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Assessment and Possible Development of the Fishery Resources of Pedro Bank

By

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INTRODUCTION

Pedro Bank is that part of the continental shelf lying at the mouth of the Palk Strait off Point Pedro (Fig. 1). In the north it is continuous with the shelf along the eastern coast of India, and in the south tapers to a narrow strip off Mullaithivu and is continuous with the shelf along the eastern coast of Ceylon. The area of the shelf between the 10 and 100 fathom line from a line running north-east of Calimere Point (India) to Mullaitivu (Ceylon) is approximately 1,300 squares miles. The southern end of the shelf is 360 miles by sea from Colombo.

Though the bank forms part of the Island's continental shelf, a major part of it, except for its southern end, is beyond reach of the existing non-mechanised craft. It is also farther away than Wadge Bank for the Colombo based trawlers. Wadge Bank is being actively fished with the help of two trawlers (Sivalingam and Medcof 1957). The proximity of the Pedro Bank to the island permits the operation of mechanised boats much smaller than trawlers during at least a major part of the year. Smaller boats require less capital investment than large trawlers and this will attract those interested in commercial fishing, but hesitating to invest on large trawlers either as a result of lack of necessary capital, or as a result of poor records of earlier trawler operations.

The object of this paper is to present an account of available information on the fishing characteristics of the Pedro Bank with a view to fuller development of its resources. The chief sources of information are, (1) the results of two surveys carried out in 1907 and from 1920 to 1921 respectively, (2) records of the commercial trawler operations from 1928 to 1935, and (3) results of the more recent trials carried out between 1949 and 1957 and in August 1961.

PRESENT STATUS OF THE FISHERY OFF POINT PEDRO

There is very little fishing activity beyond about five miles off shore from Point Pedro and adjoining areas. Most of the effort is concentrated within this limit exploiting the small inshore varieties mainly Clupeids and the pelagic offshore varieties like Carangids and Scombrids that move within the above area. Various types of gear like gill nets, beach seines, traps, etc., are used for this fishery.

The limited activities beyond five miles from shore are mainly for bottom fishes, and till recent years were carried out almost exclusively by migrant fishermen from south-western parts of the island during the south-west monsoon season (May to September), when fishing is not possible in their areas due to bad weather. These men have used Thalayady and centres south of it as their base and tapped the resources of the southern end of the Pedro Bank. Fishing has been carried out with handlines and, to a limited extent, with bottom longlines from outrigger canoes which were the only type of boat used for fishing operations beyond about five miles from shore till the recent introduction of the mechanised craft. Mechanisation has helped the fishermen to fish in areas farther away from shore than was possible earlier but there are still many unpowered craft participating in the fishery.

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In 1961 two or three mechanised vallams or dug out canoes (Anon 1958) owned by local residents were operated from Point Pedro in about 13 to 16 fathoms depth for demersal varieties, using handlines. The handlines were made up of No. 100 monofilament nylon for depths up to about 25 fathoms and of No. 150 for deeper areas where the weight of individual fish caught, mostly *lomaha* (*Aprion pristopoma*), is heavier. These lines cost Rs. 4·20 and Rs. 7·20 per 100 yards respectively. There are two hooks to a line with a cone-shaped lead sinker of about one pound weight. For areas deeper than 25 fathoms, weight of the sinker was increased to one and a half to two pounds. Small fish like *sudai* and *salai* (Clupeids) and other forms like cuttlefish, squid and prawns were used as bait. Whenever the bait fish is abundant in the inshore waters, the fishermen catch their own bait with the help of gill nets, on their way to the fishing grounds. During the other seasons the bait is brought from the Jaffna Lagoon area.

