

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



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## EXPLORATORY TRAWL FISHING AND GROUND FISH RESOURCES ALONG THE KERALA COAST AND ADJACENT WATERS

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### ABSTRACT

The paper deals with exploratory fishing operations mainly trawling conducted along Kerala Coast and adjacent waters since 1908. Early operations prior to 1950 demonstrated the occurrence of rich grounds for percoid fishes in the Cape Comorin area and good hand-line fishing grounds off South Kerala Coast.

Bull trawling in the Cannanore-Cape Comorin region by the vessels of the Deep Sea Fishing Station of the Government of India showed that elasmobranchs and miscellaneous fish comprising small sciaenids, lizard fishes, flatheads, etc., were common for the area with a dominant catfish element in the Cannanore-Calicut sector, perch element south of Alleppey including Cape Comorin grounds and a transitional middle sector having a few catfishes and perches.

Inshore otter trawl operations with medium-sized boats were increasingly carried out by the Indo-Norwegian Project, Deep Sea Fishing Station and private agencies mainly centred around Cochin during the last decade. Deep Sea Fishing Station operations in the region revealed a composition of about 30% miscellaneous fish, 20-35% prawns, 8-14% *Nemipterus japonicus*, 6-14% elasmobranchs and 1-2% *Lactarius lactarius*.

These operations showed the area between Calicut and Alleppey to be more productive, those off river and bar mouths yielding good quantity of prawns. The catch rate of prawns and fish increased steadily around Cochin from 1957 to 1961 and since then showed a slight decline. The picture is indicative of excessive fishing pressure over a limited area. This points to the necessity for even dispersal of fishing effort.

Indo-Norwegian Project hand-line fishing operations provided considerable information regarding the 'Kalava' (*Epinephelus* spp.) resources of the rocky grounds on the continental shelf usually lying in 70-110 m depth zone off Kerala Coast.

The occurrence of a variety of deep sea prawns, densely shoaling bathypelagic fishes like *Cubiceps natalensis*, *Chlorophthalmus* spp., *Antigonia* spp., mid-water concentrations of balistids etc. have been found out along the Kerala Coast mainly by the fishing operations of the Indo-Norwegian Project. These as well as the "Kalava" resources could be better exploited with increased effort.

EFFORTS to explore the deep sea fishing grounds by trawlers along the South Canara and Kerala Coasts, including the adjacent Cape Comorin region, were made since 1908 by the Madras Government and earlier, in 1902, by the Ceylon Company of Pearl Fisheries Ltd., in the Cape Comorin region (Gravely, 1929; Sundara Raj, 1930). Though varied types of vessels were employed for this purpose, more systematic efforts were put in by S. T. *Lady Goschen* of the Madras Government from 1927-29 in the region between Bassas de Pedro bank off Mangalore and the Manappad grounds east of Cape Comorin (Gravely, 1929; Sundara Raj, 1930).

Subsequent operations by different agencies from Ceylon (Chidambaram, 1951; John, 1959) and later by the Travancore University and West Coast Fisheries Ltd. (Gopinath, 1954) in the Anjengo-Cape region corroborated and elucidated information on the topography, catch composition and productivity of these grounds. Details of all these earlier operations are summarised in Table I. It will be seen that these early operations till 1950 were concentrated around the Cape

TABLE I.

Results of early exploratory trawline operations conducted along the Kerala coast and adjacent waters

Name and other details of vessel	Agency and period of operation	Ground	Gear and catch/effort	Dominant species caught and remarks
Steam trawler 'Violet' 150 GRT 95 ft. overall length	Ceylon Company of Pearl Fisheries, Ltd., 1902-07	Ceylon and adjacent waters Cape Comorin Bank	Otter trawl do.	Rays, Plough fish ( <i>Rhynchobatus</i> sp.), sharks, 'velamin' ( <i>Lethrinus nebulosus</i> ) 'kalava' ( <i>Epinephelus</i> spp.), Red gurnards (Triglidae), etc.
S.S. 'Margarita' a small steam vessel	Madras Government 1908	Malabar coast and Laccadives	..	Boat was found to be too small and feeble and unsuitable for trawling.
'Sutherland'—sailing vessel—12 tons	Madras Government, 1909-11	Off Cannanore (and Tuticorin) beyond the usual range of local fishing boats	Conducted fishing experiments	Experiments showed that these boats were too big for small work but not big enough for large work.
'Turbinella'—15 H.P. motor vessel				
2 'Ratnagiri' Sailing Machuwas 'Drifters'—6-8 tons	1910-11	15-22 nm westcoast of India	..	Well adapted for deep sea fishing for drift net fishing in west coast waters but without sufficient room for gutting and storing fish.
S.T. 'Lilla' 250 GRT 126 ft. OAL	Ceylon Government 1920	Wadge Bank— grounds of Cape Comorin 18-82 m	88·70 kg. per hour after John (1959)	Confined the studies to an evaluation of the fishing potentialities of the region.
'Lady Goschen' Admiralty—Steam trawler—T.R.S.	Madras Government 1927-28 1928-29 (Data re-analysed after Gravely (1929) and Sundara Raj (1930))	Cape and Manapad grounds Cape Camorin grounds Off Cochin 57-71 m Off Quilon Off Calicut Off Mangalore Bassas de pedio Bank	Otter trawl 65·84 kg per hour 83·01 kg per hour 15·24 kg per hour 382·47 kg per hour 93·96 kg 156·23 kg 62·88 kg	'Cheppilli' ( <i>Lutjanus doedecanthus</i> ) <i>L. rinulatus</i> , <i>Lethrinus nebulosus</i> , <i>Diagramma unctatum</i> , <i>serranus</i> sp., <i>Trygon</i> spp., <i>Pristis</i> spp. etc. <i>Epinephelus</i> spp. 10%, <i>Diagramma</i> 10%, <i>Lutianus</i> 12·5%, <i>Lethrinus</i> 11% and others. Young sharks, 'Cheppilli' and miscellaneous fish. Huge catch of Balistids ( <i>Balistis maculatus</i> ) Sharks, rays, plough fish, cat fish, <i>Lactarius</i> , many times large quantities of <i>Dentex tolu</i> ( <i>Nemipterus Japonicus</i> ) and miscellaneous fish. do. do. as Cape Comorin Bank—
'Bulbul'—294 tons 125 ft OAL	Ceylon Fisheries Ltd., May-September 1928	Wadge Bank	2011·36 kg	(After John, 1959)

