

**A PRELIMINARY ACCOUNT OF THE EXPERIMENTAL  
ROCK-LOBSTER FISHING CONDUCTED ALONG  
THE SOUTH-WEST COAST OF INDIA  
WITH BOTTOM-SET GILL NETS**

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INTRODUCTION

THE authors in the present communication describe the details of the preliminary experiments conducted by them on the South West Coast of Peninsular India for the introduction of a new fishing gear for Rock Lobsters.

The hard rocky bottoms of the sea below the tidal zone are usually the abode of the Rock Lobsters. They hide in the crevices and inside the holes of submerged rocks and lurk on stony corals and sea weed beds. Similar ecological conditions exist in certain areas off the East and West coast of India and is suggestive of an abundance of this Decapod crustacea. Though the resources for lobsters appear to be extensive, systematic exploitations have not so far been organised. From the available records of the total annual landing of shell-fishes in India, it has not been possible to assess the actual quantity of lobsters landed each year. During the preliminary survey conducted by the authors, it has been estimated that during the 1956-57 season about 5,95,000 lobsters weighing 1,13,400 kg. (2,50,000 lb.) and valued at Rs. 1,98,000 were landed along the twenty mile stretch of the West Coast extending from Collachel to Kanyakumari. According to Miyamoto and Shariff (1958) in Muttam village alone during 1957-58 season about 53,998.4 kg. (1,19,044 lb.) of lobsters were landed. Chacko and George (1958) have recorded that in a good fishing season 6,500 lobsters can be collected per day from Muttam and nearby villages.

Lobsters fetch a reasonable price in several markets in India and they are always held in high esteem in the markets of Bombay and Calcutta. In the South-West Coast of India, where the present series of experiments were conducted, the price offered by some freezing companies ranged from Rs. 0.25 to Rs. 0.88 per lobster depending on their size. For sometime past, the Indian Rock Lobsters are greatly sought for in the foreign markets

of U.S.A. and Australia. Consequent on the increasing demand from foreign countries, several freezing and canning factories have been established along the West Coast of India and appreciable quantities of particularly frozen lobster tails are exported annually. Never before was there such a demand for Indian lobsters abroad as it is now. The possibility of earning enough of foreign exchange by increased exports might perhaps give a new fillip to this hitherto less exploited industry.

Four species of Rock Lobsters belonging to the genus *Panulirus* have been hitherto recorded from Indian waters. Gravely (1927) has indicated the occurrence of *Panulirus dasyptus* in the littoral fauna of Krusadai in the Gulf of Mannar. Rai (1933) has mentioned that *P. ornatus* and *P. fasciatus* are commonly found on the Bombay coast. Chopra, (1939 and 1943) has stressed the importance of lobster as a valuable food item just like prawns and crabs and has further stated that the common species available along the East Coast is *P. polyphagus* while *P. ornatus* is common in Bombay waters.

#### A BRIEF ACCOUNT OF THE EXISTING METHODS OF FISHING

Season for lobsters in the South-West Coast commences during the month of November of one year and extends up to March of the succeeding year. The local fishermen employ different indigenous gear for catching them. Traps, anchor hooks and line and scoop nets are the common gear used. In certain places, occasionally old pieces of surface hemp drift nets are converted as bottom set nets for catching of lobsters. A comprehensive account describing in detail the traps and anchor hook and their methods of operation along this coast has been given by Miyamoto and Shariff (1958). However, a brief descriptive resume of the various gear and their methods of operation for lobsters is presented below:

(a) *Lobster traps*.—Lobster traps or pots are the conventional fishing gear vastly employed all over the world for the catching of lobsters and they account for the entire catch of these Decapods in countries like Canada and Australia. The lobster traps operated along the South-West Coast of India are made of vegetable fibres extracted from the leaf stalk of Date-palm tree (*Phoenix sylvestris*) locally available. They are constructed in the form of a heart-shaped contrivance measuring about 76.2 cm. in length, 60.9 cm. in breadth and 53.3 cm. in height. The entire construction is such that the trap can easily be separated into three pieces and can also be assembled together with ease. This enables the operator for the easy removal of the catch and for placing the bait and sinkers inside. Though

these traps differ from the perch traps of Gulf of Manrar described by Prabhu (1954) in their construction and material, the method of operation is similar. After baiting with live sea-mussel (*Mytilus* spp.) and placing granite stone sinkers inside the traps, they are set on fishing grounds lying within a mile away from the shore line and at depths ranging from 5.52–14.72 m. A fisherman dives down to the rocky bottom for setting the trap. On an average, about 10 traps are set by a single catamaran unit of two fishermen. The next day the same ground is located with the guidance of shore bearings and the traps are hauled up one by one by diving. The catches emptied, the traps are laid again after replenishing the bait.