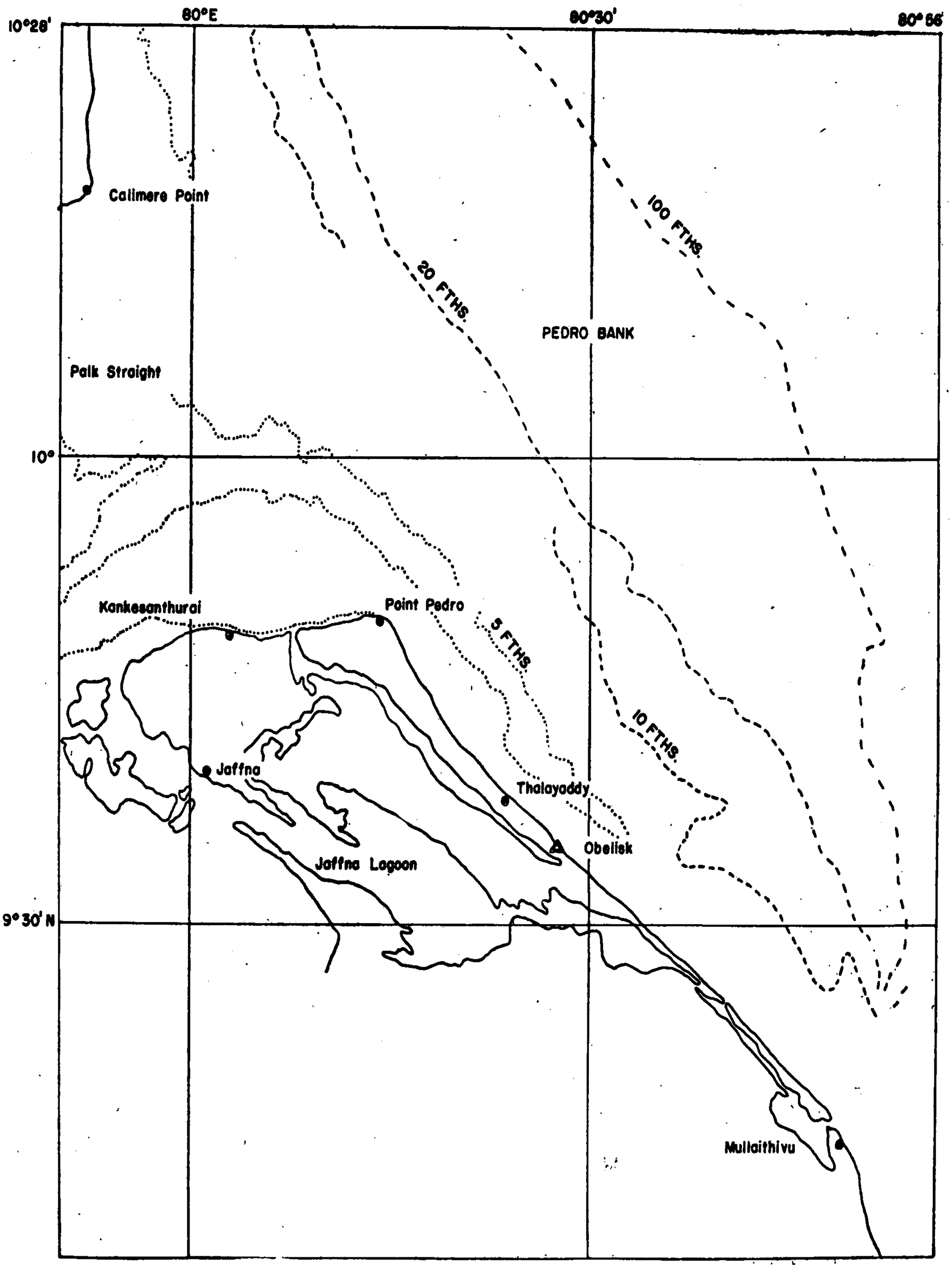

FIG. 1

Personal discussion with the fishermen revealed that about seven men (i.e., seven handlines) operate from each boat and the daily catch per boat is very variable, ranging from 100 pounds to about 700 pounds. On rare occasions it has exceeded 1,000 pounds. The high variability is probably due to insufficient knowledge of the fishing area. Gradually, as the fishing grounds become more familiar, the fishermen should be in a position to bring in steadier catches. The fishermen sell their catch at the wholesale rate of 30 cts. per pound for Grade II* demersal varieties. Often they do not own the mechanized boat and it is hired at the rate of Rs. 50/- per day, plus expenses for fuel, etc. The total cost for the boat, fuel, bait and food per day is approximately Rs. 100. On this basis the fishermen share as profit, anything in excess of about 330 lbs. per working day.

TRAWL SURVEYS OF 1907 AND 1920-1921

The first recorded trawl survey on the Pedro Bank was carried out by a private organisation, "The Ceylon Company of Pearl Fisheries Ltd.", with S. T. "*Violet*" under the charge of Captain Crib in 1907 (Hornell 1916). According to Hornell (1916) the only really satisfactory trawling area revealed by the survey was off the north-east coast of the Island between Mullaithivu and Point Pedro. Here, outside the Mullaithivu shoals in depths from 15 to 40 fathom sandy ground, good fishing was obtained and the trawling master was of opinion that a full powered steam trawler would pay its way working there.

Captain Crib's survey was followed by another carried out by the Government of Ceylon in 1920–21 with the help of "*Lilla*" (Malpas 1926). During this survey, "*Lilla*" systematically explored about 650 square miles. While "*Violet*" had experienced difficulty with coral outgrowth during her survey "*Lilla*" encountered quantities of gorgonids and sponges, but did not encounter coral to the same extent. Twentysix trawl hauls of 32½ hours duration were made on the bank proper. The total catch was 4,106 lbs. with an average catch of 126·3 lbs. per hour of trawling. The catch per hour for Wadge Bank for the same boat during the same survey was 195·3 lbs. On the Pedro Bank better catches were obtained from 11–45 fathoms. On these results, assuming 18 actual trawling hours per day, a trawler was expected to catch about a ton daily. But with experience and knowledge of the grounds a better catch was expected. Malpas (1926) was of opinion that, with continuous trawling, bottom conditions could be improved.

COMMERCIAL TRAWLING 1928–1935

Records

The first commercial trawl operation on the Pedro Bank commenced in 1928. Two trawlers "*Bulbul*" and "*Tongkol*" were operated from Colombo on the Pedro and Wadge banks by a private company "The Ceylon Fisheries Limited". The original of the records maintained by the company is available for study. This record gives the trip number of each trawler, dates of sailing and return, name of fishing ground, weather, total quantity of fish landed in tons, hundredweights and pounds and proceeds in rupees and cents. The analysis given in the following pages is based on these records.

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* Sea breams snappers, rock cods, etc. (Pearson and Malpas, 1926.)

