

PROCEEDINGS OF THE SYMPOSIUM  
ON  
**LIVING RESOURCES**  
*of*  
**THE SEAS AROUND INDIA**



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**SPECIAL PUBLICATION**  
**CENTRAL MARINE FISHERIES RESEARCH INSTITUTE**  
**COCHIN-11**  
**1973**

# TRAWL FISHERY POTENTIAL OF THE SOUTH-EAST COAST OF INDIA

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## ABSTRACT

Scanty information is available regarding trawl fishery resources of the waters of the South-East coast of India in the Gulf of Mannar. Until the establishment of the Offshore Fishing Station of the Government of India at Tuticorin in 1958, no organisation has conducted trawling along scientific lines for charting the offshore fishing grounds, in order to delineate the distribution of commercially important fish and prawns in space and time. Since 1959, exploratory trawling by medium-sized trawlers has been mainly conducted in the offshore waters around Tuticorin between latitude  $8^{\circ} 00' - 9^{\circ} 10' N$  and longitude  $77^{\circ} 30' - 79^{\circ} 00' E$ . The results show that fairly rich fishing grounds exist in this area. The paper indicates scope for further exploitation of the grounds so far charted.

## INTRODUCTION

CHIDAMBARAM (1952) has given a historical account of trawling experiments made in Indian waters from 1902 onwards, the results of fishing surveys, causes for failures and the renewed efforts and attempts made to improve on the type of vessels. Gopinath (1954) has discussed the results of the operations (both trawling and mother-ship) of "KANYAKUMARI", "SAGAR-KUMARI" and "ASHOKKUMARI" of the West Coast Fisheries Company of the erstwhile Travancore State and "CHANDRIKA" of the Department of Marine Biology and Fisheries, University of Travancore, during 1949-50 in areas around the "Wadge Bank". Subsequent papers of interest on results of trawling in Indian waters include those of Jayaraman *et al.* (1959) and Rao *et al.* (1966).

Five vessels of the erstwhile Madras State attempted exploratory fishing between 1908 and 1930. In 1908, the pearl fishery inspection steamer, "MARGARITA" was utilised by Hornell for conducting a preliminary trawling cruise along the Malabar Coast (now in Kerala State) and Laccadive Islands. The vessel was found to be too small and unsuitable for experimental trawling. In 1909, two boats, one a sailing vessel of Scottish design, "SUTHERLAND" and another, a motor vessel, "TURBINELLA" were commissioned; the former conducted fishing experiments off Cannanore (now in Kerala State), and the latter, off Cannanore and Tuticorin till 1910-11. These were also not found suitable. In 1922, a powerful sea-going launch, "SEA SCOUT" was engaged for fishing using Danish seine. She too proved to be a failure after experimental fishing off Cochin in 1923. "LADY GOSCHEN" made preliminary exploratory surveys for charting and fishing with trawls on the west and east coasts of India during 1927-30. She located a few good trawl grounds, especially in Cape Comorin waters.

Sivalingam and Medcof (1957) while discussing the productivity of the "Wadge Bank" have reviewed the trawling attempts made by Ceylon-based vessels up to 1953. The possibilities of exploiting "Punnaikayal Madai", off the Tambrabarni estuary in the Gulf of Mannar, about 20 km. south of Tuticorin, have been discussed by Venkataraman *et al.* (1958). Thyagarajan

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and Mahadevan (1962) have reported on the results of experimental fishing in the "Punnai-kayal Madai". Rao (1967) has summarised the results of trawl and gill net operations in Tuticorin and Pondicherry zones by the Government of India vessels based at Tuticorin during 1963-66. Apart from these and the reports (1960, 1961, 1962, 1963, 1964, 1965 and 1966) of the Central Marine Fisheries Research Institute and those of the offshore Fishing Station, Tuticorin (1959-61, 1962, 1963, 1964, 1965 and 1966), there are no published records of the trawl fishery resources of the offshore waters of the Gulf of Mannar along the Indian coast. The present report is a further attempt in this direction.

With the establishment of the Government of India offshore Fishing Station at Tuticorin in 1958, concerted attempts have been made to explore and chart the offshore fishing grounds in the Tuticorin and Pondicherry waters using medium-sized power driven vessels with trawls, gill nets, hooks and lines, R.C. hooks, etc. Of these, trawl nets have been in use consistently since 1959 to date, and the present account delineates the results of exploratory trawling in the offshore waters around Tuticorin, mainly between latitude 8° 00'-9° 10' N and longitude 77° 30'-79° 00' E during 1959-66.

#### VESSELS, GEAR AND AREAS COVERED

The specifications of the vessels and the gear employed by them are given in Table I. In addition to the five vessels listed in the Table, two vessels, *viz.*, "KALYANI V" and "PRATAP" also operated trawl nets in the offshore waters of the Gulf of Mannar and off Madras, Cape Comorin and Quilon. Since the efficiency of these vessels is much greater as compared to vessels like "SAGARSUNDARI" of lesser horse-power, their results are not comparable and hence

TABLE I  
*Vessels, their specifications and gear employed (1959-66)\**

	MEENALOHANI	SAGARSUNDARI	SARDINELLA	SAGARKUMARI	MEENAKSHI
BHP ..	56	42	42	42	42
Gross tonnage..	26.7	11.2	11.2	11.2	11.2
Net tonnage ..	12	7	7	7	7
Length (metres)	13.7	10.1	10.1	10.1	10.1
Breadth (metres)	5.0	3.5	3.5	3.5	3.5
Draft (metres)	1.8	1.1	1.1	1.1	1.1
Gear used ..	12, 15, 17, 18 and 19 metre trawl	12, 14, 15, 17 and 18 metre trawl	12 and 18 metre trawl	12 and 18 metre trawl	15 metre trawl
Years of operation	1960-63	1960-66	1960-61 and 1963-64	1959 and 1962	1960-62

\* The results of the operations of the following vessels are beyond the scope of the paper for reasons given in the text:

"KALYANI V" (B.H.P-300) operated trawl nets for 125.25 hrs. in area 8-78 and off Madras in 1964 and landed 12,374 kg. of fish.

