Raw Material Supply to Shrimp Freezing Plants: Some Significant Aspects

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The shrimp processing plants located at any particular place receive their raw material supplies from local and outside centres. The raw material received, the form in which it was received, the relative contribution by local and outside centres and the seasonal variation in the supplies were studied with respect to the shrimp processing plants located at three places - Cochin, Veraval and Kakinada.

The marine products freezing industry made a beginning in India in the year 1953, with freezing of small quantities of shrimp at Cochin for export. The response for this product from abroad was encouraging and the industry started expanding. With subsequent increase in demand, the expansion was rather fast and new centres of freezing sprang up. Today, besides Cochin there are a few other centres on East and West coasts of India, where the plants are located in clusters. This rapid expansion of the industry has created a lot of freezing capacity–more than the availability of raw material. The excess freezing capacity could be partly utilised by freezing other types of marine products (for which ready market existed abroad) and also by obtaining raw material from outside centres. The problem of the spare capacity has been highlighted by the National Commission on Agriculture (Anon, 1976). Recent studies have shown that 70–75% of the freezing capacity of the plants on East and West Coasts is still lying idle (Iyer *et al.*, 1981, 1982). In this context the pattern of supply of raw material to the freezing industry of marine products has assumed significance. To understand the relative contribution by local and outside centres to the industry at any particular centre and the related aspects, a study was conducted recently at three centres of the industry–Cochin (where there is still a fairly heavy concentration of the industry) Veraval and Kakinada (on West and East Coasts of India respectively, to represent the corresponding regions). The period of study was 1980–1983 for Cochin and 1981–1983 for the other two centres.

Materials and Methods

At each of the centres of study, freezing plants which could be considered to represent the local industry were included in the study for obtaining detailed information. 25–30% of the plants operating at Cochin, 50–70% of those operating at Veraval and Kakinada during the month were covered by the sample. The quantities of raw material of the different varieties, the form in which they were received and the source of supply for each of them were the main factors on which information was collected. This was done for the material pertaining to the dates of 5th, 10th, 15th, 20th, 25th and 30th of each month. The information obtained was utilised for working out estimates on the different aspects which were of interest for the study. Cochin was found to be getting supplies from a number of centres scattered near about, as well as to its north and south. To get a clear picture, the centres were combined to form four zones as given below.

Zone I: Cochin (Fisheries Harbour, Vypeen Island and other centres in and around Cochin) and centres upto Alleppey. (Zone I could be considered as local supply centre for Cochin)

Zone II: Alleppey and beyond, covering southern part of Kerala.

Zone III. North of Cochin, Malabar coast and upto Mangalore.

Zone IV: Tamilnadu and northern states.

The material received at Kakinada was almost completely from Kakinada itself and hence no other centres were distinguished. At Veraval again, few centres were involved in supplying material to the freezing plants. Besides local supplies, Okha and Surajwari were the other main centres of supply of the material taken as a whole for the year. The accompanying tables give average contribution of the different supplying centres to the processing plants at each location, besides the centrewise information on the number of plants operating each year of the study, the average arrival of raw material for a plant and the estimated total quantity of raw material (with the sampling error). The Tables also give mean monthly percentage of varietywise arrivals, as also other related information in this respect.

The monthwise percentage values were made use of to arrive at mean monthly percentages and the corresponding standard error in respect of each of the factors given in the Tables.

Results and Discussion

Table 1 shows that the number of plants functioning at Cochin was on an average, 4 to 5 times that at Veraval, and 8 to 10 times that at Kakinada. Plants at Veraval were receiving higher quantities of raw material (on an average again) than at the other two centres. The quantities of material received by a plant at Cochin and Kakinada was of the order of 4–5 hundred tonnes a year, while it was 7–8 hundred tonnes at Veraval. The average per day arrival was of the order of 1 – 2.5 tonnes, ranging from nil to 5 tonnes on any single day (This could be even more on certain other days). Varietywise, shrimp figured as the most important of the materials, accounting for 87% at Cochin, 63% at Veraval and 100% at Kakinada. Next in order of importance at Cochin was froglegs with a share of 11% of the total arrivals,

Table 1. *No. of freezing plants and average arrival of material*

Year	Cochin		Veraval		Kakinada	
	(a)	(b)	(a)	(b)	(a)	(b)
1980	45	424	—	—	—	—
1981	43	630	8	943	6	461
1982	45	408	12	525	5	484
1983	45	363	10	656	4	545

(a) No. of freezing plants operated during the year
(b) Average estimated quantity of raw material received by a freezing plant (figures in tonnes)

Table 2. *Contribution from different types of raw material at each centre - Mean percentage/standard error*

