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Indian marine products exports: Growth, instability and geographical diversification

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Abstract

The export of marine products is a significant source of foreign exchange and plays a crucial role in the Indian economy by generating income and employment opportunities. The marine sector contributed 25% (4.13 million t) to the overall fish production in India during the fiscal year 2022-23. The primary objective of this study is to analyse the growth rate, instability, and geographical diversification of marine product exports in terms of both quantity and value. Secondary data related to the major export destinations (Japan, USA, European Union, China, South-East Asia, Middle East and others) and item-wise export (shrimp, finfish, cuttlefish, squid, dried, live, chilled and others) of marine products from India during the period 2000-01 to 2019-20 were collected from the Marine Product Export Development Authority (MPEDA). The growth rate, instability and geographical diversification of exports were estimated using the semi-log regression model, instability index (Ray's method), and Simpson's diversity index, respectively. The findings reveal that the overall growth rate of marine product exports over the last two decades was 7.13%. Dry fish exhibited the highest growth rate (15.34%) among all products, and South-East Asia showed the highest growth rate (16.05%) among destinations. However, a significant decline in growth rates of export quantity and value was observed between the two decades for all items, except for frozen shrimp, accompanied by an increase in export instability. The Simpson's diversity index indicated a significant diversification of 70%, reflecting wide variety of marine products exported as well as the broad range of destination countries.

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Introduction

Marine products export has been a significant source of foreign exchange for India since the late 1930s. The seafood industry has played a crucial role in generating income and employment for the country. With an increasing demand for fresh and processed fish both domestically and internationally, the marine product export sector has experienced rapid economic growth (Aswathy *et al*., 2012). Fish is a highly nutritious commodity rich in omega-3 fatty acids and protein, making it a sought-after product in global markets. The liberalisation of the Indian economy in the 1990s and the inclusion of fisheries in Non-Agricultural Market Access (NAMA) in 2001 were two landmark developments that contributed to the growth of the fisheries sector. As a result, more processing industries, including cold storage facilities, were established to make the supply chain network more profitable for the fisheries business.

In 2019-20, the marine sector contributed 26% (3.72 million t) of India's overall fish production. During the same period, the quantity of Indian marine products export was about 1.28 million t, valued at approximately ₹46,663 crores (USD 6678 million). The different forms of marine products export comprise frozen (shrimp, finfish, cuttlefish, squid), dried, live, chilled and others. The major export markets for Indian marine products are Japan, United States of America (USA), European Union (EU), China, South-East Asia (SEA), Middle East (ME) and others. While the liberalisation of quantitative restrictions led to a boost in marine products export growth, mandatory qualitative restrictions were imposed on seafood exports by importing countries after the WTO agreements (Sarada *et al*., 2006). The rise in demand for processed food overseas has led to an increase in the volume of seafood trade in the international markets.

However, changes in fish harvest, international trade barriers, and variation in trade and exchange rates caused fluctutaions in the exports of various marine products. In developing countries like India, the growth and instability of export are major concerns (Pal, 1992). Therefore, this paper aims to study the nature, extent, and dynamics of growth and instability of Indian marine products export in terms of destination and items, so as to -take appropriate policy measures for achieving high and stable growth. The study analyses the decadal performance of marine products export from India, with focus on growth, instability and their geographical concentration, both in terms of product categories and destination countries

Materials and methods

Secondary data on the export of marine products from India, including information on different types of products (such as shrimp, finfish, cuttlefish, squid, dried, live, chilled and others) and major export destinations (such as Japan, USA, European Union, China, South-East Asia, Middle East and others), was collected from the Marine Products Export Development Authority (MPEDA) for the period of 2000-01 to 2019-20. The data was analysed to assess the growth rate and instability of the marine products export sector, across two decades (2000-01 to 2009-10 and 2010-11 to 2019-20) as well as for the overall period. To measure the geographical diversity index, mathematical equations were used to estimate the growth rate, Ray's Instability Index (RII) and Simpson Diversity Index (SDI) for three specific fiscal years *viz.*, 1999-00; 2009-10 and 2019-20).