'Tongkol' 292 tons, 125 ft. OAL	do. Sept. 1928, 1929	do.	1401·86	Per day of absence from shore.
'Raglan Castle' steam vessel 280 126 ft. OAL	Ceylon Government GRT, Sept. 1945 to Nov. 1947	do.	2570-07*	* 216 kg/hr, 1947 (Granton trawl) operations over Cape Comorin Banks—(Hickling, 1951)
'Aringa'	Lanka Deep Sea Fishing Co. Ltd., Feb. 1947 to Nov. 47	do.	2905·30	
'Kanyakumari' 90 ft., 135 tons displacement	Travancore Govern- ment, Nov. 1949 to Feb. 1950	Northward extension of Wadge Bank, 25-35 fathoms	41·22 kg per hour	<i>Lethrinus</i> spp., <i>Paraupeneus</i> spp. <i>Lutjanus</i> spp., <i>Aprion</i> spp., <i>Epinephelus</i> spp., <i>Carcharhinus</i> spp., <i>Dasyatis</i> spp., <i>Rhynco-</i> <i>batus</i> spp., <i>Holocentrum rubrum</i> , <i>Fistularia serata</i> (after Gopinath, 1954).
'Sagarkumari'	Travancore Govern- ment Dec. 1949 to May 1950	do.	54-60 kg per hour	

Comorin region where rich grounds for percoid fishes and elasmobranchs were discovered. However, it may be remembered that the then prevailing English types of craft and gear were employed without any modification. These vessels could fish only in fairly deep waters of the shelf and it was hard to prove the commercial feasibility of deep sea fishing in these waters. In addition, the limited facilities for berthing and handling these vessels in the local ports, dearth of trained local crew, etc., hampered successful operation of the vessels.

The next phase in the exploratory fishing in the area started with the establishment of the Indo-Norwegian Project in Kerala in 1953. By 1955 three modern schooners of the Project (50-70' long) based at Cochin equipped with cold storage and modern fishing equipments started exploratory trawling from 7 miles limit to the edge of the continental shelf from Cape Comorin to Calicut, to about 30 miles out to sea. These operations showed that the most productive grounds existed north and south of Cochin where substantial shrimp beds were located (Per Sandven, 1959). No catch statistics of these operations, as to the seasonal or area-wise availability of fish were published. They however, recorded that from Quilon to north Kozhikode the bottom appeared to be covered with sand and mud extending approximately to 30-40 fathoms (55-73 m), whereas the area from Quilon to Cape Comorin was found to consist mainly of sand and shale, the absence of mud being noticeable. The presence of coral reefs and rocks in some fishing grounds made trawling operations difficult. Along the edge of the continental shelf, the rocky bottom with big peaks and coral reefs likewise prevented the use of trawls.

The Deep sea fishing station of the Government of India established a station at Cochin in 1957. Systematic exploration of the fishing grounds along the Kerala and Canara coasts was started by the Government vessels which consisted of *Asok* and *Pratap* (240 h.p. 91.71 GRT, 25.42 m LBP) and 3 smaller vessels *Tarpon* and *Samudra* (42 h.p., 8.45 GRT, 10.4 m. LBP) and *Durga* (56 h.p., 10.65 GRT and 11 m). *Asok* and *Pratap* conducted mainly 'bull trawling' (pair trawling) with a bull trawl net (head rope 58 m, foot rope 62 m, cod end mesh 65 mm) from Cannanore to Cape Comorin in deeper waters. The smaller vessels conducted shrimp trawling in shallower waters (5.5-64 m depths) from Mangalore to Quilon concentrating their efforts around the 18 m line. (Shrimp trawls are generally made with 12-20 m head rope and 25-40 mm mesh). Bull trawling was conducted in numbered blocks of 600 sq. miles area in the 24-49 m depth range and some Otter trawling by *Pratap* was carried out in the Calicut-Cape Comorin region at depth varying from 18 to 49 m. The results of these operations are presented in Table II.

These operations proved the existence of rich fishing grounds off Calicut, Cochin and Alleppey-Quilon, the catch per hour of 'bull trawling' in these areas being respectively 2,035, 1,184 and 1025 kg. Bull trawling operations off Cannanore and Trivandrum yielded 591 and 509 kg per hour of operation while on the Cape Comorin Banks a return of 352 kg was observed.

Otter trawling by *Pratap* also showed comparatively higher abundance of ground fish off Calicut (136 kg/hr) and Cochin (153 kg/hr). In the Cape Comorin Banks the catch per hour was 69-83 kg. Since fish trawls of large mesh were used in these operations, conducted in comparatively deeper grounds, the abundance of prawns in the areas could not be ascertained. However prawns were taken in the catches from the Cochin-Alleppey stretch where some shallow areas were fished.

The operations of the smaller vessels in the shallower waters off Mangalore to Quilon with shrimp trawls recorded catches at the rate of 177-206 kg per hour off Mangalore, 268 kg off Cannanore, 91-250 kg off Cochin and 105-220 kg off Alleppey-Quilon, during the operations spread out from 1957 to 1961.

From 1961 onwards only the medium-sized boats of Government of India and INP were engaged in exploratory trawling off Cochin and Mangalore. Unlike the operations prior to 1960, when 600 sq. mile area was considered as a unit for purposes of assessing productivity of

**TABLE II**  
*Results of Government of India Exploratory trawling along the Kerala coast and adjacent waters from 1957-1961*