	Cochin		Veraval		Kakinada	
	Mean	SE	Mean	SE	Mean	SE
Shrimp	87.4	2.0	62.9	5.0	100	–
Froglegs	10.9	1.8	–	–	–	–
Cuttle fish & squid	1.7	0.6	24.2	4.3	–	–
Lobster tails	–	–	2.2	0.4	–	–
Fish	–	–	10.7	2.2	–	–

Table 3. *Products of shrimp - percentage contribution to total shrimp arrivals*

Products of shrimp	Cochin		Veraval		Kakinada	
	Mean	SE	Mean	SE	Mean	SE
PD and PUD	82.0	1.6	1.8	0.9	33.8	1.9
Headless	6.5	0.9	62.8	4.9	12.4	1.7
Head on	4.2	1.2	35.4	5.1	53.8	2.5
Cooked and other forms	7.3	1.0	–	–	–	–

while at Veraval they were cuttle fish and squid (24%) and other varieties of fish (comprising of fish like pomfrets, perches etc. –11%). The contribution of lobster tails to the total arrivals at Veraval was 2%. 82% of the shrimp received at Cochin was in PD and PUD form, while the corresponding figure was only 2% for veraval and 34% for Kakinada. At Veraval it was HL shrimp which accounted for 63% of shrimp arrivals while it was only 12% at Kakinada and 7% at Cochin. Head-on shrimp (whole shrimp) supplies formed only 4% at Cochin while they were 35% and 54% at Veraval and Kakinada respectively. 7% of the shrimp received at Cochin was in cooked or other forms.

As regards centres of supply, major quantities, as expected, were from closeby centres. 63% of the material at Cochin, 50% of that at Veraval and the entire quantity at Kakinada were from local supplies only. For Cochin plants, southern part of Kerala supplied 22% of the material while Malabar coast and Mangalore accounted for 10%. Tamilnadu and other states contributed 6%. Surajwari and Okha turned

Table 4. *Arrivals from different sources of supply - mean percentage*

Cochin			Veraval			Kakinada
Source	Mean	SE	Source	Mean	SE	Local
Zone I	62.6	2.4	Local	50.5	5.4	100
Zone II	22.0	2.4	Surajwari	18.3	6.7	
Zone III	9.6	1.0	Okha	14.8	2.8	
Zone IV	5.8	1.6	Others	16.4	2.2	

Table 5. *Seasonal variation in arrivals- monthly mean percentage for each quarter*

(a) All types of material

Period	Cochin		Veraval		Kakinada	
	Mean	SE	Mean	SE	Mean	SE
January–March	9.8	0.6	9.1	1.2	5.9	1.6
April–June	6.9	0.4	2.9	1.5	7.1	0.7
July–September	8.7	0.8	5.3	1.9	8.9	1.5
October–December	7.9	0.7	16.0	1.4	11.4	1.0

(b) Shrimp

January–March	10.5	0.8	7.0	1.3	5.9	1.6
April–June	7.1	0.4	1.3	0.8	7.1	0.7
July–September	8.5	1.0	8.0	2.8	8.9	1.5
October–December	7.2	0.8	17.0	2.0	11.4	1.0

(c) Others

	Cochin		Veraval					
	Froglegs		Cuttle fish/squid		Lobster tails		Fish	
	Mean	SE	Mean	SE	Mean	SE	Mean	SE
January–March	6.6	1.4	14.2	2.8	7.0	1.5	15.3	3.3
April–June	8.3	2.0	6.3	3.4	1.1	0.6	3.3	2.3
July–September	7.3	2.9	0.5	0.5	1.3	1.0	1.2	0.9
October–December	11.2	3.0	12.3	2.7	23.9	5.8	13.5	3.8

out to be important supplying centres for Veraval with 18% and 15% respectively. Surajwari is purely of seasonal importance, supplying material during the months of August and September. In fact it accounts for 80% of supplies during the above months. There were more than 10 other centres supplying material to Veraval to a less extent and these were all combined together under 'other centres'. At either of the processing centres of Cochin and Veraval, the material received from outside centres consisted mostly of shrimp. Besides, Cochin received froglegs from Tamilnadu and other states, and cuttlefish/squid from Quilon area, most of the times. The other materials processed at Veraval, – lobster tails, cuttle fish and squid and certain varieties of fish-were all mostly from local supplies only.

Tables 5 (a) to 5 (c) give mean monthly percentage contribution for total as well as individual materials, quarterwise, at each centre. As shrimp forms the maximum quantity in the over all picture, the seasonal variation in the total arrivals of the material is due to that of shrimp only. If no seasonal variation is present, each month's share of the arrival figure could be 1/12th of the total quantity (i.e. 8.3% of the total quantity) excepting for random variations. The mean values in the table were arrived at by considering all the months of the corresponding quarter over the entire period of study. As such, any significant departure from the above expected value of 8.3% could reasonably be attributed to the seasonal factor only.

