EXPLOITATION OF FISH IN TANKS AND PONDS WEST BENGAL, 1957-61

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SUMMARY. This is a methodological study for estimating the quantity of fish exploited per year from inland waters like tanks and ponds. The experimental surveys carried out for this purpose was however interrupted resulting in an incomplete sample of very small size. Nevertheless, the results indicate that (i) a large proportion of tanks, specially the larger ones, are often left un-exploited (ii) quantity of catch per acre falls with an increasing size of the tank (iii) variability between villages is high, thus calling for a large number to be sampled in the first stage (iv) variability in total catch per tank is lower than variability in catch per acre. Over the five years, average catch was obtained as nearly 2 mds., giving a gross profit of about Rs. 100/- per acre, after deducting the direct expenses.

A large sample for the estimation of inland water area and a smaller subsample for estimating "yield" per acre would be a suitable plan. For observation on the spot, investigators have to be stationed throughout the year in a samall coverage and to be economic, such an enquiry must be linked up with other seasonal activities in a multipurpose scheme.

1. INTRODUCTION

1.1. *Object.* A pilot enquiry into the exploitation of fish in tanks, ponds and jheels in West Bengal, was taken up along with the special land utilisation experiments in the spring season of 1960-61.

1.2. The object of this exploratory investigation was to find out as to what extent relevant data relating to (i) expenses incurred during a year on tanks, (ii) quantities of fish exploited in bulk catches in the last year as also during the last few years, could be recalled and furnished by the household informant on interview. It should be kept in mind that unlike the usual seasonal crops, fish is not a 'crop' of just one year's production; the breeding and rearing of fish have to be continued over a number of years. In enterprises, where cultivation of fish is seriously carried out, spawns are thrown afresh into the tanks from year to year, while fish which have attained a certain size are exploited intermittently. Tanks which are relatively shallow and which dry up in the summer are often exploited exhaustively and fresh spawns are thrown at the advent of the rains when the tanks are filling up. This is not however a very common practice. For a proper assessment, it is obviously necessary that the investigators remain posted on the spot, and keep a continuous record of all operations going on in the individual tanks under his observation, and this for a number of years in succession. It is hardly possible however for an investigator to keep watch over a large number of tanks spread over a wide area and be in a position to arrive at the spot on the day of the particular operation, i.e. throwing of spawns, clearing of tanks or catching of fish etc. Such a vigilance can be effectively maintained only if the tanks under his charge are relatively close together, i.e. confined within a very few villages.

1.3. This calls for a large number of investigators to be appointed for a period of several years if an extensive region is to be covered. This is of course quite feasible on a small scale for purposes of a type study, but a major survey for estimation purposes seems to be prohibitive. Of course, with other enquiries linked up in a multipurpose scheme, an enquiry on fish cultivation may be carried out within reasonable costs.

1.4. It has to be remembered also that unlike the seasonal crops, we cannot select a random sample of tanks and analogous to crop-cutting experiments, conduct a fish catching experiment either by a complete exploitation of the sample tanks or by having a number of throws of the fishing net on specified date. This however would not have fulfilled our object.

Let our object be clearly defined. It was *not* to estimate the total outturn of fish yield which we would get if the full stock of existing fish reserves be 'harvested'. It is neither the exploitable fish-weight per acre without causing depletion of the potential stock such that the yield-rate in subsequent years does not suffer.

1.5. If our object had been to measure the increment rates of the different species in different ages and then to evolve an optimum programme for breeding and exploitation, so as to give the highest aggregate of yield at a given level of expenditure, our approach could have been a series of laboratory-type controlled experiments. This is also not of course our present objective.

1.6. What we are after, is to ascertain the resultant yield in the form of actual exploitation rates per acre per year according to current practice and to estimate the total volume of exploitation in a particular year on the basis of an existing complex of average practices. Thus our object was merely to estimate the exploitation rates now realised in practice and incidentally to collect broad information regarding the operational expenses incurred in cultivation, by way of spawns, clearing of tanks, nourishment given to the fish, if any, etc. etc.

