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Indian Seafood Export: Trends, Forecast and Market Stability Analysis

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Abstract: In India, the seafood export gradually increased from a mere earning of Rs. 3.98 crores in 1961-62 to Rs. 30213.26 crores in 2013-14 and in terms of quantity the export increased from mere 15732 tonnes to staggering 9.83 lakh tonnes in the same period. Three-year moving average for export and production shows increasing trend with a correlation coefficient of 0.87 between them. Lowest CGR was observed for the decade 1981-1990 (2.50% for quantity and 4.76% for value) whereas for the rest of the decades the figures were higher than 3.0 % for quantity and 5.0% for value. Using Markov chain approachit was observed that Japan was the most stable market among the major importers of Indian Seafood as reflected by the probability of retention at 86.36 % and the most unstable markets was the Middle East with the 40 % retention.The forecast for the marine product export for 2020 was found to be 13.82 lakh tonnes using Holt method.

Key Words: Compound growth rate (CGR), Holt method, Markov chain approach, Seafood export

India's exports of marine products had its beginning as early as 1938-39. The exports included dried, salted or smoked fish, aquatic animal oils, fish meal& fertilizers and miscellaneous marine animals and plant products. Most of the dried fish were exported to East Asian countries such as Hong Kong, Singapore, Myanmar (Burma) and Sri Lanka (TNAU, 2015). The landmark in Indian Seafood export was created when the first shipment of 13 tonnes frozen shrimp (worth Rs. 70,000) was sent to the United States in 1953 from Cochin (SEAI, 2015). There was a significant drop in the quantity exported by 1960-61 but with a higher value. The drop was for the reason that canned shrimp exports came down owing to the prohibitive cost of cans. From then onwards there was a steady growth (TNAU, 2015). The important factors which has contributed to the expansion of foreign seafood trade are favorable price offers in foreign market for frozen shrimp and lobster, increase in fishing effort by introduction of deep sea fishing vessels (charter policies), rise in USD price in international market which meant more rupees realization per US dollar, emphasis of government on export promotion and massive centrally sponsored schemes to provide infrastructure at fishing harbors and landing centers to improve fresh fish handling and provide sanitation and other assistance required for quality processing of fisheries produce. Indian seafood industry has undergone several changes over the years in terms of quantity exported, the composition of item exported and even destination of export. Hence, a deeper insight in seafood export trends, dynamics and market shifts is required to predict the future prospects of the sector. The current study, based on secondary information, was an attempt to explore the seafood export industry of India.

MATERIAL AND METHODS

The current study is based on time series data on quantity and value of marine products exports from India obtained from secondary sources (DAHDF, 2013-14; Sathiadhas *et al*., 2012). Double Exponential Smoothing (Holt) method has been employed to allow for forecasting non-seasonal time series data of seafood exports with trends. The forecast for Holt's linear exponential smoothing is found by having two equations to deal with – One for level and one for trend. The forecast is found using two smoothing constants, and (with values between 0 and 1), and three equations:

Level: $l_t = \alpha y_t + (1-\alpha)(l_{t-1} + b_{t-1})$,

Trend: $b_t = \beta(l_t - l_{t-1}) + (1-\beta)b_{t-1}$,

Forecast: $y_t(h) = l_t + b_t h$.

Here l_t denotes the level of the series at time t and b_t denotes the trend (additive) of the series at time t. The optimal combination of smoothing parameters and should be chosen by minimizing the MSE over observations of the model data set.

The decadal compound growth rate was calculated to ascertain the growth in exports of marine products from Indiawhich was estimated by following method used by Prajneshu and Chandran (Prajneshu and Chandran, 2005). If yt is the study variable at time period t, then the mathematical expression employed for computation of compound growth rate (CGR) r is conventionally given by

$y_t = y_0 (1 + r)^t$

In general, after a multiplicative error ε is assumed in the above equation, logarithmic transformation is done throughout to make it a linear statistical model. That is,

$\log y_t = \log y_0 + t \log(1+r) + \log ?$

The above model can be rewritten as

$\text{Log} y_t = A + B\, t + ?'$

Where,

$A = \log y_0$; $B = \log (1 + r)$ and $?' = \log ?$

Then the unknown parameter constants A and B are estimated by the method of ordinary least squares. Thus, once B is estimated, the CGR r is given by

$r = \exp (B) - 1$

Markov chain approach was used to get insight into structural change and change in the direction of seafood export of India. Annual export data for period 1991-92 to 2013-14 were used to analyze the direction of trade and changing pattern of Indian marine products exports. In the present study, the dynamism of seafood export trade in terms of gains and losses in import quantity of Indian marine products by the major importing countries was examined using the Markov chain model employed by Kusuma and Basavaraja (2014).

