in effort, the catch rate had been gradually declining. In case of hooks and lines the catches showed a positive relationship with the effort expended but the catch rate from 1981 to 1984 remained more or less of the same magnitude. In general, the catch rate of dol nets showed an inverse relationship with the effort expended.

The landings (in thousand tonnes) of Bombayduck, non penaeid prawns, penaeid prawns, croakers, pomfrets, ribbon fish and catfishes by the mechanised units in the state are presented in the next page.

Variety of fish/prawn	1980	1981	1982	1983	1984
1. Bombayduck	56.58 (27.7)	79.63 (33.0)	43.91 (19.1)	44.85 (17.8)	58.27 (20.3)
2. Non-penaeid prawns	42.99 (21.0)	47.43 (18.7)	37.31 (16.2)	30.33 (12.0)	38.97 (13.6)
3. Penaeid prawns	21.54 (10.5)	19.31 (8.0)	32.98 (14.3)	34.78 (13.8)	42.61 (14.8)
4. Croakers	11.58 (5.7)	14.38 (6.0)	14.02 (6.1)	16.17 (6.4)	19.76 (6.9)
5. Pomfrets	8.33 (4.1)	15.35 (6.4)	15.72 (6.8)	21.10 (8.3)	18.41 (6.4)
6. Ribbonfish	10.49 (5.1)	7.12 (2.9)	11.99 (5.2)	10.76 (4.3)	10.72 (3.7)
7. Catfish	7.12 (3.5)	8.03 (3.3)	6.01 (2.6)	10.47 (4.1)	10.15 (3.5)

(Figures in paranthesis denote the percentage contribution to the total mechanised landings.

The landings of Bombayduck which dominated the mechanised landings fluctuated widely both in quantity and in its percentage contribution to the total mechanised landings. The landings of Bombayduck by the mechanised crafts formed 97-99% of the total Bombayduck landings of the state. The landings of non-penaeid prawns and its share by the mechanised boats showed a general decline. However, the contribution by the mechanised crafts to the total non-penaeid prawn landings of the state which was about 90% during 1980-81 had shown a gradually progression, the share of mechanised crafts during 1984 being 99%. Compared to 1980 and 1981, the penaeid prawn catch by the mechanised crafts had increased during 1982 to 1984. During 1980-81, about 90% of the total penaeid prawn landings in the state was accounted by the mechanised crafts which increased to 97% during 1982-84 period. The landings of croakers indicated an increase both in quantity and its share in the total mechanised landings. During 1980-81, about 83% of the total croaker landings in the state was accounted by the mechanised crafts which increased to 88% during 1982-84 period. The share of pomfret landings of mechanised craft in the total pomfret landings of the state had shown an increasing trend from 83% during 1980 to 96% in 1984. Except during 1981, the ribbon fish landings by the mechanised crafts remained more or less stable during 1980-84. However, its share in the total mechanised landings had shown a declining trend. On an average the ribbonfish landings by the mechanised sector constituted about 94% of the ribbonfish landing of the state ranging from 88% during 1981 to 99% during 1983. The landings of catfish

by the mechanised crafts which ranged from 6 to 8 thousand tonnes during 1980-82 had increased to about 10 to 10.5 thousand tonnes during 1983 and 1984. Except in 1981 and 1982, its percentage contribution to the total mechanised landings was of the same magnitude in 1980, 1983 and 1984. A similar observation was noticed in the contribution of catfish landing by the mechanised crafts to the total catfish landings of the state.

Districtwise Landings

Among the maritime districts of the state, namely Thane, Greater Bombay, Raigad and Ratnagiri (estimates of Sindhudurg are included in Ratnagiri) during 1980-'84, Greater Bombay ranked first with a contribution of 38.3% followed by Thane (37.6%), Ratnagiri (15%) and Raigad (9%). The details of marine fish landings in each district are dealt with in the following sections.

Thane

The quarterwise total marine fish landings (in tonnes) in the district during 1980-84 are given below.

	1980	1981	1982	1983	1984
I	25402	37291	23129	22630	20150
II	18004	30968	24890	16845	11048
III	1966	4094	3960	7069	10676
IV	53995	62295	33860	40582	54071
Total	99367	134648	85839	87126	95945

During the five year period the higher landings took place in the fourth quarter followed by the first, second and third quarter. Although the overall landings of the district, which ranged from 85,839 tonnes in 1982 to 134648 tonnes in 1981 did not exhibit any trend, there seemed to be some trend in the landings in some of the quarters. However, the lack of trend in the total landings may be attributed to absence of trend in the landings during the fourth quarter. The highest landings during 1981, may be attributed to record high landings of Bombayduck in the state for which Thane was the main contributor. When we consider October to September as the fishing year, an interesting trend was observed in the landings. The landings for the fishing year from 1980-81 are given below.

Fishing year	1980-81	1981-82	1982-83	1983-84
Catch (in tonnes)	126,348	114,274	80,404	82,456

Thus, when we consider the fishing year data, we observe a clear decreasing trend in the landings.

Bombayduck, non-penaeid prawns, pomfrets, catfish and penaeid prawns are the major components constituting about 80% of the total landings in the district. The landings (in tonnes) of these groups are given below.

Name of fish	1980	1981	1982	1983	1984
Bombayduck	49420	66439	40536	38162	49935
a	49.7	49.3	47.2	43.8	52.0
b	86.1	80.9	89.8	84.2	85.6
Non penaeid prawns	20849	27708	15186	12389	10271
a	21.0	20.6	17.7	14.2	10.7
b	44.1	52.4	37.4	38.6	26.2
Pomfrets	5458	10639	10630	14496	11991
a	5.5	7.9	12.4	16.6	12.5
b	54.1	62.1	63.1	64.4	62.5
Catfish	2086	2882	1431	1556	1735
a	2.1	2.1	1.7	1.8	1.8
b	24.1	26.1	13.1	13.0	12.9
Penaeid prawns	2347	2041	1042	1739	1321
a	2.4	1.5	1.2	2.0	1.4
b	10.0	9.4	3.1	4.8	3.0

(a = % in the total landings of the district, b = % of the total landings of same fish in the state).

The Bombayduck was the major component of marine fish landings in the district and contributed over 80% to the total Bombayduck landings in the state. However, neither the landings nor its percentage composition in the total landings exhibited any discernible trend. The non-penaeid prawns which ranked second in the order of magnitude of the landings constituted about 21% of the total landing 1980-81 but showed a gradual decline and its contribution to the total non-penaeid prawn landings of the state which was about 44% during 1980 declined to about 26% during 1984. The landings of pomfrets improved and scored over that of non-penaeid prawns both in quantity and its percentage composition in the total landings in 1983 and 1984. Although, the contribution of cat fish in the total landings of the district did not show much variation during the five year period, the quantity landed and its contribution to the catfish landings in the state declined. A similar trend was observed in the landings of penaeid prawns also. Its contribution to the total penaeid prawn landings in the state declined from 10% during 1980 to 3% in 1984.

The gearwise mechanised landings in the district during 1980-84 period are given below.

Year	Gear				Total
	Dolnet	Gillnet	Hook & Lines	Others	
1980	c	90210	8589	15	98814
	f	82860	24887	151	107899
	u	1089	345	99	—
1981	c	118944	12029	134	131224
	f	95365	18583	379	114568
	u	1247	647	345	—
1982	c	75956	8332	—	84288
	f	90063	13018	—	103081
	u	843	640	—	—
1983	c	81247	5649	—	86896
	f	80352	11865	—	92217
	u	1011	476	—	—
1984	c	90564	5286	—	95850
	f	70644	12803	—	83447
	u	1197	413	—	—

(C= Landings in tonnes, f effort in unit operations, u= catch per unit in Kg, others include 4 tonnes from Trawl nets and the rest from 'pag', a type of cast net).

The highest landings of 1.31 lakh tonnes in 1981 was mainly due to higher landings of Bombayduck. In fact, the variations in the dol net landings can be directly ascribed to the variations in Bombay duck landings over the five year period. The catch from dolnets and the effort expended in terms of unit operations seemed to have a positive relationship during the five year period. But the catch rate and the effort expended did not have any clear relationship. In the case of gill nets except for 1980, from 1981-84 declining trend was observed in catch, effort expended and the catch per unit effort. The contribution of the district of the total mechanised landings in the state ranged from 34% in 1983 to 54% in 1981, exhibiting a steady declining trend.

The mechanised landing centres, Satpati and Bassein Kolliwada situated in this district are treated as single centre zones where sampling coverage is relatively more. The landings at these centres are given below.

Satpati

Dol nets and gill nets are the major gears employed by the mechanised crafts which land their catches at this centre. The gear wise details are furnished below.

Year		Gear			Total
		Dolnet	Gillnet	Trawl net	
1981	c	7066	4651	4	11721
	f	3788	4659	4	8451
	u	1865	998	1000	
1982	c	2939	7064	—	10003
	f	3824	8299	—	12123
	u	768	852	—	
1983	c	4339	5209	—	9547
	f	4559	9099	—	13658
	u	952	572	—	
1984	c	8470	4425	—	12895
	f	6198	7817	—	14015
	u	1366	566	—	

(c = catch in tonnes, f = effort in unit operations. u = catch per unit operation).

The dol net landings were less in 1982 and 1983 but had improved in 1984. In the case of gill nets, except for 1981, a gradual decline was observed in catch and catch rate, though effort did not vary significantly.

Bombay duck constituted the bulk of dol net landings followed by non-penaeid prawns, these two together forming about 80% of the landings.

Gear : Dol net

	1981	1982	1983	1984
Bombay duck (tonnes)	5042	1908	2402	6223
%	71.4	64.9	55.4	73.5
Non-penaeid prawns (tonnes)	725	360	882	1035
%	10.3	12.2	20.3	12.2

More than fifty percent of gill net catch was dominated by pomfrets, followed by cat fish and elasmobranchs. These three accounted for about 70-81% of the gill net landings during 1981-84.

(Figs. in tonnes)

Gear: Gill net

	1981	1982	1983	1984
Elasmobranchs (tonnes)	628	694	264	246
%	13.7	9.8	5.1	5.6
Cat fish (tonnes)	479	724	546	595
%	10.5	10.2	10.5	13.5
Pomfrets (tonnes)	2514	4334	2859	2503
%	55.0	61.3	54.7	56.6

While the landings of elasmobranchs have declined during 1981-84, those of catfish and pomfrets, except in 1981, remained more or less stable.

Bassein Kolliwada

At this landing centre, mechanised landings consisted only those from dol nets. The landings by dol nets during 1980-84 are given below.

Gear: Dol net

	1980	1981	1982	1983	1984
c	4055	5208	5856	9896	13801
f	4257	4881	6284	7146	7430
u	953	1083	1108	1385	1857

(c= catch in tonnes; f= effort in unit operations; u= catch per unit operation).

There is progressive increase in catch followed by enhanced effort resulting in gradual increase in catch rate. The landing of dol nets at this centre, which formed about 5% of the total dol net landings in the district during 1980 had increased to 15% in 1984. Bombay duck, non-penaeid prawns, clupeids and pomfrets are the major components of dol net landings accounting for more than 80% of the catch.

Gear: Dol net

	1980	1981	1982	1983	1984
Bombay duck (tonnes)	868	1106	1639	2155	1470
%	21.4	21.2	28.0	21.8	10.7
Non-penaeid prawns (tonnes)	1675	1340	1023	1361	1313
%	41.3	25.7	17.5	13.8	9.5
Clupeoids (tonnes)	644	996	893	1944	3351
%	16.0	19.1	15.3	19.6	24.3
Pomfrets (tonnes)	151	841	1199	2890	5612
%	3.7	16.1	20.7	29.2	40.7

The landings of Bombay duck increased gradually from 1980 to 1983 and had a sudden fall in 1984. Although the landings of non-penaeid prawn from 1981-84 remained more or less of the same magnitude, its share in the total landings showed a substantial decline from 41.3% in 1980 to 9.5% in 1984. But, the share of pomfrets and clupeids, whose landings showed a considerable increase during 1980-84, had been increasing during the period which resulted in the increasing trend of the total landings at this centre.

Greater Bombay

The quarterwise landings (in tonnes) in the district during 1980-84 are furnished below.

Quarters	Year				
	1980	1981	1982	1983	1984
I	26938	28503	20671	29069	30094
II	20076	23414	16866	21871	16553
III	8493	9738	16493	14512	24710
IV	28777	31251	47987	40084	54230
Total	84284	92906	1022017	105536	125587

From the above, we observe that peak seasons, in general, are the fourth quarter and the first quarter. Unlike, in the Thane district, the marine fish landings in this district exhibited a clear increasing trend during the five year period. Except during 1982, the landings during the first quarter remained more or less of the same magnitude. The landings in the third and fourth quarters have, however, have shown an increasing trend over the years barring 1983. In general, this district had shown promising positive trend over the five year period. When we consider the fishing year as October to September period the following trend is observed.