1.7. The present enquiry was however somewhat disturbed owing to some other enquiry coming in the middle of the operations. As a result, the size of sample became somewhat inadequate.

1.8. An attempt has nevertheless been made here to obtain certain broad indications as regards the average pattern of yield rates and the dimensional order of variations in yield in the different stages, namely between the different villages and between plots within the same.

2. PLAN OF SURVEY

2.1. *Sampling design.* The sampling design originally adopted for the present enquiry (although disturbed during actual operations) conforms to a two-stage stratified sampling procedure with the revenue village as the first-stage sampling unit, and 12 plots with tanks and ponds were to be selected in the second stage. The whole of the rural West Bengal was split up into 21 strata comprising generally of administrative sub-divisions or groups of such sub-divisions. A total of 780 villages

were allocated to these strata on the basis of official acreage under total *rabi* cultivation as in the year 1955-56. These were drawn in 6 instalments grouped into 3 sets of priorities, namely, 1, 2 and 3, each being in turn split into two half-samples. The sets were to be visited in the order of priorities assigned to them.

2.2. *Selection of sample villages, in the first stage.* For an enquiry into the practice of fish-cultivation in tanks and ponds, a sub-sample of 104 villages were selected out of a sample of 260 belonging to priority 1; half of this, i.e., 52 were taken out of half-sample 1 and 52 were taken from half-sample 2, into which each priority sample was split up.

2.3. *Selection of tanks and ponds in the second stage.* A complete listing of all plots within the selected sample villages was then to be carried out. The investigator was to make a plot to plot recording of land-utilisation in Schedule (0.1) with the help of a village map. Along with the percentage utilisations under various crops and non-crops in the season entered in columns (4)-(7), acreage under tanks and ponds and the number of such water-patches constituting it, were also to be noted in columns (17) and (20) and Schedule (0.1). All plots with tanks and ponds were then renumbered serially on the body of the schedule itself, from which 12 tanks were selected systematically in the second stage. This was to be done by accumulating the number of tanks in the sequence of an increasing serial of the plots containing water area. If the total number of tanks in a sample village was found to be only 12 or less, all of them were to be selected for the survey. The detailed enumeration regarding individual sample tanks was to be made in Schedule (3.0).

3. Collection of the data

3.1. From each household possessing a sample tank the quantities of fish caught in bulk per year in each of the last five years 1955-56 to 1959-60 and the corresponding value of the catches in rupees were collected in Schedule 3.0 (specimen appended).

3.2. The information was to be obtained by interviewing the possessor of a sample tank residing within the village. In cases where the 'possessor' of a particular tank was not a resident of the village, the tanks had to be rejected as a casualty and replaced. The first two blocks of the schedule refer to the identification particulars and are to be filled up in the usual manner. In column (1) of block (3), the survey number of the plot is noted. In column (2), name of the head of the household possessing the tank will be entered. In column (3), share of the household, if the tank was under a joint possession was to be recorded. In columns (4)-(13), the details regarding the quantity and values of catch were to be entered for each of the five years 1362-BS-1366-BS (1955-56 to 1959-60). In columns (14)-(15), the expenses incurred on spawns and on other accounts, such as clearing of tanks, hiring of nets etc., were to be noted. References as to the year or years in which the above expenses were incurred had been recorded in column (16).

3.3. Where the informant could not recall the actual quantities exploited but remembered the price at which it was sold, imputed quantities were calculated

on the basis of prevalent rates of the year and entered. On the other hand, if the quantities were not sold or if the informant could not recall the value at which it was sold, the imputed value at prevalent rates was noted. Cases were not found, where the informant could recall neither the quantity nor the value. Minor catches by angling tackles and other methods were not taken into account.