"PRATAP" (B.H.P-240) operated trawl nets for 27.50 hrs. in areas off Manapad, Cape Comorin and Quilon 1963 and landed 315 kg. of fish.

are excluded from the scope of this paper. Though the horse-power of "MEENALOCHANI" is slightly greater than that of other vessels, for all practical purposes, the efficiency of this vessel is considered to be almost same as that of others. All vessels with trawls are taken as one unit and the effort (hours) and catch (kg.) are pooled on a regional/seasonal basis for purposes of comparison and discussion.

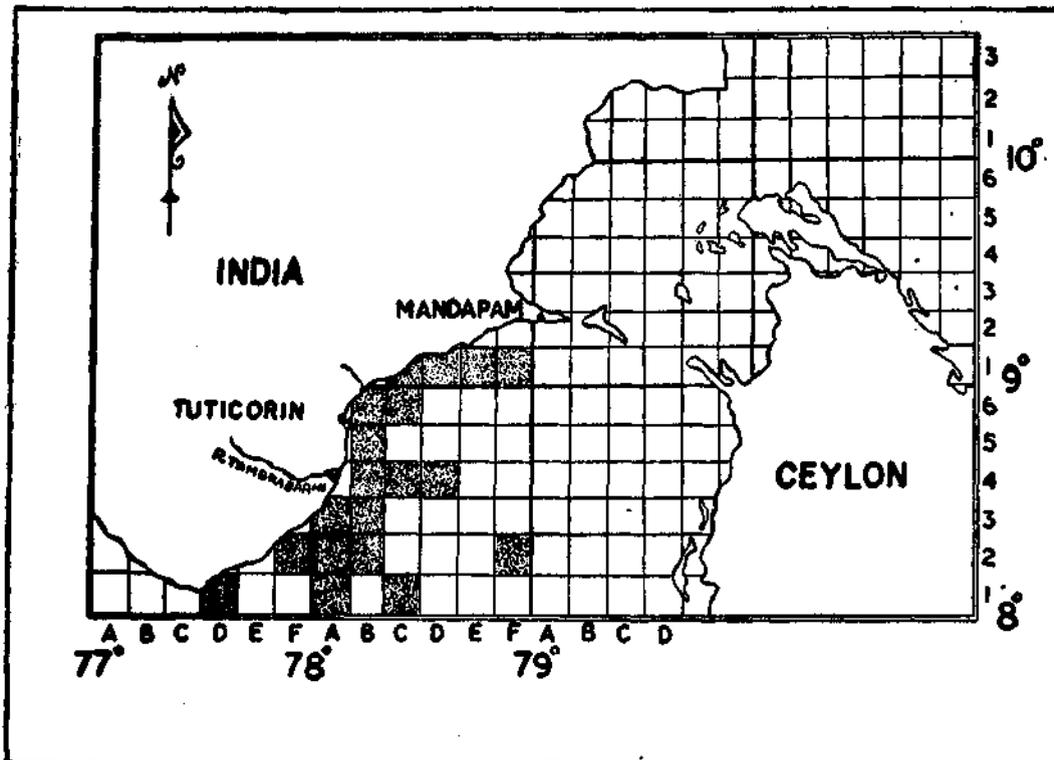


FIG. 1. Map showing areas fished during 1959-66.

In Fig. 1 are shown areas trawled by all vessels in the Gulf of Mannar during the period 1959-66. Three major areas 8-78 (3-40 meters depth), 8-77 (9-24 metres depth) and 9-78 (9-18 metres depth) were fished; of these, area 8-78 was fished intensively (99.32% of the total effort expended) and extensively; areas 8-77 and 9-78 were sparsely fished.

YEAR-WISE DISTRIBUTION OF CATCH ('ALL FISH'), EFFORT AND CATCH RATE IN ALL AREAS

In Tables II and III are shown the total catch, effort and catch per hour details from all areas during the period 1959-66. During the entire period, for a total effort of 5,939.60 hrs., 6,98,002 kg. of fish were obtained with a catch rate of 117.52 kg./hr. In 1959 (trawling operations having just begun), effort of a small magnitude was expended (as compared to later years) which brought in 3,138 kg. of fish. Maximum effort (1,262.91 hrs.) was expended in 1962 which yielded 1,36,247 kg. of fish at 107.88 kg./hr. The highest catch 1,68,845 kg. and catch rate 234.40 kg./hr. were recorded in 1966. In 1961, for an effort of 1248.33 hrs., 74,902 kg. of fish were obtained with a catch rate of 60.00 kg./hr. During 1960, 1,133.61 hrs. were expended which yielded 88,815 kg. of fish at 78.35 kg./hr. The three years, 1960-62 accounted for 61.37% of the total effort expended and 42.97% of the total catch landed during

TABLE II  
Distribution of catch, effort and catch rate in area 8-78

Years	Effort (hrs.)	Prawns		Elasmobranchs		Other fishes						All fish	
		Catch (kg.)	Catch rate (kg./hr.)	Catch (kg.)	Catch rate (kg./hr.)	Leiognathids		Sciaenids		Miscellaneous fishes		Catch (kg.)	Catch rate (kg./hr.)
						Catch (kg.)	Catch rate (kg./hr.)	Catch (kg.)	Catch rate (kg./hr.)	Catch (kg.)	Catch rate (kg./hr.)		
1959	58·17	820	14·10	324	5·57	1,994		34·28		3,138		53·95	
1960	1,130·53	15,617	13·81	4,112	3·64	69,015		61·05		88,744		78·50	
1961	1,229·74	27,251	22·16	3,027	2·46	7,730	6·89	13,284	10·80	23,080	18·77	74,372	60·48
1962	1,259·16	12,134	9·64	21,221	16·85	24,391	19·37	40,378	32·07	38,121	30·27	1,36,245	108·20
1963	644·11	3,947	6·13	10,327	16·03	14,341	22·26	29,348	45·56	42,828	66·49	1,00,791	156·48
1964	332·67	501	1·51	6,940	20·86	14,887	44·75	8,464	25·44	17,693	53·18	48,485	145·75
1965	594·30	4,637	8·84	7,267	13·86	22,921	43·72	18,393	35·08	23,021	43·91	76,239	145·41
1966	720·33	19,513	27·09	14,691	20·39	52,216	72·49	38,417	53·33	44,008	61·09	1,68,845	234·40
						1,36,486	28·98	1,48,284	31·48	1,88,751	40·07	..	..
						(1961-66)							
1959-66	5,899·01	84,420	14·31	67,909	11·51	5,44,530		92·31		6,96,859		118·13	

