COMPARATIVE FISHING ABILITY AND ECONOMIC EFFICIENCY OF MECHANISED TRAWLERS OPERATING ALONG THE KERALA COAST

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This study was undertaken with a view to finding out the comparative fishing ability and economic performance of different fishing vessel sizes 9.15 m (30′), 9.76 m (32′) and 10.97 m (36′) designed by the Central Institute of Fisheries Technology and operating along the Kerala coast. Data were collected from selected vessels of these sizes for four consecutive fishing seasons from 1964–65 to 1967–68. The catch / unit effort and total effort per year for the 10.97 m (36′) vessels were much better than those for the 9.76m (32') vessels. The yearly landings and the crew remuneration for the former were about twice those of the 9.76 m (32') vessels. The economic efficiency of the 10.97 m (36′) vessels was also much better. The decline in landings per year in both size groups was more due to the reduction in the effort per year than the decline in catch / unit effort.

INTRODUCTION

Introduction of mechanised trawlers to exploit the prawn beds along the coast in 15 to 30 meters depth, has been a major improvement in the fishing activities in Kerala. It has considerably assisted the expansion of the prawn processing industry and the exports of fishery products during the last ten years. Vessels of 9.15 m (30'), 9.76 m (32') and 10.97 m (36') length-over-all built according to the designs supplied by the Central Institute of Fisheries Technology are very popular and an estimated 600 or more of them are operating in the region. An appraisal of the comparative fishing ability and economic efficiency of the above sizes of vessels in operation are important. Data regarding the catch, fishing time and costs of operation were collected from a number of selected commercially operating vessels of the above sizes for four consecutive years from 1964–65 to 1967–68 to find out their comparative performances. In judging the comparative performances, two basic factors viz. the catching ability and the

economics of operation require consideration separately. The catching ability of a vessel represented by the catch/unit effort is mostly determined by the size and features of the vessel and its equipments and thus reflect its basic performance. The economics of operation partly depends on the catching ability. But it is determined more by other factors (not connected with the vessel) e. g. the price of fish, catch composition etc. which show widely varying trends. 'Catch per hour' and 'profit and loss' respectively are the normally used criteria for judging these two factors. However, Kanda (1961) has proposed a statistically derived co-efficient of fishing ability for more objective comparison of 'catching ability'; and for comparing economic efficiencies a criterion based on the cost of production of 1 kg of fish by a vessel has been suggested. The latter has the further advantage of showing directly the basic cost of raw material for processing. The yearly trends, analysis of the factors contributing to the relative efficiency of one size group of vessels compared to the others and the break up of the costs of operation which are important for judging the comparative performance are presented in this paper.

Materials and Methods

At the beginning of the 1964-65 fishing season four 10.97 m (36'), five 9.76 m (32') and two 9.15 m (30') fishing vessels were selected for collection of data. These vessels comprised the fishing fleet of prawn processing factories in Cochin area. The particulars of the vessels are given in Table I.

The vessels were engaged in stern trawling and the fishing season generally extended from September to May (of the next year). Data were collected in a proforma containing the essential details. It was decided to fill in the proforma for each vessel for all days fished by them, to enable detailed analysis of several aspects of operation. Accordingly on every fishing day data were collected directly from each boat after they returned from fishing as long as they fished from Cochin. Unfortunately, for some time the vessels were fishing off the bases at Quilon and Calicut and the data could only be collected once in a week or sometimes once in a month from the log books of these vessels. The ownership of the 9.15 m vessels changed during the later half of 1964-65 and it was not possible to collect any more data from them. For the same reasons data from two 9.76 m vessels could not be collected during 1967-68.