3.4. The informant was asked to report the quantities which fell to his share or the whole lot, if he could recall it. All quantities and values were subsequently converted to a full 100%, by inflating the returns by the inverse of the share-proportion to which they referred.

4. RESULTS

4.1. The pilot enquiry, as already stated, was somewhat disturbed by another urgent enquiry and a part of the field strength had to be switched off from this study. Out of a total of 104 villages to be surveyed 35 distributed over 11 districts could only be covered. A total of 265 tanks altogether has been reported. An analysis of the data thus collected has nevertheless been attempted and the results are being presented here with a view to give some sort of a dimensional picture of the pattern of yield and the order of variation in the rate of fish-yield in different stages of sampling.

4.2. *Mean yield rate of fish exploited in maunds per acre per year.* Table 1 gives a frequency distribution of the 265 tanks under three size-classes in each of the five years by levels of exploitation rates in maunds per acre. The tanks were grouped into the following size-classes: (i) those below 1/3 of an acre i.e. one bigha (ii) those between one-third acre and one acre, i.e. 1-3 bighas and (iii) those above 1 acre i.e. 3 bighas or more in size, the size being "gross", i.e. total area including the banks, net water area being much less.

4.3. It will be seen that the 'zero' level of yield is the most crowded one and about one-third of all tanks falls into this category. No catch has been made in them in one or other of the five years. From the chart given at the bottom of the table, which refers to the five year period taken as a whole, 32 out of 165 tanks remained unexploited over a length of five years' time. It will be noticed that this ratio of unutilised tanks is highest in the third category i.e. the largest size of tanks. On the other hand, although the operational costs per acre were lower in the larger tanks, total cost for the entire tanks was considerable. All these factors might have contributed to the lower exploitation rates in larger tanks.

4.4. *Value of fish exploited in rupees per acre per year.* Table 2 is identical with Table 1, where it gives the frequency of tanks in class intervals of market value of catch per acre in each of the five years instead of by the levels of quantities. The features noticed in Table 1 will be reflected in Table 2 also.

4.5. Table 3 gives the cost of operations in rupee per acre per year and a frequency distribution of the sample tanks separately for the three classes of tank size by levels of operational cost for the total period of five years taken as a whole.

TABLE 1. FREQUENCY DISTRIBUTION OF TANKS UNDER A JOINT CLASSIFICATION BY SIZE AND BY QUANTITY OF FISH CATCH PER ACRE PER YEAR IN WEST BENGAL[1] IN THE YEARS 1362 B.S.—1366 B.S.[2] (1957-58 TO 1961-62)

year B.S.	gross size of tanks (in acres)	not specified	quantity (in mds.[3]) of catch per acre													total
			0	—.50	—1.00	—1.50	—2.00	—2.50	—3.00	—4.00	—5.00	—7.50	—10.00	—12.50	above 12.50	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
1362	— 0.33	—	33	—	14	7	6	2	1	9	11	11	14	5	13	126
	— 1.00	1	27	3	5	2	5	2	6	14	6	13	3	1	1	89
	above 1.00	—	17	11	8	2	2	2	2	3	—	2	—	1	—	50
	total	1	77	14	27	11	13	6	9	26	17	26	17	7	14	265
1363	— 0.33	1	37	1	11	7	4	5	3	6	7	16	9	5	14	126
	— 1.00	2	36	3	6	4	4	4	5	5	6	9	2	2	1	89
	above 1.00	—	24	8	6	—	3	1	—	2	4	—	—	1	1	50
	total	3	97	12	23	11	11	10	8	13	17	25	11	8	16	265
1364	— 0.33	1	28	1	13	6	7	4	2	8	6	15	18	7	10	126
	— 1.00	1	33	3	4	3	3	6	3	6	6	11	8	1	1	89
	above 1.00	—	22	11	5	—	2	2	1	2	1	2	1	1	—	50
	total	2	83	15	22	9	12	12	6	16	13	28	27	9	11	265
1365	— 0.33	1	19	2	11	7	6	3	4	8	9	15	16	10	15	126
	— 1.00	1	31	3	4	2	4	6	1	8	10	14	2	1	2	89
	above 1.00	—	17	11	7	2	3	1	2	3	2	1	1	—	—	50
	total	2	67	16	22	11	13	10	7	19	21	30	19	11	17	265
1366	— 0.33	—	33	2	10	5	5	4	2	8	8	19	9	10	11	126
	— 1.00	—	44	3	4	5	2	2	2	4	6	12	4	—	1	89
	above 1.00	—	23	11	4	1	3	1	1	2	2	1	1	—	—	50
	total	—	100	16	18	11	10	7	5	14	16	32	14	10	12	265
1362 to 1366 B.S.	— 0.33	—	10	2	12	8	4	8	5	16	10	23	10	9	9	126
	— 1.00	1	12	9	13	8	10	2	5	7	4	14	2	1	1	89
	above 1.00	—	10	20	7	3	1	2	1	1	2	1	2	—	—	50
	total	1	32	31	32	19	15	12	11	24	16	38	14	10	10	265