Compound growth rate (CGR)

Several studies (Fauzi and Anna, 2012; Jeyanthi and Gopal, 2012; Rani *et al*., 2012; Radhakrishnan *et al*., 2016) utilised the CGR method to calculate the growth rate of Indian fish and fishery products exports. CGR was calculated as follows:

$$\log Y_t = \log \alpha + t \log \beta + \varepsilon$$

where 'y' represents the exported quantity of fish and fishery products at time t, α is a constant, β is a coefficient that determines the growth rate and ε is an error term.

$$CGR = [\exp(\beta) - 1] \times 100$$

Ray instability index (RII)

The Ray instability index was initially developed and used by various researchers (Ray,1983;Mahendradev, 1987; Rao *et al*., 1988; Chand and Raju, 2008) to evaluate the instability index of agriculture. This index, known as RII, is free of any unit and quite sturdy, as it gauges the deviation from the underlying trend, which is log-linear in this case. When there is no variation from the trend, the ratio of Y_{t+1} to Y_t remains constant, resulting in a standard deviation of zero. To estimate the RII, the following formula is employed:

$$RII = SD\left\{ \ln\left(\frac{Y_{t+1}}{Y_t}\right)\right\}$$

This index measures the deviation from the underlying trend (which is log-linear in this case) and is unit-free and highly robust. It is calculated using Y_t, which represents the current year's export and Y_{t+1}, the export for the next year.

Simpson index of diversity (SID)

The Simpson index of diversity (SID), measures species diversity. It is a valuable tool for assessing the degree of diversification or concentration in exports for a specific geographic region over a given period.The index is scaled between 0 and 1, with values closer to 0 indicating complete specialisation and those closer to 1 representing complete diversification (Singh *et.al.,* 2020). In the case of fishery exports, the SID has been computed for the two decades spanning 1999-00 to 2008-09, 2009-10 and 2018-19, as well as for the overall period. The calculation of the SID is based on the following formula:

$$SID = 1 - \sum_{t+1}^{n} W_t^2$$

$$W_t = \frac{X_t}{\sum_{t+1}^{n} X_t}$$

where, *Xi* = Value of export/import of i^{th} commodity

Wi = Proportionate value of export/import of ith commodity, out of total marine products exports/imports

Results

Indian marine products export trend

The quantity and value of Indian marine product exports (MPE) from 1995-96 to 2019-20 have increased over the years. In 2019-20, India exported approximately 12.8 lakh t of marine fish worth ₹46.66 lakh crores (6.68 lakh million USD) (Fig. 1). However, the value in terms of dollars decreased by about 0.74% compared to the previous year. Frozen shrimp exports contributed 51% of the total volume of marine product exports from India in 2019-20, while in terms of value, it accounted for 73% of the total export or $ 4883 million. Table 1 shows the average quantity of item-wise MPE from India over the years from 2000-01 to 2019-20. During the first decade, frozen finfish exports accounted for 40% of the total export basket, but generated only 15% of its value. In contrast, even though the average export quantity of frozen shrimp was comparatively less in the first decade, it generated 57% of the total MPE value of the same period. In the second decade, frozen shrimp exports averaged 10% in quantity and value, estimated at over $ 3290 million dollars out of almost $ 5135 million dollars of seafood exports from India.