The total fuel consumption figures from some of the vessels in each group were collected at the end of the fishing season. For the vessels from which such data were not available, the fuel consumption figures were estimated in the ratio of the number of hours of operation. The crew's salary was mainly on the basis of a percentage of the catch and its structure varied slightly. For the 1964-65 season the crew were paid only regular wages and this is shown in the calculations. However, during the subsequent years the crew's remunerations were as follows. For the 10.97 m vessels it was 30% of the receipts and for the 9.15 m. vessels it was 30 to 40% of receipts minus oil expenditure. (However, 35% is used for the calculations). The fixed costs of operation were estimated as 20% of the equipped cost of the vessel, the break up being, depreciation 7%, interest 6%, maintenance 3%, fishing gear 2% and overhead 2%. The capital costs of the vessels used in the calculations were those shown in Table I. The landings and receipts, the number of fishing days and the number of trawling

hours per day were obtained from the collected data and the catch/trip values were worked out. Catch/hour was calculated seperately for each vessel for a season and the mean catch/hour for a size group and the variances were worked out from these figures.

The co-efficient of fishing ability according to Kanda (loc. cit.) when the productivity of the fishing ground does not vary significantly from month to month, is defined as $a = \frac{\sum Ai\ Si}{i \sum Si^2}$ where 'Ai' is the average catch per unit effort (catch/hr) of the boat size 'A' in the 'i' th month. 'Si' is the average catch per unit effort (catch/hr) in the 'i' th month taking into account the total catch obtained by all the selected vessels irrespective of size operated in the 'i' th month divided by the total fishing effort of all the boats in the 'i' th month.

To determine the economic efficiency, the Banker's criterion, defined as follows was used.

$$\text{Percentage return} = \frac{\text{Receipt} - \text{Expenditure}}{\text{Capital cost}} \times 100$$

The average total receipts and expenditures for the fishing season for cach vessel size group were used in the above calculations. The cost of production per/kg. of total catch was obtained by dividing the total expenditure (i. e. fuel, salary and fixed costs) incurred by all the vessels in the group for the season by the total catch of all the vessels in the group.

Results and Disscussions

Summary of collected data from all the vessels are given in Table II. The annual landings for each vessel can be obtanied by multiplying the catch/trip by the corresponding number of trips given in the Table. In the presentation of the results 9.15 m, 9.76 m and 10.97 m l. o. a. vessels are designated as 9 m 10 m and 11 m. Data from the 9 m size group are not sufficient. So the results and discussions are limited to the 10 m and 11 m size groups. However, the figures for the 9 m size are shown wherever they are available. All the vessels carried out only daily trips and a 'trip' always means day's fishing.

Fig. 1 shows the average catch/trip (seperately for prawn, fish and total) and the average nnmber of days fished/year for the 10 m and 11 m vessels for the four consecutive fishing seasons. Though the figures show a general decline over these seasons, the catch/trip figures for the 11 m size are 1.5 to 1.7 times more than those of 10 m size group. The average number of fishing days/year for the 11 m size group is 20 to 25% more than that of 10 m size. As a result of the combined effect of these two factors the average total landings/year of a 11 m vessel are 1.9 to 2.2 times those of 10 m vessel, except for 1964-65 when the factor is 1.6. The maximum landings of prawns recorded by a vessel for the four seasons from 1964-65 to 1967-68 for the 11 m size are 42, 46, 30 and 22 tonnes against 22, 23, 25 and 10 tonnes for 10 m size. The maximum total catches for the four seasons are 122, 188, 89 and 43 tonnes for a 11m vessel and 78, 56, 47 and 23 tonnes for a 10 m vessel. It is also seen from Fig. 1 that the decline tn the catch is accounted more by the decrease in fish catch, the reduction in prawn catch being much less. The average rate of decrease with 1964-65 as base are 11% and 9% for prawn, 20% and 19% for fish and 18% and 15% for total catch. The first and second figures refer to 10 m and 11 m vessel size groups respectively. The percentage of prawns in the total catch remains practically constant at 32%

to 36% in both size groups for the first three years. But this increases to 46% to 49% during the 1967-68 season and helps the prawn catch/trip during 1967-68 to remain nearly the same as 1966-67 figure, in spite of a large reduction in the total catch/trip.