[1] excluding, Jalpaiguri, Darjeeling, West Dinajpur and Purulia districts.
[2] Bengali Calendar year
[3] 1 md (=37.32) kilogram

TABLE 2. FREQUENCY DISTRIBUTION OF TANKS UNDER A JOINT CLASSIFICATION BY SIZE AND BY VALUE OF FISH CATCH PER ACRE PER YEAR IN WEST BENGAL IN THE YEARS 1362 B.S.—1366 B.S. (1957-58 TO 1961-62)

year	size of tanks (in acres)	value in (Rs.) of catch per acre														
		not specified	00	—25	—50	—75	—100	—125	—150	—200	—250	—375	—500	—625	abov 625	total
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
1362	— 0.33	3	33	—	6	5	2	6	4	14	4	12	10	6	21	126
	— 1.00	—	27	4	3	4	3	5	1	3	12	13	10	—	3	89
	above 1.00	—	17	11	4	5	1	2	1	2	4	1	1	—	1	50
	total	3	77	15	13	14	6	13	6	19	20	27	21	6	25	265
1363	— 0.33	3	37	2	6	2	4	3	5	10	11	7	11	5	20	126
	— 1.00	—	36	4	4	3	6	2	1	5	8	10	6	1	3	89
	above 1.00	—	24	8	4	3	—	—	3	2	2	3	—	—	2	50
	total	3	97	14	14	8	10	5	8	17	21	20	17	6	25	265
1364	— 0.33	4	29	2	7	2	4	7	2	10	7	12	8	9	23	126
	— 1.00	—	32	3	4	3	2	4	1	6	5	15	8	4	2	89
	above 1.00	—	22	9	4	2	1	1	3	1	1	3	1	1	1	50
	total	4	83	14	15	7	7	12	6	17	13	30	17	14	26	265
1365	— 0.33	3	20	3	3	4	8	3	5	10	8	12	9	10	28	126
	— 1.00	1	30	3	4	1	3	5	—	6	5	17	8	2	4	89
	above 1.00	—	17	10	6	4	2	—	2	2	—	6	—	—	1	50
	total	4	67	16	13	9	13	8	7	18	13	35	17	2	33	265
1366	— 0.33	4	33	2	6	1	5	4	1	8	8	17	9	5	23	126
	— 1.00	—	44	2	2	5	3	2	—	2	4	10	8	5	2	89
	above 1.00	—	23	10	3	2	1	2	2	1	1	4	—	1	—	50
	total	4	100	14	11	8	9	8	3	11	13	31	17	11	25	265
1362	— 0.33	4	10	2	8	2	5	5	5	14	14	16	10	15	16	126
to	— 1.00	—	12	9	9	11	5	3	4	5	6	15	5	3	2	89
1366	above 1.00	—	10	18	7	3	1	1	2	2	2	3	—	—	1	50
	total	4	32	29	24	16	11	9	11	21	22	34	15	18	19	265