the entire period. During the period 1963-65, moderate efforts were expended ranging from 332.67 hrs. in 1964 to 644.11 hrs. in 1963 when the total catches ranged from 48,485 kg. to 1,00,791 kg. in the respective years; catch rates were consistently high (as compared to earlier years) which ranged from 142.32 kg./hr. in 1965 to 156.48 kg./hr. in 1963.

#### AREA-WISE DISTRIBUTION OF CATCH (PRAWNS, ELASMOBRANCHS AND 'OTHER FISHES'), EFFORT AND CATCH RATE

As could be seen from Tables II and III, area 8-78 was the most intensively fished. Area 8-77 was fished only in 1960 and 1961 to the extent of 3.08 hrs. and 18.59 hrs. respectively. Area 9-78 was also fished sparsely in 1962 and 1965 to the extent of 3.75 hrs. and 15.17 hrs. respectively. Negligible quantities of prawns, elasmobranchs and 'other fishes' were landed from 8-77 and 9-78

##### *Area 8-78*

This was fished during the entire period (Table II). For a total effort of 5,899.01 hrs., 6,96,859 kg. of 'all fish' were obtained with a catch rate of 118.13 kg./hr. A major part of the effort was expended during 1960-62. The height of the operations was in 1962 when for an effort of 1,259.16 hrs., 1,36,245 kg. of fish were landed at 108.20 kg./hr. Next in order is 1961 when the total effort expended was 1,229.74 hrs. and the catch 74,372 kg. at 60.48 kg./hr. This is followed by 1960 when 1,130.53 hrs. yielded 88,744 kg. at 78.50 kg./hr. The efforts expended from 1963 to 1966 ranged from a minimum of 332.67 hrs. in 1964 to a maximum of 720.33 hrs., in 1966, when the total catches also varied from 48,485 kg. to 1,68,845 kg. in the respective years. The highest catch rate 234.40 kg./hr. was obtained in 1966.

##### *Prawns*

During the entire period, 84,420 kg. (12.11%) were landed at 14.31 kg./hr. The highest catch 21,251 kg. was obtained in 1961 when the catch rate was 22.16 kg./hr. In 1966, 19,513 kg. were landed at 27.09 kg./hr., this being the highest catch rate. In 1960 and 1962, fairly good quantities were landed, the catches being 15,617 kg. and 12,134 kg. and catch rates 13.81 kg./hr. and 9.64 kg./hr. respectively. Moderate quantities were landed in 1963 and 1965. In 1959 and 1964, small quantities were obtained.

##### *Elasmobranchs*

A total of 67,909 kg. (9.75%) were obtained, the catch rate being 11.51 kg./hr. Maximum catch 21,221 kg. at 16.85 kg./hr. was landed in 1962. Landings were good during 1963-66 when the catches ranged from 6,940 kg. in 1964 to 14,691 kg. in 1966; the catch rates varied from 13.86 kg./hr. in 1965 to 20.86 kg./hr. in 1964. Moderate quantities were landed in 1960 and 1961 and small quantity in 1959.

##### *Other fishes*

This category comprises of leiognathids, sciaenids and miscellaneous fishes. In all, 5,44,530 kg. at 92.31 kg./hr. were landed during the entire period. In 1960, good quantity (69,015 kg.) was landed with a catch rate of 61.05 kg./hr. In 1959, small quantity was obtained.

The data for leiognathids, sciaenids and miscellaneous fishes are available from 1961 onwards. Hence, the period 1961-66 is dealt with separately.

##### *Leiognathids*

During 1961-66, 1,36,486 kg. (22.56%) were landed with a catch rate of 28.98 kg./hr. Maximum catch 52,216 kg. was got in 1966 when the highest catch rate 72.49 kg./hr. was also

TABLE III  
Distribution of catch, effort and catch rate in areas 8-77 and 9-78

8-77											
Years	Effort (hr.)	Prawns		Elasmobranchs		other fishes					
		Catch (kg.)	Catch rate (kg./hr.)	Catch (kg.)	Catch rate (kg./hr.)	Catch (kg.)		Catch rate (kg./hr.)			
1960	3.08	1	0.32	..	..	70		22.73			
						Leignathids		Sciaenids		Miscellaneous fishes	
						Catch (kg.)	Catch rate (kg./hr.)	Catch (kg.)	Catch rate (kg./hr.)	Catch (kg.)	Catch rate (kg./hr.)
1961	18.59	24	1.29	2	0.11	80	4.31	100	5.38	324	17.43
1962	..	..	..	..	..	..	..	..	..	..	..
1963	..	..	..	..	..	..	..	..	..	..	..
1964	..	..	..	..	..	..	..	..	..	..	..
1965	..	..	..	..	..	..	..	..	..	..	..
1960-61 (8-77) 1962 & 1965 (9-78)	21.67*	25	1.15	2	0.11	574		26.49			

TABLE III (Contd.)

9-78										
All fish		Effort (hr.)	Prawns		Elasmobranchs		Other fishes		All fish	
Catch (kg.)	Catch rate (kg./hr.)		Catch (kg.)	Catch rate (kg./hr.)	Catch (kg.)	Catch rate (kg./hr.)	Catch (kg.)	Catch rate (kg./hr.)	Catch (kg.)	Catch rate (kg./hr.)
71	23.05	..	..	..	..	..	..	..	..	..
530	28.51	..	..	..	..	..	..	..	..	..
..	..	3.75	..	..	..	..	2	0.53	2	0.53
..	..	..	..	..	..	..	..	..	..	..
..	..	..	..	..	..	..	..	..	..	..
..	..	15.17	..	..	67	4.42	473	31.38	540	35.60
601*	27.73	18.92	..	..	67	4.42	475	25.11	542	28.65

\* Exclusive of catch and effort particulars from subarea 1C.

recorded. The lowest catch 7,730 kg. and catch rate 6.89 kg./hr. were obtained in 1961. Good quantities were landed during 1962 and 1965, and moderate quantities during 1963-64.