Name of vessel and other details	Period of operation	Ground/depth	Gear and catch/hour kg	Dominant species caught and remarks
'Tarpon' and 'Samudra'—42 h.p. each	1959-60	Off Mangalore 15-27 m	Shrimp trawl 177·71	Prawns, miscellaneous fish
'Durga'—56 h.p.	1960-61	11-46 m	206·13	do.
'Asok' and 'Pratap'—240 h.p. each 91·71 GRT	1957-58	Off Cannanore 37-49 m	Bull trawl 590·60	Sharks, rays, cat fish, miscellaneous small fish
'Samudra', 'Durga' and 'Turpon'	1960-61	13-37 m	Shrimp trawl 267·93	Prawns, elasmobranchs, miscellaneous fish
'Asok' and 'Pratap'	1957-58	Off Calicut 33-46 m	Bull trawl 717·24	do.
'Pratap'	1958-59		2035·55	Few prawns, sharks and rays, <i>Drepane</i> and miscellaneous fish
	1960-61		Otter trawl 135·94	
'Asok' and 'Pratap'	1957-58	Off Cochin 15-46 m	Bull trawl 1184·26	Prawns, sharks, rays, cat fish and miscellaneous fish
	1958-59	24-46 m	Bull trawl 1015·13	Prawns, sharks, rays, Karkara ( <i>Pomadasys hasta</i> ), <i>Drepane</i> , etc.
'Pratap'	1959-60	13-49 m	Otter trawling 153·67	do.
'Tarpon' and 'Samudra'—42 h.p.	1957-58	9-40 m	Shrimp trawl 91·47	Prawns, miscellaneous fish, sharks and rays.
'Durga'—56 h.p.	1958-59	9-55 m	244·17	
	1959-60	6-49	249·78	
	1960-61			
'Asok' and 'Pratap'	1957-58	Off Alleppey —Kanyakulam Quilon 26-49 m	Bull trawl 1025·65	Perches, sharks, rays, cat fish and miscellaneous small fish
'Asok' and 'Pratap'	1958-59	24-48 m	583·11	Prawns, sharks, rays, 'Karkara', <i>Drepane</i>
	1959-60	..	Otter trawl 158·45	Composition same—but 'karkara' component increased in the Quilon region
'Pratap'	1960-61	..	187·29	do.
'Tarpon', 'Samudra' and 'Durga'	1958-59	11-22 m	Shrimp trawl 105·06	Prawns, sharks, rays, Paravan ( <i>Lactarius lactarius</i> )
	1959-60	13-42 m	220·07	Composition as above with inclusion of <i>Nemipterus</i> spp from deeper grounds
'Asok' and 'Pratap'	1957-58	Off Trivandrum 35-48 m Cape Comorin Banks 26-42 m	Bull trawl 508·82 351·53	No prawns—sharks and perches dominant. Perches predominant.
'Pratap'	1959-60	Cape Comorin Banks	Otter trawl 68·61	Sharks, rays with dominant perch component.
	1960-61	do.	83-30	do.

grounds, the evaluation of the fishing results were based on exploration in 100 sq. mile areas on the shelf. Catch details with regard to fish and prawns of the Government of India and INP vessels from 1961 to 1966 at Cochin are presented in Table III and IV. Though extensive and uniform coverage of the inner half of the shelf from Calicut to Vizhingam from the Cochin base was envisaged in the programme, due to operational and other reasons, adequate coverage could be made only in the Cochin region.

Figures 1 and 2 depict the overall catch rate of these operations off Cochin showing the total effort, catch and catch per hour of the Government of India and INP boats from 1961 to 1965. These operations were, in fact, a modified continuation of the work started by these boats in 1957. A detailed account of the species composition, their depthwise abundance and seasonal fluctuations have already been given by Tholasilingam *et al.* (1964 unpublished) covering the period 1957-62. The noteworthy feature evident from the data presented now is that the overall catch per hour in both the fleets have steadily decreased from 1961. In the case of Government of India vessels catch per hour has come down from 216 kg in 1961 to 112 kg in 1965, while in the INP boats it has come down from 173 to 106 kg for the same period. The most disturbing trend in this decline is the steep fall in the catch of prawns. In the case of the Government of India vessels the prawn catch fell from 55 kg per hour in 1961 to 16 kg in 1965 and in the INP fleet from 75 kg/hour to 14 kg for the same period.

A perusal of Table II for the conditions in the Cochin region as evidenced by the catch per hour of the medium sized-vessels of the Government of India shows that there is a steady rise in the overall catch per hour of trawling from 1957 to 1961, in spite of steady increase in fishing effort; the catch per hour being 91 kg in 1957 and 250 kg in 1960, the peak year. A steady fall has been recorded since then as seen from Table III. In the case of the INP medium boats, which operated in the Cochin region, the same trend is noticeable—the catch per hour of 111 kg in 1957 having risen to its peak in 1960-61 to 207 kg (Tholasilingam *et al.*, unpublished) showed a steady decline to 106 kg per hour during 1965-66.

The present trend of reduction in the catch per hour within the grounds off Cochin may not however depict the depletion of the stocks of the different species of grounds fish available in the area. But, it may reflect a reduction in the quantum of catch for each boat due to the steep increase in the number of boats operating in the area for, the extent of the distribution of the stock of different species of ground fish and their pattern of recruitment and migration have not yet been fully understood. Regarding the increase in fishing effort it is seen that during the period from 1955 to 1967 an increase of over 50-fold in the number of mechanised boats in the Kerala region is recorded (*Souvenir*, 20th Anniversary, C.M.F.R. Institute, Mandapam Camp, 1967).

A closer look at the present-day density distribution of ground fish along a large part of the Kerala coast has been possible from the results of exploratory fishing conducted by the Government of India with the medium trawlers in the Calicut-Trivandrum section, from December 1963 to June 1966. The entire area has been divided into  $0^{\circ} 10''$  squares (100 square miles area) and classified into 4 categories according to the yield per hour of trawling the rather unproductive grounds yielding less than 40 kg per hour, grounds which yield 40-100 kg, 101-200 kg and those which yield more than 200 kg.\*

The areas between Calicut and Alleppey have been found to be generally more productive than the areas south of it. The inner 2/3 of the shelf area between Cochin and Alleppey is found to be uniformly productive with one area about 30 miles south-west of Cochin showing very high returns. North of Cochin and south of the Chetuwayi river mouth the 10 mile inshore belt is observed to be of low yield. However, farther out of this zone off the Periyar river

\* *Bull. Cent. Mar. Fish. Res. Inst.*, 6., Chart 29:



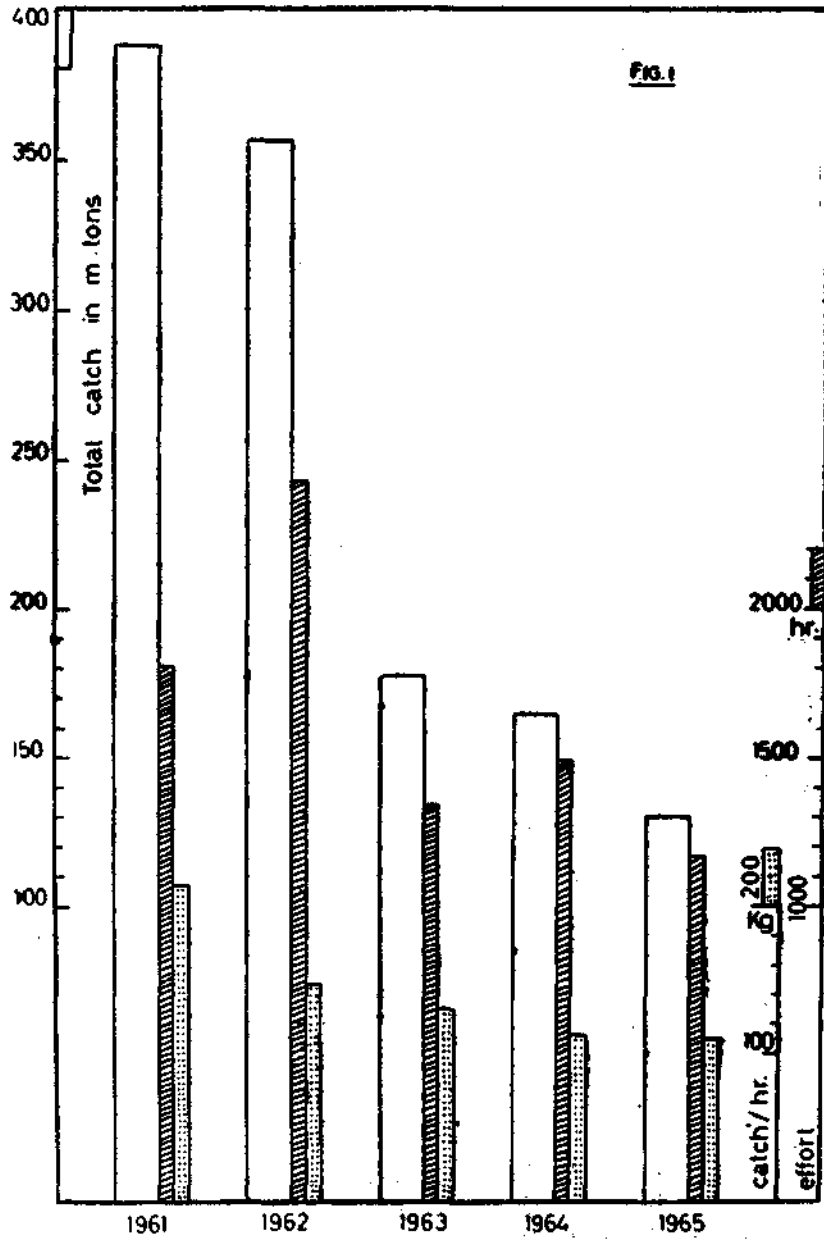


FIG. 1. Catch, effort and catch rate of Government of India trawlers at Cochin for the years 1961-1965.

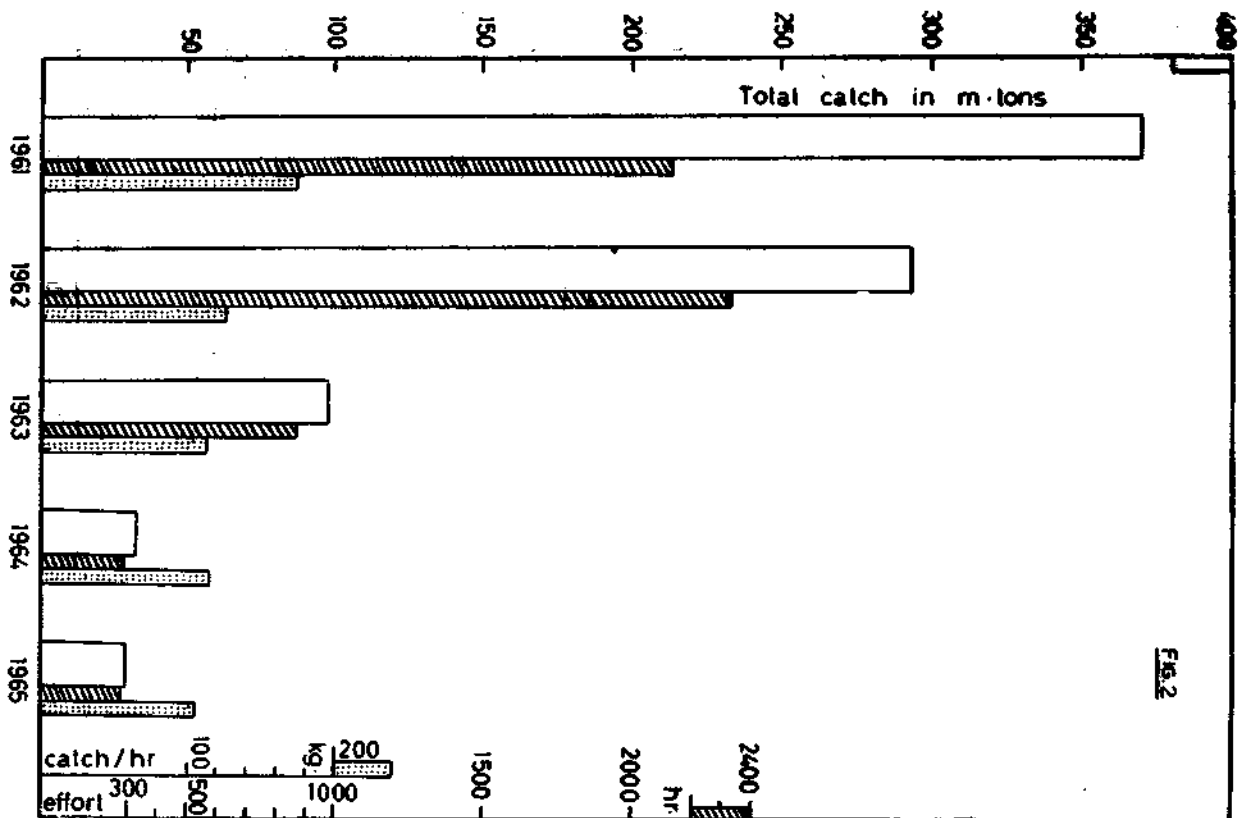


FIG. 2

FIG. 2. Catch, effort and catch rate of Indo-Norwegian Project medium size trawlers at Cochin for the years 1961-1965.