TABLE 3. DISTRIBUTION OF TANKS BY THEIR SIZE CLASSES WITH (i) YIELD RATE (ii) VALUE AND (iii) OPERATIONAL COST PER ACRE PER YEAR

(Based on five year average)

total operational cost in rupees per acre	size class of tanks in acres			total
	—.33	.34—1.00	above 1.00	
(1)	(2)	(3)	(4)	(5)
nil	27	12	12	51
— 5	6	17	14	37
6— 10	6	10	8	24
11— 15	7	6	3	16
16— 20	6	9	6	21
21— 30	13	7	2	22
31— 40	12	11	2	25
41— 60	13	13	3	29
61— 80	5	2	—	7
81—100	6	1	—	7
101—200	13	1	—	14
above 200	12	—	—	12
total	126	89	50	265
yield in mds/acre	4.88	2.45	0.94	1.84
value of yield in Rs./acre	313.1	152.2	56.9	115.9
operational cost in Rs./acre	62.5	19.1	8.0	17.8
sampled acreage (of tanks)	4.3	11.1	21.3	36.7

4.6. The yield rates i.e., quantity of fish exploited per acre per year in maunds, along with the corresponding (a) market value of the catch, (b) the cost incurred, per acre per year and total acreage covered by the sample tanks of different classes, have been given at the foot of the table. It will be seen that major proportion of area is commanded by tanks of large size while yield rate will be found to go down as the size of tank increases.

4.7. It will also be seen that while the average cost per acre is lowest in higher tank-sizes, the proportion of tanks on which no cost was incurred is also much higher for the bigger tanks. This indicates that the larger tanks possessed by the rural households are not fully taken care of, i.e. relatively neglected. Whether this results from financial difficulties on the part of the possessors, who may have been retaining their nominal rights from absentee land lords, calls for further investigation,

4.8. *Distribution of ponds according to their size.* Table 4 gives a frequency distribution of the sampled tanks according to their size level. The percentage of the number in each class to total has been given in column (3). It will be seen that 81.1% of tanks are of size one acre and below, while only 5.7% of tanks exceed two acres in size. The proportion of small ponds below 4 cottahs (.08 acres) represent no less than 10.9%.

TABLE 4. FREQUENCY DISTRIUBTION OF TANKS ACCORDING TO THEIR SIZE

size of tanks in acres	number of tanks	percentage to total
(1)	(2)	(3)
up to .08	29	10.9
.09 — .16	31	11.7
.17 — .25	37	14.0
.26 — .33	29	10.9
.34 — .50	35	13.2
.51 — .67	19	7.2
.68 — .83	17	6.4
.84 — 1.00	18	6.8
1.01 — 1.33	16	6.0
1.34 — 1.67	10	3.8
1.68 — 2.00	9	3.4
above 2.00	15	5.7
total	265	100.0

4.9. *Gross profit per acre by district.* Table 5 gives the average rates of catch-yields in maunds as well as in rupees, along with the average price-rates relating to the five-year period taken as a whole, by individual districts. Columns (7) and (8) give the operational costs per acre broken under two heads, namely, (a) for spawns (b) other expenses. It will be seen that the yield rate is highest in Nadia district where the operational cost is Rs. 37.5. The gross profits per acre, i.e., market value of the total proceeds minus the direct operational expenses are highest in Howrah district and lowest in Birbhum district. The yield rate is found to be largest in Howrah district. Column (10) gives the differences between value of fish exploited and the operation costs incurred per acre per year based on the five years under enquiry. This represents the gross profits, which vary widely from district to district, the over-all average being Rs. 98.1 per acre per year.