The average performances of the vessels are further analysed in Fig. 2 which shows the number of hours of trawling/trip and the catch/hour of the vessels during the four seasons. The bands for 95% confidence level for the catch/hour are also shown. The figures show a general decline for both size groups. The average total catch/hour for the 11 m size is 1.32 to 1.60 times that for 10 m size. The average number of trawling hours/trip for 11 m vessels are about 20-25% more than that for 10 m vessels except for 1964-65 when both are same. It is significant that the variation in prawn catch/hour is much less than the total catch. The prawn catch/hour for the four seasons from 1964-65 to 1967-68 for 10 m and 11 m vessel sizes are 21, 21, 17 and 19 kilograms per hour and 35, 33, 23 and 30 kilograms per hour and 35, 33, 23 and 30 kilograms per hour respectively.

A detailed analysis of the total catch/hr figures is shown in Table III. The median values from the table and the mean values shown in Fig. 2 are very close to each other. The figures for 11 m size, however, show a larger degree of variance than those for 10 m size. Table IV shows the co-efficients of fishing ability for the size groups for the four seasons. The ratio of these abilities actually reflects a more balanced comparative catching ability/hr.

But this does not reflect the ratio of the total landings per year since the latter is also dependent on the total fishing effort per year. The ratios of the co-efficient of fishing ability show that the 11 m vessel size is 1.4 to 1.63 times more efficient than the 10 m size in total catch. This agrees well with the catch/hr ratio and correlates quite well with the installed horse power, the power in 11 m being 1.43 times that in 10 m size. From the 1964-65 data available it is seen that the ratio of the co-efficient of fishing ability of 11 m size is approximately 3.3 times that of the 9 m size.

Table V shows the summary of the average expenditures, receipts and percentage returns for the size group. The returns are 18.9% to 8.6% for the 11 m size and 11.6% to — 2.5% for the 10 m size. Except for 1967-68 the returns from the 10 m size are satisfactory though less than 11 m size. The wide fluctuations in the percentage of returns make objective comparisons difficult.

The average cost of production of 1 kg of fish and the average receipt/kg of total catch for the two size groups for the four seasons are shown in Fig. 3. During the first three seasons the receipt figures (Rs/kg) are 1.01, 0.62, 0.47 and are practically same for both the size groups. But during 1967-68 the average receipt by 11 m size is Rs 1. 17/kg against Rs 1.00/kg by 10 m size. The reason is that the 11 m size group caught more quantities of the costlier varieties of prawns and other fishes. This price differential explains the poor performances of the 10 m size during the season. The sharp rise in price during the period from '65-66 to '66-67 is due to the general effects of devaluation which fetched higher prices from exports and increased the demand for raw material. But this levelled off during 1967-68.

The cost of production (Fig 3) also shows a steady increase for both sizes but the figures for the 11 m size are always lower than those for the 10 m size. For

11 m size it rises from Rs 0.39/kg to Rs 1.03/kg during the period 1964-65 to 1967-68. The corresponding figures of 10 m size are Rs 0.41/kg to Rs 1.07/kg. This index of economic efficiency shows more steady trends and is more useful in comparing economic performance.

Table VI shows the percentage contribution of the items of expenditure towards total expenditure. From Tables V and VI it is seen that the crew's remunerations have increased considerably over the year. This is because of the change over from payment of fixed salaries to payments by percentage of catch. The total crew-remunerations for the 11 m class are about twice the figure for the 10 m class. The number of crew per boat on both size group being 6 to 7, the earnings per crew member for the 11 m class are also double those of 10 m class and thus have more incentive to increase the total hours of trawling. This is seen from the average number of trawling hours per year for both sizes presented in Fig. 3. During 1964-65, crew were paid on fixed salary basis and the total effort for both sizes are same. But during latter years payments were on percentage catch basis and the 11m class shows about 45% more fishing effort than the 10 m class during these years.