Year	1980-81	1981-82	1982-83	1983-84
Catch (Tonnes)	90432	85281	113439	111441

Although, there is a general increase in the landings during 1982-83 & 1983-84 as compared to 1980-81 period, gradual increase was not observed as it was noticed from the trend from the calendar year data.

Penaeid prawns, non-penaeid prawns, croakers, cat fish, ribbon fish, Bombay duck, pomfrets and elasmobranchs are the important components of marine fish landings in the district. The landings in tonnes of these components are given below.

	1980	1981	1982	1983	1984
Penaeid prawns	16561	15376	25188	23577	32439
a	19.6	16.6	24.7	22.3	25.8
b	70.7	70.8	74.3	65.4	73.8
Non-penaeid prawns	13911	15069	14316	11814	21024
a	16.5	16.2	14.0	11.2	16.7
b	29.4	28.5	35.1	36.8	53.6
Croakers	8701	9827	7473	7757	9442
a	10.3	10.6	7.3	7.4	7.5
b	62.3	56.2	46.9	42.4	41.8
Cat fish	3931	3841	5710	5213	5301
a	4.7	4.1	5.6	4.9	4.2
b	45.4	34.8	52.3	43.4	39.5
Ribbon fish	5572	4678	5412	4472	4498
a	6.6	5.0	5.3	4.2	3.6
b	48.2	58.1	43.8	41.0	38.7
Bombay duck	7331	15006	4074	6363	7476
a	8.7	16.2	4.0	6.0	5.9
b	12.8	18.3	9.0	14.0	12.8
Pomfrets	2660	4681	3508	3308	3966
a	3.2	5.0	3.4	3.1	3.2
b	26.4	27.3	20.8	14.7	20.7
Elasmobranchs	3783	3827	5490	8221	6667
a	4.5	4.1	5.4	7.8	5.3
b	48.8	39.6	44.4	62.0	57.9

(a = % of the total landings of the district. b = % of the total landings of same fish in the state).

The landings of penaeid prawns have, in general, shown an increasing trend. Its percentage contribution to the total landings of the district has also increased. However, the share of this district in the total penaeid prawns in the state had increased only by about 2% from 1980-81 to 1982-84, except during 1983, when its share declined by 6% as compared to 1980. The landings of non-penaeid prawns fluctuated during the five year period without showing any clear trend, although compared to 1980, during 1984 there was an increase of about 7000 tonnes. However, the share of the district in the non-penaeid prawn landings of

the state has shown an increasing trend from 29% during 1980-81 to 54% in 1984. The landings of croakers, fluctuated in the five year period but its contribution to the total landings of the district and share of the district in the total croaker landings of the state have gradually declined from 10.5% to 7% and 62% to 42% respectively. Although the cat fish landings in the district have increased from 3931 tonnes in 1980 to 5301 tonnes in 1984, following a positive trend, its percentage contribution, except in 1982, to the total landings remained more or less of the same magnitude. The share of this district to the total cat fish landings of the state did not exhibit any trend ranging from 35% in 1981 to 52% in 1982. The contribution of ribbon fish to the total landings of the district showed a gradual decline, from 6.6% in 1980 to 3.6% in 1984, and similar trend was observed in the district's share in the ribbon fish landings of the state. The landings of Bombay duck exhibited wide fluctuations ranging from 4074 in 1982 to 15006 tonnes in 1981. Its percentage contribution to the total landings of the districts and the district's share in the Bombay duck landings of the state also exhibited a trend similar to that of the absolute landings. Except in 1981, the contribution of pomfrets to the total district landings remained more or less stable around 3%. The district's share, however, showed general declining trend. The landings of elasmobranchs have increased during the five year period from 3783 tonnes in 1980 to 6667 tonnes in 1984 with a peak in 1983 (8221 tonnes). However, except for 1983, there was only a marginal increase of about 4% to 5% in respect of its contribution to the total district landings. The district's share in the total elasmobranchs landings of the state increased from about 49% during 1980 to 58% in 1984 with a peak of 63% in 1983.

During the five year period the total mechanised landings in the district showed an increasing trend, however, its percentage contribution to the total mechanised landings did not show much variation. It was 41% in 1980 followed by a fall with 38% in 1981 and was 44, 42 and 44% during 1982, 1983 and 1984 respectively. Trawl nets and dol nets together accounted for more than 90% of the mechanised landings of the district. The contribution of Trawl net which was about 51% in 1980 increased to 59% in 1984 with a peak during 1982 and 1983 with 67%. The contribution of dol net was 42.5%, 49.5%, 27%, 25.9% and 33.8% respectively during five year period. The percentage contribution of gill nets remained more or less of the same magnitude. The trawl net landings showed a steady increase in the five year period which is reflected in the overall mechanised landings of the district. Although the landings increased from 42771 tonnes in 1980 to 74172 tonnes in 1984, the effort expended did not experience such an increase, and remained with 41213 unit operations in 1980 to 47375 unit operations in 1984, the effort expended during 1982-84 being more or less in the same order. The catch rate, except in 1981, also increased over the five year period. One salient feature observed was that the contribution of the district to

The gearwise mechanised landings in the district are furnished below.

Year		Gear					Total
		Trawl Net	Dolnet	Gill Net	Hooks & lines (H&L)	Pag (Cast net)	
1980	c	42771	35763	5010	204	—	83748
	f	41213	71234	36911	965	—	150323
	u	1038	502	136	211	—	
1981	c	39786	45750	6194	519	136	92385
	f	40528	71900	29231	2071	284	144014
	u	982	636	266	251	479	
1982	c	68083	27498	5683	520	—	101784
	f	46068	77641	29771	1963	—	155443
	u	1478	354	191	265	—	
1983	c	70718	27376	7311	447	—	105852
	f	46382	74544	44771	1788	—	167485
	u	1525	367	163	250	—	
1984	c	74172	42384	8301	381	—	125238
	f	47375	85349	44154	1645	—	178523
	u	1566	497	188	232	—	

(c = catch in tonnes; f = effort in unit operations; u = catch per unit operation in Kg)

the total trawl landings which was about 78% during 1980 and 1981 decreased to 68% in 1984, showing a gradual decline from 1982. The landings of dol nets fluctuated in the five year period without exhibiting any discernible trend, although the effort expended showed an increasing trend. The catch and effort did not have any relationship because inspite of a steady increase in effort, there was no trend in the catch. The contribution of dol nets to the mechanised landings of the state ranged from 26% in 1983 to 49.5% in 1981. The share of this district in the dol nets landings of the state was in the range of 26-28% in 1980, 1981 and 1984 and was about 23% during 1982 and 1983. The gill net landings have increased from 5010 tonnes in 1980 to 8301 tonnes in 1984, with 6194, 5683 and 7311 tonnes in 1981, 1982 and 1983 respectively. The effort expended ranged from 29331 unit operations in 1981 to 44771 in 1983. The catch rate, however, did not respond positively with the effort expended. The contribution of gill net landings to the mechanised landings of the district did not show much variation, ranging from 6.7%, in the five year period. During the five year period, about one third of the total gill net landings of the state was from this district. The share of hooks

and lines was only marginal to the total mechanised landings of the district. However, from 1981, there is gradual decline in the catch, effort and catch rate. The share of the district to the total hook & lines landings of the state, which was in the range of 78-100% during 1980-83, declined to 32% in 1984.

The mechanised landing centres, Sassoon dock and New Ferry wharf in this district are considered as the single centre zones where the sampling coverage is relatively more. The gearwise mechanised landings during 1980-84 at these centres are given in the following sections.

Sassoon Dock

The landings by mechanised craft using the gears, trawlnet, dolnet, gillnet and hooks and lines for the five year period 1980-84 are as follows:

Year		Gear				Total
		Trawl net	Dolnet	Gill net	Hooks & lines	
1980	c	18148	1574	928	185	20835
	f	21466	12562	2645	785	37458
	u	845	125	351	236	
1981	c	19587	1925	1732	359	23603
	f	21540	13999	4533	1617	41689
	u	909	137	382	222	
1982	c	36890	2260	2451	520	42121
	f	24753	12519	3989	1963	43224
	u	1490	180	614	265	
1983	c	26866	1940	1652	361	30819
	f	20669	14177	3254	1478	39578
	u	1300	137	508	244	
1984	c	33840	2004	2143	381	38368
	f	23799	15274	4191	1645	44909
	u	1422	131	511	232	

(c=landings in tonnes, f=effort in unit operations, u=catch per unit operation).

There is, in general, an increasing trend in the mechanised landings during the five year period. The landings from trawl nets dominated, forming about 88% of the landings except during 1981, which was about 83%. The general increasing trend in the trawl landings is reflected in the total landings.

Although there is, in general, an increasing trend in the trawl landings, its contribution to trawl net landings of the district varied from 38% in 1983 to 54.2% in 1981, without exhibiting any trend. There was a positive relationships with catch and effort during the five year period. The landings of dol nets, except in 1980, remained more or less of the same magnitude. Its contribution to the total landings at this centre ranged from 5.2% in 1984 to 8.2% in 1981. The dol nets landings accounted for only 4.8% of the total dol net landings of the district. The gill net landings, whose contribution ranged from 4 to 7% during the five year period, varied with 928 tonnes in 1980 to 2451 tonnes in 1982 without any discernible trend. The contribution of hooks and lines during 1980-84, ranged from 1-1.5% and the landings except in 1980, 1982 remained more or less of the same magnitude. The catch rate did not show much variation over the five year period.

Elasmobranchs, cat fish, perches, croakers, ribbon fish and penaeid prawns are the important components of trawl net landings. The quantities (in tonnes) landed being during 1980-84 are given below.

Gear: Trawl net

	Year				
	1980	1981	1982	1983	1984
Elasmobranchs	1224	1439	1816	1282	1571
%	6.7	7.3	4.9	4.8	4.6
Cat fish	2084	1720	3237	1687	1962
%	11.5	8.8	8.8	6.3	5.8
Perches	1801	1094	3704	2239	1849
%	10.0	5.6	10.0	8.3	5.5
Croakers	2937	4135	3002	1554	2220
%	16.2	21.1	8.1	5.8	6.6
Ribbon fish	1805	1364	2355	912	904
%	10.0	7.0	6.4	3.4	2.7
Penaeid prawns	4880	6171	13368	11630	16415
%	26.9	31.5	36.2	43.3	48.5

The percentage contribution of all these important groups except that of penaeid prawns showed a declining trend in general. In the case of penaeid prawn, not only its percentage contribution but also its landings showed a general increasing trend in the five year period.

In the gill net landings, elasmobranchs, catfish, pomfrets, seerfish and tunnies formed more than 70% of the catch.

Gear: Gillnet

	Year				
	1980	1981	1982	1983	1984
Elasmobranchs	105	300	371	266	235
%	11.2	17.3	15.1	16.1	15.6
Cat fish	3	1	248	139	269
%	0.3	0.1	10.1	8.4	12.6
Pomfrets	231	393	440	310	275
%	24.8	22.7	17.9	18.8	12.8
Seer fish	132	187	217	231	196
%	14.1	10.8	8.9	14.0	9.1
Tunnies	239	508	380	192	447
%	25.6	29.3	15.5	11.6	20.9

Barring 1980, from 1981 onwards the landings of elasmobranchs, pomfrets and seer fish did not show wide variations, whereas that of Tunnies and catfish fluctuated. Catfish landings showed considerable improvement, ranging from 3 tonnes in 1980 to 269 tonnes in 1984.

In the dol net landings, Bombayduck and penaeid and non-penaeid prawns accounted for more than 80% of the landings during 1980-84, the quantities landed during the period are given below.

Gear: Dolnet

	Year				
	1980	1981	1982	1983	1984
Bombay duck	345	441	225	203	474
%	21.9	22.9	10.0	10.5	23.6
Penaeid prawns	121	121	206	316	222
%	7.7	6.3	9.1	16.3	11.1
Non-penaeid prawns	836	1066	1398	1071	905
%	53.2	55.4	61.9	55.2	45.2

The landings of penaeid prawns had increased whereas that of Bombayduck and non-penaeid prawns fluctuated during the five year period. A similar trend was observed in the percentage contribution of these groups.

Elasmobranchs, eels, catfish and croakers formed about 98% of the hooks & lines landings during 1980-84.

Gear: Hooks & lines

	1980	1981	1982	1983	1984
Elasmobranchs	3	52	69	69	85
%	1.6	14.5	13.3	19.1	22.3
Eels	65	29	96	113	65
%	35.1	8.1	17.7	31.3	17.7
Catfish	101	25	275	124	164
%	54.6	70.2	52.9	34.3	43.0
Croakers	13	21	58	36	31
%	7.0	5.8	11.1	10.0	8.1

The landings of eels, croakers and catfish fluctuated without any trend whereas that of elasmobranchs showed in general, an increasing trend.

New Ferry Wharf

At this centre almost the entire landings are accounted by the trawl nets and the dol nets, gill net contributing only very marginal portion of the total landings. The gearwise details for the five year period 1980-84 are furnished below.