(b) *Anchor hooks*.—An anchor hook essentially consists of a 12.7 cm. long iron rod bent in the form of a hook with 6 upwardly curved pointed arms. To this hook is attached a brass snood of .305 m. long which in turn is attached to 46.0 to 55.2 m. of cotton twine forming the hand-line. To lure the lobsters, sufficient quantity of mussel meat is fastened to the brass snood with thin fibres of Agave. Generally, the fishing is conducted from a catamaran during nights, when the lobsters are expected to have a nocturnal ramble near their rocky abode. The hand-line with the baited hook attached to the snood is released to the bottom of the sea. As soon as the bite of the lobster is felt through the hand-line, the operator pulls up the hook with such a force that the body of the lobster that happens to come near the bait is pierced by the sharp arms of the hook. The hooked lobster is hauled up and the operation is continued after rebaiting. The bottom being rocky, at times the hook gets caught among the rocks. On such occasions, a stone messenger locally known as “*Sarani*” (Tamil) is let down through the hand-line which strikes the entangled hook and effects its immediate release.

(c) *Line and scoop net*.—This type of fishing is done with the help of two implements, the one being the cotton line and the other the scoop net. The line consists of 18.4 to 27.6 m. length of cotton twine (20/15/3) to one end of which a small sinker is attached by means of coir rope of 0.62 cm. diameter and of 0.91 m. length. The scoop net is made as follows:

About 2.15 m. bamboo of 1.92 cm. diameter is taken, bent in the form of a circular ring and tied with coir rope leaving a small handle. A piece of cotton webbing of 85 meshes at top, 40 meshes at bottom, 16 meshes in depth and 5.08 cm. mesh is laced to the above circular frame with nearly 55% take up and both free edges and bottom are laced to form a funnel-shaped bag. During nights, the lines with sufficient mussel meat attached to it, are released from a catamaran to the bottom of the rocky lobster

fishing ground. As soon as the bite of the lobster is felt, unlike as in the anchor hook operation, the line is very slowly hauled up with least disturbance. The lobster is thus lured by the bait and comes to the surface when it is quickly scooped with the help of the scoop net.

(d) *Net fishing*.—Rarely the local fishermen use nets for the catching of lobsters. But, in a fishing village at Collachel, fishermen have been found to use some old pieces of surface drift nets after converting them as bottom sets. Each piece of surface net is made of hemp twine and measures 250 meshes long, 50 meshes deep with 14.47 cm. mesh size in stretched condition. 0.84 cm. diameter coir rope forms the head-rope and there is no foot-rope. The net has usually a hang up of 45% and it is generally operated as a surface drift net. When these nets become old, several pieces, usually about 8, are joined together and attaching 2 to 3 stone sinkers weighing about 1.81 kg. each to the bottom webbings, they are set at the bottom. The net is buoyed up with nearly 8 floats made of local light wood (*Albizzia* spp.) attached to the coir head-rope. They are operated adjoining rocky beds at 9.20 to 14.72 m. deep. The fishing operations are conducted from a small catamaran during nights and the nets are hauled the next morning. Along with lobsters, few fishes are also caught.

#### NEED FOR THE NEW GEAR AND RECOMMENDED REQUISITES FOR THE NEW DESIGN

A close study of the existing indigenous lobster gear and their methods of operation have revealed the fact that each system of fishing has its own merits and demerits. All the existing types of gear are only operated very near the shore with the result the area of operation is very much limited. Lobsters caught by the anchor hook are very often badly injured. Injured lobsters are not good for freezing. The line and the scoop net fishing appear most ideal as it can catch lobsters alive. But the method of operation is, however, time-consuming and requires special experience in handling the line and the net. There are more chances for the lobsters to escape without being caught in this gear. As the fishing operations are conducted only during nights, the fishermen have to keep awake all through the night. Setting of the lobster traps at the sea-bottom involves considerable risk and hardship. The fishermen have to dive down to various depths every time a trap is set or hauled up. Each catamaran can set at best 12 traps a day. The catch always depends upon the quality and quantity of bait used besides the ground at which the traps are set. On account of the limitations in the naked diving, the traps are set only very near the shore at fairly shallow grounds.