It is crucial to investigate the growth and instability of fish and fishery products export in terms of earnings, as developing countries rely heavily on foreign exchange earnings from this sector (Coppock, 1962). Table 2 provides the estimates of growth and instability of marine products export from India over the last two decades, item-wise. In the first decade, frozen finfish export showed a major contribution to the marine products export with a growth rate of approximately 4.16%, while shrimp had a lesser growth rate (<1%). However, in the second decade, shrimp showed a drastic change with a growth rate of 17.82% and a major export basket share, while finfish had negative growth. Although dry and chilled fish had lower export volumes, they exhibited higher growth rates of about 22 and 25%, respectively, in the first decade, which significantly reduced in the second decade. Frozen shrimp continued to maintain stability with an instability index of less than 10% in both decades, and the

Table 1. The percentage share of average quantity and value of marine products exported from India

Items	2000-01 to 2009-10		2010-11 to 2019-20		Overall	
	Quantity	Value	Quantity	Value	Quantity	Value
Fr. Shrimp	131764 (26%) *[2850]*	930 (57%) *[18]*	386888 (36%) *[56206]*	3290 (64%) *[420]*	259326 (33%) *[40082]*	2110 (62%) *[339]*
Fr. Fin Fish	205473 (40%) *[13704]*	250 (15%) *[33]*	307810 (29%) *[14788]*	636 (12%) *[24]*	256641 (32%) *[15300]*	443 (13%) *[49]*
Fr. Cuttlefish	45504 (9%) *[3143]*	126 (8%) *[16]*	65727 (6%) *[2429]*	279 (5%) *[13]*	55615 (7%) *[3020]*	202 (6%) *[20]*
Fr. Squid	45356 (9%) *[2956]*	104 (6%) *[9]*	86804 (8%) *[3500]*	293 (6%) *[21]*	66080 (8%) *[5251]*	199 (6%) *[24]*
Dried items	18590 (4%) *[4083]*	54 (3%) *[19]*	71728 (7%) *[5089]*	162 (3%) *[10]*	45159 (6%) *[6873]*	108 (3%) *[16]*
Live items	2666 (1%) *[349]*	15 (1%) *[2]*	6104 (1%) *[562]*	45 (1%) *[3]*	4385 (1%) *[509]*	30 (1%) *[4]*
Chilled items	8729 (2%) *[2820]*	25 (2%) *[5]*	24330 (2%) *[1870]*	95 (2%) *[6]*	16530 (2%) *[2432]*	60 (2%) *[9]*
Others	57255 (11%) *[5305]*	130 (8%) *[18]*	128471 (12%) *[7493]*	335 (7%) *[22]*	92863 (12%) *[311]*	233 (7%) *[27]*
Total	515336 (100%) *[28711]*	1634 (100%) *[94]*	1077862 (100%) *[66903]*	5135 (100%) *[471]*	796599 (100%) *[73614]*	3385 (100%) *[465]*

Figures in the parenthesis () and [] represent percentage share and standard error, respectively.
Quantity in t and Value in million USD.

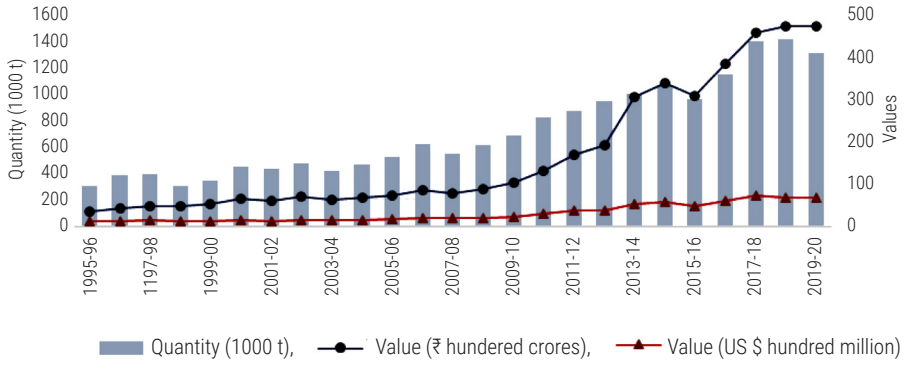

Fig. 1. Quantity and value of marine products export from India (1995-96 to 2019-20)

