A PRELIMINARY NOTE ON AN EXPERIMENT IN PADDY FIELD PRAWN FISHING

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INTRODUCTION

The low lying single crop paddy fields, locally called "Pokkali nilam" tretching along the banks of backwaters and connected canals in Central Kerala are being made use of during the off season as prawn fishing grounds. The total extent of these fields may be well over 10,000 acres and their annual production may be estimated at about five thousand metric tons. Fairly detailed accounts of this fishery which exists at present only in Kerala (particularly in the Taluks of Vaikom, Shertalai, Cochin, Kanayannur, Mukundapuram and Parur) have been published by Panikkar (1937), Menon (1954), Gopinath (1955) and Panikkar and Menon (1955).

Realising its importance in the fishing industry of the State it was felt that a scientific study of the fishery should be made as a first step for assessing possibilities of improving the yield and cultural practices. Menon (1954) has reported on the results of experimental fishing carried out in a one acre field at Narakkal. From the results obtained he has suggested the probability of the annual yield being influenced by factors like area of the field, number of sluice gates, location etc. The present study was designed to verify some of these observations.

DESIGN OF THE EXPERIMENT

The field selected for the experiment was situated in the Kulasekharamangalam Village, about 16 miles S.E. of Cochin and 4 miles North of Vaikom (9°47' 30" N., 76°22'43" E.). An area of about 14 acres was utilized for the experiment. It was surrounded by backwaters on two sides and paddy fields and coconut grooves on the other two. The field was divided approximately into 4 one acre divisions and 4 two acre divisions, by putting up subsidiary bunds. These were grouped into two sets, each consisting of 2 one acre division and 2 two acre divisions. Of the one acre divisions of each set one was fitted with one sluice and the other with two sluices (Text Fig. 1). Similarly, one of the two acre divisions in each set was provided with one sluice and the other with two. All the sluices used for the experiment were of the same dimensions (Length 2·835 m., breadth 0·533 metre and height 1·778 metres). The nets used for fishing were bag-like with tapering cod ends and measurements were when stretched : Length-3·85 metres, mouth circumference-3·30 metres and cod end circumference-0·75 metre. Each was made of six pieces and their mesh sizes from mouth backwards were 1·4 cm., 1·4 cm. 1·2 cm., 1·2, cm, 1·0 cm., and 1·0 cm.

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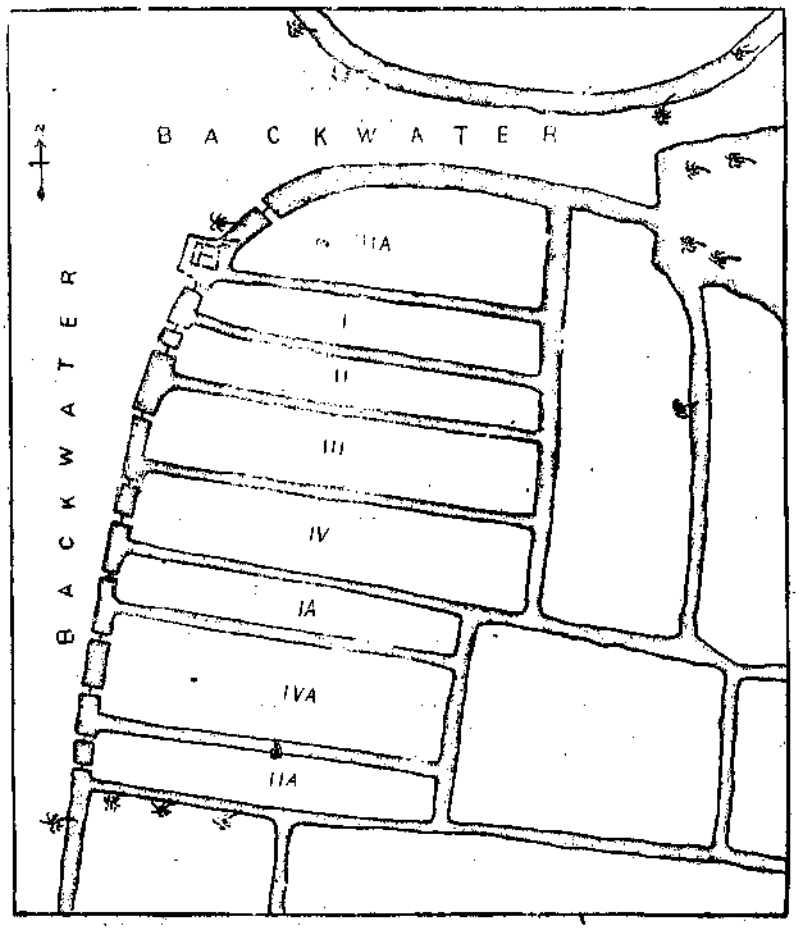