TABLE III

*Results of exploratory trawling of Government of India medium-sized vessels based at Cochin during 1961-65*

Year	Depth range in metres	Effort in hours	Catch and (catch per hour—kg)		
			Fish	Prawn	Total
1961-62	4-55	1,811	291,656 (161)	98,948 (55)	390,604 (216)
1962-63	11-57	2,438	267,472 (110)	89,774 (37)	357,246 (147)
1963-64	8-46	1,347	148,088.5 (110)	28,587.5 (21)	176,676 (131)
1964-65	10-57	1,482	136,867 (92)	28,730.5 (19)	165,597.5 (111)
1965-66	9-48	1,174	112,794 (96)	18,619.5 (16)	131,413.5 (112)

TABLE IV

*Results of trawling on INP medium boats based at Cochin during 1961-65*

Year	Depth range in metres	Effort in hours	Catch and (catch per hour kg)		
			Fish	Prawn	Total
1961-62	5-55	2,135	210,306 (98)	159,772 (75)	370,078 (173)
1962-63	4-50	2,332	137,296 (59)	156,339 (67)	293,635 (126)
1963-64	7-49	866	77,949 (90)	20,323 (23)	98,272 (113)
1964-65	5-44	283	28,275 (100)	4,172 (15)	32,447 (115)
1965-66	7-42	279	25,720 (92)	3,901 (14)	29,621 (106)

mouth productive areas exist. Areas off Chetuwayi river mouth is also observed to be highly productive. South-west of Calicut the inner half of the shelf off the Beypore river mouth has been observed to be a productive zone. With regard to the availability of prawns it is noticed that productive zones lie in the inner half of the continental shelf generally adjoining river-mouths and bar mouths of lakes. Areas south of Quilon as well as the seaward half of the shelf except patches off Cochin are found to be unproductive with regard to yield of prawns. It may be mentioned here that the largest of the coastal lakes of the west coast—the Vembanad lake opens out to the sea through the Cochin bar mouth. The lake is known to be a good nursery ground for the important penaeid prawns of the coast (George, 1962). The silt and fine mud discharged into the sea through the Cochin bar mouth settle off the region to form a good ecological niche for the adult prawns.

## TRAWL CATCH COMPOSITION

A synoptic picture of the catch composition of recent years could be pieced together from the results of exploratory fishing operations carried out along the Kerala coast and adjacent waters from 1957 to 1966. It may be mentioned here that broadly two types of operations were conducted during the period, one by the medium-sized vessels (below 100 h.p.) using shrimp

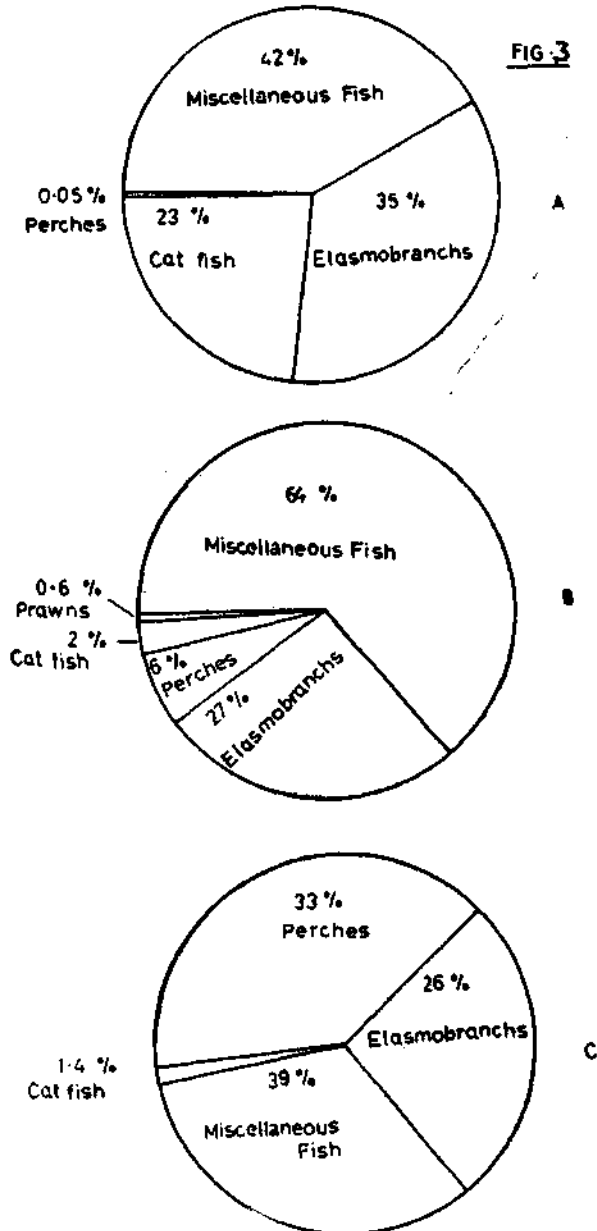


FIG. 3. A, B, C. Catch composition of ground fish based on 'bull trawling' by Government of India vessels *Asok* and *Pratap* during 1957-58. A. Cannanore-Calicut region (33-49 m depth). B. Cochin-Alleppey region (14-49 m). C. Quilon and South including Cape Comorin grounds (25-48 m).

trawls in shallow waters within about 50 m and the other 'bull trawl' and 'otter trawl' operations by large vessels (240 h.p.) in comparatively deeper grounds. The catches have been usually classified into about half a dozen component groups. Differences have been observed in their proportions in relation to time and depth strata in the different zones.

Bull trawl operations in 1957-58 in the Cannanore Cape Comorin region indicated interesting pattern in the distribution of ground fish. Elasmobranchs and miscellaneous fish comprising small sciaenids, lizard fishes and flatheads, etc., have been common all along the region. However, the whole region could be divided into three sectors—northern (Cannanore to Calicut), middle (Cochin-Alleppey) and southern (south of Alleppey including Cape Comorin grounds) based on catch composition. The northern sector showed a significant catfish component (Fig. 3 A) and the southern sector a dominant perch component (Fig. 3 C). The middle sector appeared to be a transition zone (Fig. 3 B) with small quantities of cat fish and perches but more of the miscellaneous small fish.