demand for it, along with its unit price, remained high in Japan, USA, European Union and China. The overall product-wise export growth rate was estimated at about 7.13% from 2000-01 to 2019-20. Table 3 presents the growth and instability estimates of marine products export in terms of value. In the first decade, export of dried items showed rapid growth of about 22.33%. However, their average value share constituted only about 4% of the total export value (Table 1), which increased to 7.8% in the second decade. Frozen shrimp, on the other hand, exhibited a higher growth rate of 17.8% in the second decade, with RII value of 0.10. While frozen shrimp accounted for only about 62% of the total export basket (Table 1), its value was consistently maintained over the two decades.

Table 4 displays the average quantity of marine products exported by India to different markets from 2000-01 to 2019-20. China dominated the market share in terms of quantity during the first decade (28%), followed by the European Union (23%) and SEA (15%). In the second decade, South-East Asia (SEA) became the biggest market with a 35% share of the total quantity of the export basket and generating a market share value of 24%. However, the USA emerged as the leading country in terms of value, despite having only 15% of the export quantity during the same decade.

Table 2. Item-wise growth and instability of marine products export quantity during the past two decades

Items	2000-01 to 2009-10		2010-11 to 2019-20		Overall	
	Growth (%)	RII	Growth (%)	RII	Growth (%)	RII
Fr. Shrimp	0.96	0.06	17.82	0.08	9.93	0.10
Fr. Fin Fish	4.16	0.26	-2.17	0.21	3.40	0.24
Fr. Cuttlefish	6.84	0.15	1.39	0.14	3.95	0.14
Fr. Squid	4.45	0.22	2.38	0.18	5.97	0.19
Dried items	22.33	0.26	2.95	0.33	15.34	0.30
Live items	10.30	0.18	7.82	0.20	8.94	0.19
Chilled items	25.02	0.38	-0.95	0.29	13.49	0.35
Others	10.80	0.09	5.22	0.13	8.54	0.12
Total	5.21	0.12	6.12	0.10	7.13	0.11

Table 3. Item-wise growth and instability of marine product export value (million USD) during the past two decades.

Items	2000-01 to 2009-10		2010-11 to 2019-20		Overall	
	Growth (%)	RII	Growth (%)	RII	Growth (%)	RII
Fr. Shrimp	-0.41	0.10	15.81	0.22	11.18	0.19
Fr. Fin Fish	12.67	0.23	-0.27	0.20	9.41	0.22
Fr. Cuttlefish	15.18	0.16	2.39	0.19	8.98	0.18
Fr. Squid	8.42	0.17	5.21	0.25	9.97	0.21
Dried items	30.50	0.30	0.07	0.34	15.30	0.36
Live items	13.31	0.13	5.68	0.18	11.72	0.16
Chilled items	17.72	0.21	4.04	0.17	14.43	0.19
Others	15.69	0.13	5.65	0.19	10.64	0.16
Total	5.71	0.10	10.17	0.17	10.84	0.13

Table 4. Percentage share of average quantity and value of marine products exported from India (Market-wise)

Markets-	2000-01 to 2009-10		2010-11 to 2019-20		Overall	
	Quantity	Value	Quantity	Value	Quantity	Value
Japan	61993 (11) [1963]	326 (19) [13]	76253 (7) [29]	407 (8) [2440]	69634 (8) [1944]	359 (10) [17]
USA	44762 (8) [2688]	318 (18) [238]	151097 (15) [22]	1370 (28) [20124]	109373 (13) [8440]	964 (27) [182]
European Union	126110 (23) [10781]	480 (28) [42]	173536 (17) [56]	910 (19) [6502]	156035 (19) [4280]	745 (21) [58]
China	151640 (28) [8320]	234 (13) [120]	119201 (11) [25]	428 (9) [16205]	131016 (16) [29767]	342 (9) [67]
South-East Asia	83242 (15) [10006]	181 (10) [168]	359910 (35) [20]	1143 (24) [40272]	244343 (29) [37070]	754 (21) [149]
Middle East	24097 (4) [1910]	76 (4) [18]	51621 (5) [9]	245 (5) [3871]	39868 (5) [2891]	177 (5) [23]
Others	48750 (9) [8648]	130 (7) [26]	109933 (11) [19]	359 (7) [8480]	85050 (10) [5616]	271 (8) [31]
Total	540595 (100 %) [28934]	1745 (100 %) [471]	1041551 (100 %) [94]	4862 (100 %) [72508]	835318 (100 %) [66903]	3612 (100 %) [462]