FIG. 1. Showing the layout of the various divisions in the experimental field : I—One acre division with gate. II—One acre division with 2 gates. III—Two acre divisions with 1 gate. IV—Two acre division with gates. IA, IIA, III and IVA form replication.

DESCRIPTION OF THE EXPERIMENT

The experiment was conducted during three seasons viz. 1957, 1958 and 1959. In 1957 it was possible to make observations only during 2 fortnights (*thakkoms* as they are locally called) towards the end of the season. After harvesting the paddy crop the experiment was started in 1958 in January and in the following year in February. In both years observations were continued up to the end of April.

All divisions were filled simultaneously when the high tide at night was at its maximum height. Hurricane lamps hung at the outer end of sluices a few minutes before opening them were used for attracting prawns. Depending on the strength of tides one acre divisions with two sluices took 12-18 minutes to get filled while those with one sluice took 18-24 minutes and the two acre divisions with two sluices were filled in 24-29 minutes, but those having only one sluice each took 32-39 minutes to fill. At low tide during day time the sluices were

opened simultaneously to drain out a portion of the water inside the fields, screening the openings with bamboo gratings. This process of filling and draining was continued for about a fortnight and then the fishing started. Every fortnight the fishing commenced on the 11th day after the full or new moon and continued for eight days. Hurricane lamps were used while fishing also. Only one net was used for fishing in each division irrespective of its size and number of sluices.

The fishing used to take 35-50 minutes depending on the phase of moon and consequent height of the tide. On the first day it took about 35 minutes and maximum of about 50 minutes was reached on the 4th or 5th day, after which the time taken again became progressively shorter. Since only one net was used for each division the outward flow in the one acre divisions slackened first and so they were hauled in first followed by the nets of the larger divisions in which the flow naturally continued for a longer time. During the fishing operations especially at the middle of the *thakkom*, when they take a longer time, the nets were emptied once or twice before they were finally hauled in. All the divisions were filled at high tide late in the night and after fishing as usual but were not drained during day time as on other days.

ANALYSIS OF CATCH DATA

Table I gives the catch of prawns from each division for every fortnight for the three seasons—1957, 1958 & 1959.

TABLE I. Showing the catch of prawns from each division for every fortnight for the three seasons (1957, 1958 and 1959).

I. 1 acre division with one sluice. II. 1 acre division with two sluices. III. 2 acre division with one sluice. IV. 2 acre division with two sluices. IA., IIA, IIIA and IVA form replication.