Bull trawl operations off Calicut (35-37 m) and Cochin-Alleppey (16-53 m) during 1958-59 indicated the availability of large quantities of rays off Calicut and the presence of the large grunter *Pomadasys hasta* in fair quantities off Cochin as well as Alleppey, which hitherto was known in the trawl catches off the north-west coast of India (Jayaraman *et al.*, 1959). Otter trawling from Cochin to Quilon (18-55 m) and in the Cape Comorin grounds (38-62 m) in 1959-60 showed more or less the same trend in the catch composition of the region as observed in bull trawling during 1957 and 1958. It was observed that cat fish and karkara (*Pomadasys hasta*) did not figure in the catches of the Cape grounds where a variety of other percoids dominated.

During the period from 1957 to 1962, catches mostly from the inner half of the continental shelf, off Cochin by medium sized trawlers, were composed of, on an average 49% (by weight) of miscellaneous small fish, 35% prawns, 8% *Nemipterus japonicus*, 6% elasmobranchs and 2% *Lactarius lactarius* (after Tholasilingam *et al.*, 1964, unpublished, *loc. cit.*) (Fig. 4 A).

This pattern had changed during the operations from December 1963 to June 1966 showing 49% miscellaneous fish, 21% prawns, 14% elasmobranchs, 14% *Nemipterus japonicus* and 1% *Lactarius lactarius*. Increase in elasmobranch and *Nemipterus* proportion and a considerable reduction in prawn component are noticeable (Fig. 4 B).

Off Mangalore during 1959-61 and 1962-63 seasons medium trawlers yielded 62% miscellaneous fish, 24% prawns, 11% elasmobranchs, 2% *Lactarius lactarius* and nearly 1% *Nemipterus* (Fig. 4 C).

#### DEPTHWISE AVAILABILITY OF FISH AND PRAWNS OFF COCHIN

Tholasilingam *et al.* (1964—unpublished) studied the relative abundance of fish and prawns in the trawl grounds off Cochin for the years 1959-62. They found that maximum return of prawns per hour of trawling was taken from the 7-20 m depth zone (50 kg/hr), which gradually declined to less than 5 kg/hr in the 37-42 m zone. Fish showed a reverse pattern with increased catches towards deeper grounds, as far as the 34 m zone, beyond which comparable fishing effort was not put in.

Results of trawling in the same region during January 1964 to June 1966 showed almost the same pattern of depthwise distribution of prawns and fish. The catch per hour of prawns gradually increased seaward up to 19 m, the 15-19 m depth zone having the most productive

grounds (40 kg/hr). \* Towards further depths prawns catches gradually declined and to insignificant levels beyond 35 m (9 kg/hr). The fish yield was least in the 10-14 m zone, which gradually increased to the maximum in the 35 m and deeper areas.

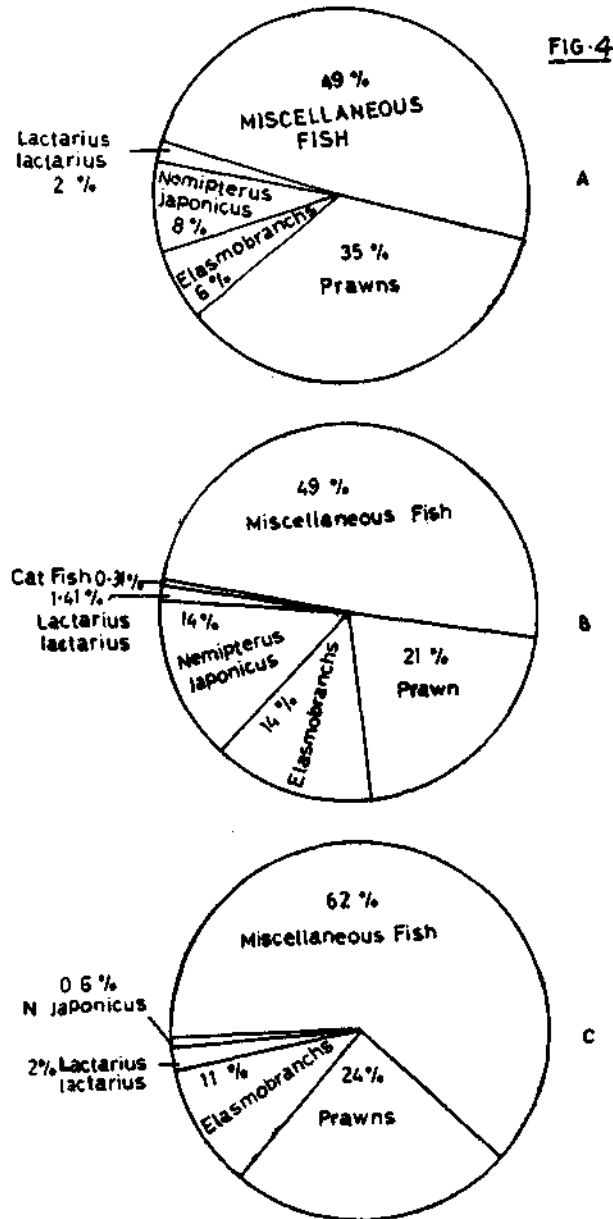


FIG. 4, A, B, C. Catch composition of ground fish based on (Otter) trawling by Government of India vessels  
 A. Cochin region (1957-62). B. Calicut to Trivandrum (December 1963 to June 1966—7-57 m).  
 C. Mangalore region (1959-61 and 1962-63, 11-46 m).

\* Bull. Cent. Mar. Fish. Res. Inst., 6, Chart 30.

## PRESENT TREND OF SEASONAL AVAILABILITY OF FISH AND PRAWNS OFF COCHIN

Data pertaining to April 1965 to March 1966 season has been considered for this purpose and a month by month presentation is given here.

During April (1965) the dominant species occurring in the shallow grounds (within 11 fathoms = 20 m) are the prawn *Metapenaeus dobsoni* (Poovalan) and the fishes *Pseudosciaena sina* and *Otolithus argenteus*, while in the intermediate depths (22-35 m) *Leiognathus* spp., *Opisthopterus tardoore*, *Nemipterus japonicus*, *Caranx* sp. and the prawn *Parapenaeopsis stylifera* (Karikadi) have been common. *Nemipterus japonicus* and *Penaeus indicus* (Naran) are caught in fair quantities from the deeper grounds up to 42 m during this month.