Year		Trawl net	Dol net	Gill net	Total
1980	c	24618	—	—	24618
	f	19694	—	—	19694
	u	1250	—	—	
1981	c	20189	38	—	20227
	f	18970	189	—	19159
	u	1064	201	—	
1982	c	31182	54	7	31243
	f	21302	389	14	21705
	u	1464	139	500	
1983	c	43842	236	—	44078
	f	25701	1672	—	27373
	u	1706	141	—	
1984	c	40332	284	11	40627
	f	23576	1384	31	24991
	u	1711	205	355	

(c= catch in tonnes, f =effort in unit operations u= catch per unit operation in kg)

There was an increasing trend in the mechanised landings with increasing effort during the five year period. The contribution of this centre to the total mechanised landings of the district ranged from 21.9% in 1981 to 41.6 % in 1983. The trawl net landings formed 57.6, 50.7, 45.8, 62.0 and 54.4% of the total trawl landings of the district during 1980 to 1984 respectively. The increasing trend of trawl landings with increased effort has also resulted in higher catch rates over the five year period.

Elasmobranchs, eels, catfish, croakers, ribbonfish and penaeid prawns accounted for more than two third of the trawl landings. The quantities landed (in tonnes) during 1980-84 are furnished below.

	1980	1981	1982	1983	1984
Elasmobranchs	1527	1101	2599	5654	4068
%	6.2	5.4	8.3	12.9	10.1
Eels	2637	1697	3126	2412	2288
%	10.7	8.4	10.0	5.5	5.7
Catfish	750	618	1221	2314	1525
%	3.0	3.1	3.9	5.3	3.9
Croakers	3720	3953	3169	4832	4995
%	15.1	19.6	10.2	11.0	12.4
Ribbonfish	1953	1697	1958	1722	1667
%	7.9	8.4	6.3	3.9	4.1
Penaeid prawns	6515	6013	8850	9640	12193
%	26.5	29.8	28.4	22.0	30.2

The landings of penaeid prawns, elasmobranchs, catfish and croakers have increased. Whereas, ribbonfish landings have decreased. The percentage contribution of catfish, except in 1983, did not show much variation over the years. The contribution of eels and ribbon fish which were 11 and 8% reduced to 6 and 4% respectively from 1980 to 1984.

Raigad

The quarterwise marine fish landings (in tonnes) in the district during 1980-84 are given below.

Quarters	1980	1981	1982	1983	1984
I	4796	5139	6527	6857	6918
II	7320	8706	9325	1860	1129
III	1967	395	1030	892	6289
IV	7965	5466	4458	14586	19510
Total	22048	19706	21340	24195	33846

This district ranked last in respect of marine fish landings in the state contributing 9.5, 7.2, 8.4, 9.0 and 11.1% respectively during 1980 to 1984. Unlike in Thane and Greater Bombay where in general, the seasonality in landings maintained over the years, in this district the order of landings of the seasons varied over the years. During 1980, the fourth quarter realised higher landings followed by second, first and third quarters. In 1981, higher landings took place in the second quarter followed by the fourth, first and third quarters. In 1982, while the second quarter maintained its rank as in the previous year, the first quarter replaced the fourth quarter followed by the third quarter. But in 1983, 1984, the seasonal behaviour of the landings conformed to that of Thane and Greater Bombay districts. The total landings in the district remained more or less constant during 1980-82 but experienced sudden increase in 1983 and 1984, mainly due to increased mechanised landings. When we consider the landing in the fishing year, from October to September period we get, the following picture.

	1980-81	1981-82	1982-83	1983-84
Catch (tonnes)	22205	22348	14067	28922

Thus, we see the landings were almost the same during 1980-81 and 1981-82. There was a sudden fall in 1982-83 and then increased to 28922 tonnes in 1983-84.

Non-penaeid prawns, penaeid prawns, croakers, and pomfrets are the important components of the marine fish landings in the district. The landings of these groups (in tonnes) are given below.

	1980	1981	1982	1983	1984
Non-penaeid prawns	10618	8930	11296	7842	7859
a	48.2	45.3	52.9	32.4	23.2
b	45.3	41.1	33.3	21.8	17.9
Penaeid prawns	2422	2231	1930	3719	4627
a	11.0	11.3	9.0	15.4	13.7
b	5.1	4.2	4.7	11.6	11.8
Croakers	1224	994	920	2333	4827
a	5.6	5.3	4.3	9.6	14.2
b	8.8	5.7	5.8	12.8	21.4
Pomfrets	810	842	821	1459	884
a	3.7	4.3	3.8	6.0	2.6
b	8.0	4.9	4.9	6.5	4.6

(a - % of the total landings of the district. b - % of the total landings of the same fish in the state).

The landings of non-penaeid prawns in this district have declined over the five year period. Its contribution to the district marine fish landings which was in the range of 45-53% during 1980-82 fell down to 23% in 1984. The share of the district to the total non-penaeid prawn landings of the state which was as high as 45.3% gradually declined and accounted for only 18% in 1984. The landings of penaeid prawns which were more or less of the same order during 1980-82 has increased to 3719 and 4627 tonnes in 1983 and 1984 respectively. A similar trend was observed in its contribution to the total landings of the district. The share of the district to the penaeid prawn landings of the state increased from range of 4-5% during 1980-82 to 12% in 1983 and 1984. There was a considerable increase in the landings of croakers in 1984 as compared to 1980-82 period. Its contribution to the district landings and the share of the district in croakers landings of the state have shown considerable progress. The landings of pomfrets, except in 1983, remained more or less of the same magnitude during the five year period.

The mechanised landings in the district are mainly from trawl nets, dol nets and gill nets. The gearwise landings during 1980-84 are presented below.

Year		Gear			Total
		Dol net	Trawl net	Gill net	
1980	c	8603	1102	46	9751
	f	24783	4959	366	30108
	u	347	222	126	
1981	c	5649	550	—	6199
	f	19003	633	—	19636
	u	297	869	—	
1982	c	12851	1501	886	15238
	f	76493	7416	5869	89778
	u	168	202	151	
1983	c	9402	5325	479	17206
	f	27757	20210	34363	64241
	u	339	263	72	
1984	c	18730	10252	3347	32329
	f	53390	29173	35283	117846
	u	351	351	85	

(c= catch in tonnes, f= effort in unit operations and u= catch per unit effort in kg)

The overall mechanised landings in the district have increased considerably during the five year period. This was mainly due to increased effort expended by trawlers, dol netters and gill netters. The share of the district in the mechanised landings of the state which was about 5% in 1980 increased to 11% in 1984.

The dol nets which contributed 84-91% of mechanised landings during 1980-81 although realised higher landings in 1984, its contribution fell down to 58%. The catch rate, except during 1981 & 1982, remained more or less of the same magnitude. The trawler landings which accounted for only 9-11% during 1980-82 have shown considerable improvement during 1983 and 1984, its contribution in these two years being 31 and 32% respectively. The gill net landings which were almost non-existent during 1980-81 period, contributed 5.8, 14.4 and 10.4% of the total mechanised landings of the district. The share of these gears in their respective landings in the state had also increased over the five year period. The trawl net landings which constituted only 1% during 1980 of the trawl landings of the state increased to 9% during 1984. While landings by dol net increased from 6.3% in 1980 to 12.3% in 1984. The gill net landings which were negligible during 1980, accounted for 14.3% of the total gill net landings of the state.

Ratnagiri

Ratnagiri ranks third among the maritime districts of the state in respect of marine fish landings. The quarterwise fish landings (in tonnes) in the district during 1980-84 are given below.

Quarter	Year				
	1980	1981	1982	1983	1984
I	8122	8270	12657	18498	18958
II	8072	6865	19531	10551	7956
III	3290	864	4583	1781	1523
IV	6080	9328	7454	21969	22246
Total	26064	25327	44225	52799	50683

The landings of the district which were of the same magnitude during 1980 1981, have suddenly increased during 1982, 1983 and 1984. It is observed except during the third quarter in all the quarters the landings increased considerably during the five year period. This increase in the landing was mainly due to increased fishing effort during 1982-84 period. The contribution of the district to the total landings in the state during the five year period was 11.2, 9.3, 17.5, 19.6 and 16.5 percent respectively.

Elasmobranchs, catfish, croakers, ribbonfish, pomfrets and penaeid prawns are the important constituents of the marine fish landings in the district. The landings in tonnes of these groups during the five year period are given in the following table.

	1980	1981	1982	1983	1984
Elasmobranchs	1895	2620	4332	2803	2638
a	7.3	10.3	9.8	5.3	5.2
b	24.4	27.1	35.1	21.1	22.9
Catfish	2570	4060	3690	5032	6061
a	9.9	16.0	8.3	9.5	12.0
b	29.7	36.8	33.8	41.9	45.2
Croakers	2889	4012	5940	6797	6690
a	11.1	15.8	13.4	12.9	13.2
b	20.7	23.0	37.3	37.2	29.6
Ribbonfish	3125	1289	5039	4097	4081
a	12.0	5.1	11.4	7.8	8.1
b	27.0	16.0	40.8	37.6	35.1
Pomfrets	1153	982	1881	2917	2341
a	4.4	3.9	4.3	5.5	4.6
b	11.4	5.7	11.1	12.9	12.2
Penaeid prawns	2103	2069	5654	6992	5547
a	8.1	8.2	12.8	13.2	10.9
b	9.0	9.5	16.7	19.4	12.6

(a=% of total landings in the district, b=% of the landings of the fish in the state).

These groups constitute more than 50% of the marine fish landings in the district. The landings of elasmobranchs did not exhibit any trend during the five year period. Except during 1980 and 1982, the landings were more or less of the same magnitude. Its contribution to the total landings showed a decline for 10.3% in 1981 to 5.2% in 1984. The share of the district in the elasmobranch landings of the state ranged from 21% in 1983 to 35% during 1982. The landings of cat fish and the district's contribution to the total state landings of catfish have progressed over the five year period. However, its percentage contribution to the total landings of the district fluctuated without any trend. The landings of croakers increased from 2889 tonnes in 1980 to 6690 tonnes in 1984. However its percentage contribution to the total landings and the share of district in the total croaker landings in the state did not exhibit any trend. The magnitude of ribbon fish landings during 1982-84 period was much higher as compared to that during 1980-81 period. Its contribution to the total landings of the state fluctuated from 5.1% during 1981 to 12% during 1980. The share of the district

in the ribbonfish landings of the state improved during 1982-84 period as compared to 1980-81 period. The landings of pomfrets did not exhibit any trend over the five year period. Its contribution to the fish landings in the district remained more or less of the same magnitude barring 1983. Similarly, the share of the district to the pomfret landings of state, except for 1981 remained more or less of the same magnitude. The penaeid prawn landings, which were the same order in 1980 and 1981 have increased considerably from 2103 tonnes in 1980 to 5547 tonnes in 1984 with peak landings of 6992 tonnes in 1983. Its contribution to the district landings, which was about 8% during 1980-81, has increased to 11% in 1984, with a maximum of 13% in 1983. Similarly, the share of the district to the penaeid prawn landings of the state, increased from 9% in 1980 to 13% in 1984 with a maximum of 19% in 1983.

Trawl nets contributed more than 90% of the mechanised landings of the district followed by gill nets, dol nets, hooks and lines and purse seines (which operated during 1984 only). The gearwise landings are given below.

		Trawl net	Gill net	Dol net	Hook & lines	Purse seine	Total
1980	c	10815	73	1103	—	—	11991
	f	38699	705	3178	—	—	42759
	u	279	104	347	—	—	
1981	c	10436	190	723	13	—	11362
	f	31599	3007	2741	78	—	37425
	u	330	63	264	167	—	
1982	c	27909	1186	—	—	—	29095
	f	105350	24764	—	—	—	30054
	u	265	48	—	—	—	
1983	c	35360	7432	56	86	—	42934
	f	95937	74591	155	673	—	171356
	u	369	100	367	128	—	
1984	c	25522	6493	37	788	589	33429
	f	61909	73427	318	2858	264	138776
	u	412	88	116	276	2231	

(c=catch in tonnes, f = effort in unit operations, u =catch per unit effort in Kg).

The total mechanised landings, have shown an increasing trend during the five year period, increasing from about 12,000 tonnes in 1980 to 33,429 tonnes in 1984, with a maximum of 42,934 tonnes in 1984. The contribution of the district to the total mechanised landings of the state increased from 6% in 1980 to 12% in

1984, reaching a maximum of 17% in 1983. A similar trend was observed in the landings by trawl nets during the five year period. However, its contribution to the total mechanised landings of the district which was 90% in 1980 reduced to 76% in 1984. The contribution of gill nets increased from 0.6% in 1980 to 19.4% in 1984. However, the dol net landings which accounted for 9.2% of the mechanised in 1980 became almost non-existent in 1984, experiencing a drastic reduction in catch and effort expended. The landings of purse seines were recorded in 1984 only, mainly employed for pelagic fishes like mackerel and oil sardine. The share of the district in the total trawl landings of the state fluctuated without any trend, ranging from 20% in 1980 to 32% in 1983. The share of gill nets in the total gill net landings of the state showed a substantial increase from 0.51% in 1980 to 28% in 1984 with a maximum of 33% in 1983. Although, the contribution of landings by hooks and lines during the five year period was only marginal, the share of the district to the total hooks and lines landings of the state increased tremendously from 2% in 1981 to 67% in 1984.