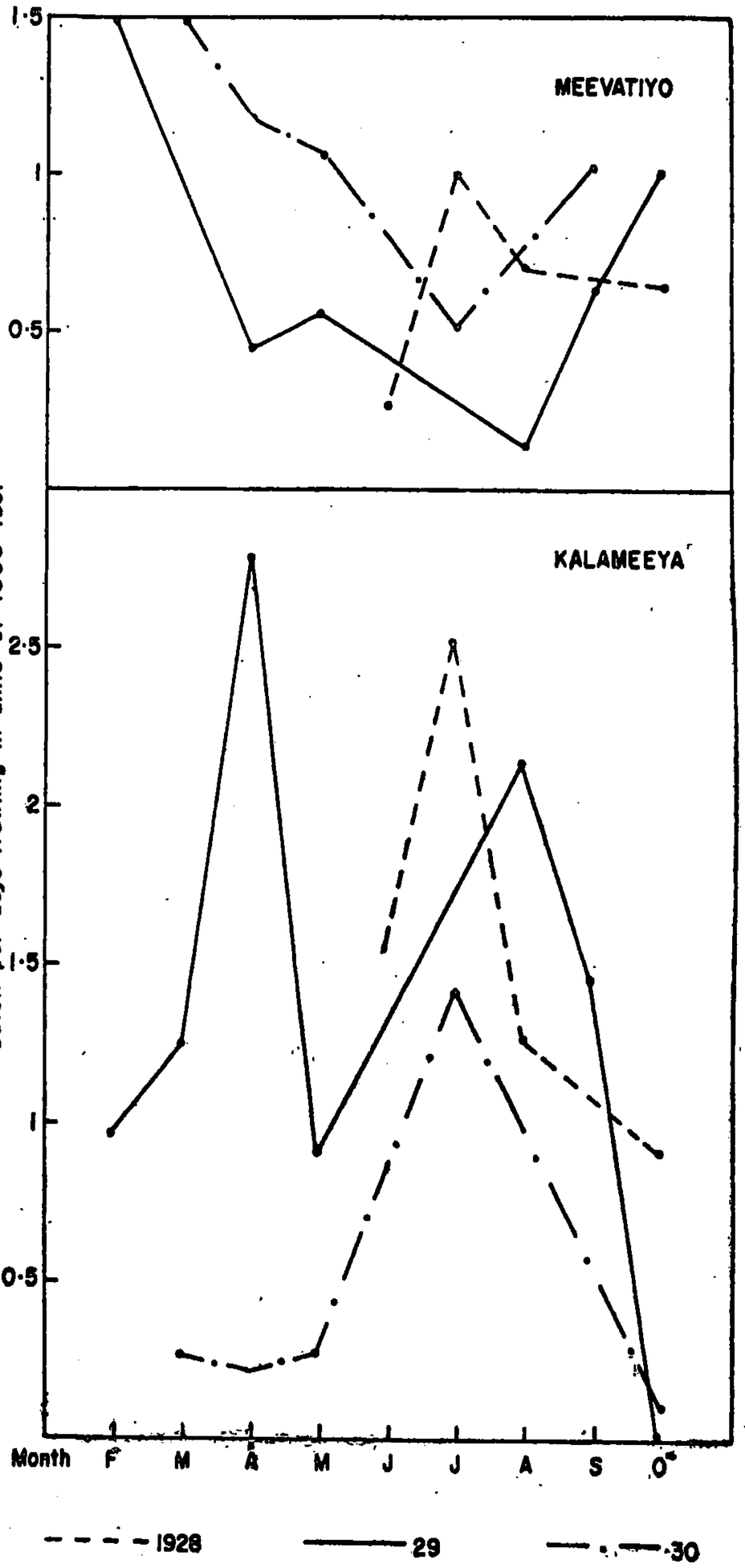

FIG. 2

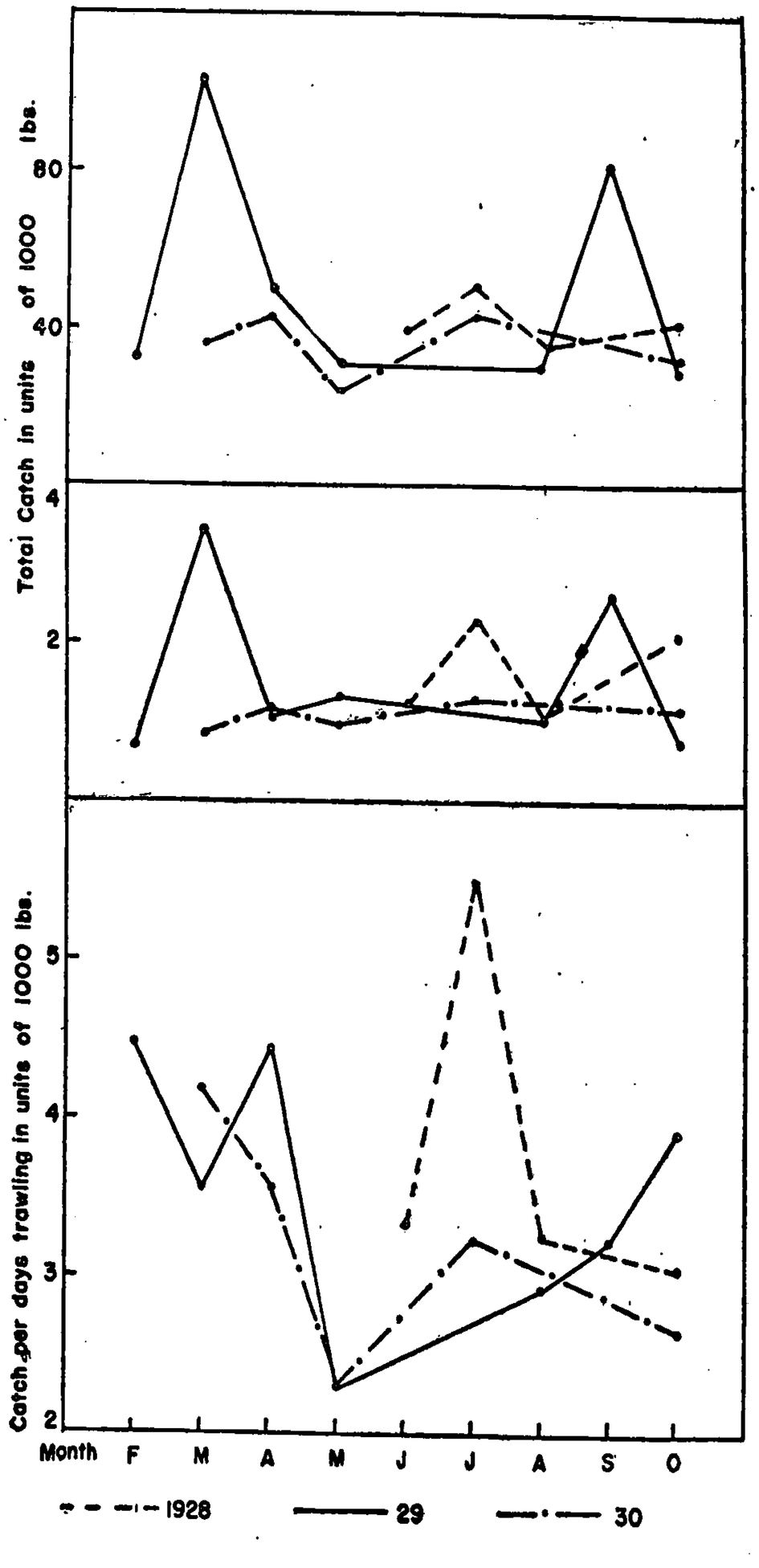

FIG. 3

Period of Operation

"*Tongkol*" (292 tons) operated from 1928 to 1929 and "*Bulbul*" (294 tons) from 1928 to 1935. But Pedro Bank was actively fished for only three years, 1928 to 1930, after which only two trips were made, one in 1932 and another in 1935. Even during the period of active fishing, trawling was never continuous throughout the year. For long periods, especially during north-east monsoon months when weather conditions are bad on the Pedro Bank, fishing activities were concentrated on theWadge Bank. During the period of active fishing total number of trawling days ranged from 109 in 1929 to 56 in 1930 with annual total landings of approximately 384,000 lbs. and 178,000 lbs. respectively. Number of days out of port for each trip varied from 10–17 days.

Efficiencies of the Trawlers

The catch per day by the two trawlers for the year 1929 for Pedro and Wadge banks is given in Table II. The catch by "*Tongkol*" had been slightly smaller than that of the "*Bulbul*". The difference is less than 8 percent. of the catch by the latter and therefore, for the purpose of the following analysis it is assumed that the efficiencies of the two trawlers were equal.

Varieties landed

The fish landed has been classified into the following varieties and the weight of each variety is recorded in pounds:—

Name of variety as it appears on record	*Probable scientific name*
Kalameeya ..	.. *Aprion pristopoma* (Bleeker)
Parau ..	.. *Caranx* (various sp.)
Tambua ..	.. *Lutianids* (?)
Atissa ..	.. *Sparus* sp.
Meevatiyo ..	.. *Lethrinus nebulosus* (Forskal)
Jeelawa ..	.. *Sphyraena jello* (Cuvier)
Laweya ..	.. *Epinephelus undulosus* (Quoy and Gaimard), and other *E.* spp.
Bedau ..	.. *Lutianus rivulatus* (Cuvier)
Gal pulunna ..	.. *Kuhlia marginatus* (?) (Cuvier)
Orawa ..	.. *Acanthurus matoidis* (Valenciennes)
Kossa ..	.. *Epinephelus* sp.
Mixed fish ..	.. (?)

Plectorhynchus pictus and *Arius thalassinus* (Catfish) are important species on the Wadge Bank and are being caught in appreciable numbers in the present trawl fishery (Sivalingam and Medcof 1957). In all probability they would have been caught during the commercial fishery operations of 1928–1935. But it is not known under which variety they have been classified.

The most important varieties found on the Pedro Bank are *Kalameeya* and *Meevatiyo* (Table I). Together they contributed on the average 56% of the total catch. There appears to be no regular seasonal variation in the appearance of these two varieties (Fig. 2).

