

AN APPRAISAL OF THE RIBBONFISH FISHERY IN INDIA WITH SPECIAL REFERENCE TO MECHANISED FISHING*

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ABSTRACT

Ribbonfishes comprising mainly of *Trichiurus lepturus* contributed 4% of the total marine fish production in India during the period 1976-85. Seasonal catch trend along the different maritime States and the role played by the mechanised boats in augmenting production have been described. Based on the findings of the exploratory fishing vessels of the Fishery Survey of India especially along the west coast potential resources of ribbonfish in different areas have been identified in various depth zones. It has been suggested to tap the resource by the mechanised sector beyond the coastal waters as the fishery is underexploited at present.

INTRODUCTION

THE RIBBONFISHES of the family Trichiuridae especially contributed by *Trichiurus lepturus* Linnaeus is an important pelagic resource exploited in the Indo-Pacific region. Ribbonfish landings from the eastern Indian Ocean and western central Pacific have been estimated at 26,500 t (Fischer and Whitehead, 1974) whereas the recent estimates from western Indian Ocean is around 30,000 t (Fischer and Bianchi, 1984). Contributing to about 4% of the total marine fish catch, the ribbonfishes constitute one of the important fisheries exploited from the Indian seas. Apart from the traditional fishery in the shallow coastal waters along the Indian coasts, intensification of mechanised fishing has paved the way for a better exploitation of the resource in recent years.

Though some information is available on the ribbonfish fishery in different places and periods (Jacob, 1949; Gupta, 1967; James, 1967, 1973; Rao, 1973; Rao, 1977; Sastry, 1980;

Kasim and Khan, 1985; James *et al.*, 1986), still there exist lacunae in our knowledge regarding the causative factors for the high variability in the spatial distribution, area of abundance, etc. of this migratory species. The present investigation attempts to throw light on certain salient aspects of the fishery with special reference to mechanised fishing along the Indian Coast during the period 1976-85.

Seasonal fluctuations of the fishery based on quarterwise catch trend along the Indian Coast and the part played by the mechanised sector in augmenting the ribbonfish production together with the potential areas in different depth zones along the west coast as evidenced from the findings of the Fishery Survey of India exploratory vessels are studied to gather information on the fishery.

Seasonal trend of the fishery along the Indian Coast

During the period 1976-85, ribbonfishes contributed to an estimated average of 58,450 t in the country forming 4% of the total marine fish catch. The study revealed that Kerala, Tamil Nadu and Maharashtra landed an annual average of more than 10,000 t of ribbonfishes

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(Table 1). The catch trend of ribbonfish production in different maritime States and

Union Territory is indicated in Fig. 1. The percentage contribution of the resource to total

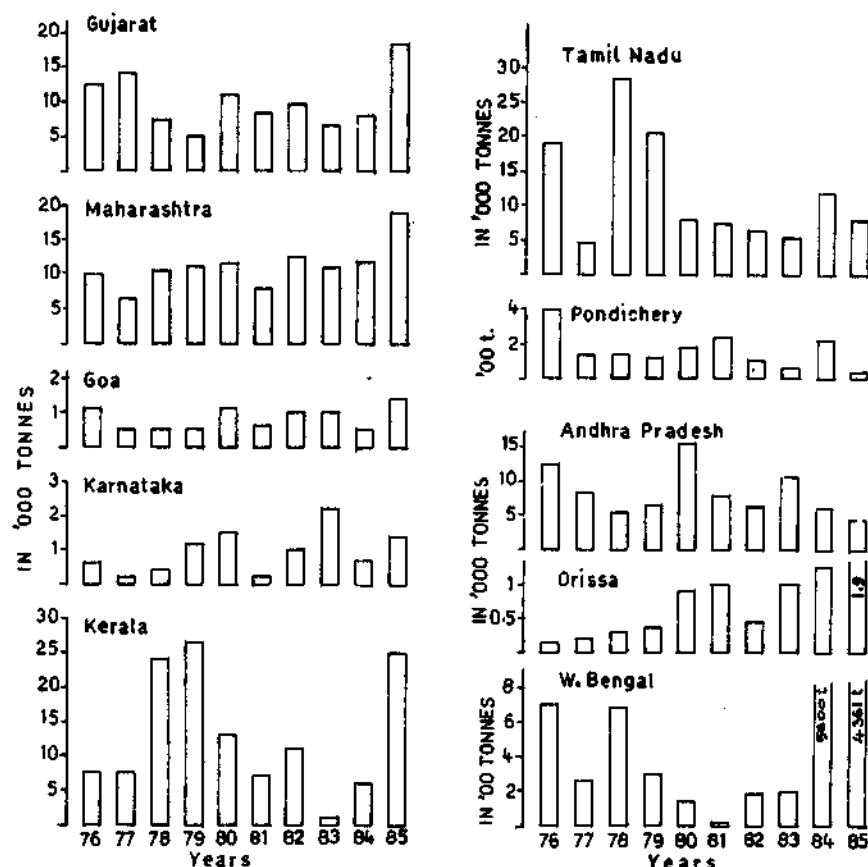


Fig. 1. Ribbonfish landings in the maritime States/Union Territory of India during 1976-85.

TABLE 1. Average ribbonfish production (in tonnes) and the percentage contribution to total fish landings during 1976-85 along the Indian Coast

States/Union Territory	Average landings (in tonnes)	Percentage to total fish catch
Gujarat	9,953	3.31
Maharashtra	11,127	3.96
Goa	833	2.52
Karnataka	961	0.77
Kerala	12,881	3.83
Tamil Nadu	12,032	5.24
Pondichery	165	1.45
Andhra Pradesh	8,507	7.26
Orissa	741	2.00
West Bengal	1,250	6.86
All India	58,450	4.00

fish landings accounted more than 5% in Tamil Nadu, Andhra Pradesh and West Bengal during the period.

Studies on the quarterwise catch of ribbonfishes with the percentage contribution to total fish landings in the maritime States and Union Territory are summarised hereunder so as to evaluate the recent trend of the fishery along the Indian Coast during the period, the results of which are represented in Tables 2-11.

With an average of 9,953 t forming 3.31% of the total fish catch, Gujarat contributed to a sizable share in the ribbonfish fishery.

TABLE 2. *Quarterwise ribbonfish production (in tonnes) in Gujarat and percentage contribution to total fish landings during 1976-85*

Years	I Quarter		II Quarter		III Quarter		IV Quarter		Total	
	Ribbonfish catch	percentage	Ribbonfish catch	Percentage	Ribbonfish catch	Percentage	Ribbonfish catch	Percentage	Ribbonfish catch	Percentage
1976	1,553	4.17	2,139	16.15	497	7.57	8,152	7.14	12,341	7.20
1977	5,700	1.72	4,403	1.09	745	0.92	3,332	1.35	14,180	1.33
1978	2,480	6.11	1,038	4.40	256	1.31	3,170	2.68	6,944	3.44
1979	1,265	2.18	783	4.22	944	3.51	1,499	1.70	4,491	2.35
1980	2,921	4.97	4,313	14.91	81	0.88	3,543	3.32	10,858	5.34
1981	2,435	3.98	2,557	5.49	252	1.79	3,083	2.74	8,327	3.56
1982	3,566	5.21	4,173	9.19	277	1.64	1,458	1.90	9,474	4.57
1983	1,289	2.24	1,932	3.70	27	0.21	3,057	3.29	6,305	2.93
1984	2,304	3.22	3,380	6.57	130	1.01	2,158	1.88	7,972	3.18
1985	3,446	3.14	4,885	11.78	110	0.68	10,201	8.48	18,642	6.97
Average	2,696	3.69	2,960	7.75	332	1.95	3,965	3.45	9,953	4.09

TABLE 3. *Quarterwise ribbonfish production (in tonnes) in Maharashtra and percentage contribution to total fish landings during 1976-85*

Years	I Quarter		II Quarter		III Quarter		IV Quarter		Total	
	Ribbonfish catch	percentage	Ribbonfish catch	Percentage	Ribbonfish catch	Percentage	Ribbonfish catch	Percentage	Ribbonfish catch	Percentage
1976	1,850	2.89	4,846	4.55	970	2.24	2,386	3.00	10,052	3.42
1977	2,728	3.07	1,308	1.66	559	2.06	1,743	2.50	6,338	2.40
1978	2,376	4.57	2,631	4.62	1,930	6.38	3,463	2.39	10,400	3.66
1979	4,583	5.37	2,905	3.83	786	2.51	2,709	2.69	10,983	3.74
1980	3,678	5.64	3,279	6.13	1,012	6.44	3,611	3.71	11,580	4.98
1981	3,059	3.86	1,964	2.81	852	5.65	2,173	2.00	8,048	2.95
1982	4,298	6.82	4,443	6.29	1,424	5.46	2,190	2.34	12,355	4.88
1983	3,086	4.00	2,023	3.96	710	2.93	5,078	4.33	10,897	4.04
1984	3,407	4.48	1,877	5.12	1,037	2.40	5,291	3.53	11,612	3.79
1985	2,255	2.81	3,069	4.94	1,275	4.15	12,410	7.63	19,009	5.66
Average	3,132	4.35	2,834	4.39	1,056	4.02	4,105	3.41	11,127	3.95