The effect of any increase or decrease in the items of expenditure on the total running expenses can readily be determined by the values in Table VI, eg., a 10% reduction in the fuel price reduces the total operating expenses of 11 m size during 1967-68 by 2.2%. A 10% reduction in the capital cost of the vessel reduces the operating expenses of the same vessel during the same period by 4.4%.

The total fishing effort/year (Fig. 3) during 1967-68 is only about 50-60% of the figures for 1964-65. This trend adversely affecting the performances of the vessels, is due to several factors. During earlier seasons the grounds were nearer the base of operation. But later on it was necessary to shift from one base to another e. g. Quilon, Cochin and Calicut during one fishing season and also more time was required to locate reasonable fishing grounds because of decline in catch/hour figures. The former reduces the trips/year and the latter trawling hours/trip. The 10 m class suffers more than 11 m class in these respects. Analysis of the cost figures and catch rates (Figs. 2 & 3) pre-

TABLE I VESSEL PARTICULARS

Vessel No	Dimensions loa × Bmax × Dmld (metres)	GRT	HP	Net size (Head rope metres)	Cost of equipped vessel Rs.
1.	10.97 × 3.5 × 1.91	14	62	23.5, 26.3, 29	85,000
2.	10.97 × 3.5 × 1.91	14	62	29	85,000
3.	10.97 × 3.5 × 1.91	14	62	15.3	85,000
4.	10.97 × 3.5 × 1.91	14	62	21.3	85,000
5.	9.76 × 2.90 × 1.28	9	43.5	13.7, 26.3, 21.8	56,000
6.	9.76 × 2.90 × 1.28	9	43.5	13.7	56,000
7.	9.76 × 2.90 × 1.28	9	43.5	13.7	56,000
8.	9.76 × 2.90 × 1.28	9	43.5	17.1, 18.3	56,000
9.	9.76 × 2.90 × 1.28	9	43.5	18.3	56,000
10.	9.15 × 2.83 × 1.17	6	33	13.7	34,000
11.	9.15 × 2.83 × 1.17	6	33	13.7	34,000

TABLE II VBSSEL WISE AVERAGE CATCH LANDINGS PER TRIP AND NO. OF TRIPS PER YEAR

Vessel No.	No. of trips performed				Prawn landings/trip (kgs.)				Fish landings/trip (kgs.)				Total landings/trip (kg3.)			
	'64-65	'65-66	'66-67	'67-68	'64-65	'65-66	'66-67	'67-68	'64-65	'65-66	'66-67	'67-68	'64-65	'65-66	'66-67	'67-68
1.	174	180	148	123	181	165	109	135	399	383	230	124	580	548	339	259
2.	108	143	140	143	181	208	129	134	307	340	260	131	488	549	389	265
3.	188	195	167	127	183	234	177	138	469	369	216	172	652	603	393	310
4.	188	195	175	144	223	200	151	150	388	356	355	147	611	556	506	296
5.	163	98	151	99	117	113	101	98	227	185	155	100	344	297	256	198
6.	134	168	146	131	110	103	94	75	367	223	168	104	302	326	262	178
7.	146	136	104	107	107	85	80	74	345	191	151	77	314	276	230	151
8.	157	158	108	—	121	142	83	—	207	216	109	—	488	358	192	—
9.	159	162	143	—	145	114	74	—	158	212	326	—	490	326	400	—
10.	146	—	—	—	94	—	—	—	128	—	—	—	221	—	—	—
11.	104	—	—	—	84	—	—	—	99	—	—	—	182	—	—	—

TABLE III CATCH PER HOUR ANALYSIS OF DIFFERENT SIZE GROUPS

(All figures are in kg.)