TABLE 5. QUANTITY, PRICE RATE AND MARKET VALUE OF FISH CATCH PER ACRE PER YEAR WITH OPERATIONAL COST PER ACRE PER YEAR IN DIFFERENT DISTRICTS OF WEST BENGAL FOR THE FIVE YEAR PERIOD 1362 B.S.-1366 B.S., TAKEN AS A WHOLE

districts	number of sample units		price in Rs. per md.	yield in mds/ acre	value of yield in Rs./ acre	operation cost (Rs.) per acre			difference col. (6)– col. (9)
	villages	tanks				spawns	others	total	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1. Burdwan	4	43	64.4	.86	55.5	6.5	6.0	12.5	43.0
2. Birbhum	2	27	56.4	.15	8.6	4.8	1.4	6.2	2.4
3. Bankura	5	43	60.3	2.84	171.4	3.9	2.1	6.1	165.3
4. Midnapore	5	33	65.8	3.52	231.5	10.9	20.3	31.1	200.4
5. Howrah	2	22	80.0	3.09	247.1	44.1	—	44.1	203.0
6. Hooghly	3	20	78.9	2.94	233.0	44.9	20.8	65.6	167.4
7. 24-Parganas	2	21	70.6	3.01	212.2	20.0	8.9	28.8	183.4
8. Nadia	4	22	64.1	3.67	198.8	25.9	11.6	37.5	161.3
9. Murshidabad	4	20	63.5	3.46	219.9	12.4	19.3	31.8	188.1
10. Maldah	2	12	43.2	2.49	107.5	8.9	3.2	12.2	95.3
11. Cooch Behar	2	2	58.7	.14	8.2	0.5	0.5	1.0	7.2
total	35	265	63.1	1.84	115.9	11.7	6.1	17.8	98.1

4.10. *Frequency of exploitation during a period of five years.* Table 6 gives the distribution of tanks by the number of years 0, 1, 2, 3, 4 and 5 in which a catch was made during the whole period of five years. This has been shown separately for the three size-classes.

TABLE 6. NUMBER OF TANKS BY THEIR SIZE CLASSES AND NUMBER OF YEARS ON WHICH BULK CATCHES WERE MADE DURING FIVE YEARS

size class of tanks in acres	number of years on which bulk catches were made during five years						
	0	1 only	2 only	3 only	4 only	5	total
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
— .33	10	6	12	17	8	73	126
—1.00	12	13	8	10	13	33	89
above 1.00	10	9	2	3	5	21	50
total	32	28	22	30	26	127	265

4.11. It will be seen that in about 12.1% of tanks, no catches were made in the course of 5 years, while the number of tanks which were exploited every year is about 50%.

4.12. The enumerators had been instructed to make a careful note of individual tanks which were completely exploited within the year, leaving no residual stock. This is a system, analogous to the seasonal crop-cultivation, applied to shallow tanks sometimes. Some spawns are thrown during the rains, and when the tank begins drying up in April to May, the entire yield is exploited and the same process may be repeated from year to year. This practice, we understand, is widely employed in some of the East Asian countries, where fish is seasonally cultivated in the inundated or waterlogged paddy fields. In West Bengal however, this has a very limited application, the number of such tanks or ponds must be rather few, and in fact, not a single tank of this type has been reported out of the 265 tanks sampled.

4.13. *Variability in fish yield per tank per year and per acre per year.* Table 7 gives the analysis of variance of yield in maunds per tank per year based on the average of five years showing : (a) mean yield per tank, (b) observed variance, (c) coefficients of stage variation and (d) degrees of freedom, separately for the three size-classes and combined.