TABLE 4. *Quarterwise ribbonfish production (in tonnes) in Goa and percentage contribution to total fish landings during 1976-85*

Years	I Quarter		II Quarter		III Quarter		IV Quarter		Total	
	Ribbonfish catch	Percentage	Ribbonfish catch	Percentage	Ribbonfish catch	Percentage	Ribbonfish catch	Percentage	Ribbonfish catch	Percentage
1976	555	4.58	496	7.75	24	0.52	48	0.41	1,123	3.21
1977	222	2.59	198	4.37	10	0.30	19	0.22	449	1.81
1978	249	2.64	222	4.47	11	0.31	22	4.24	504	1.85
1979	271	3.08	248	5.34	12	0.36	23	0.27	554	2.16
1980	789	8.65	242	1.40	6	1.17	52	0.52	1,089	4.46
1981	408	3.52	224	4.47	3	0.06	14	0.11	649	1.88
1982	331	2.73	653	12.07	19	0.36	29	0.20	1,032	3.03
1983	359	2.57	602	6.45	3	0.10	97	0.85	1,061	2.82
1984	145	1.13	205	4.32	50	0.64	12	0.10	472	1.23
1985	790	4.98	533	4.35	43	1.01	36	0.22	1,402	2.87
Average	412	3.65	368	5.45	18	0.48	35	0.71	833	2.53

TABLE 5. *Quarterwise ribbonfish production (in tonnes) in Karnataka and percentage contribution to total fish landings during 1976-85*

Years	I Quarter		II Quarter		III Quarter		IV Quarter		Total	
	Ribbonfish catch	Percentage	Ribbonfish catch	Percentage	Ribbonfish catch	Percentage	Ribbonfish catch	Percentage	Ribbonfish catch	Percentage
1976	77	0.14	253	2.22	41	0.84	212	0.84	583	0.61
1977	70	0.37	60	0.60	55	0.63	52	0.09	237	0.24
1978	73	0.23	111	0.71	169	0.47	51	0.07	404	0.26
1979	162	0.52	270	1.39	626	4.83	127	0.20	1,185	0.94
1980	455	1.47	555	4.54	75	0.40	414	0.78	1,499	1.30
1981	43	0.10	97	0.60	89	0.46	1	---	230	0.15
1982	98	0.19	753	2.77	70	0.36	137	0.25	1,058	0.68
1983	344	1.33	611	2.69	192	1.06	1,117	2.49	2,264	2.03
1984	120	0.45	248	1.79	119	0.31	244	0.50	731	0.58
1985	88	0.45	398	2.85	204	0.93	725	1.14	1,415	1.19
Average	153	0.53	336	2.02	164	1.03	308	6.40	961	0.80

TABLE 6. *Quarterwise ribbonfish production (in tonnes) in Kerala and percentage contribution to total fish landings during 1976-85*

Years	I Quarter		II Quarter		III Quarter		IV Quarter		Total	
	Ribbonfish catch	Percentage	Ribbonfish catch	Percentage	Ribbonfish catch	Percentage	Ribbonfish catch	Percentage	Ribbonfish catch	Percentage
1976	480	0.66	1,419	2.10	5,328	7.30	460	0.39	7,687	2.32
1977	37	0.06	262	0.48	6,852	5.65	289	0.26	7,440	2.16
1978	1,153	1.95	3,418	6.07	17,984	12.94	1,652	1.39	24,207	6.48
1979	92	0.15	2,547	4.19	20,770	18.06	2,309	2.50	25,718	7.78
1980	48	0.09	1,175	1.71	11,577	11.83	137	0.23	12,937	4.63
1981	36	0.08	579	1.47	6,178	8.22	273	0.23	7,066	2.58
1982	15	0.02	1,281	2.15	9,210	9.22	528	0.56	11,034	3.39
1983	27	0.03	42	0.07	871	0.93	172	0.12	1,112	0.29
1984	42	0.05	2,457	3.55	3,672	3.09	293	0.26	6,464	1.04
1985	135	0.18	3,857	7.18	14,024	13.54	7,126	7.78	25,142	7.72
Average	207	0.33	1,704	2.90	9,647	9.08	1,324	1.37	2,514	3.84

TABLE 7. *Quarterwise ribbonfish landings (in tonnes) in Tamil Nadu and percentage contribution to total fish landings during 1976-85*

Years	I Quarter		II Quarter		III Quarter		IV Quarter		Total	
	Ribbonfish catch	Percentage	Ribbonfish catch	Percentage	Ribbonfish catch	Percentage	Ribbonfish catch	Percentage	Ribbonfish catch	Percentage
1976	280	0.54	1,805	4.25	14,686	17.80	2,283	4.64	19,054	8.43
1977	335	0.77	1,192	2.97	2,348	4.14	719	1.09	4,594	2.23
1978	321	0.60	2,279	5.25	25,745	34.76	319	0.76	28,664	13.46
1979	266	0.43	1,360	2.72	18,880	27.99	534	0.97	21,040	8.95
1980	576	1.14	784	1.36	5,758	10.39	744	1.39	7,862	3.62
1981	370	0.59	457	0.84	5,555	9.29	1,223	2.77	7,605	3.44
1982	278	0.36	815	1.44	4,818	7.51	454	0.96	6,365	2.59
1983	167	0.25	54	0.07	4,816	6.45	309	0.50	5,346	1.90
1984	292	0.46	7,633	0.12	3,678	5.13	297	0.57	11,900	4.72
1985	541	1.24	3,260	6.17	3,392	6.48	699	1.35	7,892	3.94
Average	343	0.64	1,964	2.52	8,968	13.00	758	1.50	12,033	5.33

TABLE 8. *Quarterwise ribbonfish production (in tonnes) in Pondicherry and percentage contribution of total fish landings during 1976-85*

Years	I Quarter		II Quarter		III Quarter		IV Quarter		Total	
	Ribbonfish catch	Percentage	Ribbonfish catch	Percentage	Ribbonfish catch	Percentage	Ribbonfish catch	Percentage	Ribbonfish catch	Percentage
1976	141	6.86	22	0.77	159	4.83	106	5.48	428	4.23
1977	56	3.45	6	0.52	20	0.95	61	3.87	143	2.21
1978	45	2.48	43	2.50	33	1.50	18	1.65	139	2.04
1979	28	2.67	19	0.72	27	0.71	55	2.14	129	1.28
1980	33	1.49	3	0.10	59	2.52	84	4.80	179	1.91
1981	96	3.84	43	1.47	21	0.62	57	2.96	217	2.02
1982	43	1.96	24	0.86	7	0.18	34	1.06	108	0.90
1983	33	0.10	8	0.19	10	0.23	33	1.09	54	0.37
1984	133	3.73	42	1.08	6	0.13	34	1.19	215	1.44
1985	15	0.42	4	0.11	7	0.13	12	0.32	38	0.23
Average	59	2.70	21	0.83	35	1.19	49	2.46	164	1.66

TABLE 9. *Quarterwise ribbonfish production (in tonnes) in Andhra Pradesh and percentage contribution to total fish landings during 1976-85*

Years	I Quarter		II Quarter		III Quarter		IV Quarter		Total	
	Ribbonfish catch	Percentage	Ribbonfish catch	Percentage	Ribbonfish catch	Percentage	Ribbonfish catch	Percentage	Ribbonfish catch	Percentage
1976	4,175	8.92	3,088	9.94	3,677	14.00	1,503	5.50	12,443	9.48
1977	1,429	4.50	2,274	7.70	3,867	16.74	976	5.96	8,546	8.48
1978	625	2.08	1,843	14.05	1,885	8.96	1,152	6.45	5,505	6.70
1979	928	3.39	1,454	10.71	2,439	9.42	1,516	6.16	6,337	6.93
1980	1,861	5.09	1,077	5.74	10,821	33.15	1,887	6.72	15,646	13.49
1981	2,152	4.72	3,396	12.30	1,595	10.76	1,064	3.78	8,027	7.07
1982	1,232	3.31	310	1.87	1,702	5.16	3,551	11.37	6,795	5.76
1983	3,323	7.35	921	3.05	3,271	9.41	3,142	7.60	10,657	7.04
1984	1,178	2.02	591	2.24	3,260	10.62	1,428	4.58	6,457	4.40
1985	703	1.58	426	1.71	1,554	6.23	1,793	7.42	4,476	3.78
Average	1,761	4.30	1,538	6.93	3,407	12.45	1,801	6.56	8,507	7.31