In May in the shallow grounds *Pseudosciaena sina*, *P. axillaris*, *Trichiurus haumela* and *Metapenaeus dobsoni* are the dominant species caught and in the intermediate depths *Leiognathus* spp., *Opisthopterus tardoore*, *Parapenaeopsis stylifera* and *Metapenaeus affinis* (Kazhunthan) dominated in the catches. Deeper grounds yielded good quantities of *N. japonicus*, *Lactarius lactarius*, cat fish and *Caranx* sp.

During June dominant species from the shallow grounds are *Pseudosciaena sina* and the prawn *Parapenaeopsis stylifera*. The prawns *P. stylifera* and *M. affinis* have been important items from intermediate depths. Deeper grounds yielded mainly *Trichiurus haumela*, *Opisthopterus tardoore* and *Nemipterus japonicus*.

In July during the monsoon peak the shallow nearshore grounds (within 13 m) yielded *Opisthopterus tardoore*, *Lactarius lactarius* and some *Leiognathids*. August to October has been the offseason for the vessels.

In November the dominant species from the shallow grounds were *Leiognathus* spp. and *Arius* sp. *Otolithus argenteus*, *Platycephalus* sp. and *N. japonicus* dominated in the catches from intermediate depths, whereas 50% of the catches from the deeper grounds were formed of *N. japonicus*.

In December *Leiognathus* spp. and *N. japonicus* were the important items in trawl catches and they were caught at intermediate depths.

During January *Platycephalus* sp. elasmobranchs and the prawn *M. affinis* were the dominant species and they came from the shallow grounds.

In February the intermediate depths yielded mainly *N. japonicus*, *M. dobsoni* and *Penaeus indicus*, and in March *N. japonicus* and *Saurida tumbil* dominated the shallow water catches while *Otolithus argenteus*, *Platycephalus* spp., *N. japonicus* and *Arius* sp. were the important from the intermediate depths. More than 50% of the catches from the deeper grounds were *N. japonicus*. A close look at the foregoing account reveals the trend of depth wise availability of the various species. It is seen that fish like *N. japonicus* and the prawn *Penaeus indicus* are caught more at intermediate depths and deeper grounds while *Pseudosciaena* spp. and *Metapenaeus dobsoni* are available more in the shallow grounds. Among other species which occur in shallow and intermediate depth grounds, *Platycephalus* spp., *Leiognathus* spp., *Opisthopterus tardoore*, and *Parapenaeopsis stylifera* are more often available from the intermediate depth zone.

## DEEP WATER GROUND FISH RESOURCES

*Line-Fishing Grounds*

Hornell (1916) and John (1948) pointed out the prospects of good line-fishing grounds off the Travancore coast (South Kerala and Kanyakumari). The existence of *Kalava* (*Epinephelus*

spp.) grounds in rocky areas off Varkala, Trivandrum, Poovar, Pulluvila, etc., has been known for decades to the fishermen of these coastal areas. A seasonal fishery for the species is also in vogue during December to April in these parts. The exploratory fishing operations conducted by the Department of Marine Biology and Fisheries of Travancore University (John, 1948), Gopinath (1954) and the Madras Government (Chidambaram and Rajendran, 1951) have brought out some information on the potentialities of the grounds lying between Kayamkulam and Anjengo and off the Cape Comorin region.

Mother ship operations (towing non-mechanised fishing boats to the grounds—in the present case handline units) conducted by the Madras Government with two vessels *Lady Nicholson* and M.F.V. *Gouhar Khaleeli* and 3 Tuticorin type of canoes during February–March 1949 in the Wadge Bank region (Chidambaram and Rajendran, *loc. cit.*) showed that 15 kg of fish per handline per hour was available from the grounds. Of these 69% by weight consisted of *Epinephelus* spp., 9% *Lutjanus* spp., 11% *Aprion pristipoma* and the rest sharks, *Lathrinus* sp., etc. *Epinephelus tauvina* constituted the single largest component being 55% of the catch.

Mother ship handline operations by the Travancore University during January to April 1949 and January to March 1950 (Gopinath, *loc. cit.*) covering the region off Kayamkulam to Anjengo (Lat. 8° 40' to 9° 15' N and Long. 76° 0' to 76° 25' E) and in the Cape Comorin region (Lat. 7° 45' to 8° 00' N and Long. 76° 45' to 77° 10' E) revealed very good perch grounds in the Kayamkulam–Anjengo region and good grounds for sharks and *Lutjanus* spp. in the Cape and Muttom grounds. The catches of mother fishing operations of '*Chandrika*' (75 ft.) showed that 73% by weight of the fishes caught on the line from the Kayamkulam–Anjengo stretch were *Kalava*, 15% *Lutjanus* spp. and 12% other fishes consisting of sharks, *Anthias multidentis* and *Chromileptis*.

In the southern grounds (Muttom–Cape) the shark component was dominant being about 40% of the total catch. *Lutjanus* spp. and *Epinephelus* spp. were almost equal in their contribution being about 29% and 28% respectively. *Anthias* sp. and *Chromileptis* constituted the remaining insignificant portion of the catch. The best grounds were observed to be in the 70–106 m depth zone off Quilon.

Subsequently since 1957 several fishing trips were organised by the Indo-Norwegian Project for survey of the *Kalava* grounds off the Kerala coast. Their operations extended to almost all the rocky patches on the continental shelf usually lying in 73–110 m depth zone from Trivandrum to Cannanore. Most of the areas of this nature are possibly good *Kalava* grounds. Some very productive grounds for line fishing have been discovered north-west of Cochin off Chetuwayi and Ponnani. In these grounds the recent trend of catches show that about 80% by number is composed of *Epinephelus chlorostigma*, 10% of *Aprion microlepis* and 10% of other *Epinephelus* spp. such as *E. areolatus*, *E. diacanthus* and *E. tauvina*.

Observations showed that the main species of *Kalava* presently caught in these grounds namely *E. chlorostigma* ranged from 37.5 to 61.0 cm in total length and 1–3 kg in weight, the average weight of this fish being around 2 kg. The next common species *E. areolatus* measured 48.0–59.0 cm and weighed  $\frac{1}{2}$ –2 $\frac{1}{2}$  kg. The size range of *Aprion microlepis* was 46.0–57.5 cm and weight 1–2 kg.