While investigating the possibilities of improving the existing lobster gear and the present methods of fishing, it was felt that suitable gill nets, if properly designed, might perhaps substantially improve the catches. The design, fabrication and operation of gill nets are quite simple and different types of them are the most common fishing gear of the local fishermen (Balasubramanyan 1958). Although gill nets are being used for lobster fishing in some areas, a closer examination of these nets revealed a poor design and the catches were consequently never remunerative. The Central Fisheries Technological Research Station at Cochin designed a simple bottom set gill net and conducted trial fishing at Muttom during December 1957 (Miyamoto and Shariff, 1958). The results in these initial trials were encouraging. However, it was found necessary to make some changes in the design and the construction of the net. Accordingly, changes in the quality of material used for the fabrication of the nets, the mesh size, the length-breadth proportion and the buoyancy of the nets were all effected and a number of new nets, both of nylon and cotton, were fabricated for further studies.

DESCRIPTIVE ACCOUNT OF THE NEW DESIGN AND ITS SPECIFICATION

As shown in Fig. 1 the net is of rectangular shape designed for setting at the bottom of the sea with cement sinkers attached to the foot-rope and

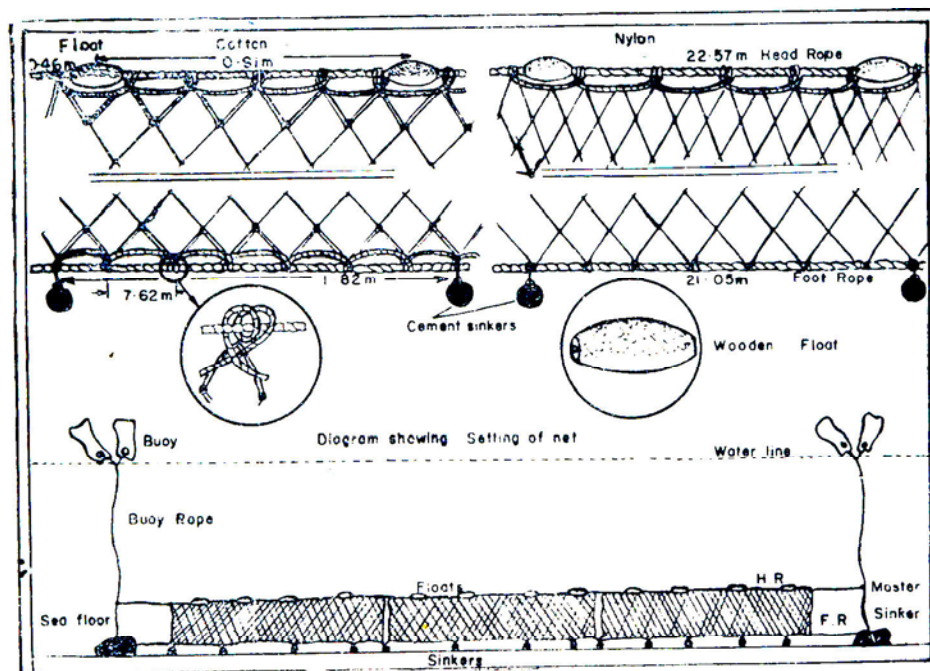


FIG. 1. Design diagram of bottom-set gill nets.

wooden floats attached to the head rope. One unit is made up of several 'shots' (pieces of webbing) numbering about 9 to 10. The details of specifications of the nylon and the cotton nets are given below:

	<i>Cotton nets</i>	<i>Nylon nets</i>
I. <i>Main webbing:</i>		
(1) Material ..	Cotton	Nylon
Count of Yarn ..	No. 20	No. 6
Ply and total yarns ..	3 ply; 12 yarns	..
Twist ..	Soft twist 2·9/cm. outer 1·2/cm. inner	..
Breaking strength ..	Dry 6·0 kg. Wet 7·4 kg.	Dry 23·2 kg. ..
Breaking stretch ..	Dry 22% Wet 16%	Dry 26·5% ..
(2) Kind of knot ..	Single trawl knot	Double trawl knot
(3) Size of mesh ..	15·24 cm. stretched condition	15·24 cm. stretched condition
(4) Number of meshes in length per shot	250	250
(5) Number of meshes in depth per shot	15	15
(6) Weight of each shot	2·205 kg. (average)	2·755 kg. (average)
(7) Percentage of take-up:		
Head-rope or float-line	46	46
Ground rope or lead-line	50	50
II. <i>Head rope or float-line:</i>		
Material ..	Sisal	Coir
Ply and diameter ..	3 ply and 4 mm.	..
Length required ..	22·57 + 0·46 m. extra on either side	22·57 m. and 0·46 m. extra on either side

	Cotton nets	Nylon nets
Number of ropes required	1	2
Breaking strength ..	72·5 kg. Dry 76·8 kg. Wet	.. ..
III. <i>Foot-rope or lead-line:</i>		
Material ..	Sisal	Coir
Ply and diameter ..	3 ply, 6 mm.	Single ply, 2 mm.
Total length required ..	21·05 m. and 0·46 m. extra on either side	21·25m. and 0·46m. extra on either side
Number of ropes used ..	1	3
Breaking strength ..	73·5 kg. Dry 84·90 kg. Wet	.. ..
IV. <i>Lacing twine:</i>		
Material	Cotton	Cotton
Count, ply and total yarn	30/3/27	20/3/27
Breaking strength ..	12·46 kg. Dry 12·45 kg. Wet	12·46 kg. Dry 12·45 kg. Wet
V. <i>Buoy rope:</i>		
Material ..	Coir	Coir
Diameter ..	1·92 cm.	1·92 cm.
Length of rope ..	18·4 to 27·6 m.	18·4 to 27·6 m.
Number of ropes ..	2	2
VI. <i>Floats:</i>		
Material ..	Wooden floats made of 'Elavu' ( <i>Bombax</i> sp.)	Same as in cotton nets
Shape and diameter of centre bore ..	Spindle-shaped with 0·8 cm. bore	„ „

	<i>Cotton nets</i>	<i>Nylon nets</i>
Dimensions	.. 10·16 cm. length, 3·8 cm. breadth at the centre tapering to 2·54 cm. at the ends	Same as in cotton nets
Buoyancy of each float	0·045 kg.	.. ..
Total floats used	.. 23 numbers	.. ..
Total buoyancy	.. 1·035 kg.	.. ..
Distance between each float	·91 m.	.. ..
<i>End marker buoys:</i>		
Material	.. Wooden floats made of 'Elavu' ( <i>Bombax</i> sp.)	.. ..
Dimensions	.. ·457 m. × ·152 m. × ·152 m., —2-3 numbers	.. ..
VII. <i>Sinkers</i>		
Material	.. Specially made cement sinkers	
Shape	.. Convex disc with 6·35 cm. diameter	
Average weight of each sinker	283·5 gm.	283·5 gm.
Number used and total weight	10-15 2·84-4·36 kg.	10-15 2·84-4·36 kg.
Distance between each sinker	1·50-1·84 m. apart	1·50-1·84 m. apart
Master sinkers	.. Granite stones of 4·54-7·26 kg. each and 2-3 numbers	
VIII. Net preservation		
	.. Dyed with 3% cutch solution	No preservative solution

GROUNDS FISHED AND FISHING OPERATIONS (FIG. 2)

With the gill nets fabricated as per the above specifications, the experimental fishing operations for lobsters were commenced on 2-2-1959 off Muttam, a coastal fishing village in the district of Kanyakumari, on the South-West Coast of India (Longitude E.  $77^{\circ} 19'$  and Latitude N.  $8^{\circ} 7'$ ).