TABLE I

PERCENTAGE COMPOSITION OF THE VARIETIES CAUGHT ON THE PEDRO AND WADGE BANKS FROM 1928 TO 1930

Variety	*Percentage*			*Name of Bank*
	1928	*1929*	*1930*	
KALAMEEYA	40 ..	41 ..	16 ..	PEDRO
	0 ..	5 ..	5 ..	WADGE
PARAU	3 ..	5 ..	7 ..	PEDRO
	2 ..	7 ..	3 ..	WADGE
TAMBUA	8 ..	9 ..	12 ..	PEDRO
	12 ..	22 ..	25 ..	WADGE
MEEVATIYO	18 ..	22 ..	32 ..	PEDRO
	28 ..	21 ..	21 ..	WADGE
LAWEYA	5 ..	5 ..	8 ..	PEDRO
	26 ..	22 ..	22 ..	WADGE
BEDAU	8 ..	6 ..	6 ..	PEDRO
	6 ..	9 ..	12 ..	WADGE
KOSSA	3 ..	2 ..	2 ..	PEDRO
	4 ..	5 ..	4 ..	WADGE
SHARK	0 ..	0 ..	2 ..	PEDRO
	4 ..	1 ..	2 ..	WADGE
OTHERS	15 ..	10 ..	15 ..	PEDRO
	18 ..	8 ..	6 ..	WADGE

TABLE II

COMPARISON OF THE EFFICIENCIES OF THE TWO TRAWLERS "BULBUL" AND "TONGKOL" FOR THE YEAR 1929

Trawler	Pedro Bank			Wadge Bank			Total		
	Total Catch in lbs.	*No. of days trawling*	*Catch per day*	*Total Catch in lbs.*	*No. of days trawling*	*Catch per day*	*Total Catch in lbs.*	*No. of days trawling*	*Catch per day*
Bulbul ..	266,099..	77 ..	3,456..	335,658..	75 ..	4,475..	601,757..	152 ..	3,959
Tongkol ..	80,804..	25 ..	3,232..	262,486..	64 ..	4,101..	343,290..	89 ..	3,857

Seasonal Variations

The catch per day by months for the three years 1928 to 1930 (Fig. 3) shows that the catch per day varied from 5,541 lbs. in July 1928 to 2,317 lbs. in May, 1930. There is no definite pattern of seasonal variations within the year but during 1929 and 1930, the only years when fishing was conducted during the early part of the year on the Pedro Bank, catches during February, March and April were heavier than during the rest of the year. With the limited data available it is not possible to say whether this is a regular feature. It is interesting to note that on the Wadge Bank on the other hand this is the period when catches are low (Sivalingam and Medcof 1957).

Productivity

An analysis of the total catch landed between 1928 and 1935 is given in Table III (Fig. 4). From this data it is not possible to come to any definite conclusions about the potentialities of the bank, since fishing was not continuous and had not been carried out for a reasonably long period, but the general indications cannot be overlooked. The number of days of trawling increased from 67 days in 1928 to 109 in 1929 but, probably with the decrease in catch, was reduced to 56 in 1930, after which trawling was more or less completely abandoned on the Pedro Bank. The significant feature of the catch is the downward trend of the catch per day trawling throughout the period, from 3,990 lb. in 1928 to 3,174 lb. in 1930. This downward trend may possibly be the reason why trawling activity was discontinued on the Pedro Bank and diverted to the Wadge Bank after 1930.

The limit of the area of operation of the trawlers during these three years is not known. But if fishing was carried out over the entire area of the bank, then this downward trend indicates that the Pedro Bank probably cannot support the regular operation of a trawler of the size of "*Bulbul*" and "*Tongkol*". But if on the other hand fishing was limited to a particular area of the bank during the period of three years, then either the above indication is still true or the fish stocks where the operation was carried out were independent of those of the adjoining areas.

The bank was not fished during the north-east monsoon months and we do not know if there were any migratory species that might have altered the catch rate during the north-east monsoon season as in the case of Wadge Bank (Sivalingam and Medcof 1957). The presence of such species may give a different picture. Evidence that the stocks can be quickly depressed is by no means conclusive, nevertheless, the result of the trawling operations should be taken into consideration in estimating the number of trawlers that can successfully operate on the Pedro Bank, without any diminishing returns.

TABLE III

SUMMARY OF COMMERCIAL TRAWLER OPERATIONS ON PEDRO AND WADGE BANKS BETWEEN 1928 AND 1935

Year	1928	1929	1930	1931	1932	1933	1934	1935	*Name of Bank*
Total catch in units of 1,000 lbs.	267·3	374·9	177·7	—	53·9	—	—	41·9	Pedro
	221·1	719·2	581·2	957·7	1,288·0	1,046·7	858·1	492·4	Wadge
Total effort in No. of days trawling *	67	109	56	—	12	—	—	16	Pedro
	89	185	147	199	178	209	169	92	Wadge
Total No. of trips †	6	11	5	—	1	—	—	1	Pedro
	12	28	16	20	24	22	18	10	Wadge
Catch per days trawling in lbs.	3,990	3,434	3,174	—	4,491	—	—	2,618	Pedro
	2,484	3,887	3,953	4,813	6,899	5,008	5,077	5,852	Wadge
Proceeds per days trawling in Rs.	966	953	801	—	404	—	—	306	Pedro
	670	941	914	698	879	632	607	549	Wadge
Proceeds per day out of Port in Rs.	762	732	631	—	323	—	—	257	Pedro
	591	817	824	635	774	571	549	495	Wadge
Proceeds per lb. landed in cents	24	28	25	—	9	—	—	12	Pedro
	23	24	23	15	13	13	12	10	Wadge

* In calculating the No. of days fishing it is assumed that the No. of days taken to steam to the fishing grounds and back is 3 and 1 for Pedro and Wadge Banks respectively.

† Trips where part of the time was spent on activities other than fishing like light-house relief and salvage works have been excluded.