#### *Sciaenids*

A total of 1,48,284 kg. (24.51%) were obtained at 31.48 kg./hr. during the period. The highest catch 40,378 kg. was got in 1962 and the catch rate 53.33 kg./hr. in 1966. The lowest catch 8,464 kg. was landed in 1964 and the catch rate 10.80 kg./hr. in 1961. Moderate quantities were recorded during other years.

#### *Miscellaneous Fishes*

This group comprised of *Polynemus* spp., *Upeneus* spp., *Therapon* spp., *Saurida* spp., *Kurtus indicus*, *Pomadourys* spp., *Ephippus orbis*, soles, other percoids, clupeoids, etc.

In all, 1,88,751 kg. (31.20%) were obtained at 40.07 kg./hr. during the entire period. The highest catch 44,008 kg. was got in 1966 and the catch rate 66.49 kg./hr. in 1963. The lowest catch 17,693 kg. was landed in 1964 and the catch rate 18.77 kg./hr. in 1961. Good quantities were landed during 1962-63 and moderate during 1961 and 1965.

#### *Area 8-77*

This was fished only during 1960-61 (Table III). A total of 601 kg. of fish were landed at 27.73 kg./hr., the bulk of which was in 1961. Prawns were available only to the extent of 25 kg. at 1.15 kg./hr. and 'other fishes' 574 kg. at 26.49 kg./hr. during the period.

#### *Area 9-78*

Fishing was conducted only during 1962 and 1965 (Table III). In all, 542 kg. of fish were landed at 28.65 kg./hr. The bulk of the catch was obtained in 1965.

### SUBAREA-WISE DISTRIBUTION OF CATCH (PRAWNS, ELASMOBRANCHS AND 'OTHER FISHES'), EFFORT AND CATCH RATE

Of the three major areas fished (Tables II and III), only area 8-78 was fished intensively and extensively (*vide infra*). In this area, three subareas, *viz.*, 4 B, 4 C and 5 B were fished intensively (93.44% of the total effort expended in all subareas). The fluctuations in catch, effort and catch rate in these subareas are discussed first (Tables IV, V, and VI), followed by other subareas of 8-78, 8-77 and 9-78 where lesser efforts were expended (Table VII).

#### *Subarea 8-78 4B*

As seen from Table IV, this was fished during the entire period. A total of 5,53,519 kg. of fish were landed for an effort of 4,509.97 hrs. at 122.73 kg./hr. The height of the operations was during 1960-61 when 2,118.23 hrs. were expended. In 1960, for an effort of 1,116.08 hrs., 87,926 kg. of fish were obtained with a catch rate 78.78 kg./hr. In 1961, 68,712 kg. of fish were landed at 68.53 kg./hr. During 1959 and 1964, very little effort was expended which brought in small quantities of fish. During 1962-63 and 1965-66, moderate efforts were expended which yielded good quantities of fish; the highest catch 1,57,923 kg. and catch rate 245.13 kg./hr. were recorded in 1966.

#### *Prawns*

A total of 74,810 kg. (13.52%) were landed at 16.59 kg./hr. The highest catch 26,250 kg. was got in 1961 and the catch rate 28.56 kg./hr. in 1966. Moderate quantities were obtained in 1960 and 1966. During the other years, small quantities were landed.

*Other Fishes*

A total of 4,32,066 kg. at 9.58 kg./hr. were obtained. In 1960, 68,351 kg. were landed at 61.24 kg./hr.

TABLE IV  
Distribution of catch, effort and catch rate in area 8-78/4B

Years	Effort (hr.)	Prawns		Elasmobranchs		Other fishes						All fish	
		Catch (kg.)	Catch rate (kg./hr.)	Catch (kg.)	Catch rate (kg./hr.)	Leiognathids		Sciaenids		Miscellaneous fishes		Catch (kg.)	Catch rate (kg./hr.)
						Catch (kg.)	Catch rate (kg./hr.)	Catch (kg.)	Catch rate (kg./hr.)	Catch (kg.)	Catch rate (kg./hr.)		
1959	58.17	820	14.10	324	5.57	1,994		34.28		3,138		53.95	
1960	1,116.08	15,524	13.91	4,051	3.63	68,351		61.24		87,926		78.78	
1961	1,002.15	26,250	26.19	2,794	2.79	7,456	7.40	11,169	11.15	21,043	21.00	68,712	68.53
1962	698.97	5,983	8.56	9,951	14.24	16,414	23.48	24,192	34.61	22,311	31.92	78,851	112.81
1963	557.78	3,643	6.53	8,702	15.60	12,963	23.24	26,169	46.92	38,339	68.73	89,816	161.02
1964	53.25	8	0.15	2,480	46.57	1,004	18.85	1,211	22.74	3,759	70.59	8,462	158.90
1965	378.92	4,185	11.04	4,867	12.84	19,490	51.44	13,911	36.71	16,238	42.85	58,691	154.88
1966	644.25	18,397	28.56	13,474	20.91	49,108	76.23	35,511	55.12	41,433	64.31	1,57,923	245.13
						1,06,435	31.91	1,12,163	33.62	1,43,123	42.91	..	..
						(1961-66)							
1959-66	4,509.97	74,810	16.59	46,643	10.34	4,32,066		9.58		5,53,319		122.73	