The average monthly arrivals of shrimp at Veraval and Kakinada in the fourth quarter were as much as twice the corresponding figure of the first quarter. 70% of lobster tail supplies at Veraval were received only during the fourth quarter, while the first and fourth quarter together accounted for 70% of shrimp, 80% of cuttle fish and squid and 85% of other varieties of fish. The second and third quarters usually show less arrivals at Veraval as all the plants close down during May-July period. At Cochin, on the other hand, the first quarter arrivals of shrimp and fourth quarter arrivals of froglegs were slightly higher than the other quarters. Barring this, this centre has not manifested any marked seasonal variation.

The standard error of estimates are all given with the corresponding estimated mean values. Some of them are high (of the order 3 and above) revealing fluctuations in the supplies. The low standard errors observed (of the order of 1 and less) reflect a consistent picture in this respect.

Table 6. *Estimated total arrivals of material*

	Cochin		Veraval		Kakinada	
	(a)	(b)	(a)	(b)	(a)	(b)
1980	19,058	6.0	–	–	–	–
1981	27,104	7.9	7545	8.5	2767	16.0
1982	18,354	9.5	6304	10.0	2421	15.9
1983	16,328	8.2	6562	11.8	2179	13.5

a = Estimate (tonnes); b = sampling error (%)

Table 6 gives the estimates of overall arrivals of materials for each centre and year, of the study. The table also gives the corresponding sampling error of the estimate. The sampling variance of the estimate has two components, one arising due to variation within the plant over the days in a month, and the other due to the variation between the plants. Mathematically, let N and n represent the number of days in a month and sampled days in the month respectively, M and m represent total number of plants and the number of plants sampled at a centre respectively, then the estimate of total arrivals at the centre during a month is given by

$$\hat{T} = \frac{M}{m}\sum_{j=1}^{m}\hat{T}_j = \frac{M}{m}\left[\sum_{j=1}^{m}\left(\frac{N}{n}\sum_{i=1}^{n} x_{ij}\right)\right]$$

where X_{ij} is the observed quantity of arrival at the j^{th} sampled plant on the i^{th} sampled day and $\hat{T}_j$ estimated monthly arrival at the j^{th} plant. Sampling variance of $\hat{T}$ is given by

$$V(\hat{T}) = M^2\left(\frac{1}{m} - \frac{1}{M}\right)s_b^2 + \frac{M}{m}\sum_{j} N^2\left(\frac{1}{n} - \frac{1}{N}\right)s_j^2,$$

Where

$$s_b^2 = \frac{\sum_j \hat{T}_j^2 - \left(\sum_j \hat{T}_j\right)^2/m}{(m-1)}, \quad s_j^2 = \frac{\sum_i x_{ij}^2 - \left(\sum_i x_{ij}\right)^2/n}{(n-1)}$$

Making use of the above, estimates of arrivals and the corresponding sampling variance were worked out for each month. The annual figures were arrived at summing up monthly figures for each year.

The estimates (of arrivals) at Cochin show wide variations over the years. In this context, it is to be noted that the supply centres for Cochin supply to some other processing centres like Alleppey, Quilon and Calicut. In certain years, it is possible that the material is diverted to one or the other of those centres, causing such variations. The square root of the sampling variance of the year is the sampling error of the estimate and is shown as percentage of the annual estimate of the arrivals in the table. Usually the arrivals show fluctuations over days, with no arrival on certain days, and with moderate to heavy ones on others. This will be reflected in the sampling variance. The sampling variance at Cochin and Veraval centres can be considered to be within reasonable limits, while that at Kakinada is somewhat high probably because of the very few plants operating there. This has resulted in the variations being depicted prominently.

The three centres covered here can be taken to represent a cross section of the shrimp freezing industry and the conclusions can be extended to other centres also in general. Thus, the average daily arrival of the material at a plant is 1–2 tonnes, of which more than 60% is shrimp. While as a single item shrimp is the most important one for freezing throughout, froglegs, cuttlefish, squid, lobster tails and certain other types of fish also are taken up for freezing, the order of importance changing from place to place. Roughly 50–60% of the raw material arrivals are from local centres. In case of small centres, the entire arrivals could be from local centres only. Whole, headless, PD and PUD are the more important forms in which shrimp is received at the plants, with order of importance changing from place to place. (Thus while PD, PUD is quite common form of shrimp at Cochin, it is conspicously low at Veraval). In the matter of seasonal variation, first and fourth quarters show better arrivals generally throughout for different types of material.

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