

A METHOD FOR ESTIMATING TRAWLER CATCHES

BY M. D. K. KUTHALINGAM*

(Central Marine Fisheries Research Institute)

INTRODUCTION

FOR a scientific study of the fishing grounds, information regarding the different categories of fishes, catch composition, etc., is essential. However, at present such information is not available from the log reports of the vessels *Kalyani* I-V of the Deep Sea Fishing Board, Government of West Bengal. The fish catch of these vessels are grouped into different classes† and the weights relating to only "A" class category and some of the large-sized fishes—*Muraenesox telabonoides*, sharks, rays and skates are available from the marketing section of the Deep Sea Fishing Board. Hence it has been attempted in the present paper to evolve a method for obtaining the species-wise weights of the remaining classes of fishes. Data on the catch composition based on the weights of the sample trays were collected from the landing centre, shore-base station. Catches of *Kalyani* IV dated 21-4-1962 have been analysed in particular and the results are presented to evolve a suitable methodology.

DESCRIPTION OF THE METHOD

The quality fishes belonging to the "A" class category were kept in a separate 'fish hold' in the trawler and the direct weight of these species were taken at the shore-base station. In the case of "B" and "C" class category, the fishes were dumped into a common "fish hold", unsorted. Generally, the unloading is done by filling up ten 'fish trays' of approximately equal size and weight kept in the landing centre. For assessing the

* Present Address: Central Marine Fisheries Research Unit, Mangalore-1.

† According to the commercial value, the catches were classified into three categories, namely A, B, and C, by the Directorate of Fisheries, Government of West Bengal.

A Class.—Pomfrets, prawns, big-sized perches, sciaenids, polynemids and Scombroids.

B Class.—Leiognathids, clupeids, mullids, mugilids, kurtids and muraenids, small-sized sciaenids, polynemids and perches.

C Class.—Trichiurids, synodontids, scopelids, tachysurids, sole fishes, sharks, rays and skates.

catch composition of the different species of fishes sample trays were chosen at random, and the contents of trays thus selected were sorted out and the weights of the individual groups of fishes taken. These weights, averaged and multiplied by the number of trays, were the total weight of the species in that unloading and this process was repeated for each unloading until the entire contents of the trawler were emptied.

SAMPLING DESIGN

(i) A stratified uni-stage sampling was adopted. The entire fishes were landed by different stages namely unloading. Each unloading was treated as a stratum. A specified number of trays were selected with equal probability within each stratum. Different species of each tray thus selected were weighed separately and estimates were obtained by species.

It may be pointed out here that stratification in any other form is difficult, and if no such stratification is adopted drawing of sample units from the entire catch, is practically impossible.

(ii) *Method of estimation.*—Let Y_{ij} be the weight of the fish of a particular species in the j -th sample of the i -th stratum. Then the estimated fish under the particular category is:

$$\hat{y} = \sum_i \frac{N_i}{n_i} \sum_{j=1}^{n_i} y_{ij}$$

where n_i is the number of sample trays and N_i the total trays in the i -th stratum (unloading).

RESULTS

Taking into consideration one of the catches of *Kalyani IV* as an illustrative example, the estimated weights of the different species of fishes are presented in Table I.

It is observed from Table I that the fourth unloading gives the highest estimate. It is also noted that there are slight variations in the weight of different species from unloading to unloading. In spite of the fact that in the fifth unloading there were only eight trays, the estimate for that is more than that of the first unloading. Taking into consideration the average weight per tray, it is seen that unloading four can also be equally contrasted against the unloading one. These differences may not only be due to regional difference but also due to the variations in the composition of the catch,

TABLE I

Estimated weights of fishes by species and unloading (U)—Kalyani IV

Species	Weight in kg.						All
	U. 1	U. 2	U. 3	U. 4	U. 5	U. 6*	
Total No. of trays	10	10	10	10	8	1	49
No. of sample trays	4	4	4	4	4	..	20
	1	2	3	4	5	6	7
<i>Sciaena</i> spp.	120.00	140.00	120.00	140.00	80.00	8.00	608.00
<i>Pellona</i> spp.	40.00	60.00	40.00	80.00	32.00	4.00	256.00
<i>Nemipterus</i> spp.	80.00	60.00	70.00	40.00	72.00	6.00	328.00
<i>Arius</i> spp.	170.00	210.00	180.00	270.00	248.00	18.00	1096.00
<i>Caranx</i> spp.	60.00	100.00	90.00	120.00	80.00	10.00	460.00
<i>Leiognathus</i> spp.	50.00	60.00	70.00	90.00	56.00	1.00	327.00
<i>Drepane punctata</i>	20.00	40.00	50.00	10.00	32.00	1.00	153.00
Miscellaneous	10.00	10.00	20.00	10.00	8.00	1.00	59.0
Total	.. 550.00	680.00	640.00	760.00	608.00	49.00	3287.000

* For stratum 6th no sampling was adopted.

However, the fact that differences occur, each unloading is treated as a separate stratum.

Once settled that each unloading is treated as a separate stratum considering the above points to take care of the differences between unloadings, it is worth looking into what should be the minimum sample size from each unloading to give a fairly good estimate. This should be looked into by clearly bearing in mind that the longer the sample size, the longer the time spent in weighing which creates much inconvenience to the unloading.

Estimates and relative standard errors have been worked out by considering all the four, the first 3 and 2 or 1 tray sampled are presented in Table II. It may be observed that the first 3, 2 or 1 trays sampled can be considered as random samples of size 3, 2 and 1 respectively.