	1964-65			1965-66		1966-67		1967-68	
	11 m.	10 m.	9 m.	11 m.	10 m.	11 m.	10 m.	11 m.	10 m.
I. Quartile	61.9	36.4	21.3	65.3	39.3	30.9	24.6	28.2	17.8
II. Median	97.9	59.2	34.8	87.9	58.0	60.4	43.3	46.7	35.7
III. Quartile	141.7	87.6	53.0	115.2	77.8	94.1	67.9	80.0	57.2

TABLE IV CO-EFFICIENT OF FISHING ABILITY OF THE VESSEL SIZE GROUPS

	1964-65			1965-66		1966-67		1967-68	
	9 m.	10 m.	11 m.	10 m.	11 m.	10 m.	11 m.	10 m.	11 m.
Bases on									
Total catch	0.38	0.87	1.22	0.72	1.17	0.78	1.21	0.76	1.13
Fish catch	0.36	0.97	1.20	0.73	1.19	0.77	1.21	0.79	1.10
Prawn catch	0.46	0.84	1.58	0.75	1.27	0.77	1.24	0.76	1.14
	9 m.	10 m.	11m.	10m.	11 m.	10 m.	11 m.	10 m.	11 m.
Total catch	1 : 2.31 : 3.25 (1.40)			1 : 1.63		1 : 1.56		1 : 1.49	
Fish catch	1 : 2.70 : 3.35 (1.24)			1 : 1.63		1 : 1.57		1 : 1.45	
Prawn catch	1 : 1.81 : 3.40 (1.88)			1 : 1.69		1 : 1.60		1 : 1.50	

(Figures in the brackets indicate 10 m : 11 m. ratio)

TABLE V ECONOMIC EFFICIENCY OF DIFFERENT VESSEL SIZES

(Figures were averaged)

	Fuel Expenditure Rs.	Salaries & shares Rs.	Other Expenditure Rs.	Annual Receipt Rs.	Profit Rs.	Profit/ capital %
1964-65						
Vessel Size						
11 m.	13565	7972	17000	45802	7265	8.6
10 m.	10092	3837	10500	27719	3289	6.3
9 m.	7979	1507	6800	13706	—2580	—7.5
1965-66						
11 m.	14659	19364	17000	64547	13523	15.9
10 m.	9592	6500	10500	28202	1610	3.1
1966-67						
11 m.	12927	19714	17000	65713	16072	18.9
10 m.	8592	8950	10500	34151	6109	11.6
1967-68						
11 m.	8662	13400	17000	44544	5482	6.4
10 m.	5736	4900	10500	19730	—1406	—2.5

TABLE VI BREAK UP OF TOTAL EXPENDITURE

(Percentage of the total expenditure)

Vessel size		1964-65	1965-66	1966-67	1967-68
11 m.	Salary	21	38	40	34
	Fuel expenditure	35	29	26	22
	Other expenditure	44	33	34	44
10 m.	Salary	16	25	32	23
	Fuel expenditure	41	36	31	27
	Other expenditure	43	39	37	50

