A STATISTICAL STUDY ON WEIGHT LOSS IN FROZEN PRAWNS

G. R. UNNITHAN, H. KRISHNA IYER,* & K. KRISHNA RAO**

Central Institute of Fisheries Technology, Cochin-682003

This paper deals with an extensive study conducted to estimate the extent of weight loss in frozen prawns. The weight loss varied from 7 to 12% in peeled and deveined (PD), 5 to 7% in headless (HL) and about 7% in cooked and peeled (CP) prawns from the date of processing to the date of inspection, normally within two weeks. To compensate the weight loss nearly 11% of excess material is being added with every frozen block resulting in an average annual loss of Rs. 2.68 crores in foreign exchange. The relevant data pertain to the period 1971 to 1973 and the annual average loss was estimated for the ten years ending 1973.

INTRODUCTION

Frozen prawn industry in India is a rapidly expanding one. The export earning from frozen prawns has gone up to 82.7 % of the total export earning of marine products during the year 1973. However, the industry is facing many technological problems. Weight loss in frozen prawns is one among them. No reliable statistics regarding the extent of weight loss in different types of packs were available thus far. This communication is intended to throw some light on the extent of weight loss occurring in frozen prawns and the average annual loss due to this phenomenon based on an extensive study conducted in Cochin area.

MATERIALS AND METHODS

The study was initiated by surveying ten prawn freezing factories situated in and around Cochin. Data on production of frozen prawns of different size grades and type of pack and the thawed weights of blocks sampled for pre-shipment inspection were collected. The types of packs covered were headless shell on (HL), peeled and deveined (PD) and cooked and peeled (CP). The size grades covered under HL were 11/15, 16/20, 21/25, 26/30,

TABLE I

Share of frozen shrimps in marine products exports from India*

Year	Quantity in Tonnes		Value in Rs. '000	
1964	5870	(27.4)	31518	(46.0)
1965	7028	(45.5)	41422	(59.8)
1966	8784	(45.8)	88792	(65.6)
1967	11173	(51.3)	129803	(65.1)
1968	14397	(58.0)	156340	(70.8)
1969	21441	(70.1)	262945	(79.5)
1970	22135	(59.5)	242515	(68.2)
1971	23181	(68.1)	313363	(80.1)
1972	30550	(79.8)	508843	(87.5)
1973	35895	(73.6)	658122	(82.7)

*Figures in brackets are the shares in percentage over the total exports of Marine Products

Source: *Statistics of Marine Products Exports*; 1974. Marine Products Export Development Authority, Cochin.

TABLE II

Percentage of different size grades of frozen prawns in the total production (both HL and PD), estimated from 10 factories

Size grades	Percentage
Large size up to 36/40	22.6
Medium from 41/50 to 71/90	19.5
Small size from 91/130 and above	57.9
Total:-	100.00

31/35, 36/40, 41/50, 51/60, 61/70 and 71/90 and those under PD were 21/25, 26/30, 31/35, 36/40, 41/50, 51/60, 61/70, 71/90, 91/110, 111/130, 130/200, 130 up, 200/300, 300/500 and broken. Side by side, data on the excess amount of prawn added to each block of a specified grade and type of pack to compensate for the weight loss were collected. These data were collected from selected factories and from the preshipment inspection score sheets maintained by the Export Inspection Agency.

The data were compiled and analysed so as to get an idea of the mean weights of frozen blocks on thawing in different size grades and types of pack, their standard deviations and the 95 % confidence interval for the population mean. Table I gives the share of frozen prawns in marine products exports from India for the years 1964 to 1973. Table II gives the estimated percentage production of different size grades of frozen prawns on the basis of the data collected from the factories. The mean, standard deviation and the 95 % confidence interval for each factory and for each type of product were worked out and are presented in Table III (a) to (c) and the analysis of variance of the mean weights of blocks on thawing are given in Table IV for different types of packs separately.

RESULTS AND DISCUSSION

The prawn processors compensate the weight loss by adding excess amount of material with each block. The additional average quantity of prawn meat added to each of the 2 kg. pack of HL was as follows:

Up to 36/40   —   150 gm.
above 36/40   —   200 gm.
and for each block of PD weighing 2.27 kg. (5 lb) was:
Up to 130/200 — 200 gm.
200/300 — 250 gm.
above 200/300 — 300 to 350 gm.
and for all size grades in CP, the excess amount was 250 gm.

TABLE III

Mean, standard deviation and 95% confidence interval for drained weights of frozen blocks

III (a)   PD blocks   2.27 kg. (5 lb)

Factory No.	Mean (kg.)	S. D. (kg.)	95% Confidence interval
1.	2.37	0.089	(2.359 — 2.381)
2.	2.39	0.089	(2.376 — 2.404)
3.	2.36	0.201	(2.338 — 2.382)
4.	2.38	0.210	(2.362 — 2.398)
5.	2.41	0.100	(2.389 — 2.431)
6.	2.34	0.235	(2.297 — 2.383)
7.	2.37	0.076	(2.343 — 2.397)
8.	2.40	0.127	(2.386 — 2.414)

III (b) : HL blocks

Factory No.	Mean (kg.)	S. D. (kg.)	95% Confidence interval
1. (2kg. pack)	2.129	0.065	(2.122 — 2.136)
2. (,,)	2.052	0.040	(2.044 — 2.060)
3. (,,)	2.075	0.070	(2.065 — 2.085)
4. (2.27kg. pack)	2.373	0.058	(2.361 — 2.385)
5. (,,)	2.381	0.058	(2.357 — 2.405)
9. (,,)	2.327	0.053	(2.317 — 2.337)
10. (,,)	2.314	0.089	(2.301 — 2.327)

III (c) : CP blocks weighing 2.27 kg. (5 lb).

