

data has improved since 1960, it was worthwhile to study the trend for the period 1960-61 to 1965-66. Our results show that, on the whole, agricultural wage rate does show a positive trend, though the rate of increase is very low. We do not have enough data to give a full explanation for the trend in agricultural wages, but the available data suggest that irrigation and industrial development are likely to have a positive influence on the agricultural wage rate.

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INDIAN FROZEN SHRIMP IN U.S.A. : A STUDY ON MOVEMENT OF PRICES

Introduction

Frozen shrimp is the most important exported item of fishery products from India, accounting usually for 70-80 per cent of the total export earnings from various fishery products. The United States of America used to be the main market for Indian frozen shrimp in the past though in recent times it is occupying only second place, the first place being held by Japan. In the year 1962, 90 per cent of the frozen shrimp exports from India were to the United States, which has come down to 39 per cent in 1972. However, India is still rated as the second largest supplier of frozen shrimp to the United States. Out of the total foreign exchange earnings of Rs. 58 crores obtained by India from the export of various fishery products in 1972, frozen shrimp exports accounted for as much as Rs. 51 crores, of which the United States accounted for nearly Rs. 20 crores.

The two important types of frozen shrimp exported from India are headless shell on (HL) and peeled and deveined (PD) varieties. The size-grade of frozen shrimp, which is the range of the number of shrimp per pound, is an important consideration in the market for price realisation. The larger the size-grade, the higher is the price paid for it. (The size-grade 21/25 implies that the number of pieces per pound in the material lies between 21 and 25, by virtue of which it is larger than size-grades like 41/50, 71/90, etc.) The monthly prices obtained by different size-grades of HL and PD Indian frozen shrimp in New York market are published.¹ 'Under 15' is the largest size-grade in both PD and HL shrimp, while the smallest is 200/300 in PD and 61/70 in HL shrimp for which prices obtained are available in these publications.

The pattern of movement of prices, referred to above, has not been uniform during the past 6-7 years. While the larger size-grades have been

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1. Statistics of Marine Products Exports, The Marine Products Export Promotion Council, Cochin-16, 1971; and Marine Products Export Review 1972, The Marine Products Export Development Authority, Cochin, 1972.

showing more or less a steady improvement during this period, the medium and smaller ones have been fluctuating about the same average price throughout. The year 1972 is an exception when the prices of all size-grades have shown vast improvement over those of the previous years. The average annual prices for some selected size-grades and the monthly variations for the period 1966-72 are presented in Table IA to explain these variations. This variation is a matter of importance and a doubt is often expressed as to how the Indian frozen shrimp react to competition from local shrimp in this con-

TABLE IA—AVERAGE ANNUAL PRICES FOR INDIAN SHRIMP IN U.S.A.

Size-grade and variety	(cents per pound)						
	1966	1967	1968	1969	1970	1971	1972
PD : 21/25 ..	118	130	143	156	150	156	216
PD : 41/50 ..	100	103	101	114	115	119	155
PD : 71/90 ..	86	78	70	85	81	86	124
PD : 130 up ..	67	48	51	68	54	67	95
HL : 26/30 ..	102	101	111	120	115	124	178
HL : 36/40 ..	88	80	84	98	91	103	138

text. A study was hence carried out to find to what extent these variations in prices can be attributed to the variations in the prices of shrimp from domestic landings in the United States. The results are presented in this paper.

Domestic Landings of Shrimp

The most significant shrimp fishery in the United States is located in the Gulf of Mexico. Seventy to eighty per cent of the shrimp landed in the United States in recent years has been in the Gulf of Mexico.² For this reason, the ex-vessel price paid to the brown shrimp at Brownsville (Port Isabel, Texas), representing the price movements of shrimp in Gulf area, is considered here as the factor associated with the variation of prices paid to the Indian frozen shrimp. Shell-fish Situation and Outlook, published periodically by the United States Department of Commerce, gives the monthly prices paid to the size-grades of 15/20, 31/35 and 51/65 of these shrimp. The annual averages for the above and also their monthly variations are given in Table IB. The monthly prices of these three size-grades, denoted by P_1 , P_2 and P_3 respectively, are considered here as the three variables and the price variation of Indian shrimp is sought to be explained in terms of price variation of these size-grades.