Figure in the parenthesis () & [] represent percentage share and standard error, respectively.
Quantity in tonnes and Value in million USD.

Table 5 provides an analysis of the country-wise quantity of marine products export growth rate and instability between the two decades. All countries experienced a decline in their growth rate, except for the USA, China and Japan. In particular, the export to the USA increased tremendously in terms of growth rate to about 22% in the second decade, which is significantly higher compared

Table 5. Country-wise growth and instability of marine fish products export quantity (t)

Country	2000-01 to 2009-10		2010-11 to 2019-20		Overall	
	Growth (%)	RII	Growth (%)	RII	Growth (%)	RII
Japan	0.13	0.11	0.73	0.12	1.94	0.12
USA	-4.20	0.21	22.05	1.48	10.95	1.04
European Union	10.19	0.07	0.84	0.07	4.39	0.08
China	-0.56	0.31	5.52	0.57	-2.96	0.44
South-East Asia	11.56	0.21	3.01	0.36	16.05	0.29
Middle East	7.45	0.17	4.44	0.16	8.52	0.17
Others	20.99	0.16	3.67	0.17	11.35	0.18
Total	5.21	0.12	6.12	0.10	7.13	0.11

to the previous decade. This can be attributed to the Unit Value Realisation (UVR) of export to the USA, which is twice as high as that of China, although China did experience a slight increase in its UVR compared to the previous year. Shinoj *et al.* (2009) stated that China primarily imports raw finfish from India for processing and re-export, which yields higher value than than direct sales. This trend increases demand for exports to China and attracts new investors to the seafood industry. It also provides opportunities for Indian seafood exporters to adopt advanced harvesting and post-harvesting technologies, expanding their market access to the USA and South-East Asia, which could further expand marine product exports from India. In contrast, exports to EU countries have remained stable in terms of both unit price and quantity, with a low instability value of 0.07 over the two decades. This stability is largely due to the fact that only EU-approved seafood processing industries in India are permitted to export marine products to EU countries.

Country-wise growth rate and instability

Table 6 provides a comparison of the growth and instability of marine product exports by country between the two decades. The data suggests that the Unit Value Realization (UVR) for exports to the USA was better than for exports to the SEA regions. Although there was a decline in export growth to SEA in the second decade, the percentage growth rate was still higher at approximately 16% compared to other countries. In addition, the average quantity of marine product exports to SEA increased from 15 to 35% between the first and second decades (Table 4), indicating that SEA is the largest buyer of seafood products. This shift may be attributed to a change in the market due to non-tariff barriers imposed by other developed countries, which has led to increased market access to SEA. While exports to the USA have increased, there is reportedly more instability compared to the previous decade. Overall, the rise in export value growth rate has been accompanied by an increase in instability. which is a matter of concern. This trend persists, despite the financial assistance provided by MPEDA through various export promotion and market development initiatives.

The Simpson Diversity Index was used to measure the diversification or concentration of marine product exports from India to different destinations during the years 1999-00, 2009-10 and 2019-20, both country-wise and item-wise quantity and value. The extent of diversification in the commodity basket of marine product exports was 0.73 in 1999-00 (Table 7), which increased gradually to 0.78 by 2009-10, indicating item-wise diversification. However, it slightly declined to 0.69 in 2019-20 due to an increase in frozen shrimp exports, which accounted for 51% of the total marine products export basket.