TABLE 10. *Quarterwise ribbonfish production (in tonnes) in Orissa and percentage contribution to total fish landings during 1976-85*

Years	I Quarter		II Quarter		III Quarter		IV Quarter		Total	
	Ribbonfish catch	Percentage	Ribbonfish catch	Percentage	Ribbonfish catch	Percentage	Ribbonfish catch	Percentage	Ribbonfish catch	Percentage
1976	52	1.26	32	1.22	8	0.10	38	0.25	130	0.44
1977	34	0.62	84	4.72	24	0.92	32	0.62	174	1.15
1978	—	—	21	0.60	38	0.69	221	0.94	280	0.77
1979	65	0.67	111	2.93	153	2.11	32	0.15	361	0.87
1980	106	1.15	21	0.39	10	0.41	782	3.89	928	2.36
1981	674	6.19	98	1.50	105	1.27	118	1.19	995	2.79
1982	56	0.67	31	1.07	53	0.99	303	1.79	443	1.32
1983	111	1.34	19	0.64	83	1.29	783	2.82	996	2.19
1984	298	2.42	75	1.98	287	4.55	575	2.36	1,235	2.64
1985	325	1.92	40	1.52	415	5.95	1,086	5.32	1,866	3.98
Average	172	1.62	53	1.66	119	1.83	397	1.93	741	1.85

TABLE 11. *Quarterwise ribbonfish production (in tonnes) in West Bengal and percentage contribution to total fish landings during 1976-85*

Years	I Quarter		II Quarter		III Quarter		IV Quarter		Total	
	Ribbonfish catch	Percentage	Ribbonfish catch	Percentage	Ribbonfish catch	Percentage	Ribbonfish catch	Percentage	Ribbonfish catch	Percentage
1976	434	3.05	18	2.75	22	1.51	227	2.51	701	2.76
1977	135	3.73	29	7.46	16	3.64	54	6.63	234	4.44
1978	95	10.76	22	4.39	16	2.42	548	5.12	681	5.34
1979	130	4.03	45	4.36	61	4.42	55	1.09	291	2.72
1980	46	2.02	59	6.16	11	1.15	26	1.37	142	2.33
1981	—	—	—	—	—	—	15	0.20	15	0.19
1982	80	0.84	2	0.47	6	0.19	93	0.64	181	0.66
1983	12	0.28	7	2.67	15	0.25	165	1.41	199	10.86
1984	924	7.09	—	—	13	0.35	4,717	20.55	5,654	14.17
1985	43	0.72	2	0.81	3	0.10	4,361	30.74	4,409	18.73
Average	190	3.25	18	5.81	16	1.40	1,027	7.02	1,251	6.20

Quarterwise catch trend over the years indicated peak landings during the fourth quarter of the year followed by first quarter, but the maximum percentage contribution of 8.35% was experienced in the second quarter followed by 4.38% in the first quarter. From a catch of 4,491 t landed in 1979, the fishery gained momentum though with fluctuations to a maximum of 18,642 t in 1985 forming 6.97% of the total fish catch.

Maharashtra ranks second along the west coast and third at all India level landing an average of 11,127 t of ribbonfish contributing to 4% of the total fish production during the period. The catch trend revealed a similar pattern as observed in the adjoining Gujarat State with a peak in fourth quarter followed by first quarter. The third quarter though experienced a minimum average of 1,055 t of ribbonfish over the years, the percentage contribution to total fish landings ranged between 2.06% and 6.44%. Increase in the production of ribbonfish could be noted in Maharashtra from 1981 with a maximum of 19,009 t in 1985.

The annual average landings of ribbonfish in Goa was estimated to be 833 t during the period forming 2.52% of the total fish production and a maximum of 1,402 t was obtained in 1985 forming 3% of the total fish catch. Seasonal landing trend over the years revealed a productive first and second quarters contributing 3.6% and 6.1% respectively while other seasons invariably recorded less catch.

The production in Karnataka with an average of 961 t contributing to 0.77% of the total fish catch exhibited a highly fluctuating trend in the ribbonfish landings. Thus, the maximum catch of 2,264 t in 1983 (2.03%) sharply declined to 731 t in 1974 (0.58%) with a subsequent increase to 1,415 t (1.19%) in 1985. Quarterwise landing trend indicates

second quarter as the peak season for the fishery contributing to 2.03% of the total catch while in all the remaining periods the percentage contribution was less than 1%.

Kerala ranked first in the ribbonfish production of the country yielding an average landings of 12,881 t forming 4% of the total fish production during the period with a maximum of 25,718 t and 25,142 t during 1979 and 1985 contributing to 7.78% and 7.72% respectively of the total fish landings. Quarterwise catch trend over the years indicated peak catch in the third quarter accounting to 9.3% of the total fish catch.

Landing an estimated average of 12,032 t with 5.24% share in the total fish catch, Tamil Nadu occupies first place along the east coast and second at all India level in the ribbonfish fishery during the period with a maximum catch of 28,664 t in 1978 (13.46%). Quarterwise catch analysis over the years revealed that best season for the fishery in this State commences towards the end of second quarter with a peak third quarter. This is in agreement with the findings of Rao (1973) who observed peak ribbonfish catch in the third quarter south of Madras. Further studies suggested better catches at Madras in the second half of the year especially October-November period whereas at Mandapam the season of the fishery extends from August to about March with peak catch during November to February (James *et al.*, 1986).

An estimated 165 t of ribbonfishes is landed annually from the 45 km coastline of the Union Territory Pondicherry contributing to 1.45% of the total fish catch. After a maximum of 428 t obtained in 1976 (4.23%), the fishery dwindled considerably with a minimum of 38 t in 1985 (0.23%). Seasonal catch trend revealed the commencement of the

fishery in the fourth quarter with a peak in the first quarter. Hence it is reasonable to assume that maximum landings from Pondicherry Coast were obtained when the fishery declines and disappears in the first quarter at Madras (James *et al.*, 1986).

With an annual yield of 8,507 t with 7.26% share in the total fish catch, Andhra Pradesh occupies second place along the east coast for the ribbonfish landings. The maximum catch of 15,646 t landed was in 1980 forming 13.49% of the total fish catch, but fluctuated considerably thereafter and declined to 4,476 t in 1985 (3.78%). Seasonal catch trend over the years revealed third quarter followed by fourth quarter as most productive contributing to 12.76% and 6.66% respectively of the total catch.

The landing trend in Orissa revealed an estimated annual average of 741 t of ribbonfishes with 2% share in the total fish production. Steady increase in the landings was evident from 130 t in 1976 to a maximum of 1,866 t in 1985 with a sharp decline to 443 t realised in 1982. Seasonal catch trend indicated peak landings during the fourth quarter. Available information suggested July-December as the most productive period for ribbonfish fishery along the Orissa Coast (James, 1973).

West Bengal recorded an annual average of 1,250 t of ribbonfishes comprising 6.86% of the total fish catch. Catch trend during the period, though with wide fluctuations, exhibits a steep increase from 199 t in 1983 to 5,654 t in 1984, but a maximum share of 18.73% in the total fish landings was obtained in 1985. The result of the study indicated fourth quarter as the productive season for the fishery. Earlier observations have shown October - February period as the peak season for ribbonfishery with a lean third quarter (Rao, 1973; James, 1973).

Remarks

The seasonal trend of the ribbonfish landings summarised above during the period 1976-85 indicates productive seasons of the fishery with reference to the percentage contribution along the Indian Coast. The results of the study showed the emergence of Gujarat as one of the leading maritime States exploiting the resource especially from the late seventies with an annual average of 9,953 t. The variations in the season of fishery in different States can be attributed to the highly migratory shoaling behaviour of the species. Thus when fourth quarter supports fishery in Gujarat and Maharashtra, first quarter brought peak catches along Goa and second quarter in Karnataka Coast. A productive third quarter was indicated for the fishery in Kerala, Tamil Nadu and Andhra Pradesh Coasts, while fourth quarter sustained maximum catch in Orissa and West Bengal. Hence three seasons were involved in the fishery along the west coast and two productive seasons along the east coast.