TABLE V

*Distribution of catch, effort and catch rate in area 8-78/4C*

Years	Effort (hr.)	Prawns		Elasmobranchs		Leiognathids		Sciaenids		Miscellaneous fishes		All fish	
		Catch (kg.)	Catch rate (kg./hr.)	Catch (kg.)	Catch rate (kg./hr.)	Catch (kg.)	Catch rate (kg./hr.)	Catch (kg.)	Catch rate (kg./hr.)	Catch (kg.)	Catch rate (kg./hr.)	Catch (kg.)	Catch rate (kg./hr.)
1961	5.08	46	9.06	16	3.15	59	11.61	82	16.14	149	29.33	352	69.29
1962	211.84	1,298	6.13	4,210	19.87	2,765	13.05	4,372	20.64	18,626	87.92	31,271	147.61
1963	81.66	304	3.72	1,604	19.64	1,342	16.43	3,150	38.57	4,474	54.79	10,874	133.15
1964	176.16	35	0.19	3,634	20.63	7,312	41.51	4,903	27.83	10,075	57.19	25,959	147.35
1965	112.55	432	3.84	1,989	17.67	2,940	26.12	3,372	29.96	6,208	55.16	14,941	132.75
1966	52.33	1,047	20.01	1,099	21.00	2,564	49.00	2,586	49.42	2,009	38.39	9,305	177.82
1961-66	639.62	3,162	4.94	12,552	19.62	16,982	26.55	18,465	28.87	41,541	64.95	92,702	144.93

TABLE VI  
Distribution of catch, effort and catch rate in area 8-78/5B

Years	Effort (hr.)	Prawns		Elasmobranchs		Other fishes						All fish	
		Catch (kg.)	Catch rate (kg./hr.)	Catch (kg.)	Catch rate (kg./hr.)	Leiognathids		Sciaenids		Miscellaneous fishes		Catch (kg.)	Catch rate (kg./hr.)
						Catch (kg.)	Catch rate (kg./hr.)	Catch (kg.)	Catch rate (kg./hr.)	Catch (kg.)	Catch rate (kg./hr.)		
1960	14.45	93	6.44	61	4.22	664		45.95		818		818	56.61
						Leiognathids		Sciaenids		Miscellaneous fishes			
						Catch (kg.)	Catch rate (kg./hr.)	Catch (kg.)	Catch rate (kg./hr.)	Catch (kg.)	Catch rate (kg./hr.)		
1961	219.51	928	4.23	198	0.90	208	0.95	1,901	8.66	1,882	8.57	5,117	23.31
1962	90.66	138	1.52	124	1.37	34	0.38	975	10.75	487	5.37	1,758	91.39
1963	4.67	..	..	21	4.50	36	7.71	29	6.21	15	3.21	101	21.63
1964	..	..	..	..	..	..	..	..	..	..	..	..	..
1965	9.50	9	0.95	98	10.32	171	18.00	621	65.37	89	9.37	988	104.01
1966	23.75	69	2.91	120	5.05	544	22.91	320	13.47	564	23.75	1,617	68.09
						993	2.85	3,846	11.05	3,037	8.72	..	..
						(1961-66)							
1960-66	362.54	1,237	3.41	622	1.72	8,540		23.56		10,399		10,399	28.69

*Elasmobranchs*

In all, 46,643 kg. (8.43%) a 10.34 kg./hr. were landed during the entire period. Maximum catch 13,474 kg. was obtained in 1966 and the catch rate 46.57 kg./hr. in 1964. Good yields were got during 1962-63. The landings were moderate during 1950-61 and 1964-65, and poor in 1959.

*Leiognathids*

The total yield was 1,06,435 kg. (23.02%) at 31.91 kg./hr. during 1961-66. The highest catch 49,108 kg. and catch rate 76.23 kg./hr. were recorded in 1966. Moderate catches were obtained during 1962-63 and 1965.

*Sciaenids*

During the entire period (1961-66), 1,12,163 kg. (24.55%) were landed at 33.62 kg./hr. The maximum catch 35,511 kg. and catch rate 55.12 kg./hr. were got in 1966. Yields were good during 1962-63 and moderate in 1961 and 1965.

*Miscellaneous Fishes*

In all, 1,43,123 kg. (30.95%) were obtained at 42.91 kg./hr. The bulk of the catch was got in 1963 and 1966 (38,339 kg. and 41,433 kg. respectively) when high catch rates (68.73 kg./hr. and 64.31 kg./hr. respectively) were also recorded; but the highest catch rate 70.59 kg./hr. was in 1964. During 1961-62 and 1965, the yields were moderate.

*Subarea 8-78 4 C*

The results of fishing operations are shown in Table V. The subarea was fished during 1961-66. The total yield was 92,702 kg. at 144.93 kg./hr. The height of the operations was in 1962 when for an effort of 211.84 hrs., 31,271 kg. of fish were obtained at 147.61 kg./hr. The highest catch rate 177.82 kg./hr. was recorded in 1966. During 1964-65, fishing was fairly intensive when 25,959 kg. and 14,941 kg. of fish were obtained at 147.35 kg./hr. and 132.75 kg./hr. respectively. Moderate efforts were expended in 1963 and 1966 which brought in small quantities of fish.

*Prawns*

The total quantity landed during the period was 3,162 kg. (3.41%) at 4.94 kg./hr. The highest catch 1,298 kg. was recorded in 1962 and the catch rate 20.01 kg./hr. in 1966 when good catch (1,047 kg.) was recorded. During 1963 and 1965, moderate quantities were landed.

*Elasmobranchs*

A total of 12,552 kg. (13.54%) at 19.62 kg./hr. were landed. Maximum catch 4,210 kg. was recorded in 1962 and the catch rate 21.00 kg./hr. in 1966. Good catch 3,364 kg. was recorded in 1964 when the catch rate was also high. Catches were moderate during 1963 and 1965-66.

*Leiognathids*

During the period, 16,982 kg. (18.32%) were landed at 26.55 kg./hr. The bulk of the catch 7,312 kg. was obtained in 1964 but the highest catch rate 49.00 kg./hr. was recorded in 1966. Moderate quantities were landed during other years.