TABLE II
Estimated weights of the fishes by species obtained through four units, three units, two units and one unit with their relative standard errors

Sample size	SPECIES																										
	Sciaenæ spp.			Pellona spp.			Nemipterus spp.			Arius spp.			Caranx spp.			Leiognathus spp.			Lepane spp.			Miscellaneous					
	E.	S.e.	r.s.e.	E.	S.e.	r.s.e.	E.	S.e.	r.s.e.	E.	S.e.	r.s.e.	E.	S.e.	r.s.e.	E.	S.e.	r.s.e.	E.	S.e.	r.s.e.	E.	S.e.	r.s.e.			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25			
X-4	608	4.9	0.8	256	4.5	1.8	328	3.9	1.2	1096	6.8	0.5	460	8.1	1.8	327	4.1	1.3	153	5.3	3.5	59	10.9	18.5			
X-3	611	5.3	0.9	256	6.5	2.5	329	4.0	1.2	1099	7.6	0.7	462	9.7	2.1	331	4.7	1.4	158	5.3	3.5	51	11.3	22.2			
X-2	608	9.3	1.6	259	5.6	2.2	330	6.5	2.0	1106	8.2	0.7	458	9.0	2.0	331	4.4	1.3	155	5.4	3.5	52	11.9	22.9			
X-1	597	..	..	256	..	..	323	..	..	1109	..	..	455	..	..	322	..	..	162	..	..	61	..	..	

$$1. \text{ S.e.} = \sqrt{\sum_i \frac{N_i^2}{n_i} \sum \frac{(y_{ij} - \bar{y}_i)^2}{n_i - 1}}$$

$$2. \text{ r.s.e.} = \sqrt{\frac{\hat{V}(\hat{y})}{\hat{y}}} \times 100$$

where

\hat{y} = estimate of the total; $\hat{V}(\hat{y})$ = estimate of the variance of \hat{Y} .

Note.—The f.p.c. has been ignored in estimating the S.e., hence the actual S.e.'s are likely to be even lesser in magnitude.

The figures in Table II show clearly that neither the estimates nor the relative standard error is highly affected by decrease or increase in the sample size. Hence, considering these aspects along with the cost involved in surveying more number of trays one is inclined to favour one unit which is enough to give a good estimate for the routine purposes.

Appendix I (Tables I and II) gives the estimates of fish by species taking three samples, two samples and one sample for the ships *Kalyani IV* and *V* dated 9-5-1962 and 12-1-1962 respectively. An examination of the results makes one agree with the conclusions drawn above.

ACKNOWLEDGEMENTS

I am thankful to Mr. Roy Choudury, the Administrative Officer of the Deep-Sea Fishing Board of the Government of West Bengal, for having given facilities at the shore-base station for collecting the data. I am personally thankful to Mr. Paul Jacob, Statistician, Indian Institute of Statistics, Calcutta, for his constant help. My thanks are also due to Mr. P. Mazumdar and other members of the staff of the Central Marine Fisheries Research Unit, Calcutta, for their co-operation. I am thankful to Dr. S. Ramamurthy for going through the manuscript.

APPENDIX I

TABLE I

Estimated weights of fishes by species obtained through three units, two units and one unit (Kalyani IV, dated 9-5-1962)

Un-loading	Sciaena spp.			Pellona spp.			Arius spp.			Caranx spp.			Leiognathus spp.			Drapane spp.			Miscellaneous				
	E.	S.e.	r.s.e.	E.	S.e.	r.s.e.	E.	S.e.	r.s.e.	E.	s.e.	r.s.e.	E.	s.e.	r.s.e.	E.	s.e.	r.s.e.	E.	s.e.	r.s.e.		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	
X-3	2453	10.9	0.4	461	8.7	1.8	3017	12.7	0.4	605	11.1	1.8	150	8.1	5.4	124	7.0	5.7	188	14.4	7.7		
X-2	2457	13.7	0.6	460	11.5	2.5	3017	9.6	0.3	610	14.8	2.4	156	12.7	8.1	122	7.5	6.1	193	16.5	8.5		
X-1	2451	18.9*	0.7*	466	15.1*	3.2*	3023	22.0*	0.7*	593	19.3*	3.1*	170	19.1*	9.4*	119	12.2*	9.8*	193	25.0*	13.3*		

* S.d. and C.v. in the population as estimated from the sample size 3.

TABLE II

Estimated weights of fishes by species obtained through two units and one unit (Kalyani V, dated 12-1-1962)

Un-loading	Sciaena spp.			Pellona spp.			Upeneus spp.			Miscellaneous			Caranx spp.			Small Prawns			Lutjanus spp.				
	E.	S.e.	r.s.e.	E.	S.e.	r.s.e.	E.	S.e.	r.s.e.	E.	S.e.	r.s.e.	E.	S.e.	r.s.e.	E.	S.e.	r.s.e.	E.	S.e.	r.s.e.		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	
X-2	12686	33.4	0.31	3035	30.0	0.9	400	15.0	3.7	888	24.9	2.7	240	17.2	7.1	190	8.6	4.5	130	11.2	8.6		
X-1	12633	47.2*	0.32*	3065	42.4*	1.3*	415	31.2*	5.3*	856	35.2*	3.8*	220	24.4*	10.1*	190	12.2*	6.4*	115	15.8*	12.0*		

* S.d. and C.v. in the population as estimated from the sample size of 2.