RESULTS AND DISCUSSION

In terms of quantity, the Indian seafood export increased from 15732 tonnes in 1961-62 to 3.43 lakh tonnes in 1999-2000 and the figure crossed 9.83 lakh tonnes in the year 2013-14. A similar rise in the value of seafood export was also evident with earnings rising from Rs. 3.98 crores in 1961-62 to Rs. 5116.67 crores in 1999-2000. The year of 2009-10 saw a landmark in seafood export with the value of export crossing Rs. 10000 crores. The export value reached a staggering figure of 30123.26 crores by the year 2013-14 (DAHDF, 2013-14).

Marine fish production has seen a rapid increase from 1988-89 to 2013-14. A relatively steeper increase in the quantity of seafood export was observed during 1989-90 to 1997-98 and from 2007-08 till now. A slower growth rate in export was realized from 1999-2000 to 2006-07 (Fig.1). An apparent overlap between the phases of steep increase in production and export was observed which can be further emphasized by the high correlation coefficient of 0.87 between marine fish production and quantity exported. The value of seafood export depends on the composition of the export basket from India. Though countries like Japan, USA and EU have lesser share in the quantity of exported Indian Seafood, they accounted for a major share in the earned foreign exchange because of shrimp exports. From 1991 till 2001, Japan was the major source of foreign currency earnings for Indiathrough seafood export. In the year 2002 and 2003, USA out-figured Japan in percentage value share (Table 1) owing to decline in quantity exported to Japan and decreased per unit price realization of Indian seafood in Japan. On the other hand, both higher unit price and an increase in quantity exported to USA have made it a leading Indian seafood importer in value. The share of shrimp, which command higher price in an export basket to USA, has recorded increase both in terms of total quantity and unit price during 2002-2003 (Raghuram and Asopa, 2008). From 2004-05 till 2008-09, EU was the major market for Indian seafood in value terms (Table 1).

The shift from USA to EU could possibly be due to prevailing deterrent in the form of an anti-dumping duty imposed by USA along with the deposit (10% value of export) which USA government can hold up to three years (Sathiadhas *et al.*, 2012). Since 2009, S.E. Asian countries (including China) are leading importers of Indian seafood in value because of relaxed sanitary standards prevailing in these countries which attract huge seafood export from India.

Table 1. Shift in value share (%) of seafood export (to the total seafood exports) from India

Years	Japan	USA	E.U	S.E Asia including China	Middle east	Others
1991-92	47.92	11.86	27.18	8.50	1.93	2.60
1992-93	44.43	10.49	29.87	10.14	2.70	2.36
1993-94	45.47	11.95	27.56	10.71	1.37	2.93
1994-95	46.49	13.70	21.17	15.86	1.31	1.47
1995-96	46.6	10.28	25.21	13.72	2.54	1.65
1996-97	46.73	19.25	10.88	1.53	19.22	2.39
1997-98	48.52	11.17	12.41	2.12	23.97	1.81
1998-99	50.42	12.91	12.90	3.87	17.48	2.41
1999-00	45.8	17.40	14.23	2.14	17.97	2.45
2000-01	41.03	15.71	18.34	2.68	19.22	3.02
2001-02	35.13	22.62	18.44	19.96	3.42	0.43
2002-03	22.79	28.78	20.48	20.90	2.98	4.09
2003-04	19.26	27.01	24.35	20.23	3.34	5.82
2004-05	18.09	23.41	27.37	19.89	3.68	7.56
2005-04	15.96	22.62	29.46	19.81	4.25	7.91
2006-07	16.19	16.11	33.00	21.21	4.44	9.05
2007-08	16.11	13.34	34.96	20.78	5.17	9.64
2008-09	14.34	11.87	32.53	25.20	5.53	10.54
2009-10	12.83	10.08	29.99	32.55	5.51	9.05
2010-11	13.05	15.43	26.81	31.72	5.19	7.80
2011-12	12.90	17.94	22.96	32.85	5.39	7.96
2012-13	10.60	21.35	22.15	30.77	5.90	9.22
2013-14	8.15	25.63	20.29	32.48	5.29	8.15

Thus higher contribution in value terms is directly related to enormous quantity exported to these countries. From 1996 till 2000, Middle East countries were among the major importers of Indian seafood in quantity (Table 2). The major factor determining the diversion of seafood exports towards S.E Asia and the Middle East was less strict quality standards in these countries compared to USA and EU (Sathiadhas *et al.*, 2012).

Table 2. Shift in quantity share (%) of seafood export (to the total seafood exports) from India