The study further indicated considerable catch outside the fishing season also especially in Gujarat, Maharashtra, Kerala, Tamil Nadu and Andhra Pradesh. This may be due to the entry of migratory shoals to the coastal waters some times more than once during the season creating further opportunities for intense fishing (James *et al.*, 1986).

The percentage contribution of ribbonfishes to total fish landings in different maritime States during the period revealed a minimum of 0.77% in Karnataka while the maximum value of 7.26% was obtained in Andhra Pradesh followed by West Bengal (6.86%). The percentage contribution over the years varied between 0.71% and 4.6% along the west coast whereas the values ranged from 1.48% to 7.26% along the east coast. Moreover

ribbonfishes contributed 5.49% of the total fish production along the east coast while the same was 3.61% along the west coast though 61.17% of the total ribbonfishes landed in the country during the period was accounted by west coast.

Ribbonfish fishery exploited by the mechanised sector

Apart from the traditional fishery in the shallow coastal waters along the Indian Coast, recent developments in the mechanised fisheries sector have paved the way for a better exploitation of the resource due to the wide range of vertical distribution of the species. To get a clear assessment of the fishery by the mechanised sector, the catch data during the five year period 1981-85 have been analysed and presented which explains the trend of landings of the ribbonfish fishery by the mechanised vessels and the role the mechanised sector plays in augmenting production.

An annual average of 18,606 t of ribbonfishes was landed by the mechanised fisheries sector and the resource formed about 36.38% of the total ribbonfish catch of the country during the period 1981-85. The percentage contribution of ribbonfish to the total mechanised catch varied between 2.35% and 3.82% whereas the share of the species landed by the mechanised units to the total ribbonfish production of the country was maximum in 1983 for 47.98% and minimum in 1985 for 25.22% (Table 12). The study revealed that more than 50% of the ribbonfish resource exploited was by the non-mechanised units along the Indian Coast. The result of the study based on the catch data of mechanised units with special reference to the ribbonfish production pertaining to the maritime States/Union Territory is given in Table 13.

TABLE 12. *Percentage contribution of ribbonfishes to the mechanised and non-mechanised fishery during the period 1981-85*

Years	Percentage contribution of ribbonfish fishery		Percentage contribution to total ribbonfish production	
	Mecha-nised	Non-mecha-nised	Mecha-nised	Non-mecha-nised
1981	2.97	3.11	35.25	64.75
1982	3.82	3.30	45.40	54.60
1983	2.80	2.37	47.98	52.02
1984	2.35	3.56	37.37	62.63
1985	3.41	6.58	25.22	74.78

Gujarat occupies second place among the maritime States with an annual average catch of 3,825 t of ribbonfishes contributing to 37.71% of the total ribbonfish catch of the State. Maximum catch of 3,796 t in 1985 sharing 20.36% of the total ribbonfish production reveals gradual increase of the landings by the mechanised units. Result of the studies further showed that a sizable share of the fishery was exploited by the mechanised sector.

Landings of ribbonfish in Maharashtra registered an annual average of 9,656 t, the maximum among the maritime States contributing to 78% of the total production in the State. This State was primarily responsible in enhancing the ribbonfish catch of the country by mechanised vessels contributing more than 50% of the fishery exploited from the Indian Seas. Recent years witnessed increased share of ribbonfishes in the total mechanised landings with 5.2% and 6.77% in 1982 and 1985 respectively, remaining years indicating more or less same trend.

An annual average of 894 t of ribbonfish was landed by the mechanised units along Goa Coast, accounting 4.80% of the total ribbonfish production from the mechanised sector in India. This State was unique in that the contribution from mechanised units to total landings of

TABLE 13. Ribbonfish production by the mechanised sector (in tonnes) in different maritime States and their percentage contribution to total ribbonfish catch (in parenthesis) and total mechanised landings of respective States during the period 1981-85

Years	Gujarat		Maharashtra		Goa		Karnataka		Kerala		Tamil Nadu		Pondicherry		Orissa		West Bengal	
	Ribbonfish catch	Percentage to mechanised catch	Ribbonfish catch	Percentage to mechanised catch	Ribbonfish catch	Percentage to mechanised catch	Ribbonfish catch	Percentage to mechanised catch	Ribbonfish catch	Percentage to mechanised catch	Ribbonfish catch	Percentage to mechanised catch	Ribbonfish catch	Percentage to mechanised catch	Ribbonfish catch	Percentage to mechanised catch	Ribbonfish catch	Percentage to mechanised catch
1981	4,729 (56.79)	9.74	7,122 (88.49)	2.95	608 (93.68)	2.07	196 (85.22)	1.98	105 (1.49)	0.11	361 (4.75)	1.23	56 (25.81)	1.59	1,171 (14.27)	8.35	225 (22.61)	1.17
1982	6,132 (64.72)	12.10	11,987 (97.02)	5.20	1,015 (98.35)	3.90	408 (38.56)	1.39	321 (2.91)	0.22	595 (9.35)	1.11	27 (25.00)	0.72	1,241 (18.26)	5.89	368 (83.07)	2.40
1983	2,002 (31.75)	5.85	10,755 (98.70)	4.26	1,049 (98.87)	3.24	1,619 (71.51)	3.75 161 (14.48)	0.08	380 (7.11)	0.85	12 (22.22)	0.24	2,121 (19.90)	7.63	467 (46.89)	1.85	
1984	2,466 (30.93)	4.99	10,715 (92.28)	3.74	454 (96.19)	1.32	495 (67.72)	1.92	297 (4.59)	0.11	855 (7.18)	2.72	129 (60.00)	3.02	1,623 (25.14)	6.95	553 (44.78)	1.89
1985	3,796 (20.36)	10.30	7,703 (40.52)	6.77	1,342 (95.72)	3.13	1,213 (85.72)	1.85	3,045 (12.11)	1.23	349 (4.42)	1.38	16 (42.10)	0.30	1,759 (39.30)	8.03	925 (49.57)	2.96
Average catch	13,825 (37.71)	8.7	9,656 (77.97)	4.29	894 (96.79)	2.75	786 (63.99)	2.26	785 (7.73)	0.41	508 (5.75)	1.37	240 (36.59)	1.10	1,583 (21.63)	7.32	508 (45.85)	2.11

ribbonfishes was of the order 90% annually, the maximum being in 1983 with 98.87%. The intensity of exploitation of the resource by the mechanised sector was so high that the traditional fisheries contributed only about 1% of the ribbonfishes landed in the State.

Contributing to 4.22% of the total ribbonfish production by the mechanised sector in India, Karnataka with an annual average of 786 t revealed wide fluctuations in the fishery. The mechanised sector contributed to about 64% on an average of the ribbonfish resource exploited in the State during the period under study and the annual contribution to total mechanised catch over the years varied from 1.39% in 1982 to 3.75% in 1983.

The annual average share of ribbonfish landings by the mechanised sector amounted to only 785 t in Kerala forming 4.22% of the total all India ribbonfish production by the mechanised sector. No impact of mechanised sector was visible in Kerala where the contribution to total production was less than 1% indicating production primarily by the traditional fisheries sector.

Tamil Nadu yielded a major share of ribbonfish production along the east coast, but the mechanised units' annual average share to the fishery was only 508 t forming 2.73% of the total ribbonfish catch by the mechanised sector in India. With a maximum of 855 t sharing 2.72% of the total mechanised units' catch in 1984, landings showed wide fluctuations. The mechanised sector's contribution over the years being only 5.75% indicated a higher non-mechanised share in the yield.

With an annual catch of 43 t in Pondicherry, mechanised sector contributed 36.59% of the total ribbonfish catch of the region. Excepting 1984 accounting 3.02%, the remaining years revealed lesser share from the mechanised fisheries sector.

Andhra Pradesh recorded annual average of 1,583 t comprising 9% of the total ribbonfish catch by the mechanised sector in India. The mechanised units contributed 21.63% of the total ribbonfish catch of this State during the period with a maximum of 1,759 t obtained in 1985.

A total of 508 t of ribbonfishes were landed by the mechanised units in Orissa comprising 2.7% of the total mechanised ribbonfish catch in India. Gradual increase in the landings by the mechanised vessels was noted with a maximum yield of 925 t in 1985 and shared 2.96% of the total catch by mechanised units. It was also observed that nearly 45% of the total ribbonfishes landed during the period was accounted by mechanised vessels.

Remarks

Three aspects were studied to assess the share by the mechanised sector with reference to the ribbonfish landings along the Indian Coast during the period 1981-85 viz. Statewise percentages of ribbonfishes to all India catch by mechanised vessels, share of mechanised units in the State's ribbonfish landings and the percentage of ribbonfishes to total catch by mechanised boats.