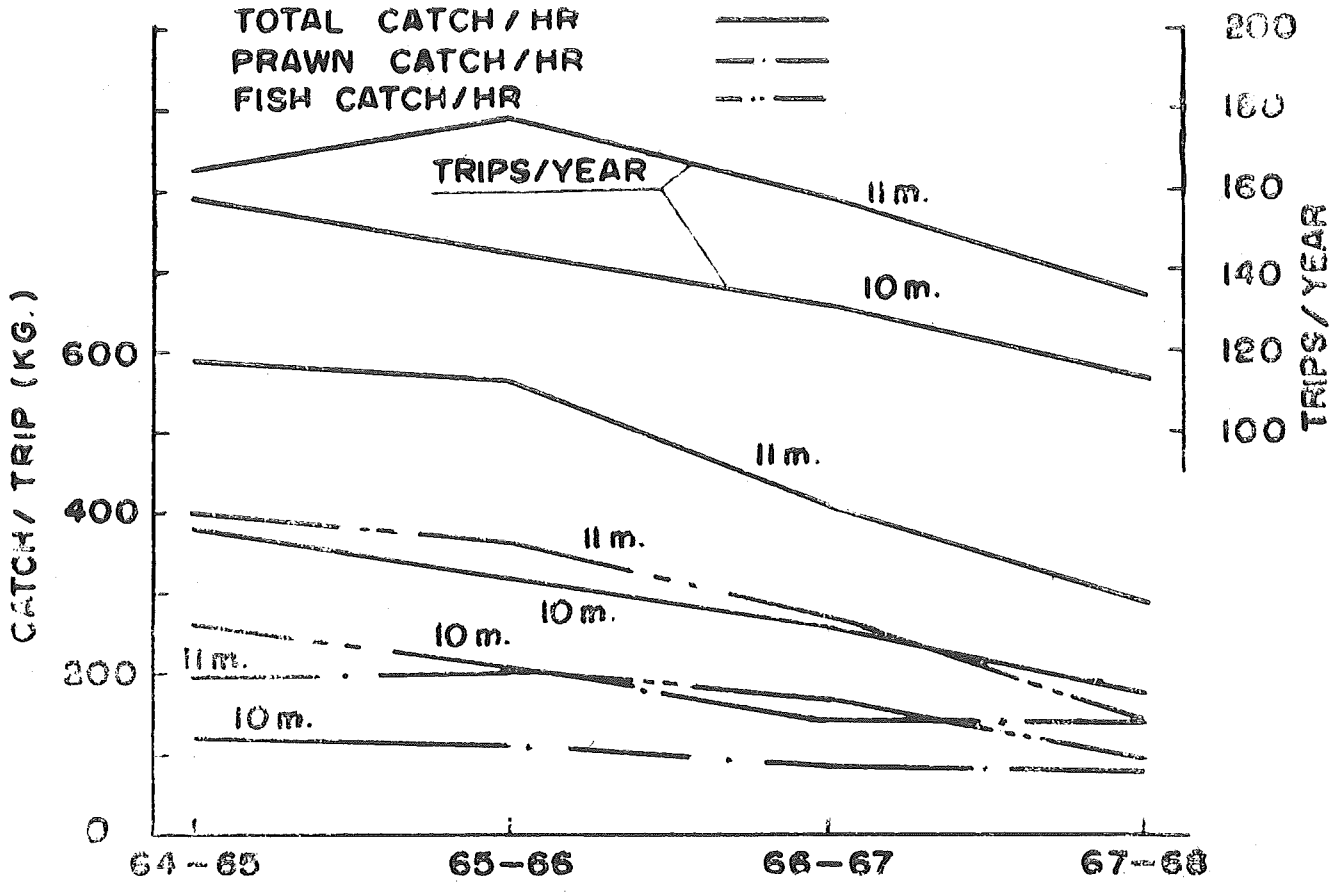

Fig 1 Catch/trip and trips/year of the different vessel sizes for the four fishing season.