ANALYSIS AND CONCLUSIONS

For a detailed assessment of exploited fish stocks, micro and macro mathematical models can be used. The micro analytic models like Beverton and Holt yield model, cohort analysis etc. require knowledge of many parameters which affect the populations. These models can only be applied to individual species and understanding of the status of marine fisheries in an area requires assessment of the individual species. The macro analytic approaches like Schaeffer's model, Pella and Tomlinson model require a time series of data on catch and effort. These models are species and gear specific and as such can not be applied to a multispecies-multigear fisheries of Indian waters. The collection of micro data on various parameters of the multiplicity of species for application of micro analytic models is laborious, time consuming and because of many species supporting the fishery it may be impossible to collect all the relevant information owing to cost considerations. For using macro analytic models, species specific effort has to be evaluated, which is rather difficult when many species and gears are involved. Recently, there have been many studies to assess the stocks with the catch data alone. Alagaraja *et. al* (1982) proposed a new approach based on some assumptions. Alagaraja (1984) proposed an alternative model which he termed as "relative response model". In a commercially exploited fishery, he contended, the effort was regulated according to the catch, and the catches over a period of time would be inter related. For analysis of catch data in the state the approach followed by Alagaraja *et. al.* has been used. This involves analysis of the trend in the percentage contributions. The assumptions for the approach are,

- i) Equilibrium is maintained over the years in the fish stocks exploited in the coastal waters.
- ii) Fishery independent factors will have more or less uniform effect on the availability of exploited stocks.
- iii) Change in the pattern and intensity of fishing, such as introduction of mechanised craft etc. will also have uniform effect on the exploited fisheries.

Under these assumptions it is obvious that, though the absolute landings may vary over the years, the respective percentage contributions are expected to remain more or less the same.

The total marine fish landings during 1975-84 are depicted in figure 1. From the figure it could be noted that the landings fluctuated without exhibiting any



Fig. 1 Total landings (in lakh tonnes) in Maharashtra during 1975-'84.

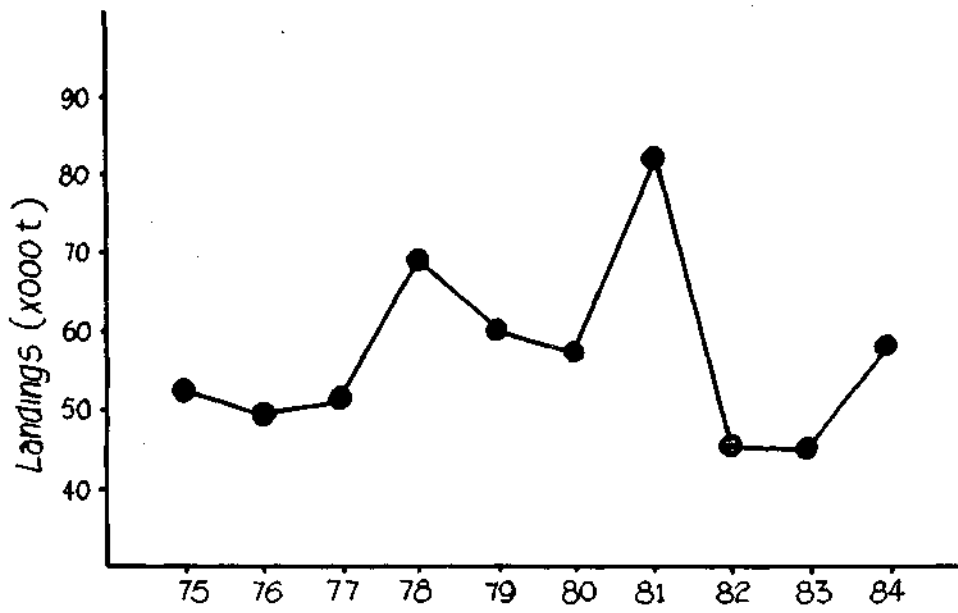


Fig. 2 Bombayduck landings (x000 t) during 1975.

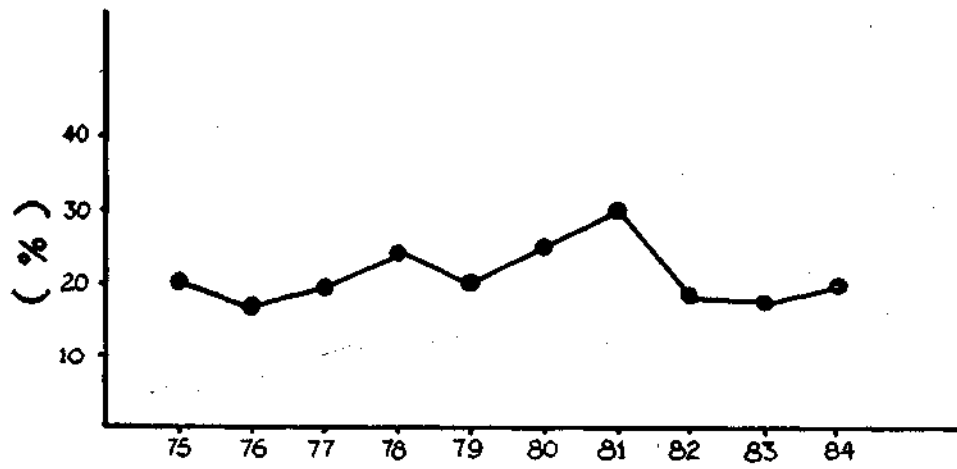


Fig. 3 Percentage composition of bombayduck in the total landings during 1975-'84.

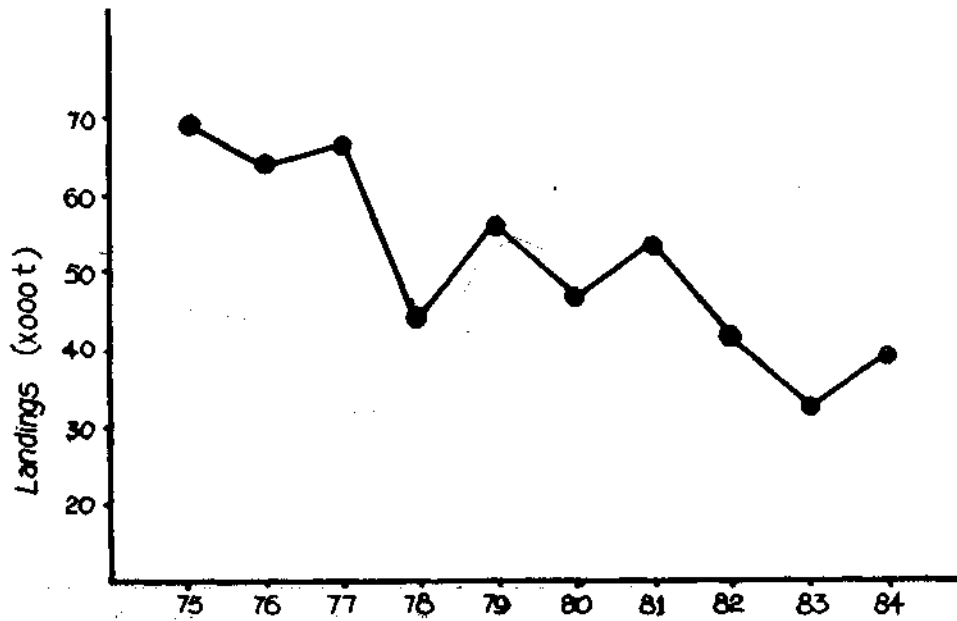


Fig. 4 Non-penaeid prawn landings (x000 t) during 1975-'84.

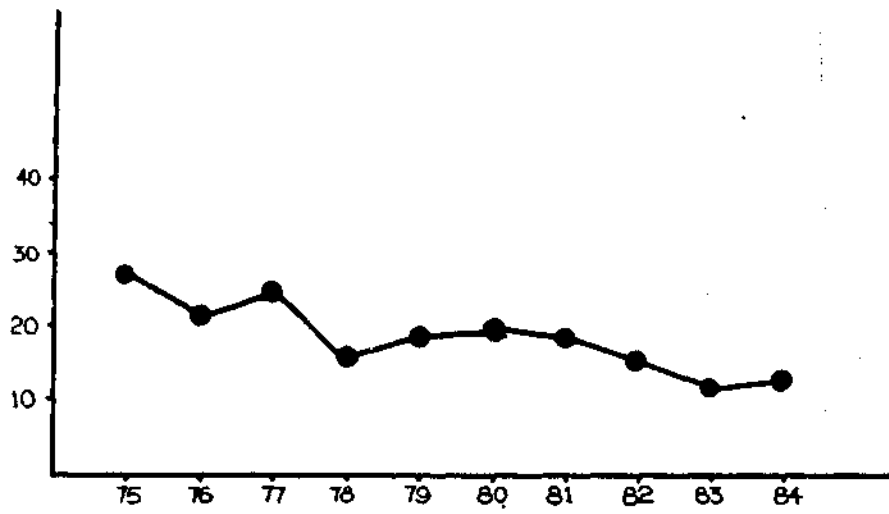


Fig. 5 Percentage composition of non-penaeid prawns in the total landings during 1975-'84.

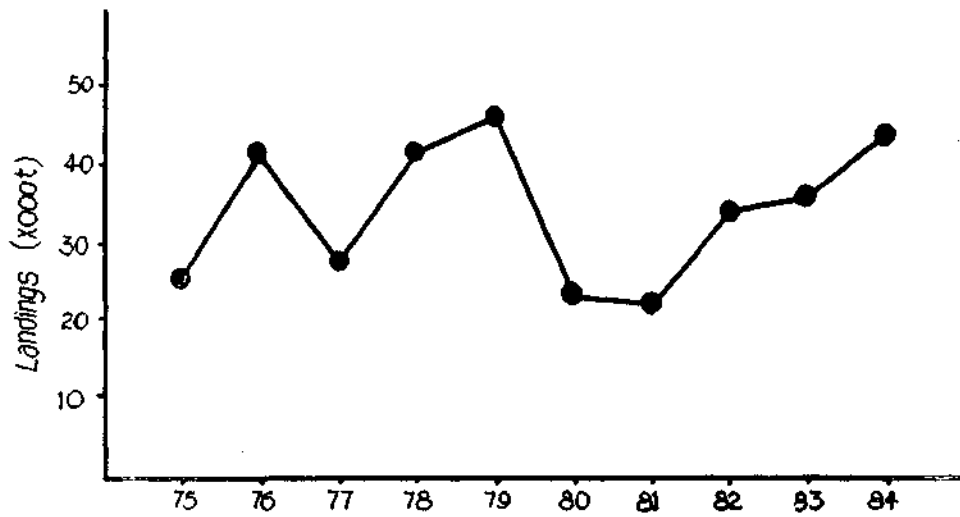


Fig. 6 Penaeid prawn landings (x000t) during 1975-'84.

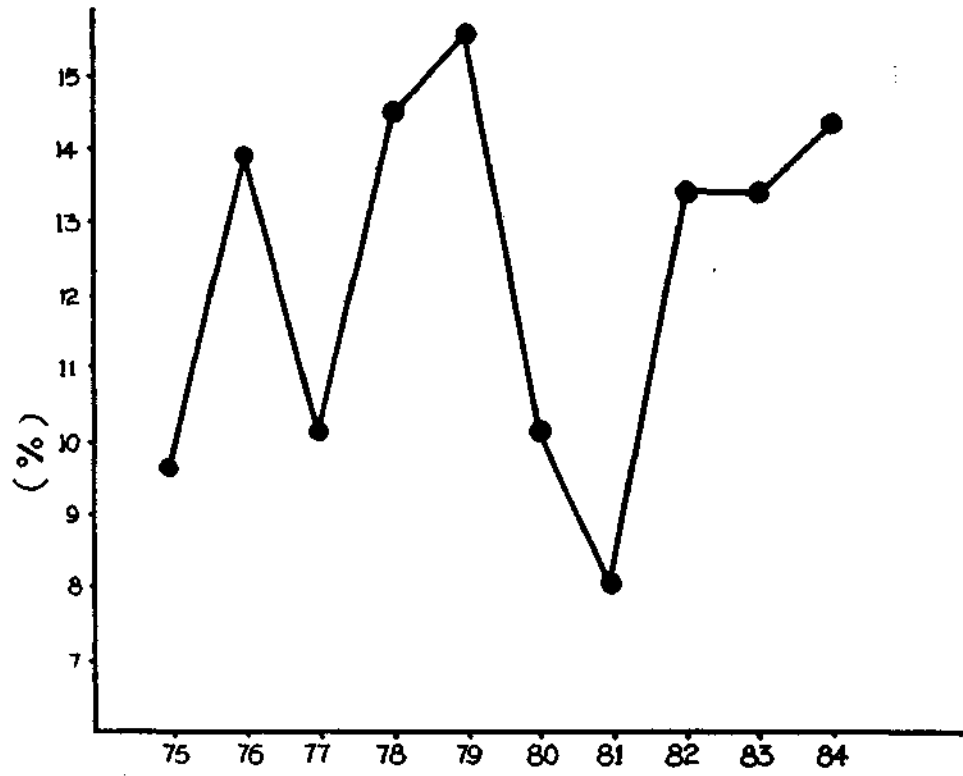


Fig. 7 Percentage composition of penaeid prawns in the total landings 1975-'84.