The ribbonfish catch by the mechanised sector during different years of the period indicated that the fishery was more or less constant and on an average contributed only 3% of the total mechanised landings thereby showing the impact of traditional fishery in exploiting the resource. It is in the light of this finding that the importance for increasing the operation of mechanised vessels to augment production is stressed. The present study revealed the impact of mechanisation on ribbonfish fishery only along the Gujarat and Maharashtra Coasts contributing to 51.9% and 20.56% respectively of the total ribbonfish

landings by mechanised sector in the country. In the case of Goa, Karnataka and Kerala the proportion was not more than 4%. Along the east coast, excepting Andhra Pradesh yielding 8.51% Tamil Nadu and Orissa contributed 2.73% each (Table 14).

Considering the share of mechanised vessels in the total ribbonfish catch in Goa, this accounted for 96.79% of the total ribbonfish

ribbonfishes landed by the mechanised sector in India during the period. Though caught by all mechanised gears, the fishery is heavily exploited by trawl nets. Small mechanised vessels (10-15 m long with 15-100 Hp engine) operating otter trawls are increasingly landing ribbonfishes (James *et al.*, 1986). The impact of mechanisation in tapping the ribbonfish resource is comparatively less along the east coast.

TABLE 14. Percentage of ribbonfish catch in different maritime States to total ribbonfish production in India and total fish landing of the State indicating percentage share to artisanal and mechanised landings of the state during 1976-85

States/Union Territory	Percentage to total ribbonfish production in India	Percentage to total ribbonfish production in state	Percentage to total artisanal and mechanised landings in the state	
			Artisanal	Mechanised
Gujarat	20.56	37.71	3.24	8.71
Maharashtra	51.90	77.97	4.36	4.29
Goa	4.87	96.79	0.52	2.75
Karnataka	4.23	63.99	0.36	2.26
Kerala	4.22	7.73	6.23	0.41
Tamilnadu	2.73	5.75	4.10	1.37
Pondicherry	0.26	36.59	0.88	1.10
Andhra Pradesh	8.50	21.63	5.28	7.32
Orissa	2.73	45.85	3.40	2.11

landings, in Maharashtra 77.97% and in Karnataka 63.99%. Along the east coast, in Orissa the share of mechanised unit was 45.85% while it was 21.63% in Andhra Pradesh.

The third aspect of the investigation *viz.*, the percentage share of ribbonfishes to the total mechanised catch in different States showed certain important characteristics. Thus, maximum percentage share of 8.71% from Gujarat was followed by 7.32% of Andhra Pradesh and 4.29% of Maharashtra while all the remaining States indicated the value of less than 3%.

One of the important findings of the investigation is that Maharashtra and Gujarat together contributed to 72% of the total

It was observed that 87% of the fish production in Maharashtra was accounted by the mechanised vessels though the artisanal units were more than double the motorised boats (Kalawar, 1980). The catch trend along Goa Coast also indicated insignificant landings of ribbonfishes by traditional fisheries sector. High percentage of ribbonfishes was reported from Karnataka by mechanised boats. Along the southwest coast of India, Kerala ranked first in ribbonfish landings in India during 1976-85 period, but sufficient exploitation by the mechanised sector was not done. These observations suggest a rich ribbonfish resource along the west coast which can be intensively exploited by mechanised sector. A good amount of information has been collected on the

ribbonfish resource along the west coast of India based on the exploratory survey results by the vessels of the Fishery Survey of India. The catch data of the survey vessels give a better evaluation on the rich ribbonfish resource available along the west coast which can be harvested by the commercial fishing vessels.

Exploratory fisheries survey results

With the establishment of the Fishery Survey of India (the erstwhile Exploratory Fisheries Project) at various bases along the

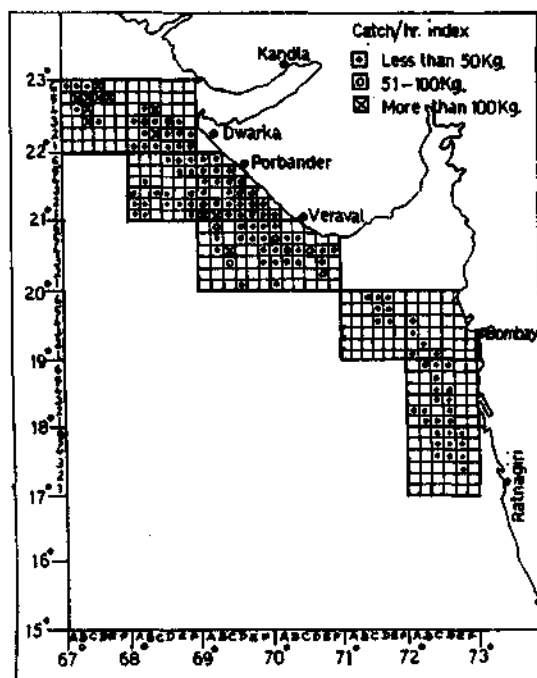


Fig. 2. Exploratory fishery survey results of Porbandar and Bombay based vessels during the first quarter period of 1976-85.

Indian Coast, concerted attempts have been made to explore and chart the different offshore fishing grounds in order to delineate the distribution of commercially important fishes in space and time. The present study summarises the results of the exploratory surveys by the vessels of the Fishery Survey of India based at Porbandar, Bombay, Goa, Mangalore and

Cochin during the period 1976-85 with special reference to ribbonfish resource. The catch data of Cochin based Integrated Fisheries Project vessels is also included in the present study.

The investigation pertained to those fishing areas abundant in ribbonfish resource during the survey operations with particular reference to depth range, catch rate and seasonal abundance. For this purpose, all vessels are taken as one unit and fishing effort (hours) and catch (kg) are pooled on a seasonal/area basis for the sake of comparison and discussion and the results presented (Figs. 2 - 9).

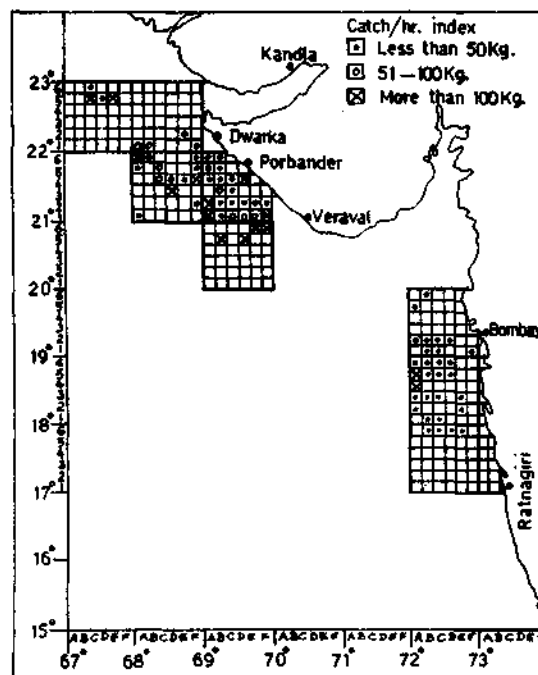


Fig. 3. Exploratory fishery survey results of Porbandar and Bombay based vessels during the second quarter period of 1976-85.

Porbandar

Survey results by the vessels of Porbandar base pertained to the period 1979-85. In the first quarter, the catch rate indices from 106 sub-areas spread over six major squares between the 20° 00' - 23° 00' N and 67° 00' - 71°

60' E surveyed indicate high catch rates off Porbandar, Dwaraka and Veraval. Five sub-areas viz. 3C, 4C, 5B, 5C and 6D of 22-67 off Dwaraka yielded a catch rate of 100 kg/hr from 50 m depth zone.

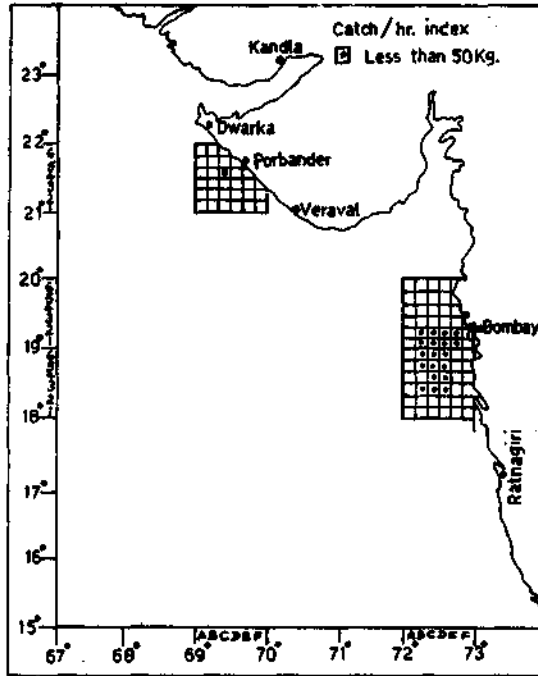


Fig. 4. Exploratory fishery survey results of Porbandar and Bombay based vessels during the third quarter period of 1976-85.