The size-grades of 21/25, 41/50, 71/90 and 130 up of PD variety and 26/30 and 36/40 of HL variety (of Indian shrimp) were selected for this study

2. Donald P. Cleary: Demand and Price Structure for Shrimp, Working Paper No. 15, Division of Economic Research, United States Bureau of Commercial Fisheries, 1969.

TABLE IB—AVERAGE ANNUAL EX-VESSEL PRICES OF BROWN SHRIMP AT BROWNSVILLE
(cents per pound)

Count size	1966	1967	1968	1969	1970	1971	1972
15/20 ..	105	108	131	139	128	176	190
31/35 ..	86	78	87	100	94	109	135
51/65 ..	71	62	58	66	64	81	71

to represent the different size-grade ranges, such as large, medium and small. Only undeflated prices were used in this study, covering the seven-year period of 1966-1972. There were some gaps in the data which explain for the number of observations varying for the different size-grades.

Regression Analysis of Prices

Taking the prices of Indian frozen shrimp as dependent variable, multiple regressions were calculated with the prices of Brownsville shrimp 15/20, 31/35 and 51/65 (P_1 , P_2 and P_3) as independent variables (Table II). (The prices paid to these three size-grades differ considerably and the amount of difference is not consistent and varies very much over different months which is the justi-

TABLE II—INDIAN SHRIMP IN UNITED STATES MARKET—PRICE REGRESSIONS WITH P_1 , P_2 and P_3

Size-grade and variety	Constant	P_1	P_2	P_3	R^2	d	n
PD : 21/25 ..	35.68	0.31014 (3.66)	1.45417 (7.07)	-0.97066 (4.97)	0.843	0.49	74
PD : 41/50 ..	41.31	0.04401 (0.85)	0.84693 (6.25)	-0.22771 (1.71)	0.789	0.39	78
PD : 71/90 ..	18.46	-0.07086 (1.38)	0.58829 (4.30)	0.28078 (2.07)	0.742	0.43	80
PD : 130 up ..	-1.00	0.14763 (2.34)	0.21494 (1.25)	0.32661 (1.89)	0.604	0.27	81
HL : 26/30 ..	25.05	0.11716 (1.10)	1.04288 (5.66)	-0.34119 (2.02)	0.841	0.70	58
HL : 36/40 ..	14.80	-0.06039 (0.78)	1.00405 (6.72)	-0.12361 (0.91)	0.881	0.67	56

Notes: P_1 = Ex-vessel price for 15/20 brown shrimp at Brownsville.
 P_2 = Ex-vessel price for 31/35 brown shrimp at Brownsville.
 P_3 = Ex-vessel price for 51/65 brown shrimp at Brownsville.
 R^2 = Multiple correlation coefficient.
d = Durbin-Watson Statistic.
n = Number of observations.

fication for treating these as independent variables.) Further, taking one of the variables of P_1 and P_2 together with P_3 , multiple regressions were fitted for the same price data (Table III). The corresponding multiple correlation coefficients, and d's (Durbin-Watson Statistic) with the 't' values of the regression coefficients for all the multiple regressions are presented in these tables.

TABLE III—INDIAN SHRIMP IN UNITED STATES MARKET—PRICE REGRESSIONS WITH P_1 OR P_2 AND P_3

Size-grade and variety	Constant	P_1	P_2	P_3	R^2	d	n
PD : 21/25	.. 40.79	—	2.01619 (13.26)	-1.22274 (6.07)	0.813	0.52	74
PD : 41/50	.. 41.87	—	0.92945 (9.85)	-0.26439 (2.10)	0.787	0.39	78
PD : 71/90	.. 17.60	—	0.45514 (4.66)	0.33952 (3.21)	0.735	0.39	80
PD : 130 up	.. 0.29	0.20211 (4.38)	—	0.50012 (4.82)	0.597	0.30	81
HL : 26/30	.. 31.95	—	1.21537 (12.57)	-0.46543 (3.69)	0.837	0.66	58
HL : 36/40	.. 11.92	—	0.90493 (11.59)	-0.05647 (0.54)	0.879	0.65	56

Notes: P_1 = Ex-vessel price for 15/20 brown shrimp at Brownsville.
 P_2 = Ex-vessel price for 31/35 brown shrimp at Brownsville.
 P_3 = Ex-vessel price for 51/65 brown shrimp at Brownsville.
 R^2 = Multiple correlation coefficient.
d = Durbin-Watson Statistic.
n = Number of observations.