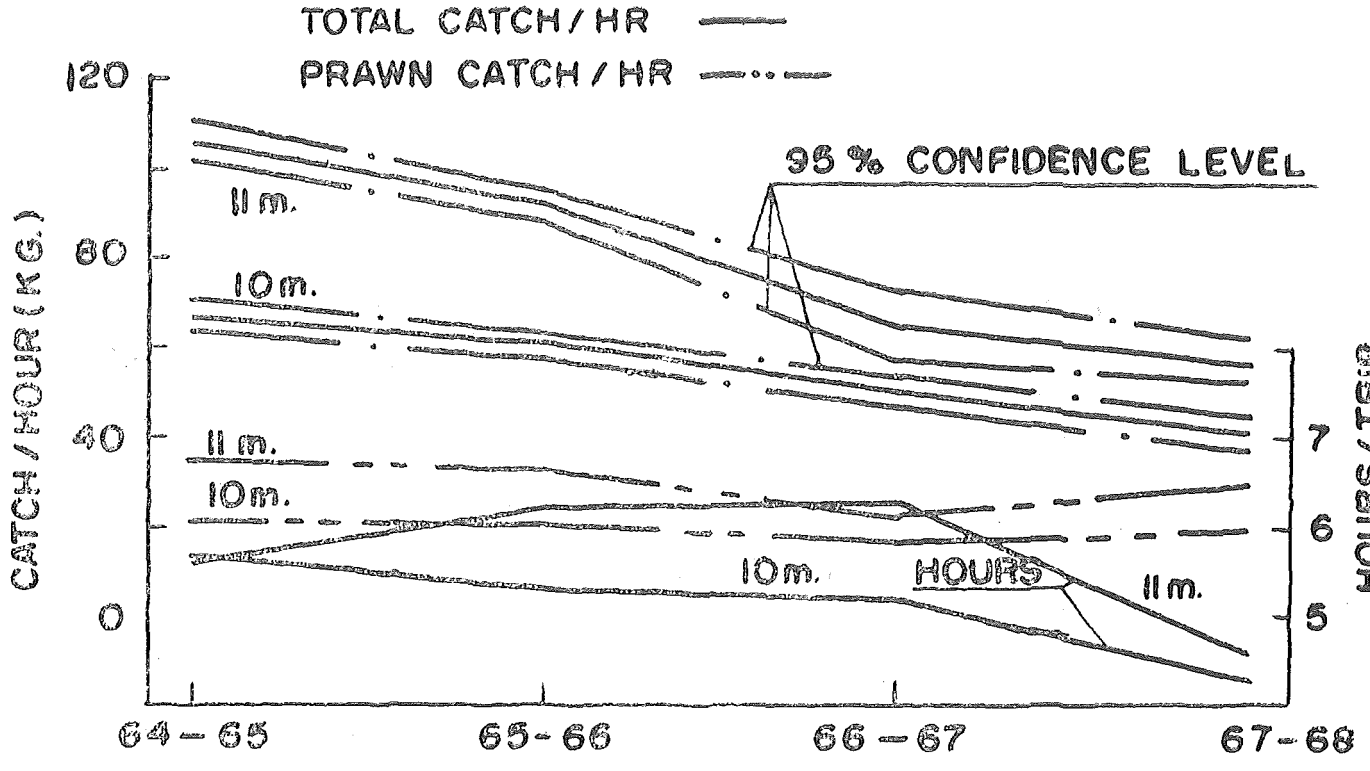

Fig. 2. Catch/hour and fishig effort/trip of the different vessel sizes for the four fishing seasons.