In the second quarter, fifty sub-areas surveyed between 20° 60' - 22° 20' N and 67° 30' - 70° 00' E presented a different distribution pattern. Thus, sub-area 1C, 1D and 1E followed by 1A and 1B of 21-69 and 6D, 6E and 6F of 20-69 indicated good concentration of the resource especially off Veraval in the 50 m depth zone with catch rate ranging between 50 kg/hr and 100 kg/hr. No results could be obtained in the third quarter as the operations were much restricted due to southwest monsoon.

A shift of ribbonfish concentration to areas off Dwaraka was noticed in the fourth quarter. Thus, six subareas viz. 5D, 5E, 6E, 1F and 2F of the major square 22-68 yielded a high catch rate of 100 kg/hr.

The ribbonfish resources in areas 22-67 and 22-68 as have been observed in the first quarter have moved to more inshore areas especially in subareas of 21-68, 21-69 and 20-69 sustaining the fishery in the second quarter. The distribution pattern of ribbonfish based on catch per hour indices during various quarters of the year suggested high catch rate off Dwaraka and Veraval and it was this concentration of the resource in the geographical zones 22-67 and 22-68 that supported peak fishery along the Gujarat Coast.

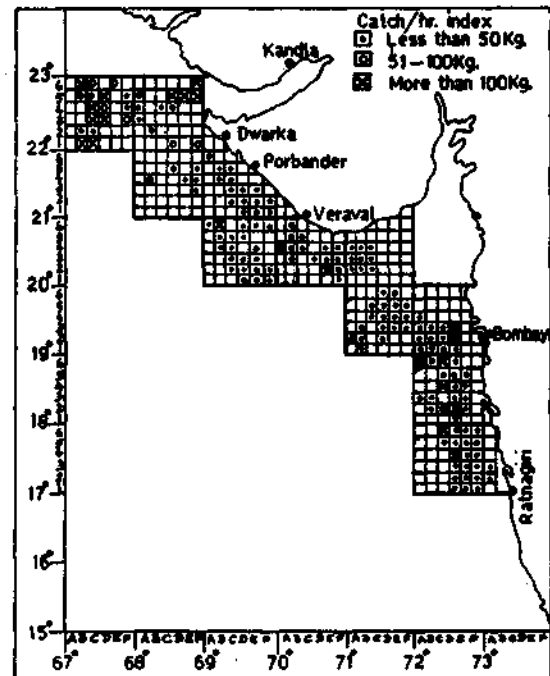


Fig. 5. Exploratory fishery survey results of Porbandar and Bombay based vessels during fourth quarter period of 1976-85.

Bombay

Quarterwise catch data during the period 1982-85 with reference to ribbonfish resource from 92 sub areas between 17° 10' - 19° 00' N and 71° 30' - 72° 00' E in five geographical squares were analysed to study the results of exploratory surveys from Bombay base.

Most of the subareas covered during the first quarter indicated a catch rate of 50 kg/hr while two subareas, 18-72/4A and 5A in the second quarter obtained a high catch rate. An increasing catch rate experienced in the offshore areas between Bombay and Ratnagiri especially

base during the period 1976-85. Two major squares viz. 15-73 and 16-73 with twentyone and six subareas respectively between the offshore waters of Goa and Ratnagiri during the first quarter revealed high incidence of ribbonfishes.

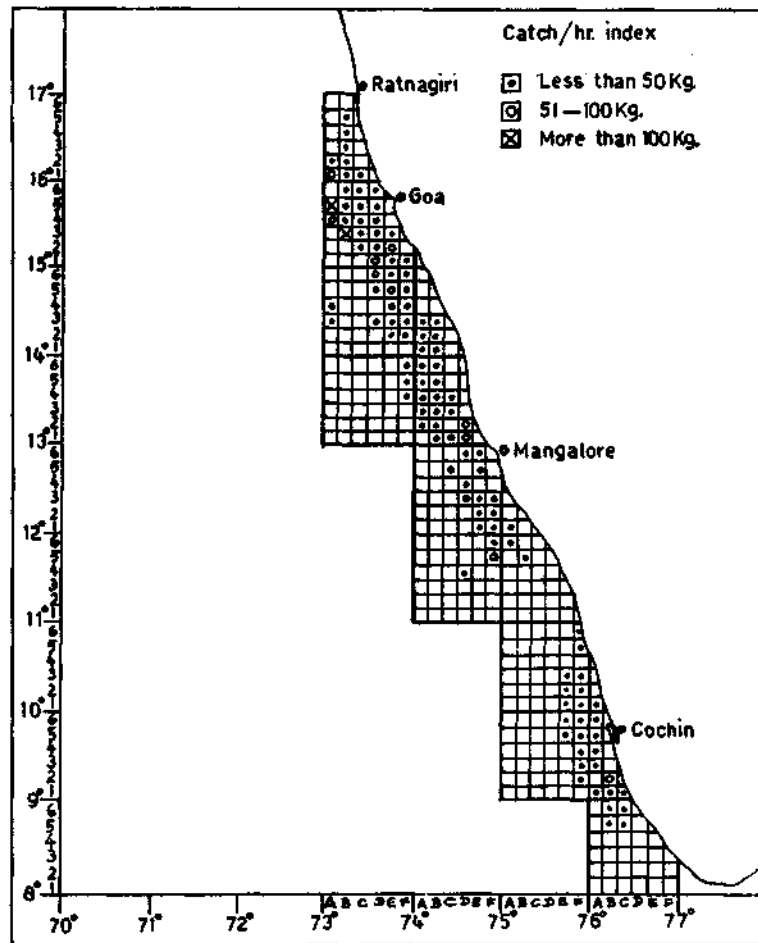


Fig. 6. Exploratory fishery survey results of Goa and Cochin based vessels during the first quarter period of 1976-85.

in five subareas each in 17-72 and 19-72 and four subareas in 18-72 showed abundance of the resource.

Goa

Subareas of four geographical areas between $14^{\circ} 50'$ - $16^{\circ} 10'$ N and $73^{\circ} 50'$ - $74^{\circ} 20'$ E were explored by the vessels of Goa

In the second quarter, three subareas viz. 1B, 1D and 1E of 15-73 yielded high catch rates of more than 100 kg/hr while sixteen subareas in the third quarter recorded moderate catch rates. High catch rates were obtained in the fourth quarter from three subareas i.e. 15-73/SB, 2C and 14-73/6F. Good concentration

of ribbonfishes in five subareas of 15-73 and also between the offshore waters of Goa and Ratnagiri in all seasons excepting the third quarter were noticed.

In the second quarter, the sub-areas off Mangalore (13-74/1A, 1D, 1E and 12-74/6D, 6E) and off Ratnagiri (16-72/6E and 6F) were most productive grounds with high catch rates.

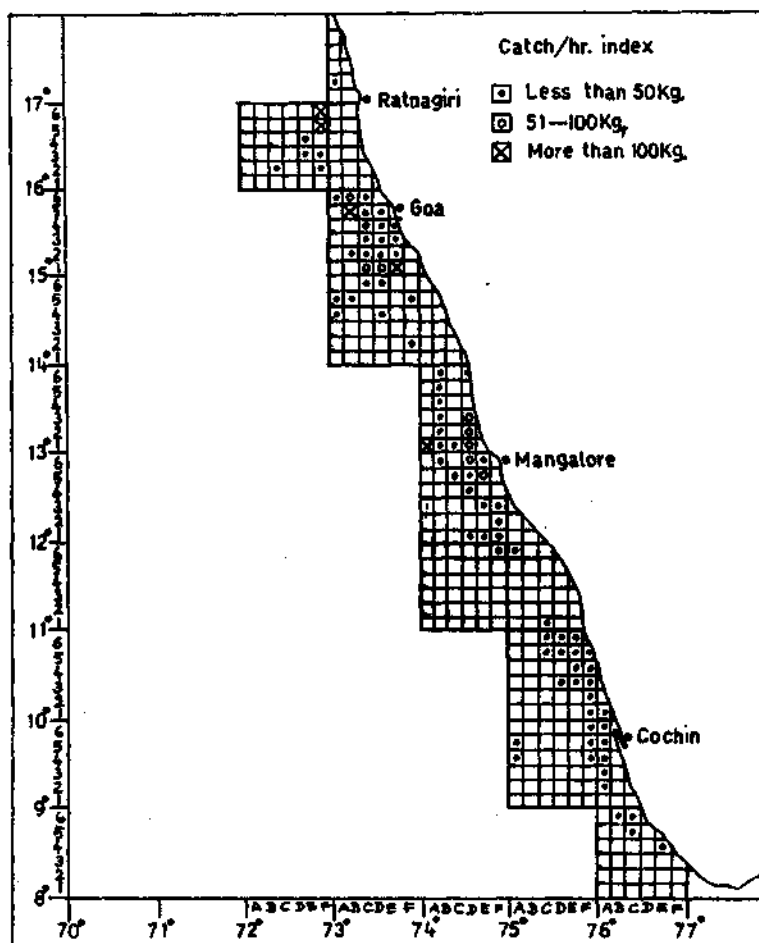


Fig. 7. Exploratory fishery survey results of Goa and Cochin based vessels during the second quarter period of 1976-85.