TABLE 7. ANALYSIS OF VARIANCE OF FISH YIELD IN MAUNDS PER TANK PER YEAR IN WEST BENGAL

(Spring season, 1960-61) based on five yearly returns

	item	size: below .33 acre	size: 34 —1.00 acre	size: above 1.00 acre	all sizes
	(1)	(2)	(3)	(4)	(5)
(a)	*mean yield per tank per year*	0.80	1.54	2.01	1.28
(b)	*variance*				
	(i) between villages	2.62	10.34	37.58	25.33
	(ii) within villages	0.48	0.86	0.64	1.87
	(iii) total	0.94	3.91	15.72	4.90
(c)	*'true' coefficient of variation*				
	(i) between villages	85.0%	113.6%	193.0%	135.9%
	(ii) within villages	86.2%	60.4%	39.8%	107.0%
(d)	*degrees of freedom*				
	(i) between villages	27	28	20	34
	(ii) within villages	98	59	29	229
	(iii) total	125	87	49	263

The true coefficients of variation between villages seem to increase with increasing tank size, while the within village variability falls with increasing tank-size. The over-all variability between villages is obtained as 136% with an 'within' variability

of 107%. Thus, a sample of about 1200 villages with about 25 tanks per village is required for estimating yield rate per tank a margin of 5% error. As there may not be so many as 25 tanks in every village, it seems to be better to have a complete survey of all tanks in a village, in which case about 800 villages are to be enumerated. But, since these are based on parameters of variability relating to five-yearly average, obviously a sample of the above size has to be kept under observation for a period of five years. The above inferences are however highly tentative, as the parameters of variation etc. are based on very meagre materials. Further pilot enquiries are obviously needed to obtain firmer results.

4.14. Total variance of yield rates per acre per year based on the five-yearly averages of the 265 tanks for all size classes combined was also calculated. A total variation of 246% between yield rates per acre was obtained against a total variation of 173% between total yields in individual tanks. This may seem somewhat unusual in the sense that the ratios are generally found to be less variable than between totals where the size of units, namely the tanks widely vary. This may perhaps be explained by the fact that, yield rate falls with increasing tank size as has been seen in Table 3, thus reducing the variation between total yields in individual tanks, an increase in tank-size being partially offset or balanced by decreasing yield rates. The per acre yield rates on the other hand have the full contribution of variation in lieu of the differential in yield rates.

5. Some observations on the problem of fish estimation

5.1. The results obtained from the present pilot study indicate: (i) the average quantity of fish exploited per acre on an average is of the order of 1.8 or say 2 maunds per year. This seems to be low when compared to results obtained in well-managed fish culturing firms. On the other hand, it is quite likely that collection of such data by an interview method is liable to underestimation, as the respondents may have a tendency to understate production and overstate expenses. (ii) A large proportion of tanks remain un-exploited in one or other year. (iii) Yield rate per acre falls as the size of tank increases. (iv) The variability between villages is high, and so for estimation purposes, the number of first stage sampling units has to be considerable. (v) The variability between the total yield of fish per tank seems to be lower than variability between the per acre yield rates with individual tanks as the ultimate unit in both cases. This tends to show that estimation of mean yield per tank and inflating the same by the total number of tanks may be more efficient than a sampling of the yield rate per acre and estimating total yield with total acreage as the multiplier. But this trend has further to be confirmed on an adequate material before drawing conclusions.

5.2. A survey for the estimation of total yield from tanks, calls for a sampling in two phases, (a) a larger sample for the estimation of acreage under tanks and ponds, (b) a smaller sample for the estimation of yield rate per acre.

5.3. Such a survey must be continued for whole years and the investigator must be personally present whenever any catch is made or any of the operations like throwing of spawns, feeding the fish, clearing etc. are taken up in the sample tanks.

5.4. As a general check and possibly, as an independent estimate, a survey may simultaneously be carried out by taking a sample of professional fishermen (ignoring amateurs) and investigating the daily exploits of a sample fishermen. In fact, it is worthwhile studying whether a sample of tanks, or a sample of fishermen on particular days spread over the year at random would be more suitable for the estimation of total yield. The latter do not tie down the investigator to a fixed spot, and a much larger sample may be attempted which may be adequate for the estimation of the number of fishermen as well. Besides, river and 'beel' (large area under water, relatively shallow resembling lakes) waters, which is more commonly exploited by organised enterprises are also automatically covered. Finally, the consumption estimates also provide parallel estimates which should tally with the direct estimations, if the quantity of sea-fish exploited and other net imports is known.