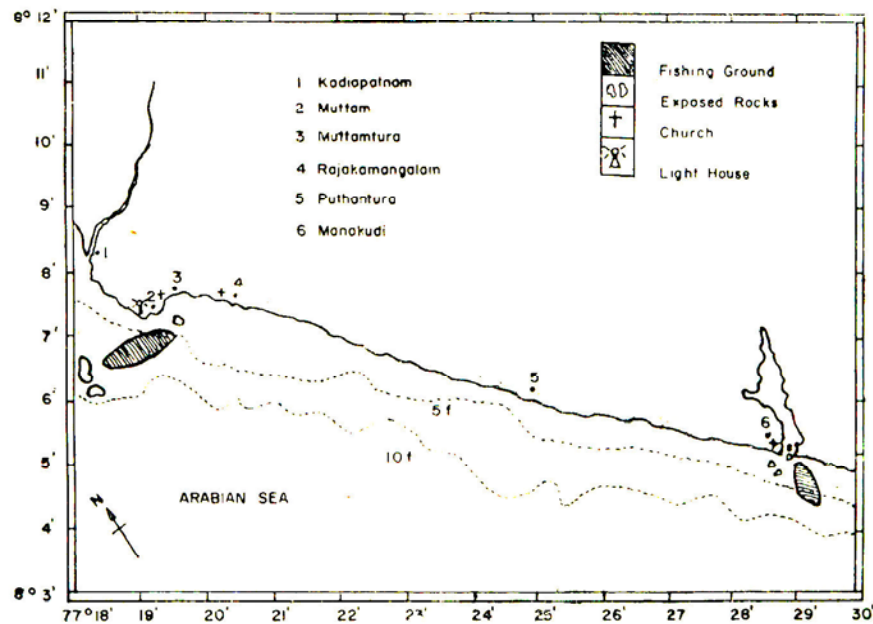


FIG. 2. Map showing the area of lobster fishing operations off Muttam and Manokudi along the South-West Coast of India.

This village is situated 12 miles from the district headquarters Nagerkoil and is easily approachable by road. There is a light house adjoining the sea-shore here. The coast contour at this area is very steep running down the sea with number of submerged and exposed rocks scattered all around. The sea at this location is generally calm with very mild breakers. The current close to the shore is always feeble with the water mostly clear. The place of fishing operation was the ground at depths ranging from 5-8 fathoms where the local fishermen also operate their various gear for lobsters. Initial operations were conducted with one unit of 3 nylon and 7 cotton shots of nets from small catamaran, the only local fishing craft. The nets were set late in the evenings at varying depths within a mile from the shore. They were kept overnight and were hauled the next morning. The operations were intensified substantially and a total of 32 to 40 shots were operated daily from 4 to 5 catamarans. The operations continued up to 13-2-1959.

The usual time taken for setting the nets was about 35 to 40 minutes for nearly 40 shots. Few trial fishing; were also conducted off the neighbouring village Manakudi. Day-to-day catches were recorded separately both for cotton and nylon nets. Observations regarding weather conditions, phases of moon, size and weight of the catches were also recorded. Besides lobsters, miscellaneous fishes comprising of sharks, rays, cat-fishes, jew-fishes, thread-fins, etc., were also caught. The results of the experimental fishing operations are formulated in the form of Tables I and II.

#### DISCUSSION

As seen from Tables I and II during the period of experimental fishing operations, a total quantity of 122 shots of nylon and 202 shots of cotton nets were used at Muttam and 30 shots of cotton nets at Manakudi.

During the 11 days of fishing at Muttam, a total number of 62 lobsters were caught. Of these, 34 numbers were caught in the nylon nets while the remaining 28 on the cotton nets. Apart from lobsters, a total quantity of 451.56 kg. of miscellaneous fishes were also caught by these nets during the above operations of which 365.60 kg. were by the nylon nets and the remaining by the cotton nets. During the 3 days of fishing at Manakudi, a total number of 17 lobsters and 4.81 kg. of fishes were caught.

In gill nets, the catch may be considered to be proportional to the area of the net under operation. The larger the net, the greater is the area of operation and consequently more of catch. Assuming 'a' as the mesh size under stretched condition, 'n' as the number of meshes in length in each shot and 'n<sub>1</sub>' as the number of meshes in depth in each shot; then,

$$A = \{an(1 - S) \times an_1 \times \sqrt{2S - S^2}\} \times N$$

where 'A' is the area of the shots operated and 'S' is the ratio of take-up and 'N' the total number of shots used.