TABLE IV

COMPARISON OF THE RESULTS OF THE 1956 AND 1961 BOTTOM LONGLINING OPERATIONS ON THE PEDRO BANK

August, 1956				*August, 1961*				
Date	*Position off Point Pedro*	*Depth in Fathoms*	*Bait*	*No. of Hooks*	*Catch in lbs. per 100 hooks*	*Date*	*Position off Point Pedro*	*Depth in Fathoms*	*Bait*	*No. of hooks*	*Catch in lbs. per 100 hooks*
8	ENE	27	Herring	840	27·0	9	NE	13	Salai	1680	2·1
10	ENE	30	„	630	33·0	10	NE	28	Sudai	840	1·2
12	ENE	30–31	Cuttlefish	1120	55·0	14	ENE	14–18	Sudai	840	6·5
13	NE	33	„	1120	50·1	15	NE	32	Sudai	840	1·8
17	NE	16–20	Sudai	1120	9·2	16	NE	22–25	Sudai	840	1·7
21	NNE	25	Cuttlefish	560	27·6	21	SE by E	14	Squid	560	6·4
22	NNE	24–27	„	1120	27·8	23	NE	22–26	Squid	840	1·2
23	NE	30–38	„	1400	22·9	25	E	14–21	Squid	840	10·6
						28	E	14	Sudai	840	31·8
						30	NE	38	Sudai	840	21·1
						1 Sept.	NE	23	Sudai	840	19·3

Comparison with Wadge Bank

Fishing operations on the Pedro and Wadge Banks during the same period with the same trawlers permit interesting comparisons. Percentage composition of the major varieties of the catch for the three years 1928 to 1930 is given in Table I. There appears to be a slight difference in the species composition. *Meevatiyo* is an important variety for both the banks, while *kalameeya* appears to be abundant only on the Pedro Bank, as was observed by Malpas (1926). On the other hand *tambua* and *laweya* are predominant on the Wadge Bank only.

The relative strength of the stocks on the two banks can be estimated from the catch per day's trawling. From Table III it appears that the strength of the stock on Pedro Bank was initially greater than that of the Wadge Bank but gradually decreased while that on the Wadge Bank increased. In 1932 fishing conditions appear to have been quite favourable on both the banks and unusually high catches were obtained. Because of lack of knowledge of the banks, the first year's catch data for Wadge Bank may not indicate the true value. This will not apply to the Pedro Bank to the same degree, since this Bank is much smaller and its fishing characteristics can be studied quicker than in the case of Wadge Bank. In all probability the gradual decrease in catch per day's fishing on the Pedro Bank was due to intensive fishing, while the gradual increase in the case of Wadge Bank was due to an increase in the strength of the stock coupled with increase in the knowledge of the fishing characteristics of the Bank (or to this latter, exclusively).

For some reason or other the catch landed from the Pedro Bank fetched a better price than that from the Wadge Bank as shown by the proceeds per pound landed, in Table III. But this higher price did not compensate for reduced returns per day out of port and as a result, commercially, the operations on the Pedro Bank were not as profitable as those on the Wadge Bank. In addition to the difference in price realised for catches from the two banks, another conspicuous feature of this entire fishery was the gradual decrease in the price per pound from 1928 to 1935 for the fish landed from both banks.

The 1935 price per pound was 50 per cent. or less, than that realised in 1928. The gradual increase in catch per day in the case of Wadge Bank was not proportional to the decrease in price and as a result the total proceeds per day out of port declined. This coupled with the gradual reduction of the catch on the Pedro Bank may have led to the commercial operations being abandoned by 1935 on both banks.

SURVEYS 1949–1957

There was no recorded fishing activity on the Pedro Bank after the single trip in 1935 by the commercial trawler "*Bulbul*" until April 1949, when the trawler "*Raglan Castle*" carried out trial trawl fishing. This was carried out under the direction of Dr. Blegvad (Anon, 1951). In 48 hours of trawling she fished 14,500 lb. averaging 7,250 lb. per day fishing. This is almost double that obtained by the slightly higher powered "*Bulbul*" and "*Tongkol*" between 1925 and 1935 (Table III). In the same year (1949) one more haul was made by "*Halpha*" (Medcof, 1955). Since then no further trawling had been carried out by big trawlers.

Between 1955 and 1957 a series of trials with smaller 45 foot boats "*North Star*" and "*Canadian*", were conducted on the Pedro Bank and other areas around Ceylon by the fisheries biologists from Canada. They were working with the Government of Ceylon under the Colombo Plan. These trials on the Pedro Bank were, like most of the earlier operations, often during the south-west monsoon season when no fishing was possible on the south-west coast. During these trials various types of gear were tried over different localities. Detailed analyses of the results of these trials are given by the biologists in their reports (Medcof, 1955, 1963 ; Jean, 1957). Their main conclusions of interest to Pedro Bank fisheries may be listed as follows :—

Medcof (1955) concluded that—

(1) Small boat trawling with boats of the "*North Star*" and "*Canadian*" size class had been discouraging.
(2) Handlining which is widely practised, gives better returns than some other types of fishing, like trolling.

(3) Bottom longlining is not widely practised in Ceylon but should be encouraged as the results are promising.

(4) Ordinarily, mother-ship operations do not pay. Results from the trials have been disappointing.

Jean (1957) from his trials concluded as follows :—

(1) Twelve different types of gear were tried and the first four in order of average catch per man-hour in pounds were—

(*a*) Lift net night fishing,
(*b*) Shark lines,
(*c*) Bottom longlining, and
(*d*) Ring net fishing.