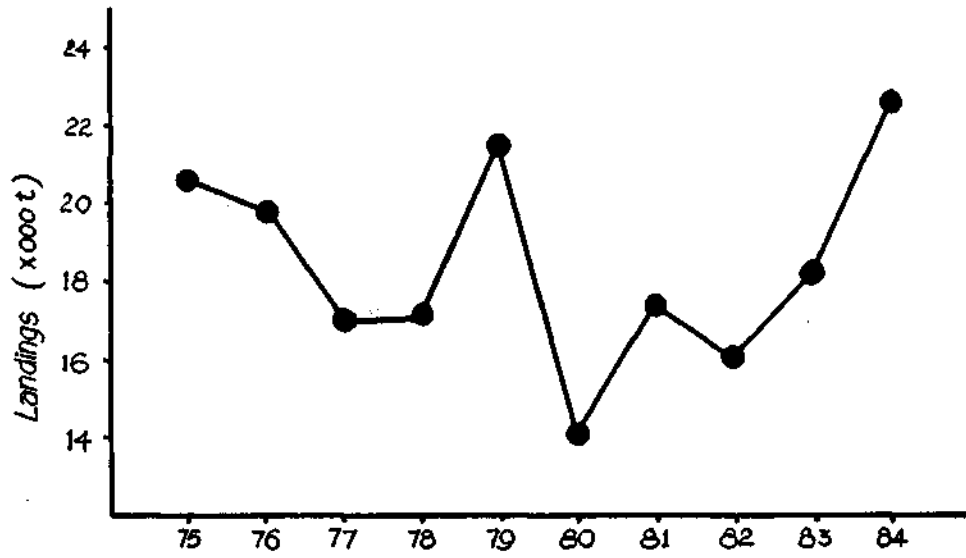


Fig. 8 Landings (x000 t) of croakers during 1975-'84.

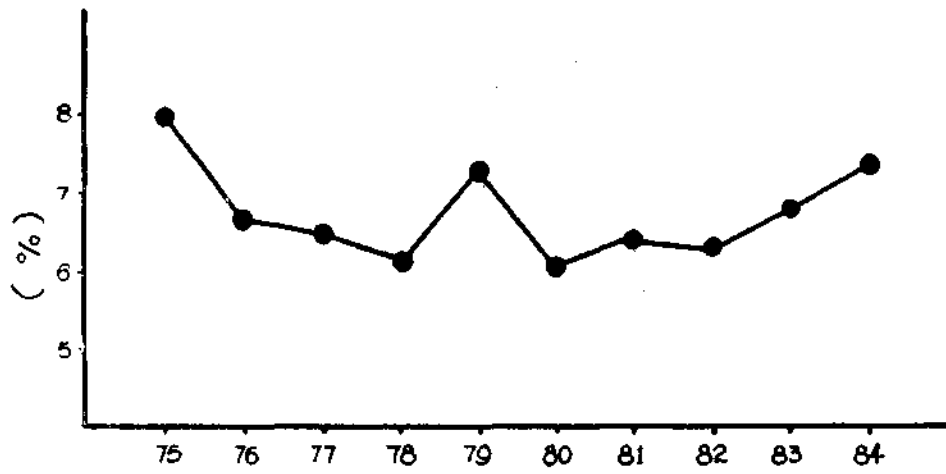


Fig. 9 Percentage composition of croakers in the total landings during 1975-'84.

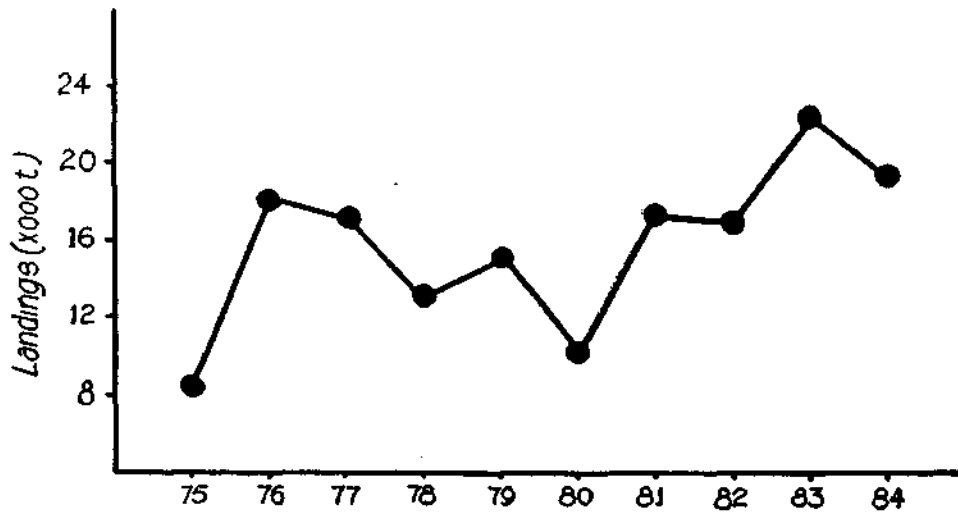


Fig. 10 Pomfret landings (x000,t) during 1975-'84.

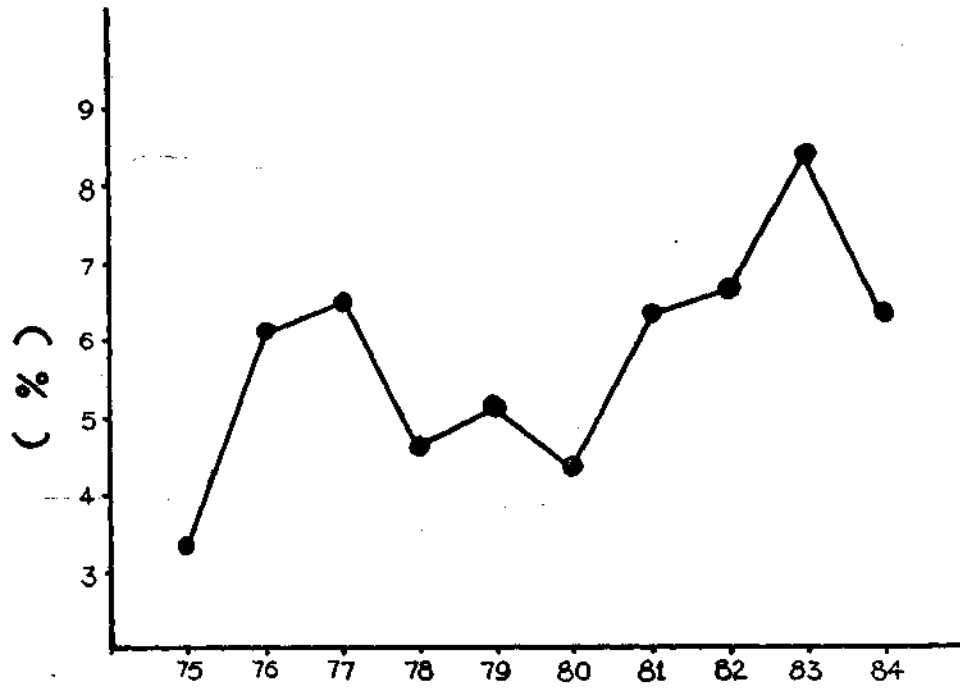


Fig. 11. Percentage composition of pomfrets in the total landings during 1975-'84.

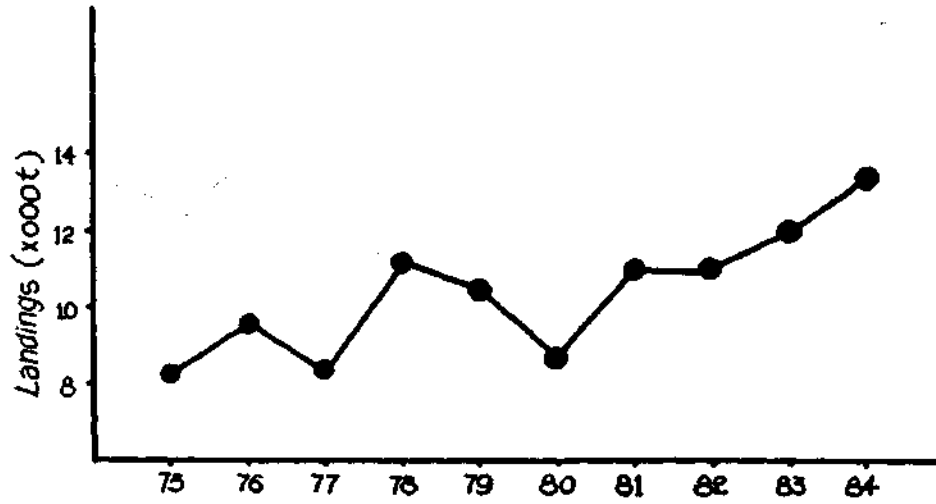


Fig. 12. Catfish landings (x000 t) during 1975-'84.

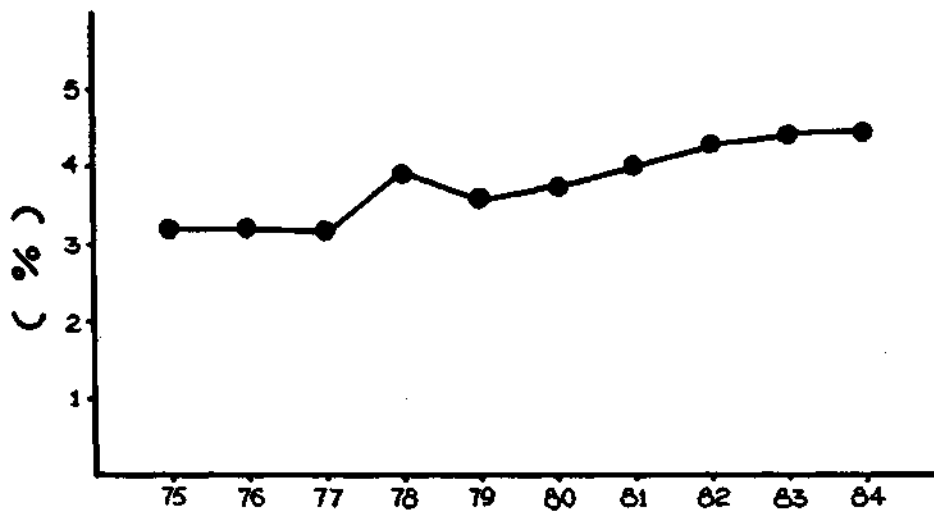


Fig. 13. Percentage composition of catfish in the total landings during 1975-'84.

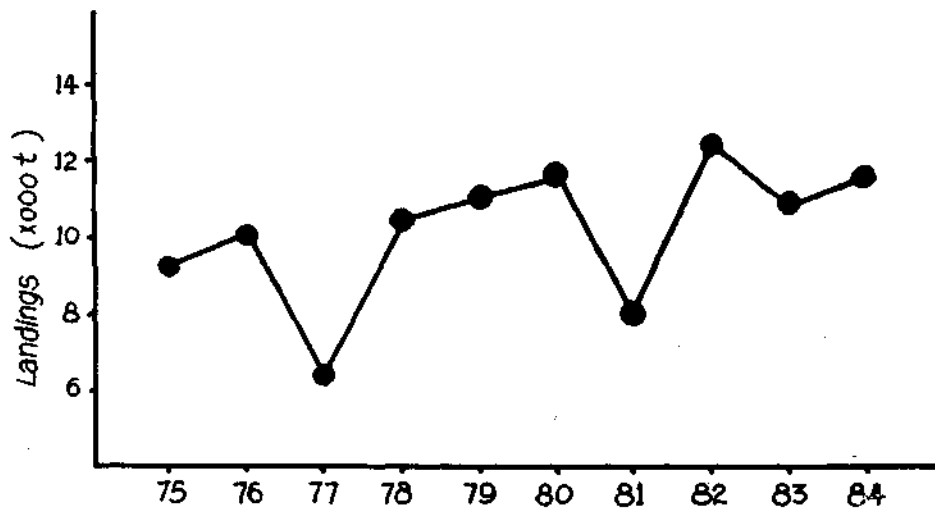


Fig. 14. Ribbonfish landings (x000 t) during 1975-'84.