Though the three variables of P_1 , P_2 and P_3 can be considered as independent for all practical purposes, P_1 and P_2 being some what adjacent, might be having substitution effect. However, P_3 which fetches the lowest price of all the three size-grades, is not likely to be influenced by the movements of P_1 and P_2 . This may be the reason for the significance of only one of the 't' values of P_1 and P_2 in most of the regressions of Table II. Hence to improve upon the regressions it was decided to recalculate the regressions by excluding either P_1 or P_2 and in doing so, the regression coefficient (of Table II) corresponding to which the 't' value was less, was excluded.

The revised regressions are given in Table III. The R^2 values in both the tables mostly range 70-80 per cent, and are quite high. The R^2 value is not much affected by the exclusion of either P_1 or P_2 .

Discussion

The prices of 21/25 PD Indian shrimp appear to be significantly affected by the prices of all the three size-grades of Brownsville shrimp, as can be seen from the 't' values of the regression coefficients (Table II). While the size-grades of 15/20 and 31/35 are positively related, the price of 51/65 is related in the opposite direction. The size-grade of 130 up seems to be affected to a small extent by the size-grade of 15/20 Brownsville shrimp and not by the other size-grades. The rest are all correlated in a significant way with the price movements of 31/35 Brownsville shrimp only.

The negative sign of the regression coefficient of 51/65 Brownsville shrimp in certain cases show that when the prices of the larger size-grades increase, there is a drop in the prices of this size-grade and vice versa which may be considered as a seasonal phenomenon.

The revised regression equations obtained after dropping of P_2 in the case of 130 up PD and P_1 in other cases, are mentioned in Table III. The equations show that except in two cases, P_3 affects the prices of all size-grades significantly, positively in smaller size-grades and negatively in others. The sign of P_3 thus remains unaffected by excluding one of the variables of P_1 and P_2 . The size-grade 130 up of Indian shrimp though significantly affected by 15/20 Brownsville shrimp, the extent affected is quiteless as is evident from the value of the regression coefficient. 31/35 Brownsville shrimp seems to be having considerable effect on almost all size-grades, the prices being affected one to two times of the price of this size-grade.

The R^2 values of Table III are only slightly less than the corresponding values of Table II. The revision of regression equations has not affected R^2 values much. A high percentage of variation, as much as 80 per cent and over in some cases, has been explained by the regression equations. Only variation in 130 up is not as satisfactorily explained as in the case of other size-grades by the regression equations.

All d values are less than 1 and consequently significant. The auto-correlations are thus significant, but the aim of the study is only to explain the variations in the prices and hence the significance of auto-correlations need not be viewed seriously.

The above analysis shows that the price movements of Indian frozen shrimp are significantly related to those of local shrimp in U.S.A., the extent of relationship varying with the different size-grades. Waugh and Norton³ who studied the price fluctuations of ex-vessel price of shrimp (taking 31/35 count per pound brown shrimp at Brownsville as representing the movements of prices of shrimp in the United States) concluded that the cumulative landings of shrimp for the previous five months in the Gulf area, the total United States personal income and seasonal variation are the main factors affecting the prices of shrimp. As the multiple regressions (worked out here) show that a high percentage of variation in the Indian frozen shrimp is explained by the prices of Brownsville shrimp, it is possible that the same factors mentioned above have a major role in determining the prices of Indian

3. Frederick V. Waugh and Virgil J. Norton : Some Analysis of Fish Prices, Working Paper No. 22, Division of Economic Research, United States Bureau of Commercial Fisheries, 1960.

shrimp also. Indices for seasonal variation in the Indian frozen shrimp have been given by the authors in a separate note.⁴

It was further observed in the past that shrimp landings in the U.S.A. (Gulf area in particular) affected the prices of Indian shrimp in a marked way. This study has brought out how the prices of domestic shrimp in the U.S.A., which are affected by local landings, influence the prices of the imported Indian shrimp. Keeping the above factors in view, the price fluctuations in the Indian shrimp can be followed in a systematic way which can be ultimately utilized for a judicious way of spacing the exports.

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4. K. Krishna Rao and R. Gopalakrishnan Nair, "Prices of Indian Frozen Shrimp in U.S. Market—A Note on Seasonal Variation," *Fishery Technology*, Vol. IX, No. 2, 1972.

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