Mangalore

The survey by the vessels of this base during 1976-85 period covered the areas between $11^{\circ} 40' - 17^{\circ} 50' N$ and $71^{\circ} 40' - 75^{\circ} 20' E$. Forty nine subareas in eight major squares explored in the first quarter, areas 13-73/6D, 5E, 6F and 13-74/1D, 2D indicated high catch rates.

Excepting 17-72/4B most of the areas explored yielded moderate catch rates during the third quarter. Nine geographical zones were covered in the fourth quarter resulting intensive fishing in fifteen subareas of 12-74 and ten subareas of 13-74 with moderate catch rates.

Cochin

Subareas between $08^{\circ} 50' - 11^{\circ} 30' N$ and $75^{\circ} 40' - 76^{\circ} 50' E$ were explored by the vessels of Fishery Survey of India and Integrated Fisheries Project of Cochin base.

Relative abundance of ribbonfish resource from various geographical zones explored by the survey vessels located potential grounds of the resource along the west coast. The results of analysis from thirty zones based on quarterly catch trend, catch rate and percentage

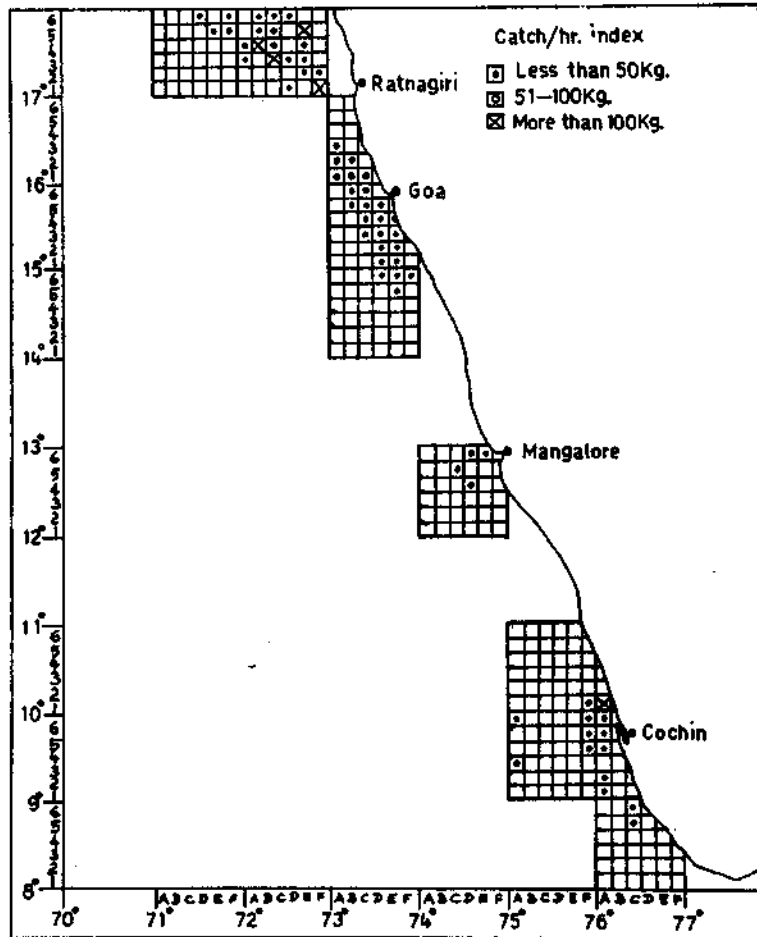


Fig. 8. Exploratory fishery survey results of Goa and Cochin based vessels during the third quarter period of 1976-85.

Along the Kerala Coast, the season of ribbonfish fishery commence towards the end of the second quarter with peak catch in the third quarter of the year. The exploratory survey results showed potential resource in the fourth quarter also with more concentration in the depth zone 40-60 m indicating the abundance outside the traditional fishing areas.

contribution of total ribbonfish production along the coast, twenty zones have been identified as potential areas. Quarterwise catch rate with the percentage contribution to total ribbonfish catch in different geographical zones are indicated in Table 15. The potential sub-areas of the above zones which afforded maximum resource have already been discussed.

TABLE 15. *Quarterwise relative abundance of ribbonfishes in different geographical zones (in percentages) and catch rates as revealed from the exploratory surveys during 1976-85*

Geographical Zones	I Quarter		II Quarter		III Quarter		IV Quarter	
	Geographical zones	Catch/hr (kg)	Percentage to total catch from the area	Catch/hr (kg)	Percentage to total catch from the area	Catch/hr (kg)	Percentage to total catch from the area	Catch/hr (kg)
22-67	87.09	44.52	33.57	21.91	—	—	90.97	22.31
21-68	14.46	17.74	56.20	48.35	—	—	10.73	17.32
22-68	26.46	19.46	224.29	72.15	—	—	98.41	33.06
20-69	44.97	32.43	69.34	73.01	—	—	20.08	18.47
21-69	22.94	28.95	31.03	33.68	16.79	31.15	22.24	26.45
20.70	29.19	38.77	—	—	—	—	26.20	19.15
19-71	4.92	8.03	—	—	—	—	8.86	11.31
17-72	2.83	7.10	6.97	17.60	13.50	25.28	24.18	19.17
18-72	2.84	5.53	9.68	18.98	8.08	17.33	22.01	22.41
19-72	3.19	6.23	17.64	38.76	26.79	43.04	32.75	27.01
14-73	18.80	12.60	213.92	18.62	13.00	97.76	14.63	19.00
15-73	12.42	12.98	22.85	26.78	5.19	12.39	25.31	19.57
16-73	16.22	9.87	—	—	10.97	20.24	12.40	22.38
12-74	8.37	9.80	41.56	41.52	5.81	14.10	7.35	12.66
13-74	19.52	17.99	41.34	40.92	—	—	9.21	13.81
9-75	10.86	12.65	2.18	2.13	9.41	6.09	—	—
10-75	17.43	14.15	5.85	4.10	0.67	3.45	1.86	5.36
8-76	6.45	5.34	4.57	4.21	3.50	3.53	5.86	8.71
9-76	6.21	4.28	9.56	7.42	6.25	4.42	19.21	13.72
10-76	2.03	0.59	2.17	3.39	8.54	7.76	20.72	48.21

Table 16 shows the distribution pattern of ribbonfishes in various depth zones which revealed maximum exploitation in 20-40 m depth range in most of the centres. Predominance of the resource has also been

Nearly 72% of the total ribbonfish landings by the mechanised vessels in India was obtained along the west coast. It is worth while to record in this connection that the average potential resource of ribbonfish off the coast of southern

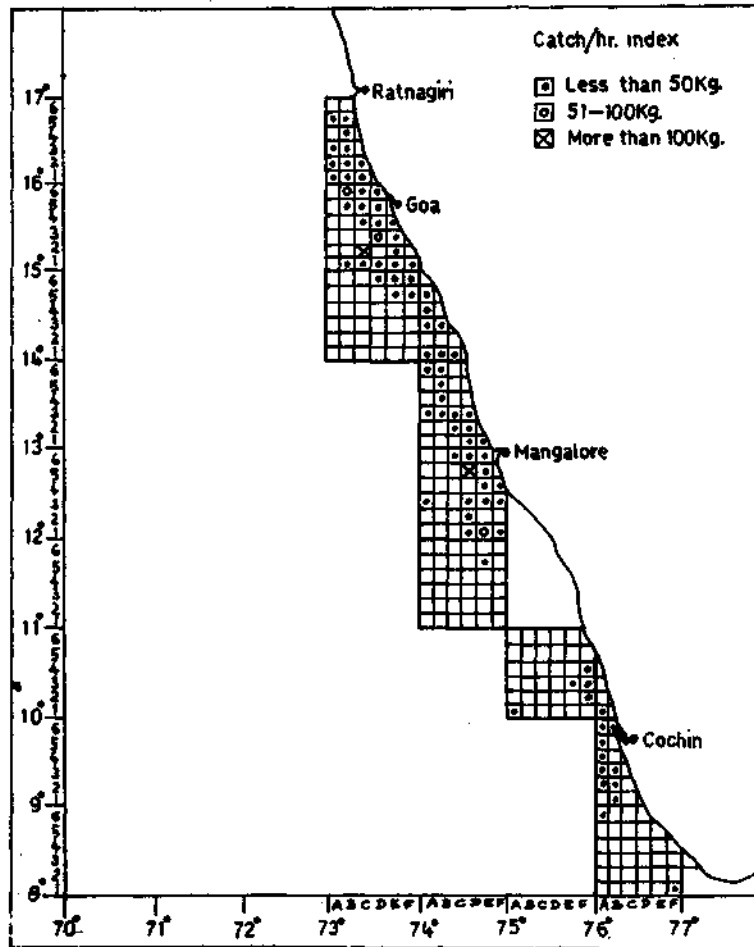


Fig. 9. Exploratory fishery survey results of Goa and Cochin based vessels during the fourth quarter period of 1976-85.