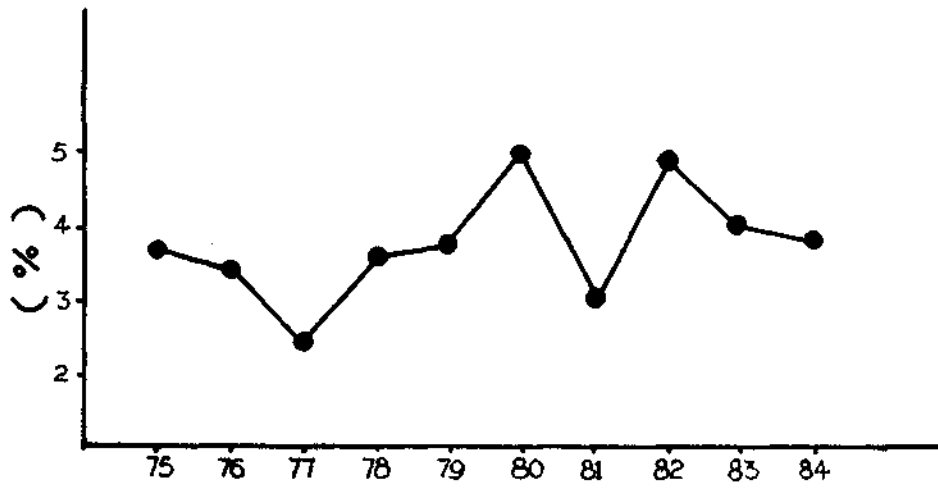


Fig. 15. Percentage composition of ribbonfish in the total landings during 1975-'84.

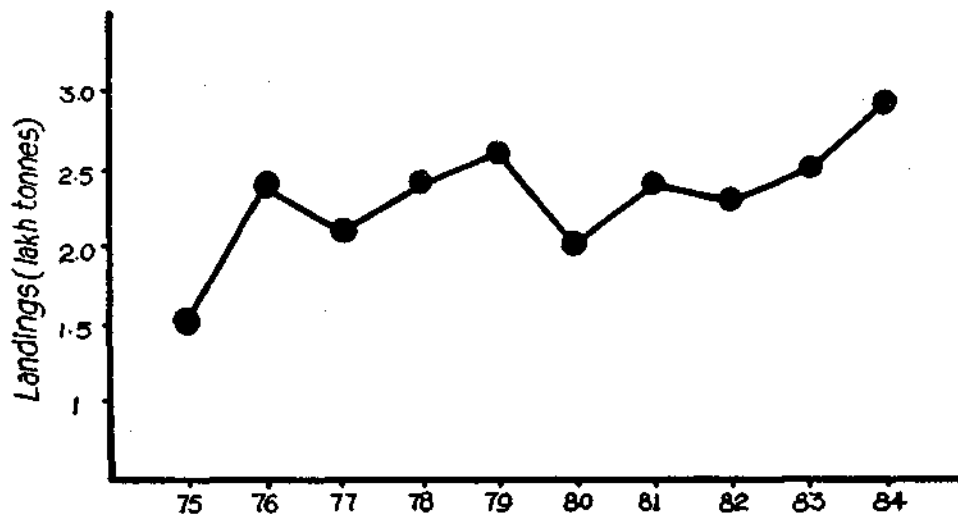


Fig. 16. Landings (in lakh tonnes) by the mechanised boats during 1975-'84

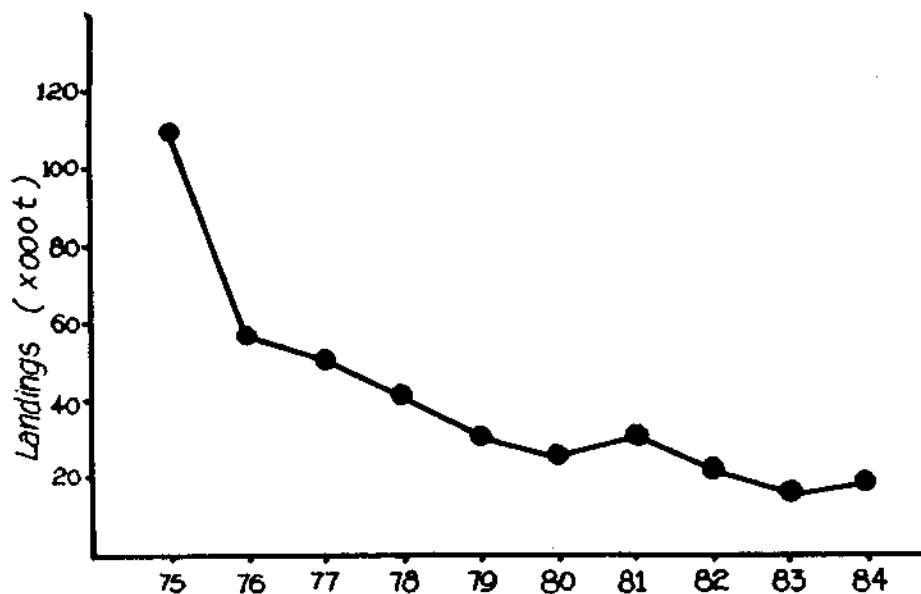


Fig. 17. Landings (x000 t) by the non-mechanised boats during 1975-'84

trend. However, during 1980-84 there seems to be a general increasing trend. This was mainly due to increased landings in the districts of Greater Bombay, Raigad and Ratnagiri. The landings in Thane district did not exhibit any trend. The overall fluctuations in the landings from 1975-84 can be attributed to the variations of the landings in Thane district. Apparently, when we consider the overall picture during the ten year period, it may be indicated that there may not be significant improvement in the landings. However, of late, during 1980-84 due to increased exploitation in Greater Bombay, Ratnagiri and Raigad districts, the catches in these districts have responded positively to the effort. So any increase in Maharashtra fish landings that may occur in future will be mainly from Greater Bombay, Raigad and Ratnagiri districts only.

The landings of the important components, namely, Bombayduck, non-penaeid prawns, penaeid prawns, croakers, pomfrets, catfish and ribbonfish and their percentage contribution to the total landings are depicted in figures 2-15. From the figures we observe that the landings of Bombayduck, penaeid prawns, croakers did not exhibit any trend at all. Their relative contributions also fluctuated during the ten year period. In the case of catfish (fig. 12) a general increasing trend was observed with a significant ($P < 0.05$) correlation coefficient ($r=0.817$). The data were smoothed by taking a three-point moving average, and found to fit the following trend line.

$$Y = 8081.762 + 374.702 t \quad (r = 0.927)$$

where Y = landings in tonnes at time t

t = the time variable ($2 \leq t \leq 9$)

The percentage contribution (fig. 13) also indicated an increasing trend.

In the case of ribbonfish (fig. 14) also, a general increasing trend was observed and the trend line fitted to the three point moving average was

$$Y = 7980.893 + 382.179 t \quad (r = 0.884).$$

However, the percentage contribution (fig. 15) did not indicate any trend during the ten year period.

Although the landings of pomfrets (fig. 10) did show an increasing trend with a correlation coefficient of 0.58, this was not significant enough to arrive at a trend line. A similar observation could be made of its percentage contribution (fig. 11).

One salient feature of the landings in the state was a significant decrease in the landings of non-penaeid prawns (fig. 4) during the ten year period, which is also reflected in its relative contribution to the total landings (fig. 5). The trend line for the 3-point moving average data was

$$Y = 71326.952 - 3687.06 t \quad (r = -0.97).$$

From the early seventies there has been a significant increase in the landings by mechanised craft and during the eighties the contribution from the non-mechanised craft dwindled to a mere 6% of the landings. The landings of non-mechanised craft during the ten year period 1975-84 are given in fig. 16. By taking a three point moving average the trend line obtained was $Y = 205963.08 + 4949.17 t$ ($r = 0.7335$). There was a significant decreasing trend in the non-mechanised landings (fig. 17). The three point moving average data resulted in the following exponential decay trend curve.

$$Y = 91513.92 \text{ Exp}(-0.1755 t) \quad (r = -0.9456).$$

This indicated a 16% decrease per year. From the trend of mechanised and non-mechanised craft landings, we may infer that in due course, if the present trend continues, the entire landings in the state may be accounted for by mechanised craft only and the non-mechanised craft may be phased out by motorising the country craft.

Although, the landings of catfish, ribbonfish and pomfrets did show increasing trend, this trend may not be reflected in the total landings of the state,

as that was mainly determined by the landings of Bombayduck and penaeid prawns which fluctuated widely over the ten year period.

Considering the trend in the landings in the recent five year period from 1980 to 1984, there was an increasing trend brought out because of increased landings in catfish, pomfrets and penaeid prawns. Except in Thane, in all the other three districts the landings exhibited an increasing trend. This was mainly due to increased mechanised landings in Greater Bombay, Raigad and Ratnagiri districts.

From the foregoing the following points emerge out.

1. There may not be significant improvement in the landings of Thane district. The catches may not respond positively to the increased effort.
2. Greater Bombay district shows promise of increased landings. This was mainly due to encouraging trend in the landings at New Ferry wharf. At this centre, during the five year period from 1980-84, increased effort resulted in higher catch rates.
3. The most salient feature of the fish landings in the state was considerable improvement over the years in the landings in the districts of Raigad and Ratnagiri. The fishing grounds off these two districts hitherto have not been fully exploited but of late, with increased effort in their fishing grounds produced higher catch rates resulting in increased catches over the last five years. Hence, these two districts hold a promise of yielding higher catches and contributing significantly to the state landings.

Potential yield

Many approaches have been made to assess the potential resources of EEZ. Earlier estimates were primarily based on primary production of seas around India and exploratory surveys etc. These estimates ranged from 2 million tonnes to 8.5 million tonnes per year for the Indian waters. (Subrahmanyam, 1959, Panikkar, 1966, Prasad *et.al* 1970, Cushing, 1971, Gulland, 1971, Jones and Banerji, 1973, Prasad and Nair, 1973, Shomura, 1976 and Silas *et. al* 1976). Some of the authors gave region wise estimates also. Jones and Banerji (1973) estimated the potential yield of Maharashtra waters as 2.62 lakh tonnes. George *et. al* (1977) while estimating the potential yield based on the rate of production, gave an estimate of 8.43 lakh tonnes for the north-west region which includes Maharashtra and Gujarat. Antony Raja (1974) arrived at an estimate of 3.53 lakh tonnes, in which 2.70 lakh tonnes obtainable in the 0-50 m depth zone.

From the above we see there are lot of variations in the estimates of potential yield of Maharashtra. From the ten year trend in landings we observe that the potential yield estimates corresponding to 0-50 m depth zone (or 0-70 m depth) are on the lower side, as the exploitation is almost entirely confined to this zone alone.

The district wise estimates of potential yields from 0-70 m depth zone given by Kalawar (1978) are furnished below.

District	Potential yield (tonnes)	Average* catch (tonnes)	Average** catch (tonnes)
Thane	95,000	1,50,078	1,00,583
Greater Bombay	57,000	1,40,672	1,02,066
Raigad	1,54,000	31,521	24,227
Ratnagiri	68,000	39,243	39,820
Total	3,74,000	3,61,514	2,66,696

(*) Average landings for four years from 1974-75 to 1977-78 as estimated by the State Government. (**) Average landings for the five year period from 1980-84 as estimated by CMFRI. From the above table we observe that the catches are higher than the potential yield in Greater Bombay and Thane districts. It may be due to the fact that the landings may include not only those by exploitation in the fishing grounds off these districts but also from else where.

Alagaraja (Mss, 1986) has proposed a procedure called 'maximum contribution approach' which would provide some indication on the potential harvestable yield that could be obtained. This involves considering the maximum catch over a period time as an indicator of potential yield. This approach was followed in the case of Maharashtra.

The potential harvestable yield that could be obtained under the conditions of exploitation during the period was obtained by taking into consideration the maximum catch of important components. The maximum catches of important groups during the ten year period resulted in a total of 3.70 lakh tonnes. The estimate is almost the same as obtained by Kalawar (*op cit.*) in the presently exploited zone. During 1984, the estimated total landings were about 3.10 lakh tonnes. Since the potential yield is estimated as 3.70 lakh tonnes, there is a scope to harvest the remaining 60,000 tonnes. To exploit this additional quantity the following suggestions are proposed.

During 1984, about 49.5% of the total landings is from the dol netters, 35.9% from the trawlers, 7.6% from the gill netters and the rest from the other

mechanised and non-mechanised craft. It has already been observed that the catches by the dol netters did not respond positively to the effort expended. The dol net landings during 1980 - 84 fluctuated widely mainly due to the fluctuations in the catches of Bombayduck and non-penaeid prawns. This indicates, perhaps, that any change in the effort may not have impact on the catches. However, during the last five years the landings by trawlers and gill netters increased with increase in the fishing effort. The relationship between the catch and effort by the trawlers was $C = 0.651 f^{1.004}$ ($r^2 = 0.90$) and for the gill netters it was $C = 12162.24 + 0.065 f$ ($r^2 = 0.77$), where, C is the catch in tonnes, f is the effort expended in unit operations and r is the correlation coefficient. This indicates that any addition to the total landings are likely to result from additional effort expended by the trawlers and gill netters. Using the above catch and effort relationship, with the effort level of 1984 as the base, the additional 60,000 tonnes are expected to be exploited with 40 and 50% increase in the efforts of trawlers and gill netters without any additional effort by the dol netters and other crafts. This increase could be made in a phased manner with initial increase of 20 and 25% in their respective efforts during the next five years, which is expected to yield an additional 30,000 tonnes to the present level of landings. After this, a reassessment could be made to study the effect of this change in the effort and any subsequent changes could be made based on the results of the reassessment. As already mentioned the districts of Greater Bombay, Ratnagiri and Raigad show a promise of higher landings. Adequate infrastructure facilities for berthing, processing and marketing etc are essential prerequisites for promotion of the industry. Compared to Thane and Greater Bombay districts, the southern districts of Raigad and Ratnagiri have less of these facilities. So the emphasis should be to provide more of such facilities in these districts.