5.5. The stationing of observers all over the year in fixed centres, has its merits and its own risks. Our experience is that the investigators should rather be moved around from time to time and permanent posting sometimes may lead to slackness and negligence.

5.6. The best compromise seems to be to have roving investigators, each in turn being posted for about a month or for a crop season in each centre and coming back at fixed intervals to their old postings. Their whole movement may be confined within a relatively small area, say of the order of a sub-division.

5.7. Regarding the coverage, i.e. the area which the investigator will have to keep under his observation cannot be made very large and should perhaps be confined to one or two adjoining villages. A larger coverage would necessarily lead to failure to attend at the proper time. In spite of all arrangements made for the different households to report and inform the investigator in advance, the risks of non-intimation, deliberate or casual, cannot be ruled out. It is desirable therefore that the investigator should go on paying recurring visits at short intervals and enquire. This is feasible only if the coverage is small. With a small coverage again, actual work-load will be too small and supplementary work must be found to keep up the morale of the field worker.

5.8. The question of providing sufficient work all the year round for investigators is thus quite an important one. Obviously, the fishing operations are undertaken at infrequent levels and are practically nil during certain months. Useful work must therefore be found for them to ensure a steady work-load. The best solution seems to be to link up fish yield investigation with other enquiries in a multi-purpose scheme.

Appendix

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INDIAN STATISTICAL INSTITUTE

Special Crop Survey (NSS) : West Bengal 1960-61

Schedule 0.1 : List of all plots and their utilisation

(Rabi season)

[1] identification particulars of village

1. sri. no..... 2. district..... 3. police station.....

4. J. L. no..... 5. village (name)..... 6. village area (acres 0.00).....

[2] percentage area under utilisation

serial number	survey no. of plot	area of plot (0.00 acres)	cultivation type	cereals				pulses				oil seeds										remarks
				paddy (boro)	wheat	barley	others	gram	masur	khesari	others	mustard	till	others	sugarcane	potato	tank, pond, jheel	rest	total	no. of tank, pond, jheel		
(0)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)		(21)

[3] investigation particulars

1. investigator : name.....roll..... (i) survey..... (ii) despatch..... sign.....

2. investigator : name.....roll..... (i) inspection..... (ii) despatch..... sign.....

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INDIAN STATISTICAL INSTITUTE

Special Crop Survey (NSS) : West Bengal 1960—61

Schedule 3 : Bulk catches of fish

(Rabi season)

[1] identification particulars of village

1. serial number	5. half-sample	9. police station
2. district	6. priority	10. J. L. no.
3. investigation zone	7. village (s.u.I.)	11. village (name)
4. stratum	8. visit number	12. village area (acres 000)

[2] investitation particulars

1. investigator : name.....roll.....date : (i) survey.....(ii) des.....sign.....

2. inspector : name.....date : (i) insp on.....(ii) scrutiny.....(iii) des.....
sign.....

3. scrutiniser : name.....date : (i) receipt.....(ii) scrutiny.....(iii) des.....
sign.....

[3] details of bulk-catches of fish from tanks, ponds, jheels

serial no.	survey no. of plot	name of land of household possessing the plot	share of the household	quantity of catch in mds years (B.S.)[a]					value in rupees years (B.S.)[b]					expenses incurred		ref. to yours for figures in cols. 14 & 15	remarks
				1362	1363	1364	1365	1366	1362	1363	1364	1365	1366	on account sparwns	on account others		
(0)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
1.																	
2.																	

[a] imputed quantity or quantity figures not available form value figures [to be given within ( )]

[b] if actual value is not available given imputed value at present market rate [to be given within ( )]

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