Therefore, the catch per unit area of the net 'C<sub>1</sub>' may be represented as C<sub>1</sub> = (C/A) where 'C' is the total catch.

In the case of the nets under discussion  $a = 15.24$  cm.,  $n = 250$  meshes,  $n_1 = 15$  meshes and  $S = 0.5$ .

Therefore, the area of one shot is 37.566 sq. m. The total area of nets operated during the entire period of experimental fishing is 4584.997 sq. m. for nylon, 7588.419 sq. m. for cotton at Muttam and 1126.956 sq. m. for cotton at Manakudi.

Taking 9.281 sq.m. as unit area of net per operation, then the ratio of catch-per-unit area 'C<sub>1</sub>' is calculated by:

$$C_1 = \left\{ \frac{C}{\text{Total area of webbing}} \right\} \times 9.281.$$

The values of C<sub>1</sub> derived from the above for the present series are given below:

		<i>For lobster</i> (kg.)	<i>For fish</i> (kg.)	<i>Total</i> (kg.)
<i>At Muttam:</i>				
Nylon net	..	0.025	0.743	0.768
Cotton net	..	0.011	0.105	0.116
<i>At Manakudi:</i>				
Cotton net	..	0.047	0.038	0.085

It would be seen from the above that the efficiency of both nylon and cotton nets in catching lobsters appears to be more or less the same whereas nylon nets have landed more fishes (nearly 7 to 8 times) than cotton nets. The number of lobsters caught with cotton nets at Manakudi are greater than those caught with cotton nets at Muttam. This may perhaps be due to the richness of the fishing ground at Manakudi. During one of the operations at Manakudi, few pieces of mussel meat were left tied to the webbings of the net just to see whether this could lure the lobsters. Though the result seems to be quite satisfactory, further experiments may be necessary in this direction (Table II).

Thyagarajan (1958) at Tuticorin has worked out the catch of fish per 100 sq. ft. of both nylon and cotton nets (*Pachu valai*—Tamil) as 0.50 kg. and 0.34 kg. respectively. These figures are quite comparable to those obtained at Muttam and Manakudi. It is worth mentioning here that the local fishermen did not operate lines and anchor hooks for catching lobsters at the time of the above investigations. However, some fishermen were tending traps for lobsters at selected grounds. As only few traps were operated and as the catches were meagre, it was not possible to compare their catch with those of the new design of net to work out the relative efficiency of each gear. It can be stated that when conditions are not ideal



(a) 8-2-1959	7.36-14.72	15	25	..	1	0.34	28.35	10.43
(b) 9-2-1959								
(a) 9-2-1959	7.36-9.20	12	20	2	1.39	4	1.59	52.39
(b) 10-2-1959								9.07
(a) 10-2-1959	11.04	13	21	4	2.04	2	0.91	23.02
(b) 11-2-1959								3.18
(a) 11-2-1959	9.20-14.72	13	21	10	3.40	6	2.04	25.06
(b) 12-2-1959								7.71
(a) 12-2-1959	11.04-14.72	13	21	13	4.87	8	2.15	36.51
(b) 13-2-1959								3.63
(a) 13-2-1959	11.04-14.72	14	20	1	0.23	3	1.13	16.78
(b) 14-2-1959								12.25
TOTAL ..	122	202	34	12.69	28	9.52	365.60	85.96
Catch per shot ..	..	..	0.280	0.104	0.140	0.047	2.99	0.425
Catch per 100 sq. ft. (9.281 sq. m.) of webbing	..	..	..	0.025	..	0.011	0.743	0.105

a, Nets laid. b, Nets hauled.

\* New-moon.