observed beyond 60 m as seen from the survey results by the vessels of Porbandar base. Of the total ribbonfish production by the survey vessels during the period, maximum contribution of 27.07% was realised from Porbandar based vessels followed by Goa and Cochin for 24.91% and 21.52% respectively.

Maharashtra, Karnataka-Goa and Kerala were estimated to be 11.8, 13.4 and 3.3 times higher than the average landings in the respective regions (Rao *et al.*, 1977).

Along the east coast too, vast resource of ribbonfish has been reported (Sastry, 1980; Radhakrishna *et al.*, 1981; Gopalakrishnan,

1973; Sivasubramaniam, 1985) in recent years. No information could be ascertained from the exploratory survey operation along east coast due to paucity of catch details.

DISCUSSION

Contributing to 4% of the total marine production in India ribbonfishes constitute one of the important pelagic fishery resources

Ratnagiri were considered to be rich areas for ribbonfish resource. Areas of abundance were also indicated by the exploratory vessels along Goa, Karnataka and Kerala Coast. Ribbonfish contributed to about 7% of the total marine fish landed along the Tamil Nadu Coast. The findings of an estimated stock of 67,200 t of ribbonfishes in the area from Ratnagiri to Gulf of Mannar were four times higher than the

TABLE 16. Distribution of ribbonfish in various depth zones as revealed from exploratory fishery surveys during 1976-85 (A) percentage to total ribbonfish catch landed by the vessels of all bases and (B) percentage to total ribbonfish landed by the vessels of respective bases

Bases	Depth zones (metres)										Percentage to total ribbonfish catch from all bases
	21-40		41-60		61-80		81-100		101-120		
	A	B	A	B	A	B	A	B	A	B	
Forbandar and Veraval	22.44	41.33	31.29	47.91	19.70	5.12	87.35	3.69	99.51	1.95	27.07
Bombay	11.48	53.03	11.66	44.77	3.11	2.02	1.75	0.18	—	—	10.80
Goa	27.84	55.71	21.28	35.40	31.46	8.89	—	—	—	—	24.91
Mangalore	20.94	66.44	4.86	12.80	44.56	19.95	10.90	0.79	0.49	0.02	15.72
Cochin	17.30	40.09	30.91	59.53	1.17	0.38	—	—	—	—	21.50

exploited from the seas around India. The catch data during 1976-85 period revealed maximum ribbonfish landings in Kerala, Tamil Nadu and Maharashtra yielding an annual average catch of 12,881, 12,032 and 11,127 tonnes respectively followed by Gujarat and Andhra Pradesh. Sharp fluctuating trend in the fishery was due to the highly migratory shoaling nature of the species.

The results of the exploratory surveys of FSI vessels from the west coast and the available information on the fishery suggested highly productive areas along the Indian Coast. Along the Gujarat Coast, abundance of the resource was noticed in the fourth quarter of the year. Recently heavy catch of the species was reported off Veraval during March-April and September-November period in gill nets (Kasim and Khan, 1985). The geographical zones 17-71, 18-71 and 19-72 between off Bombay and

landings of this species is of particular interest in this connection (Rao *et al.*, 1977).

Based on the fishery at Kakinada along the Andhra Pradesh Coast, Sastry (1980) has estimated that annual catch varied from 371.6 to 632.4 tonnes and on average formed 6.3% of the total fish catch. The resources were better in the area 16° 35' N to 17° 25' N and 82° 20' E to 83° 10' E to the depth of 70 m. Based on the trawl fisheries of Kakinada, Muthu (1977) estimated peak ribbonfish landings during July-November period. Also in the inshore waters along Visakhapatnam Coast heavy catch of ribbonfish has been reported (Radhakrishna *et al.*, 1981).

Available information indicated that the coastal waters of Orissa sustain the fishery contributing to 2% of the total marine fish catch. 6.86% of the total marine fish catch was contributed by ribbonfishes in West Bengal. In

the Hoogly-Matlah estuarine system and also in the trawling grounds of 'swatch of no grounds', ribbonfish constitute one of the important resources (Gopalakrishnan, 1973). According to a recent study, along the northeast coast and southeast coast of Bay of Bengal ribbonfishes comprise 2.1% and 4.6% respectively of the total marine fish production of the area. (Sivasubramaniam, 1985). All these findings are indications of the vast resources of ribbonfish available for exploitation along the east coast.

Of late, ribbonfish has been contributing to an important share in the mechanised fish landings. The landing trend observed in the present study during the period 1981-85 confirm to this. Ribbonfish production by the mechanised sector as revealed from the present investigation indicated a maximum in Goa (96.79%). It is 77.97% in Maharashtra, 68.79% in Karnataka and 37.71% in Gujarat while in Kerala it is the minimum (7.73). Along the east coast maximum contribution recorded was from Orissa (45.85%). In Pondicherry the contribution from mechanised catch was 36.59% and in Andhra Pradesh it was 21.63% while in Tamil Nadu it was a minimum of 5.75%.

The study further indicated that nearly 72% of the total ribbonfish landed by the mechanised sector was contributed by west coast. One of the reasons attributed for higher catch was that the continental shelf along the west coast is more than three times as large as that of east coast (Panikkar and Jayaraman, 1966). Later investigation has shown that the area of continental shelf for trawling is not a limiting factor, but it is the smaller number of mechanised fishing units which was responsible for the low catch along the east coast (Prasad *et al.*, 1970). Hence increase in the number of mechanised fishing fleets especially along the east coast may bring higher returns. To increase the exploitation of ribbonfishes, fishing pressure

in the monsoon months on the shelf and extending the fishing operation to deeper waters have also been suggested (James *et al.*, 1986). It is also essential to introduce larger vessels to exploit the resource during the southwest monsoon period (Rao *et al.*, 1977).

At present ribbonfish resource is under exploited (Rao *et al.*, 1977; Narasimham, 1983). Though maximum contribution is obtained from 40 m depth zone along the coastal belt, the study indicated good abundance even beyond 60 m especially along the west coast. Large concentration of the resource were also observed even beyond 250 m depth on the southern side of the Wadge Bank (Rao *et al.*, 1977). Present exploitation is restricted to small mechanised units in the length range of 10-15 m with 15-100 HP engines trawling along the coastal waters.

Apart from bottom trawling, pelagic trawling also gives good results in exploiting the resource. Experiments have indicated a catch rate of 150 kg/hr of ribbonfish off Dwaraka, Veraval and Goa by pelagic trawling (Venema, 1978). Hence, based on the present study and available information, it can be concluded that extending the fishing operations upto the Exclusive Economic Zone by larger vessels with bottom and pelagic trawls may augment the ribbonfish production from the present level of exploitation. It has been reported that even doubling the catch will not affect the stock in the shelf region from Ratnagiri to the Gulf of Mannar since the stock of *Trichiurus lepturus* especially along the east coast is underfished (James, 1976). Ribbonfishes being predators on other economically important fishes, their overfishing can hardly do harm to the fisheries as a whole (Jacob, 1949).

A major share of more than 70% of the ribbonfish resource in the marine fish landings of India is caught by the traditional units like

boat-seines, shore-seines, gill-nets, bag-nets, etc. Majority of mechanised units which are of lesser horse power cannot venture to deeper waters with the result that the rich areas beyond the coastal waters are practically unexploited.

Therefore steps have to be taken by the mechanised sector to exploit the ribbonfish resource from the Indian seas as this fishery occupies a prominent place in the marine fishery resources of the country.

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