Years	Japan	USA	E.U	S.E Asia including China	Middle east	Others
1991-92	24.62	12.85	31.88	23.25	4.03	3.38
1992-93	20.01	9.77	32.34	29.16	3.91	4.82
1993-94	18.16	10.47	31.19	32.13	3.14	4.91
1994-95	17.94	10.95	24.88	41.20	2.65	2.37
1995-96	17.23	8.56	28.10	39.86	3.44	2.81
1996-97	18.29	20.42	8.30	2.53	46.68	3.77
1997-98	18.03	11.34	8.23	3.27	56.30	2.83
1998-99	20.91	14.98	11.35	6.24	42.53	3.98
1999-00	19.93	19.22	10.45	3.92	42.83	3.65
2000-01	16.88	15.78	10.07	3.86	49.45	3.96
2001-02	16.10	10.79	19.86	43.74	4.64	4.87
2002-03	11.34	12.64	23.16	41.37	4.58	4.46
2003-04	12.14	12.90	23.37	42.33	3.57	5.69
2004-05	12.54	10.85	25.52	40.90	3.60	6.59
2005-04	11.67	10.90	26.72	38.51	4.35	7.86
2006-07	11.01	7.14	24.45	44.26	3.85	9.29
2007-08	12.44	6.76	27.58	37.59	4.75	10.89
2008-09	9.50	6.12	25.15	39.19	4.51	15.54
2009-10	9.24	4.93	24.29	43.28	5.15	13.11
2010-11	8.70	6.16	21.03	48.35	5.41	10.36
2011-12	9.95	7.93	17.89	49.71	4.43	10.09
2012-13	8.26	9.96	17.06	46.19	4.46	14.07
2013-14	7.27	11.27	17.76	46.34	5.90	11.47

Computed decadal compound growth rate (CGR) for seafood export quantity reveals a maximum growth during 1961-1970, whereas, the least was recorded during 1981-1990. An increase in CGR (quantity) from 1981-1990 to 1991-2000 could be attributed to the rapid increase in frozen fish export from India owing to the increased marine fish production and emerging seafood export facility in the country. The speedy motorization of traditional fishing crafts during the 1980s was instrumental in augmenting marine fish production during late 1980s and early 1990s (Srinivas Gopal and Leela, 2013). A CGR maxima and minima for seafood export value were recorded for 1961-1970 (12.63%) and 1981-1990 (4.76%) respectively (Table 3). A significantly higher CGR for export value has been registered for 1991-2000 when compared to previous and later decades that

Table 3. Compound growth rate of seafood export quantity and value

Decade (PR)	Quantity (CGR %)	Value (CGR %)
1960-2014	3.59	7.20
1961-1970	4.53	12.63
1971-1980	4.25	9.10
1981-1990	2.50	4.76
1991-2000	3.73	6.90
2001-2014	3.24	5.29

could be attributed to higher per unit price realization of exported shrimps.

Using annual seafood export (quantity) data from 1960-61 to 2013-14 as input in the employed model, a forecast for the marine product export is done using Holt method for 2020, which is estimated to be 13.82 lakh tonnes (Fig. 2). The projected seafood export shows increasing trend which is a positive sign for our growing seafood export industry.

Transitional probability matrix using Markov chain approach (Table 4) shows the dynamic changes in the seafood markets of India. The matrix indicates the changes in the direction of seafood export traffic for 1991-91 to 2013-14. The row elements in the matrix indicate the loss in trade of

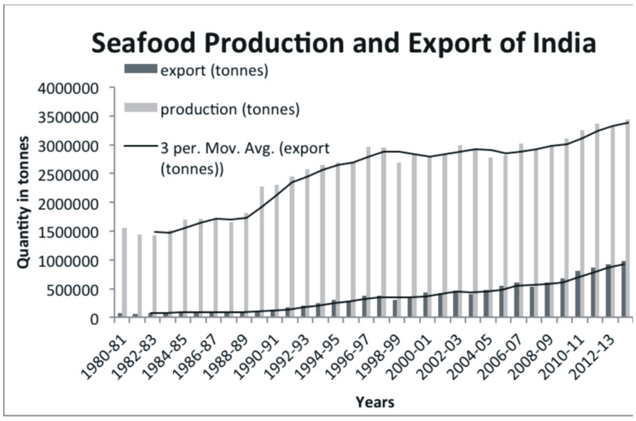

Fig. 1. Indian seafood production and export trend from 1960-61 to 2013-14

Fig. 2. Indian Seafood export (Quantity) forecast using Holt method

Table 4. Transitional Probability Matrix of Markov Chain approach for Indian Sea food Export (1991-92 to 2013-14)

Country	Japan	USA	EU	SE Asia including China	ME	Others
Japan	0.8636	0.0455	0.0000	0.0000	0.0000	0.0909
USA	0.0526	0.7368	0.1579	0.0526	0.0000	0.0000
EU	0.0000	0.2000	0.6400	0.1600	0.0000	0.0000
SE Asia including China	0.0000	0.0909	0.1364	0.6364	0.1364	0.0000
ME	0.0400	0.0000	0.0000	0.1200	0.4000	0.4400
Others	0.0526	0.0000	0.0000	0.0000	0.4737	0.4737

importing countries to other competing nations whereas the column elements represent the probability of gain in trade. The diagonal elements of the matrix represent the probability of retention of the quantity traded by the respective countries. It is evident from the matrix that Japan was the most stable market for Indian seafood with a retention probability of 86.36%. Middle East countries were found to be the least stable market with only 40% retention probability while USA and EU were found to have retained of 73% and 64% of Indian Seafood export.

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