Catch in the 8 Divisions in Kilo grams

Area (in acres)	1·11	1·08	2·15	2·16	1·45	1·25	2·00	2·81		
Fortnights—Dates of fishing	I	II	III	IV	IA	IIA	IIIA	IVA	Totals	Seasons
27-3-57 to 2-4-57 .	7·48	4·53	12·81	12·24	22·00	15·19	34·47	35·26	143·98	
12-4-57 to 18-4-57 .	2·83	4·19	8·62	11·56	13·38	6·12	23·13	27·10	96·93	1957
TOTAL .	10·31	8·72	21·43	23·80	35·88	21·31	57·60	62·36	240·91	
15-1-58 to 22-1-58 .	2·61	7·60	7·94	13·38	6·80	13·04	19·73	16·10	87·20	
31-1-58 to 7-2-58 .	16·10	10·32	40·48	29·25	24·49	29·25	57·60	30·73	238·22	
14-2-58 to 21-2-58 .	16·21	15·31	24·61	22·00	12·47	21·66	36·51	35·83	184·60	
1-3-58 to 8-3-58 .	24·38	31·52	67·92	78·47	30·84	39·35	104·55	74·61	451·64	1958
15-3-58 to 22-3-58 .	15·31	16·55	32·88	38·55	14·74	22·90	52·16	29·03	222·12	
31-3-58 to 7-4-58 .	19·39	20·52	47·51	50·91	17·12	18·60	65·09	45·92	285·06	
14-4-58 to 21-4-58 .	6·46	4·87	12·24	13·15	5·89	10·66	23·58	15·53	92·38	
TOTAL .	100·46	106·69	233·58	245·71	112·35	155·46	359·22	247·75	1561·22	

TABLE I—(*Contd.*)

Area (in acres)	1·11	1·03	2·15	2·16	1·45	1·25	2·00	2·81		
Fortnights—Dates of fishing	I	II	III	IV	IA	IIA	IIIA	IVA	Total	Seasons
3-2-59 to 10-2-59	8·84	9·18	12·24	15·87	12·93	16·10	19·96	22·90	118·02	
19-2-59 to 26-2-59	14·63	12·02	25·85	24·61	10·32	32·77	42·18	25·17	187·55	
5-3-59 to 12-3-59	13·83	24·61	31·07	34·02	18·03	35·72	50·57	40·37	248·22	
20-3-59 to 27-3-59	21·09	23·58	45·81	35·95	26·42	36·74	55·34	62·71	307·64	1959
3-4-59 to 10-4-59	6·69	8·96	21·77	22·68	12·59	16·33	38·55	24·49	152·06	
19-4-59 to 22-4-59	12·36	14·06	19·39	18·14	12·13	14·63	15·87	30·05	136·63	
TOTAL	77·44	92·41	156·13	151·27	92·42	152·29	222·47	205·69	1150·12	

As the size of corresponding divisions was not exactly the same and as the number of days of fishing varied from year to year the yield was converted to 'per acre per day' for purposes of analysis.

The analysis of variance of the data of 1958 and 1959 are given below. The analysis was intended for testing the significance of the difference in catch between divisions with different number of sluice gates and between divisions of different size.

Analysis of Variance 1958

Source of Variation	Degrees of Freedom	Sum of Squares	Mean Square
Gates	1	0·0387	0·0387
Sizes	1	0·3909	0·3909
nteraction	1	0·7980	0·7980
Between means	3	1·2276	0·4092
Within means	4	1·0388	0·2597
TOTAL	7	2·2664	
1959			
Gates	1	0·0715	0·0715
Sizes	1	0·0124	0·0124
Interaction	1	0·8467	0·8467
Between means	3	0·9306	0·3102
Within means	4	0·7368	0·1842
TOTAL	7	1·6674	

The above analysis was done taking the data for 1958 and 1959 separately. Treating the experiment as a series of experiments over time a separate analysis was made on single model including all effects and is given below.

Analysis of Variance

Source of Variation	Degrees of Freedom	Sum of Squares	Mean Square
Gates	1	0·0025	0·0025
Sizes	1	0.1322	0·1322
Years	1	0·0193	0·0193
Replicates	1	0·4461	0·4461
Gate X size	1	1·6444	1·6444
Gate X Year	1	0·1077	0·1077
Size X Year	1	0·2710	0·2710
Residual	8	1·3299	0·1662
TOTAL	15	3·9531	

5% Value of F 1,8=5·32.

The mean square values for all the main effects are less than the residual mean square and therefore are nonsignificant. Among the first order interactions only gate X size interaction is significant at 5% probability level though it is not significant at 1% probability level. All other first order interactions are nonsignificant. Remembering that all main effects and the first order interactions excepting gate X size are nonsignificant, the evidence at hand is not conclusive to prove definitely the significance of the gate X size interaction though the possibility cannot be ruled out. Physically this would mean that the number of gates may influence the yield per acre as the size of the field varies.