With regular monitoring of the resources and proper management of human, material and marine resources the productive fishing grounds of Maharashtra will continue to yield higher and sustainable yields.

APPENDIX

QUARTERWISE AND SPECIESWISE MARINE FISH LANDINGS

	1975					1976				
	I	II	III	IV	Total	I	II	III	IV	Total
1. ELASMOBRANCHS	1686	1990	560	3931	8167	1532	1680	1154	2723	7089
2. EELS	246	204	26	625	1101	980	2086	55	1047	4168
3. CATFISHES	2341	1852	203	3840	8236	2779	2845	706	3192	9522
4. CLUPEIDS										
a. Wolf herring	490	351	49	2046	2936	554	545	131	1179	2409
b. Oil sardine	646	2	19	1032	1699	403	—	1236	738	2377
c. Other sardines	163	729	2	2209	3103	613	717	89	544	1963
d. Hilsa shad	7	4	—	5	16	—	—	114	40	154
e. Other shads	416	465	15	256	1152	114	221	58	268	661
f. Anchovies										
<i>Stolephorus</i>	8	—	27	498	533	62	4	18	125	209
<i>Thryssa</i>	361	233	84	249	927	294	238	35	709	1276
g. Other clupeids	3988	5078	904	11202	21172	5305	3694	1678	6267	16944
5. BOMBAYDUCK	4378	6370	3931	33966	51615	9739	15646	9364	14721	49470
6. LIZARD FISHES	41	49	3	125	218	277	770	—	42	1089
7. HALFBEAKS & FULLBEAKS	11	3	—	38	52	7	1	2	20	30
8. FLYING FISHES	—	—	—	2	2	—	—	—	—	—
9. PERCHES	213	622	530	1119	2484	146	117	133	1064	1460
10. GOATFISHES	—	4	—	99	103	302	195	—	—	497
11. THREADFINS	496	719	96	317	1628	243	2583	24	1275	4125
12. CROAKERS	4618	4728	2794	8436	20576	3351	7854	3628	4948	19781
13. RIBBON FISHES	2575	3588	419	2853	9435	1850	4846	970	2386	10052

TABLE-I

(TONNES) IN MAHARASHTRA DURING 1975-79

1977					1978					1979				
I	II	III	IV	Total	I	II	III	IV	Total	I	II	III	IV	Total
1915	2546	504	2781	7746	1724	2490	1105	4753	10072	3773	3238	1402	4103	12516
794	125	289	2641	3849	1159	883	295	3047	5384	2015	919	101	998	4033
4306	1337	503	2172	8318	4151	2461	1614	2855	11081	3649	2675	1239	2870	10433
675	246	174	1539	2634	1182	229	87	1561	3059	365	287	230	839	1721
63	—	—	45	108	—	—	—	—	—	—	—	12	4	16
245	221	26	532	1024	319	52	77	420	868	134	121	231	441	927
60	8	—	284	352	946	7	1	605	1558	329	131	98	513	1071
673	11	110	184	978	95	69	19	283	466	96	51	39	243	429
3	77	189	—	269	—	271	43	26	340	12	49	26	295	382
565	342	73	699	1679	529	428	166	698	1821	991	506	187	1148	2832
8013	6988	1945	5836	22782	3187	2864	968	6589	13608	4590	3563	991	6531	15675
14525	12140	4291	19847	50803	3520	7904	3983	53374	68781	9135	10749	9817	29966	59667
472	624	—	39	1135	461	816	216	322	1815	1710	265	174	225	2374
9	10	—	13	32	—	4	34	13	51	12	3	32	79	126
—	—	—	—	—	—	5	—	—	5	—	—	—	1	1
1746	921	7	299	2973	1217	2485	1302	1947	6951	1069	687	421	1048	3225
68	87	—	16	171	321	10	—	13	344	678	36	—	145	859
56	535	89	182	862	570	358	80	901	1909	720	407	84	389	1600
7758	3425	2533	3370	17086	4485	2954	2284	7479	17202	8448	5286	1942	5690	21366
2728	1308	559	1743	6338	2376	2631	1930	3463	10400	4583	2905	786	2709	10983

Name of fish	1975					1976				
	I	II	III	IV	Total	I	II	III	IV	Total
14. CARANGIDS										
a. Horse Mackerel	—	—	—	—	—	196	234	162	587	1179
c. Leather-jackets	41	24	5	75	145	19	11	25	66	121
d. Other carangids	548	287	42	1392	2269	211	329	16	103	659
15. SILVERBELLIES	6	479	—	8	493	—	—	—	—	—
16. BIG-JAWED JUMPER	181	231	1	18	431	48	33	215	347	643
17. POMFRETS	1336	2445	411	4159	8351	3371	5502	2221	6885	17979
18. INDIAN MACKEREL	1019	81	11	749	1860	434	4	355	1151	1944
19. SEER FISHES	144	233	67	1406	1850	304	148	246	1418	2116
20. TUNNIES	7	7	10	250	274	83	93	86	201	463
21. BILL FISHES										
22. BARRACUDAS	4	7	—	6	17	—	3	—	47	50
23. MULLET	—	2	10	18	30	—	4	127	60	191
24. UNICORN COD	157	432	4	450	1030	179	9	—	192	380
25. PLATFISHES										
c. Soles	53	58	11	365	487	279	559	312	403	1553
26. CRUSTACEANS										
a. Penaeid prawns	3033	2025	5216	14379	24653	11500	14314	8109	6849	40772
b. Non penaeid prawns	13321	23308	2309	30074	69012	13971	32854	4579	12298	63702
c. Lobsters	64	105	17	43	245	207	98	22	92	419
d. Crabs	531	—	—	35	550	18	20	5	8	51
e. Stomatopods										
27. CEPHALOPODS	50	110	15	307	482	747	897	388	456	2488
28. MISCELLANEOUS	1297	1798	793	5354	9242	3925	7435	7096	7159	25615
Total	44476	58623	18584	134936	256619	64043	106589	43359	79610	293610

TABLE-1 (Contd.)

1977					1978					1979				
I	II	III	IV	Total	I	II	III	IV	Total	I	II	III	IV	Total
496	189	18	464	1167	250	299	119	1231	1899	1093	522	219	480	2314
35	160	12	23	230	28	31	103	138	300	15	120	68	213	416
—	—	—	—	—	10	2	—	38	50	35	36	102	263	436
6	271	23	58	358	71	47	24	181	323	148	248	35	293	724
67	46	95	39	247	212	302	87	235	836	370	14	11	35	430
3442	5265	3421	5167	17295	2442	1513	888	8207	13050	2631	3475	2563	6272	14941
268	85	21	501	875	78	26	68	615	787	830	49	155	421	1455
466	882	422	1450	3220	341	160	247	2167	2915	269	354	1712	1692	4027
103	41	1	167	312	425	77	683	754	1939	227	355	529	661	1772
—	—	—	—	—	98	10	11	269	388	36	3	9	34	82
—	11	25	12	48	4	40	53	5	102	—	28	10	—	38
30	—	—	—	30	21	—	—	—	21	—	1	—	275	276
219	436	107	483	1245	611	455	199	411	1676	321	802	266	915	2304
9530	7559	3576	6010	26675	5917	6921	9449	18804	41091	12626	13258	5003	14751	45638
26511	27098	3978	9391	66978	11600	16318	1535	14802	44255	21063	21725	1881	11539	56208
215	14	7	198	434	179	39	114	275	607	280	102	54	63	499
25	46	12	10	93	28	56	64	—	148	60	354	69	36	519
88	143	26	339	596	359	1364	57	2777	4557	1047	1104	94	1714	3959
2727	5490	4157	3136	15510	3032	2355	2336	5862	13585	2196	1527	681	2648	7052
88902	78687	27193	69670	264452	51948	56936	30241	145119	284244	85710	75788	31260	100568	293326

QUARTERWISE AND SPECIESWISE MARINE FISH LANDINGS

Name of fish	1980					1981				
	I	II	III	IV	Total	I	II	III	IV	Total
1. ELASMOBRANCHS	2778	2002	749	2223	7752	—	—	—	—	—
a. Sharks	—	—	—	—	—	2875	1677	464	2455	7471
b. Skates	—	—	—	—	—	111	2	—	63	176
c. Rays	—	—	—	—	—	373	479	92	1084	2028
2. EELS	1586	880	39	649	3154	963	456	8	863	2290
3. CATFISHES	3892	3028	365	1368	8653	4261	2126	477	4181	11045
4. CLUPEIDS										
a. Wolf herring	803	204	197	835	2039	769	212	27	1910	2918
b. Oil sardine	6	22	8	627	663	278	45	23	276	622
c. Other sardines	169	272	450	472	1363	44	6	76	294	420
d. Hilsa shad	213	389	168	247	1017	146	156	—	278	530
e. Other shads	31	215	17	344	607	1162	210	93	736	2201
f. Anchovies										
<i>Coilia</i>	—	—	—	—	—	6049	4389	604	6122	17164
<i>Srolephorus</i>	47	12	6	13	78	27	12	—	16	55
<i>Thryssa</i>	111	778	133	249	1271	276	377	95	196	944
g. Other clupeids	5920	2814	358	7805	16897	503	252	97	2298	3150
5. BOMBAYDUCK	14263	8069	1481	33580	57393	21156	13333	5534	42113	82136
6. LIZARD FISHES	394	424	127	112	1057	282	561	95	370	1308
7. HALFBEAKS & FULL BEAKS	2	3	28	9	42	17	6	2	21	46
8. FLYING FISHES	—	—	—	—	—	—	—	—	—	—
9. PERCHES	1789	853	198	872	3712	—	—	—	—	—
a. Rock cods	—	—	—	—	—	19	9	—	90	118
b. Snappers	—	—	—	—	—	19	—	2	114	135
c. Pig-face breams	—	—	—	—	—	3	1	3	1	8
d. Threadfin breams	—	—	—	—	—	443	1237	157	319	2156
e. Other perches	—	—	—	—	—	50	4	9	137	200
10. GOATFISHES	14	1	48	398	461	30	400	—	552	982
11. THREADFINS	770	722	117	367	1976	452	52	45	162	711
12. CROAKERS	3899	2967	1776	5314	13956	5945	3775	934	6821	17475
13. RIBBON FISHES	3678	3249	1012	3611	11550	3059	1964	852	2173	8048
14. CARANGIDS										
a. Horse Mackerel	709	97	106	403	1315	59	6	21	49	135
b. Scads	—	—	—	—	—	—	—	—	—	—
c. Leather-jackets	53	108	74	122	357	55	69	79	157	360
d. Other carangids	57	72	82	178	389	396	171	49	398	1014

TABLE-2

(TONNES) IN MAHARASHTRA DURING 1980-84

1982					1983					1984				
I	II	III	IV	Total	I	II	III	IV	Total	I	II	III	IV	Total
3759	2822	680	1626	8887	3260	1861	532	2544	8197	2902	1478	768	2128	7276
164	64	151	732	1111	916	495	212	562	2185	1086	281	62	304	1733
592	409	248	1128	2377	1093	726	226	822	2867	1227	466	168	638	2499
1480	462	167	1734	3843	1869	718	45	383	3015	1451	436	142	839	2868
4036	2590	1175	3118	10919	4406	2592	597	4386	11981	5786	2487	958	4187	13418
1761	590	328	1678	4357	1361	358	617	2957	5293	2029	828	1034	2312	6203
49	97	106	99	351	20	—	9	80	109	799	40	17	431	1287
57	330	3	85	475	381	32	3	117	533	14	43	26	171	254
301	54	—	77	432	351	20	6	429	806	57	13	147	339	556
238	139	51	902	1330	432	253	90	831	1606	551	412	429	1133	2525
4397	2670	407	2934	10408	2498	2432	789	4617	10336	2262	1524	1129	6678	11593
55	4	14	18	91	122	37	15	29	203	1507	63	25	13	1608
784	498	397	288	1967	1271	386	139	500	2296	668	388	285	691	2032
694	437	310	1542	2983	1054	676	509	2038	4277	2006	880	874	1673	5433
10720	10452	1824	22166	45162	14532	9624	3191	18001	45348	8778	4552	5263	39774	58367
309	520	87	244	1160	1055	970	77	1134	3236	530	446	145	1049	2170
51	40	1	65	157	52	5	—	144	201	3	—	15	28	46
—	—	—	—	—	—	—	—	2	2	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
7	170	34	123	334	21	20	8	11	60	22	3	—	181	206
26	5	—	12	43	—	—	3	377	380	35	—	—	317	352
—	4	3	—	7	—	5	1	2	8	2	5	—	1	8
1304	1812	637	657	4410	2393	2575	269	684	5821	1441	653	505	2083	4682
31	69	264	558	922	911	652	185	227	1975	275	81	93	152	601
164	633	382	541	1720	368	380	126	564	1438	141	136	96	543	916
172	132	76	102	482	163	94	105	130	492	144	98	99	159	500
4817	4424	1933	4752	15926	5938	2562	1187	8554	18241	6131	2172	4146	10136	22585
4298	4443	1424	2190	12355	3086	2023	710	5078	10897	3407	1877	1037	5291	11612
44	100	37	15	196	12	64	2	305	383	86	60	25	341	512
—	—	4	17	21	—	—	—	—	—	—	—	—	—	—
101	215	42	265	623	95	45	102	1018	1260	18	42	61	899	1020
242	487	220	850	1799	965	473	126	1449	3013	881	153	83	2821	3938

TABLE-2 (Contd.)