Factory No.	Mean (kg.)	S. D. (kg.)	95% Confidence interval
(6)	2.349	0.072	(2.342 — 2.356)

From Table II it could be seen that the percentage of production up to the size grade 36/40 was 22.6, from 41/50 to 71/90 was 19.5 and from 91/110 and above was 57.9. Thus the small size prawns constitute a major part of production over the large and medium size prawns.

As the rate of weight loss varied among different size grades, higher in smaller sizes and lower in larger sizes, to compensate the weight loss in smaller sizes larger quantity of the material was added as excess weight.

Table III (a), (b) and (c) give the

mean, standard deviation and the 95 % confidence interval for population mean of the three types of packs PD, HL and CP, respectively. In the case of PD (Table III a), the mean thawed weight of blocks in the 10 factories ranged between 2.34 kg. to 2.41 kg. and standard deviation varied between 0.076 to 0.235 kg. Smaller values for the standard deviation in certain factories might be due to the fact that these factories were constantly engaged in processing prawns of some particular size grades or the excess quantity added to different size grades were so adjusted as to get the required drained weight. Low value for standard deviation was observed in factory No. 7. High value for standard deviation was observed

TABLE IV

Analysis of variance for drained weight of frozen blocks

Variety	Source	S. S.	df	MS	F
P & D					
(2.27 kg. blocks)	Total	52.6228	1792		
	Bet. size grades	0.1868	6	0.03113	1.07
	Bet. Factories	0.4972	7	0.07103	2.43*
	Error	51.9388	1779	0.02920	
HL					
(2 kg. blocks)	Total	2.8281	579		
	Bet. size grades	0.2668	9	0.0296	8.70 †
	Bet. Factories	0.5898	2	0.2949	86.73**
	Error	1.9715	568	0.0034	
HL					
(2.27 kg. blocks)	Total	2.4173	404		
	Bet. size grades	0.0697	9	0.0077	1.48
	Bet. Factories	0.2703	3	0.0901	17.30**
	Error	2.0773	392	0.0052	
CP					
(2.27 kg. blocks)	Total	20748.0	399		
	Bet. size grades	496.0	3	165.53	3.24*
	Error	20252.0	396	51.14	

* $(p < .05)$ † $(p < .01)$,   ** $(p < .001)$

in factory No. 6 which generally processed smaller and larger size of prawns in varying quantity. Among the 95 % confidence interval worked out for the population mean, the shortest interval was observed in factory No. 1 and the longest in factory No. 6.

Out of the 10 factories surveyed only seven freeze HL variety (Table III - b). They were the factories 1, 2, 3, 4, 5, 9 and 10. Among these, factories 1, 2 and 3 process HL variety in 2 kg. pack while factories 4, 5, 9 and 10 process HL pack weighing 2.27 kg. Among the

factories which produce 2 kg. pack, factory No. 1 was observed to be having high mean weight of 2.129 kg. For this factory standard deviation was also found to be high. The mean yields in the other two factories were 2.052 and 2.075 respectively. Out of the 4 factories which produce 2.27 kg. pack, high mean yield was observed in factory No. 5 and low in factory No. 10. Standard deviation was found to be low in factory No. 9.

Among the 10 factories selected for the study only one factory process CP variety. In this factory the mean weight

of a block from the produce was 2.349 kg. with a standard deviation of 0 072 kg. The 95% confidence interval for the mean was 2.342 to 2.356 kg.

Table IV gives the analysis of variance of the thawed weight of blocks of PD, HL and CP varieties produced by the different factories in the various size grades. In PD the between factories variations were significant ($p < 0.05$) indicating that the mean weight of frozen blocks produced by the factories varied significantly, leading to the conclusion that the factories were not adopting a uniform procedure in the case of excess material to be added to each size grade. In HL also, the between factories variations were found to be significant ($p < 0.001$) both in 2 kg. pack and 2.27 kg. pack indicating that here also no uniform procedure was adopted by the processors. The between size grade variation was found to be significant only in the case of HL 2 kg. pack ($p < .01$) and CP variety ($p < .05$). Obviously when between factories variation is significant, the between size variation is also expected to be significant. The failure of between size variation to be significant in PD and HL (2.27 kg pack) may be attributed to the fact that certain factories add more quantity and certain factories less quantity as excess weight and when the mean were taken for comparison, the effects nullify themselves leading to non-significant results.

On the basis of the data collected an attempt was made to estimate the weight loss in different types of pack. For estimating the weight loss the excess quantities added were taken as 150 gm. on an average for every 2 kg. block up to the size grade 36/40, 200 gm. for 41/50 to 71/90 and 300 gm. to every 2.27 kg. block for 91/130 and the successive size grades. The weight loss thus estimated ranged between 7 to 12 % in PD, 5 to 7% in HL and about 7% in CP from the date of processing up to the date of inspection (normally within two weeks). Also, on the basis of the excess quantity added to compensate the weight loss an estimate of the total loss incurred in foreign exchange from 1964 to 1973 was worked out. It is estimated that for every 1000 tonnes of frozen prawns 113 tonnes were added as excess weight. This worked out to be approximately 11%. On the basis of this, it is estimated that foreign exchage worth Rs. 26.77 crores was lost during the period of study or an average loss of Rs. 2.68 crores annually.