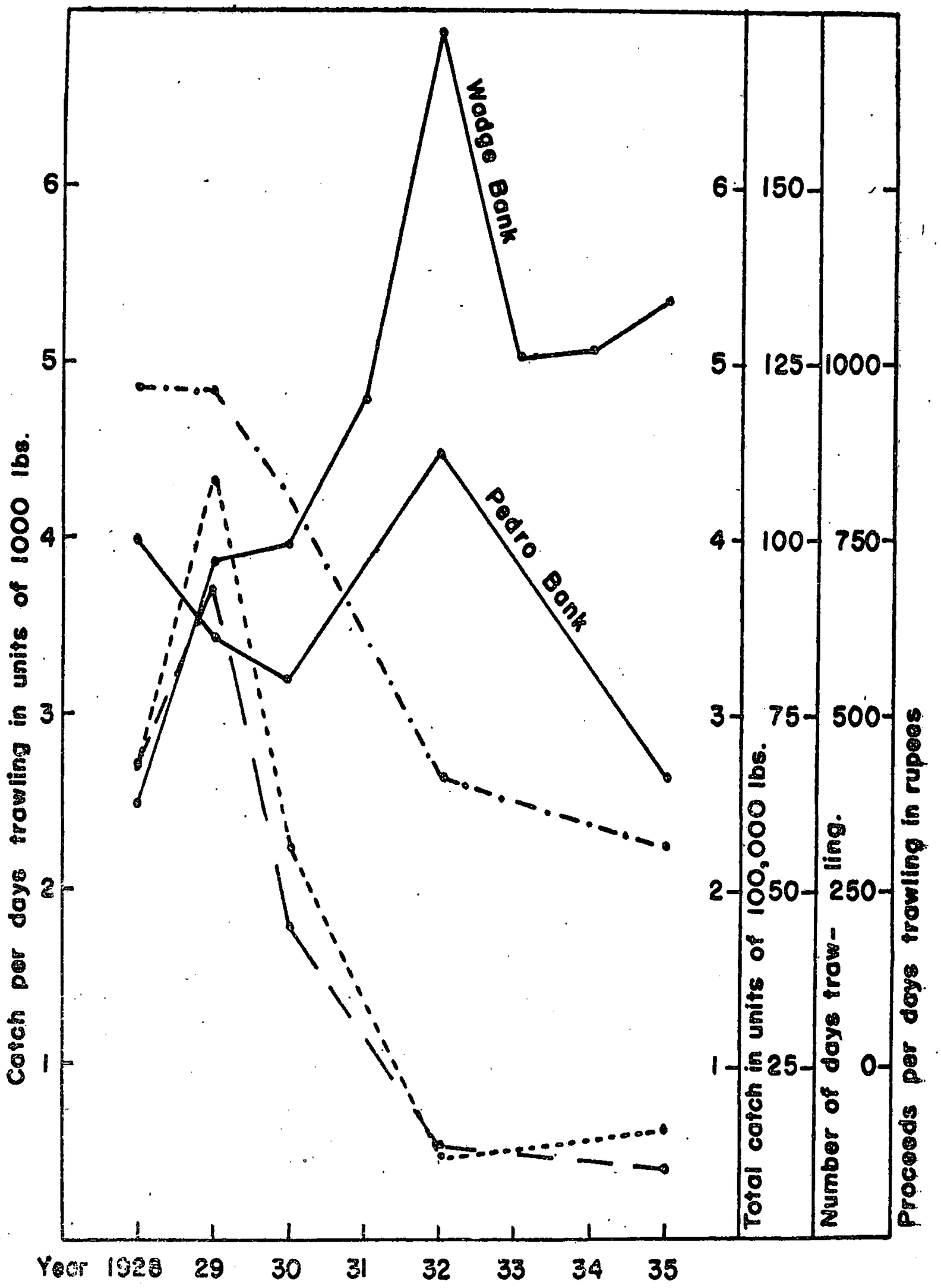

FIG. 4

(2) For demersal fishes three areas yielded larger catches. They are—

(*a*) Virgel Rocks to Batticaloa,
(*b*) Galle area,
(*c*) Pedro Bank.

(3) Results from mother-ship operations were disappointing.

Both biologists pointed out that the prospects for bottom longlining off north-east coast of Ceylon (Pedro Bank) were good and recommended a thorough test of the grounds under steady commercial style operations.

BOTTOM LONGLINING AND HANDLINING TRIALS, 1961

Longline Trials

On the recommendations made by Medcof (1955) and Jean (1957) trials on a commercial scale were carried out by the Department of Fisheries with bottom longlines in August 1961. In order to compare the results with those of the trials carried out by them the same boat " *North Star* " and similar gear were used. The ground lines were of 18 pound steam tarred rope, each 50 fathoms long, with side lines or gangings about 18 inches long. There were 35 hooks to a line and the hooks about $1\frac{1}{2}$ fathoms apart. Eight such lines were coiled in a tub and at intervals of each tub length a dhan buoy was used. These buoys were helpful in recovering the lines whenever the main lines gave way while hauling, due to snags, etc. Small inshore fishes like *sudai* and *salai* (Clupeids) were often used as bait. Occasionally when available, squids were used. The cost of a complete set of three tubs of lines, hooks and dhan buoys excluding the bait is in the region of Rs. 525.

On the first day of the trial six tubs of lines were tried. Of the six tubs two tubs were lost while being hauled up. It took exactly three hours to haul the other four lines. In order to avoid loss of too much gear and delay in hauling the lines, the number of tubs of lines was reduced from six to three, during subsequent operations. Great difficulty was experienced during rough weather in spotting the dahn buoys. For easy handling, small dahn buoys of about five feet above the water were used. These were easily lost sight of in heavy weather as a result of high waves. Taller dhans during subsequent trials proved more satisfactory. During the major part of the trials steam tarred ropes were used. Synthetic fibre lines were not tried as it was feared that it may not be easy to cast the lines and they may not coil properly while being hauled. But during the latter part of these trials, one " corelone " rope with nylon side lines was tried, which proved that these fears were groundless and that in fact these lines were superior to the steam tarred rope. It was easier to cast and haul them and at the same time reduced the number of breakages of the main line thus reducing the time spent on hauling the lines to the minimum.

In the areas where the trials were carried out, the bottom conditions appeared to vary rapidly from one type to another. It was not possible to lay the entire set of three tubs of lines on a single type of bottom. This was reflected in the catch. Often a number of fish of one or more varieties were caught on adjoining hooks in-between series of blank ones indicating the patchy nature of the fishing ground.

Results

The trials were carried out during the same month and more or less in the same area as those of 1956 (Jean, 1957), i.e., approximately northeast of Point Pedro in depths ranging from 10 to 40 fathoms. The results are given in Table IV and Appendix A. These results were very disappointing compared to those of 1956.

The average catch per 100 hooks for 1956 and 1961 was 31.6 lb. and 8.9 lb. respectively The difference in the depths of operation during the two years cannot explain this difference in the catch. The average depths during the two years were 28 fathoms and 21 fathoms respectively. While

in 1956 there appears to have been a general increase of catch with the increase in the depth of operations, there appears to be no such relationship during the 1961 operations. The possible explanation for the difference in catches may be the fact that in 1956 the operations were in charge of an experienced skipper from Canada working in Ceylon under the Colombo Plan, who had worked long enough in Ceylon waters to be in a position to locate good fishing grounds while the skipper in charge of operations in 1961 was not equally experienced. It should, however, be noted that the catches during the later stages of these trials in 1961 were better than the earlier stages possibly as a result of the experience gained during the early part of the trials.

Longlining compared with Handlining

While these longlining trials were in progress, information was received from the Point Pedro fishermen that one or two mechanised boats (2-3 ton-size) had been carrying on handlining operations and that they had been obtaining catches varying from 200 to 700 lb. per trip. To compare bottom longlining and handlining under similar conditions, arrangements were made for a batch of fishermen to carry out their handlining operations from "*North Star*" in an area where handlining is normally done.

This area was found to be directly east of the obelisk south of Thalayaddy, in about 14 fathoms depth. The first day, on arrival at the required depth, about two and a quarter hours were spent in searching for "rocky" patches where the fish were expected to be abundant.

The rocky patches are spotted by the "feel" on the line when the cone shaped lead sinker (page 134) strikes the bottom. Further confirmation is obtained by examining the material adhering to the sinker when it is lifted out of the water. After about 5¼ hours, including the searching time, with eight lines in use the catch was only 15 pounds. In the same area soon after handlining operations, two tubs of bottom long lines were laid and the catch in 2½ hours of fishing was 35 pounds. Immediately after hauling the bottom longlines, handlines were again tried and about two hours of fishing resulted in a catch of 88 lb. This worked out to 2 lb. per man hour of handlining and 4·7 lb. per man hour of bottom longlining based on a three man crew. During the second day's trials, east of Point Pedro, the catch per man hour was better, i.e., 6¼ lb. handlining and 32·4 bottom longlining.