TABLE VII

*Distribution of catch, effort and catch rate in different subareas of areas 8-78, 8-77 and 9-78*

Areas	Years	Effort (hr.)	Prawns		Elasmobranchs		Leiognathids		Sciaenids		Miscellaneous fishes		All fish	
			Catch (kg.)	Catch rate (kg./hr.)	Catch (kg.)	Catch rate (kg./hr.)	Catch (kg.)	Catch rate (kg./hr.)	Catch (kg.)	Catch rate (kg./hr.)	Catch (kg.)	Catch rate (kg./hr.)	Catch (kg.)	Catch rate (kg./hr.)
8-78/1 A, 2 A and 6B	1962	7.75	..	..	80	10.32	..	..	..	..	62	8.00	142	18.32
1 C	1965	1.00	..	..	..	..	..	..	..	..	..	..	..	..
2 A	1962	8.50	..	..	..	..	11	1.29	66	7.76	58	6.82	135	15.88
..	1964	73.25	458	6.25	512	6.99	6,487	88.56	2,274	31.04	3,655	49.90	13,386	182.74
..	1965	9.50	11	1.47	140	14.74	291	30.63	385	40.53	338	35.58	1,165	122.63
2 A and 2 B	1961	3.00	27	9.00	19	6.33	7	2.33	131	43.67	7	2.33	191	63.67
2 F	1965	3.00	..	..	115	38.33	..	..	..	..	20	6.67	135	45.00
3 A	1962	8.52	..	..	14	1.64	12	1.41	63	7.39	74	8.68	163	19.13
..	1960	4.50	..	..	35	8.75	9	2.25	14	3.50	8	2.00	66	16.50
3 B	1964	30.00	..	..	314	10.47	84	2.80	76	2.53	204	6.80	678	22.60
..	1965	2.00	..	..	13	6.50	20	10.00	20	10.00	10	5.00	63	31.50
4 B and 4 C	1962	166.36	4,714	28.27	6,725	40.33	2,765	16.58	4,372	26.22	4,481	26.87	23,057	138.27
D	1965	3.83	..	..	10	2.61	..	..	70	18.28	110	28.72	190	9.491
( B	1962	58.67	1	0.02	117	1.99	27	0.05	453	7.72	185	3.15	783	13.35
( C	1962	7.50	..	..	..	..	..	..	..	..	85	11.33	85	11.33
8-77 /1D	1961	8.67	..	..	..	..	..	..	..	..	42	4.84	42	4.84
2 F	1960	3.08	1	0.32	..	..	..	..	..	..	70	22.73	71	23.05
..	1961	9.92	24	2.42	2	0.20	80	8.06	100	10.08	282	28.43	488	49.19
9-78/1 C	1965	1.50	..	..	..	..	..	..	..	..	..	..	..	..
1 D	1962	1.00	..	..	..	..	..	..	..	..	..	..	..	..
..	1965	2.50	..	..	30	12.00	..	..	..	..	30	12.00	60	24.00
1 E	1962	2.75	..	..	..	..	..	..	..	..	2	0.73	2	0.73
..	1965	4.17	..	..	9	2.16	..	..	..	..	263	63.07	272	65.23
1 F	1965	7.00	..	..	28	4.00	..	..	..	..	180	25.71	208	29.71

*Sciaenids*

In all, 18,465 kg. (19.92%) were obtained at 28.87 kg./hr. The bulk of the catch was got in 1962 (4,372 kg.) and 1964 (4,903 kg.). The highest catch rate 49.42 kg./hr. was recorded in 1966. Good quantities were obtained during other years.

*Miscellaneous Fishes*

A total of 41,541 kg. (44.81%) were landed at 64.95 kg./hr. The highest catch 18,626 kg. and catch rate 87.92 kg./hr. were recorded in 1962. Good quantities were got during 1963-65 and moderate in 1966.

*Subarea 8-78/5B*

This was fished in all but two years, 1959 and 1964 (Table VI). For a total effort of 362.54 hrs. 10,399 kg. of fish were obtained at 28.69 kg./hr. Intensive operations were carried out in 1961 when for an effort of 219.51 hrs., 5,117 kg. of fish were landed at 23.31 kg./hr. Fishing was moderate in 1962 when 1,758 kg. of fish were got at 19.39 kg./hr. The highest catch rate 104.01 kg./hr. was recorded in 1965. During other years, small quantities were landed.

*Prawns*

The total quantity landed during the period was 1,237 kg. (11.90%) at 3.41 kg./hr. The highest catch 928 kg. was recorded in 1961 and the catch rate 6.44 kg./hr. in 1960. During other years, small quantities were landed.

*Elasmobranchs*

A total of 622 kg. (5.98%) at 1.72 kg./hr. were landed. Maximum catch 198 kg. was recorded in 1961 and the catch rate 10.32 kg./hr. in 1965. Landings were moderate during 1962 and 1966. Small quantities were landed during other years.

*Leiognathids*

During the period, 993 kg. (10.36%) were landed at 2.85 kg./hr. The highest catch 544 kg. and catch rate 22.91 kg./hr. were recorded in 1966.

*Sciaenids*

In all, 3,846 kg. (40.14%) at 11.05 kg./hr. were landed. The bulk of the catch 2,876 kg. was got during 1961-62. The highest catch rate 65.37 kg./hr. was recorded in 1965.

*Miscellaneous Fishes*

A total of 3,037 kg. (31.70%) at 8.72 kg./hr. were obtained. The highest catch 1,882 kg. was recorded in 1961 and the catch rate 23.75 kg./hr. in 1966.

*Subareas 8-78/1A, 2A and 6B*

These were fished during 1962 for 7.75 hrs. which yielded 142 kg. of fish at 18.32 kg./hr.; a major part of the catch comprised of elasmobranchs.

*Subarea 8-78/1C*

This was covered in 1965 to the extent of 1.00 hr. which did not yield any catch.