In the absence of any definite conclusive evidence we may probably agree with the suggestion of Gopinath (loc. cit.) that it is desirable to have the smallest possible number of sluices since the capture operations take place at the point of outflow.

All the eight species of prawns and shrimps recorded by Menon (loc. cit.) from a similar field at Narakkal are found in the catches here also. In addition a few numbers of *Macrobrachium rosenbergii* also were recorded rarely. *Metapenaeus dobsoni* is the predominant species throughout the period of observation. *M. monoceros* is the species next in abundance up to February and in the months of March and April *Penaeus indicus* takes its place. The other observations regarding the growth of the important species, size groups in the catch etc. are almost similar to those recorded by Menon.

It is commonly believed that the prawn catch is influenced by the phases of the moon and that there is a higher yield during the dark phase. To test the correctness of this belief the catch data for the two seasons, 1958 and 1959, were arranged phase-wise and the analysis of variance was attempted. A highly significant variation was noticed between fortnights, but none between phases. The significant variation in the yield between fortnights was expected. Such variation only shows variation in relative abundance of prawn population in

different fortnights. Each fortnight consists of eight days of fishing which belong to two phases—one phase up to the new or full moon and rest of the days belonging to another phase. Therefore each fortnight's catch was divided accordingly for arranging it phase-wise. However it may be pointed out that the catch shows the maximum on or close to the new moon and full moon days. In the stake net fishery also this phenomenon was noticed (Menon & Raman 1961). This can be attributed to the higher and longer tides during these days affording stronger flow and longer duration of fishing.

Analysis of Variance 1958

Source of Variation	Degrees of Freedom	Sum of Squares	Mean Square	F
Fortnights	6	11707·2685	1951·2114	6·5326**
Phases	1	985·8289	985·8289	3·0984 NS
Residual	48	15272·3545	318·1705	
TOTAL	55	27965·4519		

Analysis of Variance 1959

Source of Variation	Degrees of Freedom	Sum of Squares	Mean Square	F
Fortnights	5	3163·5790	632·7158	3·1609 **
Phases	1	13·4151	13·4151	14·9213 NS
Residual	37	7406·2186	200·1708	
TOTAL	43	10583·3127		

**Highly significant. N S : Nonsignificant.

SUMMARY

The results of an experiment on paddy field prawn fishing conducted near Vaikom in Kerala are presented. It was aimed at finding out the effect of variation in size and number of sluice gates, area of the field etc. on the catch. It has been found when the results of this experiment for the two years were treated separately, the catch from a unit area for any given period is not influenced by either the number and size of sluices or the area of the field. But when a separate analysis was done on a single model including all effects taking the experiment as a series of experiments over time it was found that the first order interaction GateX Size was significant at 5% probability level. Since all other interactions are non-significant and the gate X size interaction is non significant at 1% level, the evidence at hand is considered to be not conclusive. It was not possible to substantiate the common belief that the catch is influenced by the phases of the moon by the present experiment. However, it was found that catches on days around the full moon or new moon showed a rise quite likely due to the stronger tidal influence and consequent stronger flow in and out of the fields and longer duration of fishing.

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REFERENCES

Gopinath K. (1955) Prawn culture in the rice fields of Travancore Cochin, India. *Proc. Indo-Pacific Fish. Coun.* **6**, II & III, 419-425.

Menon M. K. (1954) On the paddy field prawn fishery of Travancore Cochin and an experiment in prawn culture. *Pro . Indo-Pa. ific Fish. Coun.* **5**, II & III, 131-135.

Menon M. K. & K. Raman (1961) Observations on the prawn fishery of the Cochin backwaters with special reference to the stake net catches. *Indian J. Fish.* **8**(1) 1-23.

Panikkar N. K.(1937) The prawn industry of the Malabar coast *J. Bombay Nat. Hist. Soc.*, **39** (2), 342-58.

Panikkar N. K. & M. K. Menon (1955) Prawn fisheries of India. *Proc. Indo-Paci, c Fish. Coun.* **6**, II & III, 328-3