TABLE II

*Showing the data of catch obtained from bottom-set gill nets at Manakudi*

Date and time of operation	Depth at fishing ground (metres)	No. of cotton shots operated	No. of lobsters caught	Wt. of lobsters caught (kg.)	Wt. of fish caught (kg.)	Remarks
(a) 19-2-1959— 17.30-18.3	3.38-9.20	10	1	0.45	1.18	No bait
(b) 20-2-1959— 6.30-7.30						
(a) 20-2-1959— 17.30-18.30	5.52-11.04	10	11	3.63	1.81	*Mussel bait was used.
(b) 21-2-1959— 6.30-7.30						The meat was tied in lumps along the webbing in a scattered way
(a) 1-3-1959 18.00-19.10	3.68-9.20	10	5	1.64	1.81	No-bait
(b) 2-3-1959— 7.00-8.00						
Total catch	.. ..	30	17	5.72	4.80	..
Catch per shot	.. ..	..	0.57	0.19	0.16	..
Catch per 100 sq. ft. (9.281 sq. metres) of webbing	.. ..	..	..	0.047	0.038	..

*a*, Nets laid;

*b*, Nets hauled.

\* Use of Mussel bait in the gill net is a novel experiment which has yielded some good results.

for the fishermen to operate the existing lobster gear, the new design of net could be operated with advantage. The method of catching both lobsters and fishes together with bottom-set gill net is always remunerative than gears operated exclusively for lobsters. The new design is simple and the fabrication is quite easy which does not require any special technique for operation. Either cotton or nylon can be used for the fabrication depending on their availability. A the quantity of material required for the webbing is only very little, fishermen can easily afford to take to this new design with very little investment. The setting of these gill nets is also very simple and quick.

There is no need for baits and no need for diving while operating this net. Even with the existing type of sailing craft, the area of operation for lobster fishing could easily be extended and intensified. Lobsters that abound the deeper waters can also be fished by these gill nets whereas setting of traps for them at greater depths becomes an impossible task as long as diving is resorted to.

During the coming season it has been programmed to conduct a series of fishing experiments with these nets at different depths both in inshore and offshore areas to assess the maximum efficiency of the new design. Once the design proves a success, it is bound to improve the existing method of fishing.

#### SUMMARY

Considering the vast resources for lobsters in India, their fishery can be organised in a better way than at present. The demand for Indian lobsters in the foreign markets has given a new status for the lobster fishing industry in India.

There exists an important fishery for lobsters along the South-West Coast of India. Traps, anchor hooks and scoop nets are the existing fishing gears employed for lobster fishing in this area. The present fishing is restricted to limited areas only.

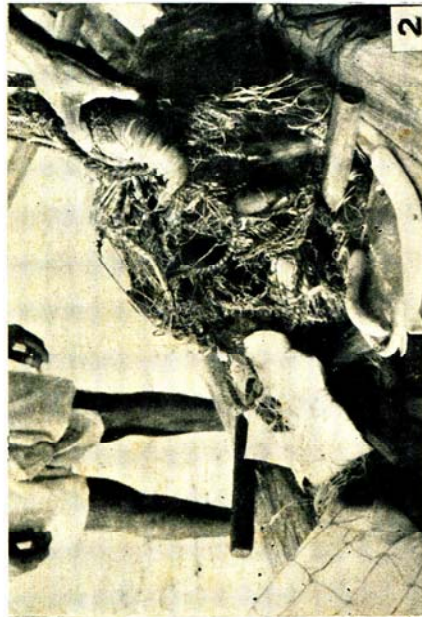
With a view to improving the existing lobster fishing and to extend the present area of operation, simple yet efficient fishing gear was designed at the Central Fisheries Technological Research Station at Cochin. In order to assess the working efficiency of the new design, preliminary experimental fishing were conducted at Muttam and Manakudi, two important centres for lobster fishing along the South-West Coast of India.

#### ACKNOWLEDGEMENTS

As a part of the programme of work undertaken at the Central Fisheries Technological Research Station, Craft and Gear Wing at Cochin during 1958-59, the present investigation was undertaken under the guidance of Dr. H. Miyamoto, FAO/ETAP Fishing Gear Technologist in India, to whom the authors owe a debt of gratitude. It is a pleasure to place on record our sincere thanks to M/s. Southern Fisheries Corporation for all the facilities offered to us while conducting our experiments at Muttam. Our thanks are also due to Shri G. K. Kuriyan, Assistant Director (Gear), C.F.T.R.S., for helpful discussions in the course of this work.

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Figs. 1-4. Fig. 1. Preparing for the day's fishing. Fig. 2. The Catch—Lobsters and Rays. Fig. 3. The Catch—Miscellaneous fishes. Fig. 4. A full-sized Lobster.