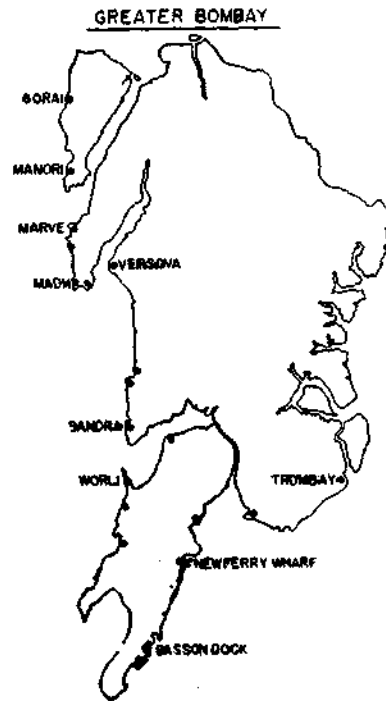
1982					1983					1984				
I	II	III	IV	Total	I	II	III	IV	Total	I	II	III	IV	Total
107	28	32	2	169	37	852	14	26	929	113	870	1	32	1016
521	1051	366	581	2519	1171	431	122	1422	3146	861	180	33	1401	2475
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
587	866	206	1036	2695	775	487	203	1651	3116	735	417	268	1295	2715
3661	1500	1536	7430	14127	2282	1585	2486	13053	19406	3497	2002	3568	7410	16477
5	13	—	—	18	—	—	—	1	1	—	—	—	—	—
68	24	8	158	258	154	19	1	244	418	355	27	—	603	985
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
497	242	381	1193	2313	400	211	76	1799	2486	525	121	104	911	1661
386	167	166	483	1202	737	320	394	3258	4709	603	400	457	1636	3096
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
174	—	—	71	245	81	28	482	983	1574	224	79	644	1713	2660
—	4	—	—	4	—	—	39	833	872	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
75	71	627	2170	2943	100	11	67	—	178	90	—	—	62	152
61	81	12	37	191	35	19	—	45	99	45	9	7	123	184
—	102	25	61	188	29	49	7	193	278	3	9	7	196	215
4	18	5	—	27	4	41	109	2	156	8	37	1	13	59
11	51	—	7	69	6	5	2	118	131	327	119	—	2204	2650
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
4	37	63	320	424	197	184	52	368	801	99	38	27	390	554
5	—	—	—	5	—	—	—	—	—	—	—	—	—	—
555	1121	399	474	2549	709	549	127	1319	2704	810	506	258	2950	4524
6261	3810	9432	14411	33914	7161	4521	8235	16110	36027	7939	3612	17206	15177	43934
5754	22148	944	11963	40809	9744	9641	1041	11708	32134	10324	6450	1867	20589	39230
280	183	104	160	727	87	63	101	78	329	139	203	109	512	963
146	218	57	53	474	158	51	61	59	329	419	89	167	115	790
285	2112	—	—	2397	1142	—	—	—	1142	1466	371	1	—	1838
1058	756	222	2745	4781	1480	912	173	4048	6613	1693	632	165	5160	7650
1826	1357	484	1865	5532	2040	1070	581	1928	5619	1623	948	697	2389	5657
62984	70612	26074	93759	253429	77054	51127	24254	117221	269656	76137	36736	43219	150193	306285
240	300	84	213	837	310	106	179	218	813	186	159	120	266	731

**SPECIESWISE MARINE FISH LANDINGS (IN TONNES) BY
MECHANISED CRAFT IN MAHARASHTRA DURING 1980-84**

Name of fish	1980	1981	1982	1983	1984
1. ELASMOBRANCHS	5720				
a. Sharks	—	4320	6092	7094	6010
b. Skates	—	176	1111	2173	1728
c. Rays	—	2019	2343	2838	2410
2. EELS	3149	2290	3824	3003	2865
3. CATFISHES	7119	8034	8008	10471	10147
4. CLUPEIDS					
a. Wolf herring	981	2101	3485	4733	5309
b. Oil sardine	97	427	96	50	562
c. Other sardines	209	144	118	188	110
d. Hilsa shad	146	86	198	550	443
e. Other shads	588	2175	1301	1584	2507
f. Anchovies	—	—	—	—	291
<i>Coltia</i>	—	16305	10195	10096	10994
<i>Stolephorus</i>	23	16	49	126	1430
<i>Thryssa</i>	599	471	1343	1222	1679
g. Other clupeids	16236	2691	2705	4281	5274
5. BOMBAYDUCK	56580	79629	43906	44851	58269
6. LIZARD FISHES	1035	1297	1089	3178	1955
7. HALFBEAKS & FULLBEAKS	1	9	38	17	38
8. FLYING FISHES					
9. PERCHES	3400	—	—	—	—
a. Rock cods	—	66	309	39	193
b. Snappers	—	136	43	378	340
c. Pig-face breams	—	—	—	—	—
d. Threadfin breams	—	2106	4409	5662	4186
e. Other perches	—	153	878	1826	527
10. GOATFISHES	452	982	1710	1432	902
11. THREADFINS	1850	421	470	489	495
12. CROAKERS	11584	14394	14023	16172	19763
13. RIBBON FISHES	10495	7122	11987	10755	10715
14. CARANGIDS					
a. Horse Mackerel	—	82	182	354	509
b. Scads	—	—	—	—	7
c. Leather-jackets	125	216	355	1189	1014
d. Other carangids	739	281	1301	2849	2395

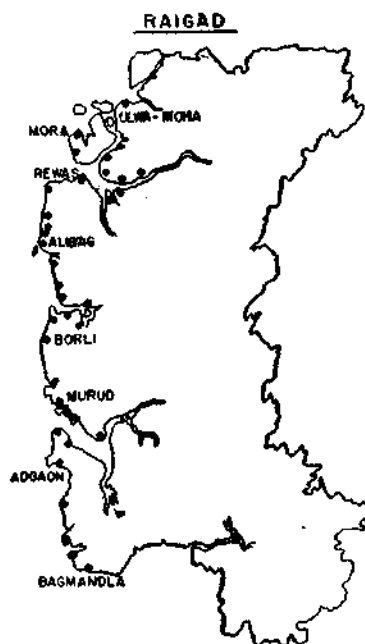
II. GREATER BOMBAY DISTRICT

- 1 Gorai
- 2 Manori
- 3 Marve-Malvani
- 4 Yerrangal Bhati
- 5 Madh
- 6 Pat-Wadi
- 7 Versova
- 8 Danda East (Juhu Tara)
- 9 Danda West
- 10 Chimbai (Bandra)
- 11 Mahim Bazaar-Causeway
- 12 Worli
- 13 Worli Seaface
- 14 Patel Stadium-Haji Ali Durga
- 15 Cooperage (Cuffe Parade)
- 16 Sasson Dock
- 17 New Ferrywharf
- 18 Sewri
- 19 Mahul
- 20 Trombay



III RAIGAD DISTRICT

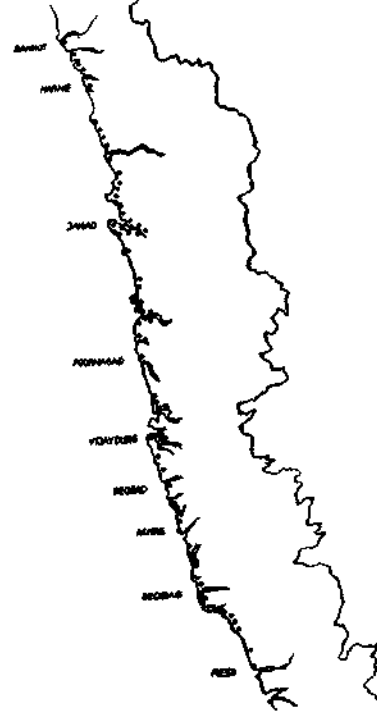
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|----|--------------------|--------------|-------------------|---------------------|
| 1 | Ulwa-Moha | 27 | Dande | |
| 2 | Mora | 28 | Dighi | |
| 3 | Kelwane | 29 | Kudgaon | |
| 4 | Navapada-Karanja I | 30 | Adgaon (Kumbhari) | |
| 5 | Sudki-Pada | } Karanja II | 31 | Bharatkol-Diva Agar |
| | Bapdeo-Pada | | 32 | Jivana |
| | Kondhari-Pada | | 33 | Mulgaon Danda |
| | Kasala-Pada | | 34 | Bagmandla |
| 6 | Dighode | | | |
| 7 | Varedi | | | |
| 8 | Revas-Gadina | | | |
| 9 | Sasawne | | | |
| 10 | Navgaon | | | |
| 11 | Thal | | | |
| 12 | Versoli-Chalmeda | | | |
| 13 | Alibag | | | |
| 14 | Sakharaxi | | | |
| 15 | Theronda | | | |
| 16 | Revdanda | | | |
| 17 | Agrao | | | |
| 18 | Salav | | | |
| 19 | Korlai | | | |
| 20 | Borle-Mandle | | | |
| 21 | Nandgaon Majgaon | | | |
| 22 | Murud | | | |
| 23 | Ekdara | | | |
| 24 | Khora Bander | | | |
| 25 | Rajpuri | | | |
| 26 | Khamda | | | |



IV. SINDHUDURG & RATNAGIRI DISTRICT

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|----|-----------------------------------|----|-------------------------------|
| 1 | Vashvi-Bankot | 27 | Kalbađevi |
| 2 | Kelshi | 28 | Sakhartar-Kasarveli |
| 3 | Ade | 29 | Jaki Mirya-Bhati Mirya |
| 4 | Paj | 30 | Miskarvada |
| 5 | Harne Port | 31 | Bhagavathi Bander (Gabitvada) |
| 6 | Boorondi | 32 | Rajivada |
| 7 | Panchavadi (Kolthare) | 33 | Karla |
| 8 | Oni-Bhati | 34 | Bhatia-Phansop |
| 9 | Dabhol | 35 | Golap-Pawas |
| 10 | Veldur-Navanagar-Dhopave-Anjanvel | 36 | Pooruagad-Ambare-Gaokhadi |
| 11 | Asgoli | | |
| 12 | Palshet | | |
| 13 | Budhal | | |
| 14 | Boria | | |
| 15 | Kondkarul | | |
| 16 | Velleshwar | | |
| 17 | Sakhar-Hedvi | | |
| 18 | Padve | | |
| 19 | Navanagar | | |
| 20 | Kudli | | |
| 21 | Jambhari | | |
| 22 | Kharvivada (Dhakti Jambhari) | | |
| 23 | Chinch Bander | | |
| 24 | Jaigad | | |
| 25 | Sakhar Jaigad | | |
| 26 | Varvade | | |

SINDHUDURG AND RATNAGIRI



- | | | | |
|----|---------------------|----|--------------------|
| 37 | Ambolgad | 52 | Sarjekot (Kolam) |
| 38 | Sakrinate | 53 | Dhurivada |
| 39 | Vadap | 54 | Makarobagh-Medha |
| 40 | Vijayadurg | 55 | Dandi-Wairi |
| 41 | Phanse-Kalmaivadi | 56 | Tarkarli-Kalethar |
| 42 | Padavne | 57 | Deobag |
| 43 | Anandavadi (Deogad) | 58 | Mobar-Bhogave |
| 44 | Mithmumbri | 59 | Kochra-Nivati |
| 45 | Katwan-Kunkeshwar | 60 | Khavans |
| 46 | Mithbaon (Tamaideg) | 61 | Kelus |
| 47 | Morvevadi | 62 | Wayangani-Dabholi |
| 48 | Achara | 63 | Navabag-Dabhosvada |
| 49 | Wayangani | 64 | Muth-Ubhadanda |
| 50 | Tondavali | 65 | Mochemad |
| 51 | Talashil | 66 | Arvali-Taak |
| | | 67 | Shiroda-Reddi |