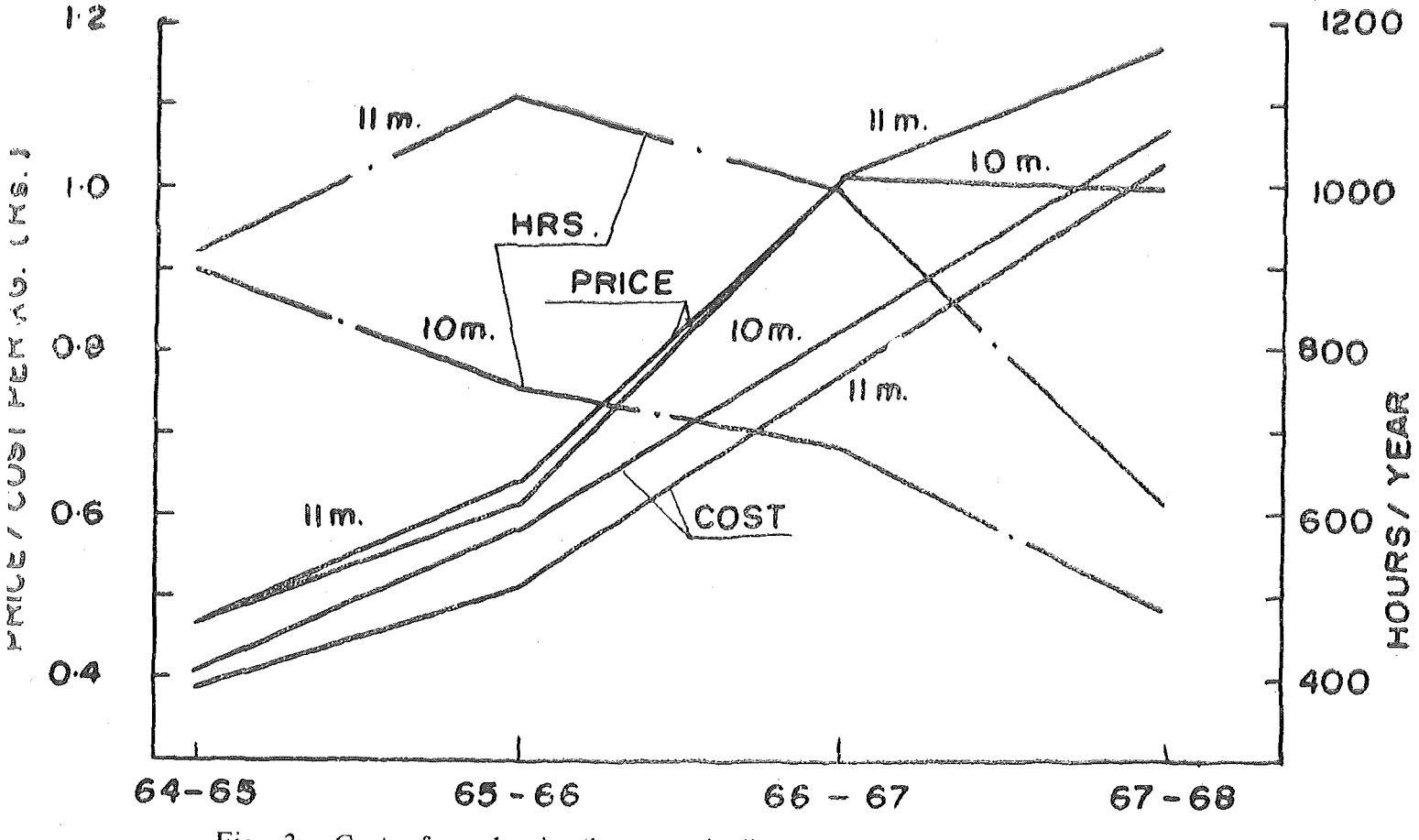

Fig. 3. Cost of production/kg , receipt/kg. and the fishing effort/year of the different vessel sizes for the four fishing seasons.

sented, indicates that a 20% increase in trawling time (i. e. roughly one more haul in each trip) increases the returns by about 3 to 4%, the increase being more in 11 m than 10 m class and so considerable improvement in the economics of operation can be achieved by increasing the trawling time. The 10 m class can have more incentive by reducing the crew to 4 to 5 from the present 6 to 7.

Conclusions

The vessels of 11m class are better than 10 m class both from the considerations of catch/unit effort and also total effort per year. The catch/hr and total effort/year for the 11m class are respectively 1.5 and 1.45 times the figures for 10 m class. As a result the landings per year from the 11 m class are double those from 10 m class. The percentage return on capital from the 11 m class are also much better. The remuneration per crew member for 11 m class is about twice that of 10 m class and this incentive contributes to the increase in total fishing effort and the earnings for the 11 m class. The prawn catch/hour during the last four seasons from 1964-65 to 1967-68 does not show much variations. The decrease in landings are more due to the reduction in fishing effort. The vessels should attempt to increase the total number of trawling hours per year and this combined with reduction in number of crew will considerably improve their economic efficiency.

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