In order to test the possibility of handlining in deeper waters, the same fishermen were taken to an area where the depth ranged from 38–45 fathoms. It was found that although the depth extended to 45 fathoms, the men did successfully operate their lines, in spite of the fact that on occasions when the wind and tide were strong, about 90 fathoms of the monofilament nylon line had to be paid out to reach bottom and hauled up by hand to land the catch. The biggest catch during these trials was obtained in the deep waters. The result worked out to 26 lb. per man hour for handlining and 18·2 lbs. per man hour for bottom longlining. On the average for the three trips the catch per man hour handlining amounted to 9·7 lb. and that of bottom longlining 19·4 lb. (Table V).

The varieties caught by both methods of fishing are given in Appendix B. It will be seen that bottom longlines catch a larger percentage of grade III varieties (dogfish, sharks, skates, catfish, etc.) than handlining. This reduces the money realised on the sales of the catch. On the basis of the prices existing at the time of the trials, i.e., Rs. 1 for grade I, 30 cts. for grade II, 10 cts. for grade III, the proceeds from the sale of the catch amounts to Rs. 2.99 and Rs. 3.05 per man hour for handlining and bottom longlining respectively.

In comparing these results it should be pointed out that the time spent on looking for "rocky" patches or good fishing ground was added to the time spent on handlining operations, and not to bottom longlining, since the former was carried out first. Also the hooks for the bottom longlines were baited while on the run to the fishing grounds and this time was not included in the time spent for bottom longlining. If more than one set of bottom longlines are to be made, then it will be necessary to take into consideration this time too. If due allowance is given to these two factors then the results of handlining operations would be better.

TABLE V

COMPARISON OF THE RESULTS OF BOTTOM LONGLINING AND HANDLINING OPERATIONS ON THE PEDRO BANK, AUGUST 1961

Date	*Total catch in lbs.*		*Total man hours fished*		*Catch in lbs. per man-hour fished*		*Proceeds in Rs. per man-hour fished*	
	Handlining	*Bottom longlining*	*Handlining*	**Bottom longlining*	*Handlining*	**Bottom longlining*	*Handlining*	**Bottom longlining*
August								
21	110·5	35·0	56·0	7·50	2·0	4·7	0·60	1·41
28	227·5	267·0	37·5	8·25	6·7	32·4	2·08	5·08
30	836·0	177·0	28·0	9·75	29·9	18·2	8·97	4·95
Total	1173·0	479.0	121·0	33 ·0	—	—	—	—
Average	—	—	—	—	9·7	19·4	2·99	3·05

* Based on a three-man crew.

Features of Handlining Operations

The trials gave us an opportunity to learn more about how handlining fishermen operate. They have preferred depths for fishing. Once they arrive at the required depth in the desired areas, they search for good fishing spots by trial and error with the help of the lead line. Sandy bottom is very poor for handlining operations. Dark muddy bottom with broken shell and coral is preferred. Once the correct type of bottom is selected baited lines are lowered and if fish are abundant in the area a " bite " is expected within about ten minutes. Once such an area is located the catch rate is high. The average catch per man hour at sea therefore depends on the speed with which good fishing spots are located. Since handlining on the Pedro Bank is still in the exploratory stage the percentage of sea time spent on locating suitable fishing areas is still high. With more knowledge of the fishing grounds this will be reduced a great deal. The mainland opposite the Pedro Bank is flat without high conspicuous landmarks and is of little help to the fishermen in fixing ranges and positions once out at sea. To circumvent this the fishermen will be forced to learn more about the depth contour of the sea bed and depend on compass bearings and running time with their motor boats and possible use of marker buoys.

A boat of the size of " *North Star* " with a heavy anchor is at a slight disadvantage for handlining operations. Owing to fairly strong winds and tides it is not possible to keep the boat steady in any particular spot without lowering the anchors. But the anchor being heavy it is not possible to heave the anchor every few minutes till a suitable fishing ground could be located. With a boat with a lighter anchor it is easier to shift positions. In actual practice the handliners operate from mechanized 40–45 ft. dug out canoes which are anchored on the fishing ground with weights which are easily lifted from the ground manually whenever it was necessary to shift positions. But the disadvantage with such a boat is its inability to work in distant grounds and under weather conditions in which " *North Star* " can operate satisfactorily.

Handlining for bottom fishes is a simple operation, is widely practised around the island and is within the capability of an average fisherman. Bottom longlining requires experienced crews. Accidents can easily happen while either casting or hauling the lines. According to the fishermen bottom longlining which was once practised from catamarans by the fishermen of the area off Point Pedro, has been more or less given up, as a result of frequent accidents and loss of life to fishermen engaged in fishing with this type of gear.

Choice of Gear for industrial Use

The trials carried out in August 1961 are not extensive enough to show which gear would give industry the best returns under present conditions. However, the following advantages and disadvantages of bottom longlining should be considered in any appraisal :

Advantages :—

(*a*) A higher catch per man hour.

(*b*) Smaller crew required for operation.

(*c*) As a result of above advantage longer time at sea is possible.

Disadvantages :—

(*a*) High capital outlay required for the installation of the linehauler and gear.

(*b*) Frequent loss of gear and costly replacement.

(*c*) Experience required for handling bottom longline equipment.

(*d*) Lack of proper knowledge of the fishing ground.

(*e*) Higher percentage of lower quality catch.

But after a certain period of time of continuous operations it should be possible to overcome lack of experience of handling gear and of knowledge of the banks, and also to a certain extent frequent loss of gear.

Considering various aspects, at the initial stages of the exploitation of the bank handlining appears to be better. But when the characteristics of the bank are better known, longlining may yield better results. Jean (1957) has expressed similar views and has suggested handlining first so that the fishermen would use a gear they already have and with which they are familiar. He expected bottom longlines to eventually replace handlines.

PROSPECTS

The Pedro Bank, being comparatively closer to land, it may be better to encourage the operation of smaller boats, which requires less capital investment. Operation of many smaller boats instead of one or few larger boats also gives employment to a larger number of fishermen.

The size of the small boat that should be selected will depend on many factors that deserve separate consideration.

Range of operation and weatner conditions.—To fish the whole of the Pedro Bank, the boat will be required to work about 35 to 40 miles from shore. Smaller boats with shorter ranges will not be able to operate during the peak of the monsoons, but the size decided on should be stable enough to work during the major part of the year. Routine maintenance services can be so arranged as to coincide with the rough season periods.

Harbour facilities.—For anchorage of boats of the 35–40 mile range class, the choice lies between Kankesanthurai, Point Pedro and Thalayaddy.

Kankesanthurai—1. Small harbour. There is a proposal to establish a jetty and provide additional harbour facilities in the near future. 2. A railway terminus. 3. Electricity available. 4. Farthest from Pedro Bank (14 miles from Point Pedro).

Point Pedro—1. Small harbour. 2. Pedro Bank within easy reach. 3. Electricity available. 4. 14 miles from the closest railway station

Thalayaddy—1. No harbour facilities. 2. Southern part of Pedro Bank within easy reach. 3. Six miles from the closest railway station. 4. Useful as a temporary base during the southwest monsoon when it may be possible to operate the boats at the southern end of the Bank.