LR-18

*Subarea 8-78/2A*

During 1962, 1964 and 1965, 8.50 hrs., 73.25 hrs. and 9.50 hrs. were expended which yielded 135 kg., 13,386 kg. and 1,165 kg. of fish at 15.88 kg./hr., 182.74 kg./hr. and 122.63 kg./hr. respectively. The bulk of the catch in 1962 comprised of sciaenids (66 kg.; 7.76 kg./hr.) and miscellaneous fishes (58 kg.; 6.82 kg./hr.), in 1964 of leiognathids (6,487 kg.; 88.56 kg./hr.), miscellaneous fishes (3,655 kg.; 49.90 kg./hr.) and sciaenids (2,274 kg.; 31.04 kg./hr.), and in 1965 of sciaenids (385 kg.; 40.53 kg./hr.), miscellaneous fishes (338 kg.; 35.58 kg./hr.) and leiognathids (291 kg.; 30.63 kg./hr.).

*Subareas 8-78 2A and 2B*

In 1961, 3.00 hrs. were expended which brought in 191 kg. of fish at 63.67 kg./hr. Sciaenids (131 kg.; 43.67 kg./hr.), prawns (27 kg.; 9.00 kg./hr.) and elasmobranchs (19 kg.; 6.33 kg./hr.) occurred predominantly.

*Subarea 8-78 2F*

This was fished in 1965 to the extent of 3.00 hrs. which yielded 135 kg. of fish at 45.00 kg./hr. Elasmobranchs constituted as much as 115 kg. (38.33 kg./hr.) of the total catch.

*Subarea 8-78 3A*

This was covered during 1962 and 1965 for 8.52 hrs. and 4.00 hrs. which brought in 163 kg. and 66 kg. of fish at 19.13 kg./hr. and 16.50 kg./hr. respectively. The bulk of the catch in 1962 comprised of miscellaneous fishes (74 kg.; 8.68 kg./hr.) and sciaenids (63 kg.; 7.39 kg./hr.), and in 1965 of elasmobranchs (35 kg.; 8.75 kg./hr.) and sciaenids (14 kg.; 3.50 kg./hr.).

*Subarea 8-78 3B*

During 1964 and 1965, 30.00 hrs. and 2.00 hrs. were expended which yielded 678 kg. and 63 kg. of fish at 22.60 kg./hr. and 31.50 kg./hr. respectively. A major part of the catch in 1964 comprised of elasmobranchs (314 kg.; 10.47 kg./hr.) and miscellaneous fishes (204 kg.; 6.80 kg./hr.) and in 1965 of leiognathids (20 kg.; 10.00 kg./hr.) and sciaenids (20 kg.; 10.00 kg./hr.).

*Subareas 8-78 4B and 4C*

These were fished in 1962 for 166.36 hrs. which yielded 23,057 kg. of fish at 138.27 kg./hr. Elasmobranchs (6,725 kg.; 40.33 kg./hr.), prawns (4,714 kg.; 28.27 kg./hr.) and miscellaneous fishes (4,481 kg.; 26.87 kg./hr.) formed the bulk of the catch.

*Subarea 8-78 4D*

An effort of 3.83 hrs. was expended in 1965 which brought in 190 kg. of fish at 49.61 kg./hr. A major part of the catch comprised of miscellaneous fishes (110 kg.; 28.72 kg./hr.) and sciaenids (70.0 kg.; 18.28 kg./hr.).

*Subarea 8-78 6B*

This was covered in 1962 for 58.67 hrs. which yielded 783 kg. of fish at 13.35 kg./hr. Sciaenids (453 kg.; 7.72 kg./hr.) and miscellaneous fishes (185 kg.; 3.15 kg./hr.) constituted the bulk of the catch.

*Subarea 8-78 6C*

This was fished in 1962 to the extent of 7.50 hrs. In all, 85 kg. of miscellaneous fishes at 11.33 kg./hr. were obtained.

*Subarea 8-77 1D*

An effort of 8.67 hrs. was expended in 1961 which yielded 42 kg. of miscellaneous fishes at 4.84 kg./hr.

*Subarea 8-77 2F*

During 1960 and 1961, 3.08 hrs. and 9.92 hrs. were expended which brought in 71 kg. and 488 kg. of fish at 23.05 kg./hr. and 49.19 kg./hr. respectively. The bulk of the catch in 1960 comprised of miscellaneous fishes (70 kg.; 22.73 kg./hr.), and in 1961 of miscellaneous fishes (282 kg.; 28.43 kg./hr.), sciaenids (100 kg.; 10.08 kg./hr.) and leiognathids (80 kg.; 8.06 kg./hr.).

*Subarea 9-78 1C*

This was covered in 1965 for 1.50 hrs. which did not yield any catch.

*Subarea 9-78 1D*

An effort of 1.00 hr. in 1962 did not yield any catch. In 1965, 2.50 hrs. yielded 60 kg. of fish at 24.00 kg./hr.; Elasmobranchs and miscellaneous fishes occurred in equal proportions.

*Subarea 9-78 1E*

This was fished in 1962 and 1965 to the extent of 2.75 hrs. and 4.17 hrs. which yielded 2 kg. (miscellaneous fishes) and 272 kg. of fish (miscellaneous fishes predominantly) at 0.73 kg./hr. and 65.23 kg./hr. respectively.

*Subarea 9-78 1F*

In 1965, 7.00 hrs. were expended which yielded 208 kg. of fish (miscellaneous fishes predominantly) at 29.71 kg./hr.

SEASONAL DISTRIBUTION OF CATCH (PRAWNS, ELASMOBRANCHS, LEIOGNATHIDS, SCIAENIDS, MISCELLANEOUS FISHES AND 'ALL FISH') AND CATCH RATE IN AREA 8-78

To study the seasonal abundance or otherwise of various categories of fishes and prawns, the catch and effort data for the period 1959-66 were pooled on a month-wise basis and details of catch and catch rate are shown in Table VIII. The average catch rate values for the 12-month period, January to December, for the different categories are indicated in the Table.

*Prawns*

The average catch rate was 13.78. The catch rates during April-October were above the average catch rate indicating seasonal abundance, the peak period being April-June.

*Elasmobranchs*

The average catch rate was 11.07. The catch rates during January and May-August were above the average catch rate suggesting abundance during these months, the peak period being May-July.