It was also observed that on an average a good ground yielded about 50 fish (about 100 kg) per hour of fishing by 3 handlines using a total of 18–20 hooks and operated reeling over pulleys. The bait used were pieces of any small fish like sardine, dog fish or shads. Sometimes even white waste cotton was enough to make *kalava* bite. Commercial exploitation of these resources are possible, provided big vessels (at least 60') with cold storage facilities are available which could stay on in the grounds for about a week and return to the base with the well-preserved catches.



*Deep Water Trawling Grounds.*

Deep water trawling operations by Indo-Norwegian Project along the continental slopes off Alleppey and Ponnani on the south-west coast (274–374 m) during March to May 1963 revealed the presence of a number of species of fish and prawns hitherto unknown from the region (Tholasilingam *et al.*, 1964, George, 1966, George and Rao, 1966). Among the fish species *Cubiceps natalensis* (catch rate up to 254 kg/hour) formed about 45% by weight of the catches, other important fish species available were *Neobythites steaticus* about 10%, *Neoscopelus macrolepidotus* 9%, *Epinnula orientalis* 5%, *Chlorophthalmus agassizi* 4% and a variety of other bathypelagic fish and crustaceans. Among the crustaceans the deep sea prawn *Penaeopsis rectacuta*, *Heterocarpus woodmasoni*, *Metapenaeus andamanensis* and *Parapandalus spinipes* and *Aristaeus semidentatus* were the important species recorded in the above cruises (George, 1966, *loc. cit.*).

John and Kurien (1959) reported the lobster *Puerulus sewelli* in beam trawl catches at 274 m off Vizhingam and at 200 m off Anjengo on grounds believed to be rocky. They also reported concentrations of the prawn *Penaeopsis philippii* at several stations between Mangalore and Anjengo in depths ranging from 157 to 274 m. INP operations yielded *Puerulus sewelli* in trawl off Alleppey, the catch rate being about 10 kg/hour: (Tholasilingam *et al.*, *loc. cit.*). The U.S.S.R. Oceanographic Research Vessel 'Akademie Knipovich' struck *Puerulus* grounds on the continental slopes off Colachel (215–240 m Lat. 8° 00' to 8° 02' and Long. 76° 39' 7" to 76° 40' 3" E) and caught about 200 kg of the lobster in two hauls (George 1966—report, unpublished). The species was met with off Quilon also (317–320 m, Lat. 8° 42' 8" N and Long. 75° 37' 3" E) in few numbers by the vessel. Large quantities of *Chlorophthalmus* spp., mainly *C. agassizi* and *Cubiceps natalensis* were caught by this vessel from the above ground. Off Cochin at 38 m the vessel caught in one haul, among other species, about 150 kg of the large grunter *Pomadasys hasta*, a good table fish more known from the Bombay region. Off Cape Comorin (195–208 m) Lat. 7° 37' N, Long. 76° 41' 7" E) the vessel came across good quantities of boar fishes (*Antigonia* spp.).

Some amount of mid-water trawling conducted by the INP off the west coast of India revealed the presence of large concentrations of Balistids on the shelf from Calicut to Kayamkulam at 50–60 m levels on ground 60–110 m deep during January 1962 (Venkataraman and George, 1964).

## SUMMARY AND CONCLUSIONS

*Resources*

The ground fish resources of the Mangalore-Cape Comorin region which have been considered in this paper consist of the species caught on the trawl grounds and those available on other gear such as handlines, from the deeper areas of the shelf where trawls cannot be used.

The species from the trawl grounds in the Mangalore—Quilon stretch are mainly the penaeid prawns and the industrial fish such as small Sciaenids, Leiognathids, flat heads, lizard fishes, sole, etc., from the shallow and intermediate depths and the *kilimeen* (*Nemipterus* spp.), carangids, cat fish, *karkara*, *Drepane*, etc. from the intermediate depths and deeper grounds. Good prawn grounds are found to lie off the river and bar mouths in the region.

In the Quilon-Cape Comorin stretch, a variety of perches (Epinephelidae), snappers (Lutianidae), breams (Lethrinidae) and elasmobranchs dominate. On the rocky outgrowths along the seaward half of the shelf from Cape Comorin to Cannanore good line-fishing grounds for *kalava* (*Epinephelus* spp.) exist.

Large mid-water concentrations of Balistids are met with 20–35 miles off the coast from Calicut to Kayamkulam.

Trawling results along the continental slopes off the south-west coast from Cochin to Cape Comorin have revealed the existence of fairly good quantities of deep water prawns, the lobster

*Puerulus sewelli* and densely shoaling fishes like *Cubiceps natalensis*, *Chlorophthalmus* spp., boar fishes (*Antigonia* spp.), snake mackerel (*Epinnula orientalis*), etc., which could either be used for industrial processing or for human consumption as the case may be.

### Exploitation

Of all these resources none except those from the shallow and intermediate depth zones off some centres such as Quilon, Cochin, Beypore, Cannanore and Mangalore are adequately exploited. Of the above centres some like Cochin are very heavily fished. Most of the commercial vessels are medium-sized shrimp trawlers (25–36 ft. and 10–40 h.p.) without auxiliary mechanised devices for shooting and hauling the net. They conduct only daily fishing within a limited range of about 15 miles. Only large Government vessels engaged in research generally fish beyond this range.

### Trend of Production

The catch rate of the Government of India exploratory fishing vessels from 1957 to 1966 for the Cochin region shows that there was a steady increase in catch per hour from 1957 to 1961 and since then the catch rates show a gradual decrease which has not attained an equilibrium so far. The decline in catch rate for the latter period is also evident from the results of Indo-Norwegian Project fishing operations for the Cochin region. This appears to be a case where increasing fishing effort in a limited area shows diminishing returns per unit of effort.

### Prospects

Ground fish resources of the shoreward half of the region from Quilon to Mangalore are fairly well exploited now by medium-sized trawlers. However there is an uneven distribution of effort, fishing pressure on some areas like Cochin being very heavy. The information now available on the fish resources in the outer half of the shelf in the region indicates good possibility for developing handline fishery for *kalava* (*Epinephelus* spp.). Exploratory trawling operations in deep waters on the south-west coast of India have shown the occurrence of certain varieties of prawns, lobster and ground fishes which though not apparently attractive for fresh consumption could profitably be used for industrial processing. Exploitation of the deep water grounds is possible with only larger vessels (about 60–90 ft.) which could use multipurpose gears for the varied types of resources available including mid-water and pelagic resources.

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