Point Pedro appears to be the best of the three possibilities for anchorage of the small boats operating on the Pedro Bank during the major part of the year.

Gear.—The choice of the gear for exploiting the demersal varieties on the Pedro Bank is limited. Small boat trawling and mother-ship operations have been found to be non-profitable. (Medcof, 1955, 1963; and Jean, 1957). The choice therefore lies between handlining and bottom longlining. Handlining is widely practised by the fishermen around Ceylon and bottom longlining has been tried out on many occasions. From results to date of commercial exploitation, handlining appears to be the better but with progressive mechanization and fuller knowledge of the resources the fishery may convert to bottom longlining.

Duration of fishing trip.—For handlining operations a large crew of about eight to ten will probably be necessary to make trips pay. This will necessitate short trips of one or two days' duration. If longlining is found to be more profitable, the crew can be reduced to three or four and the trips made longer.

Other fishing areas.—Weather conditions on the Pedro Bank will not permit the operation of small boats on the Bank during the peak of the southwest and northeast monsoons. It may be possible to operate on the southern end of the Pedro Bank (Thalayaddy to off Mullaithivu) during the peak of the southwest monsoon and off the Pearl Banks during that of the Northeast monsoon. For this purpose, if possible, the boat should be small enough to pass through the Pamban Pass.

After deciding on a suitable size for the boat the economics of the project should be worked out by a series of trials during both monsoons, before encouraging exploitation of the Pedro Bank by these means.

SUMMARY

Pedro Bank is about 1,300 square miles in extent and lies at the mouth of the Palk Strait close to the mainland, enabling smaller boats to exploit it.

Trawl surveys indicated the presence of substantial demersal varieties on the Pedro Bank, but the results of the early commercial operations indicate that a 135-foot trawler may not be operated continuously on the bank without diminishing returns.

Subsequent to the commercial operations extensive surveys with smaller boats and various types of gear were carried out. Of the various types of gear tried out, results from bottom longlining and handlining operations were promising. Trials were carried out to compare these two types of gear. Though not extensive, these trials indicated that at the initial stages of exploitation of the Bank, handlining, which is extensively practised in Ceylon, may be better but as exploitation progresses, with more experience, it should be possible to overcome some of the present disadvantages of bottom longlining and eventually bottom longlining should produce better results.

The recently introduced mechanised craft are exploiting only the fringe of the bank and it should be possible to exploit its stocks fully with slightly bigger boats with a 35–40 mile range.

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APPENDIX A

BOTTOM LONGLINING OPERATIONS–AUGUST, 1961

Date	*Fishing Time in Hrs. Mts.*	*Total Catch in Lbs.*	*Varieties Caught*	*Remarks*	**Catch/ Man Hr.*
AUGUST					
9	4–15	35	Epinephelids Lutianids Lethrinids	Lost two tubs of gear	2·7
10	4–05	10	Epinephelids	Bad weather, missed dhan-buoys several times. Groundline broke twice	0·8
14	2–35	55	Tiger Shark Epinephelids Lutianids Lethrinids	1st tub–only one tiger shark 2nd tub–no catch 3rd tub–others	7·1
15	3–00	15	Aprion pristopoma Epinephelids	—	1·7
16	3–10	15	Miscellaneous	Lost one tub lines	1·6
21	2–30	35	Epinephelids Lutianids Lethrinids	Handlining before and after bottom longlining	4·7
23	3–15	10	Mostly dogfish	Bait missing from most of the hooks	1·0
25	4–00	89	Dogfish Lutianids Lethrinids	Mostly dogfish Line broke twice	7·4
28	2–45	267	Dogfish Aprion pristopoma Epinephelids Lethrinids	Handlining before and after longlining	32·4
30	3–15	177	Aprion pristopoma Epinephelids	Handlining before and after longining	18·6
SEPT. 1	2–35	162	Epinephelids Lutianids Lethrinids Sparus sp. Dogfish	—	20·9

* Based on a 3-man crew.

APPENDIX B

CATCH STATISTICS OF BOTTOM LONGLINING AND HANDLINING OPERATIONS—AUGUST, 1961

Date and time Fishing commenced	*No. of hours Fished* Hrs.	Mts.	*Gear used*	*Depth in Fathoms*	*Catch* — *Species or variety*	*Number*	*Total weight in Lbs.*	*Average weight in Lbs.*	*Grade*
21—0915	4	45	8 Handlines	14	Sparus spinifer	5	7·5	1·5	2
1430	—	15	8 Handlines	14	Lethrinus nebulosus	—	15	—	2
					Lutianus sebae				
1445	2	30	Bottom longlines	14	Lethrinus nebulosus				
			560 hooks	—	Epinephelus undulosus		35	—	2
					Lutianus rivulatus				
1715	2	—	8 Handlines	14	Lethrinus nebulosus	—			
					Lutianus sebae	—			
					Epinephelus undulosus	—	88	—	2
					Lutianus rivulatus	—			
28—0615	2	—	9 Handlines	14	Caranx chrysophrys	1	2·5	2·5	1
					Lutianus sebae	4	18	4·5	2
					Aprion pristopoma	8	24	3·0	2
					Lethrinus nebulosus	2			
					L. miniatus	1			
					Epinephelus undulosus	2	56	3·7	2
					Epinephelus sp.	5			
					Epinephelus sp.	4			
					Lutianus rivulatus	1			
0815	2	45	Bottom longline	14–18	Caranx ignobilis	1	8	8·0	1
					Aprion pristopoma	2	13	6·5	2
			840 hooks	—	Lethrinus nebulosus	2	22	7·3	2
					L. miniatus	1			
					Epinephelus sp.	1	5	5·0	2
					Dogfish	76	219	2·9	3
0845	—	40	9 Handlines	14–18	Lutianus sebae	1			
					Epinephelus undulosus	3	27	3·9	2
					E. sp.	2			
					Dogfish	1			
1115	1	30	9 Handlines	14–18	Caranx ignobilis	1	12	6·0	1
					Caranx gymnostethoides	1			
					Mixed demersal varieties	—	88	—	2
30—0725	3	15	Bottom longlines	38–45	Aprion pristopoma	19	137	7·2	2
			840 hooks	—	Epinephelus sp.	15	16	1·1	2
					Dogfish	9	20	2·2	3
					Catfish	1	4	4·0	3
0745	—	50	5 Handlines	38–45	Aprion pristopoma	5	35	7·0	2
					Epinephelus sp.	7	9	1·3	2
1040	4	—	6 Handlines	38–45	Aprion pristopoma	82	721	8·8	2
					Epinephelus sp.	48	61	1·3	2
					Lethrinus nebulosus	1	6	6·0	2
					Miscellaneous	1	4	4·0	2

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