TABLE VIII  
Seasonal distribution of catch and catch rate in area 8-78 (1959-66)

Categories of fishes and prawns	January		February		March		April		May	
	Catch (kg.)	Catch rate (kg./hr.)								
Prawns	657	1.73	550	1.70	669	4.34	8,392	27.24	7,168	27.34
Elasmobranchs	5,146	13.49	2,115	6.54	956	6.20	2,373	7.71	3,862	14.73
Leiognathids	3,285	8.61	8,289	25.62	1,016	6.59	3,942	12.80	5,846	22.30
Sciaenids	4,501	11.80	4,468	13.81	1,106	7.18	4,181	13.57	5,687	21.69
Miscellaneous fishes	12,747	33.42	6,595	20.39	3,169	20.57	5,439	17.66	7,866	30.00
All fish	26,336	69.05	22,017	68.06	6,916	44.88	24,327	78.98	30,429	116.06

TABLE VIII (Contd.)

Catch (kg.)	June		July		August		September	
	Catch rate (kg./hr.)	Catch (kg.)	Catch rate (kg./hr.)	Catch (kg.)	Catch rate (kg./hr.)	Catch (kg.)	Catch rate (kg./hr.)	
11,152	22.70	13,709	16.90	12,634	18.51	13,684	19.07	
9,459	19.25	12,008	14.80	8,575	12.56	7,751	10.80	
6,892	14.03	9,514	11.73	11,080	16.23	17,567	24.48	
8,572	17.45	19,121	23.57	20,344	29.81	23,354	32.55	
16,339	33.25	26,873	33.12	31,295	45.85	37,868	52.77	
52,414	106.68	81,225	100.12	83,928	122.96	1,00,224	139.67	

TABLE VIII (Contd.)

Catch (kg.)	October		November		December		Average catch rate
	Catch rate (kg./hr.)	Catch (kg.)	Catch rate (kg./hr.)	Catch (kg.)	Catch rate (kg./hr.)		
9,975	15.88	4,813	8.02	1,017	1.89	13.78	
4,658	7.42	5,514	9.19	5,492	10.19	11.07	
23,786	37.87	26,826	44.72	18,443	34.21	21.60	
25,293	40.27	18,045	30.08	13,612	25.25	22.25	
44,970	71.60	47,373	78.97	19,225	35.66	39.44	
1,08,682	173.04	1,02,572	170.98	57,789	107.20	108.14	

TABLE IX

*Seasonal distribution of catch and catch rate in areas 8-77 (1960-61) and 9-78 (1962 and 1965)*

Categories of fishes and prawns	January		February		March		April-June		July		August-November		December	
	9-78		8-77		9-78		8-77		9-78		8-77		8-77	
	Catch (kg.)	Catch rate (kg./hr.)	Catch (kg.)	Catch rate (kg./hr.)	Catch (kg.)	Catch rate (kg./hr.)								
Prawns	..	..	24	1.54	..	..	..	..	..	..	..	..	1	0.32
Elasmobranchs	..	..	2	0.13	30	7.50	..	..	Not covered	37.31	3.31	Not covered	..	..
Leiognathids	..	..	80	5.13	..	..	..	..	..	..	..	..	..	..
Sciaenids	..	..	100	6.41	..	..	..	..	..	..	..	..	..	..
Miscellaneous	2	0.53	311	19.95	30	7.50	13	4.33	..	443	39.66	..	70	2.27
All fish	2	0.53	517	33.16	60	15.00	13	4.33	..	480	42.97	..	71	2.59

*Leiognathids*

The average catch rate was 21.60. During February, May and September-December, the catch rates were above the average catch rate showing abundance during these months, the peak period being October-December.

*Sciaenids*

The average catch rate was 22.25. The catch rates during July-December were above the average catch rate indicating seasonal abundance, the peak period being September-November.

*Miscellaneous Fishes*

The average catch rate was 39.44. The catch rates during August-November were above the average catch rate suggesting seasonal abundance, the peak period being September-November.

*'All Fish'*

The average catch rate was 108.14. During May and August-November, the catch rates were above the average catch rate showing seasonal abundance, the peak period being October-November.

SEASONAL DISTRIBUTION OF CATCH (PRAWNS, ELASMOBRANCHS, LEIOGNATHIDS, SCIAENIDS, MISCELLANEOUS FISHES AND 'ALL FISH') AND CATCH RATE IN AREAS 8-77 AND 9-78

The details are given in Table IX. Since only the data for February, March and December of 1960-61 relating to area 8-77, and for January, February and July of 1962 and 1965 pertaining to area 9-78 are available it is not possible to deduce any conclusions regarding seasonal abundance of different categories of fishes and prawns in these two areas.

## REMARKS

The 8-year data presented in this paper on the ground fish resources of the Gulf of Mannar along the Indian coast suggest potentiality for intensive fishing for fish and prawns. Area 8-78/4B was found to be the richest as indicated by high catch rates; subarea 4C was also found to have good concentrations of elasmobranchs, leiognathids, sciaenids and miscellaneous fishes but this gave poor yields of prawns; 5B does not appear to have much ground fish resources.

Scope for introduction of trawl nets operated from small-sized boats is great, as the yields are quite rewarding, both for fish and prawns. Now that the seasonal abundance of various categories of fishes and prawns is known, selective fishing on a commercial scale for these during periods of abundance, using suitable types of trawl nets, will be beneficial to the fishing industry. Area 8-78/4B and 4C could be exploited intensively. There does not appear to be any cause for alarm regarding depletion of fish stocks in these areas.

## ACKNOWLEDGEMENTS

We are grateful to Dr. S. Jones, Director, Central Marine Fisheries Research Institute, for the kind encouragement given in the course of this study. Our thanks are due to Mr. K. Virabhadra Rao, Senior Research Officer, Central Marine Fisheries Research Institute, for giving valuable help. To Mr. A. T. Shariff, Deputy Director, Government of India Offshore Fishing Station, Tuticorin, we are thankful for the kind assistance and making available some of the references.

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