Table 7. Item-wise Simpson's diversity index for the quantity of marine products exported from India.

Items	1999-00	2009-10	2019-20
Fr. Shrimp	110275 (32)	130553 (19)	652253 (51)
Fr. Fin Fish	131304 (38)	260979 (38)	223318 (17
Fr. Cuttle Fish	32799 (10)	63504 (9)	70906 (5)
Fr. Squid	34918 (10)	61445 (9)	87631 (7)
Dried items	6853 (2)	47053 (7)	84417 (7)
Live items	1678 (0)	5492 (1)	7287 (1)
Chilled items	3088 (1)	28817 (4)	21202 (2)
Others	22116 (6)	80592 (12)	142638 (11)
Total	343031 (100)	678435 (100)	1289652 (100)
Simpson diversity Index	0.73	0.78	0.69

Figures in the parenthesis indicate percentage to total

Table 6. Country-wise growth and instability for the value of marine fish products exported

Country	2000-01 to 2009-10		2010-11 to 2019-20		Overall	
	Growth (%)	RII	Growth (%)	RII	Growth (%)	RII
Japan	-4.89	0.16	0.69	0.17	1.70	0.17
USA	-3.97	0.21	21.01	0.65	13.73	0.52
European Union	14.54	0.09	2.30	0.14	8.30	0.12
China	10.49	0.22	10.29	0.49	6.65	0.37
South-East Asia	9.22	0.17	8.34	0.44	19.08	0.33
Middle East	14.81	0.15	6.72	0.14	13.68	0.15
Others	19.63	0.13	6.49	0.18	13.08	0.16
Total	5.71	0.10	10.17	0.17	10.84	0.13

Value in million USD

This study also examined the diversification of marine product exports in terms of their value (Table 8). It was observed that the highest level of diversification occurred during 2009-10, while lower levels were seen in 1999-00 and 2019-20, with values of 0.47 and 0.45, respectively. This trend can be attributed to the significant rise in the market price for frozen shrimp during those years, which led to a rise in its market share value to 71 and 73% of total exports, respectively, indicating a low level of product diversification in terms of export value. This can be attributed to the increased demand for frozen shrimp in the international market at higher prices, prompting Indian seafood industry to focus on shrimp-based specialisation due to its higher monetary advantage. This is a clear indication of the profitability of the shrimp-based processing industry.

The extent of diversification in Indian marine products export remained nearly constant during 1999-00, 2009-10 and 2019-20 with values of 0.80, 0.82 and 0.82, respectively (Table 9). This indicates that the existing infrastructure in the Indian fisheries sector is capable of exporting a diverse range of marine products that meet international quality standards across various market destinations.

Table 10 shows that diversification indices in terms of value for different countries have also remained within a similar range, indicating a high degree of geographical diversity. Overall, the Indian marine products export market has performed well, achieving greater penetration into various international markets.

Fig. 2 illustrates the UVR of marine product exports from India in dollars per kilogram. During 2013-14, the marine product exports to the USA realised a higher dollar value of 11.60 per kg. Compared to other markets, the USA offered premium prices to Indian marine products. However, the prices sharply declined during 2008-09 due to the financial crisis known as the Great Recession (Salim *et.al.,* 2019). This crisis resulted in a significant reduction in international trade, impacting both domestic absorption and imports. The US imports registered a shortfall of more than 50% (Levchenko *et al.,* 2010). US prices showed relative stability in the subsequent five years.

Fig. 3 displays the various fish-based products and their UVR in terms of USD from 2000-01 to 2019-20. The UVR of frozen shrimp always fetched a higher price and reached about 10.65 USD per kg during 2013-14. However, in recent years, it declined to 7.5 USD per kg, reflecting a drop of nearly 3 USD per kg. This drop may be attributed to excessive supply of frozen shrimp in the international market.

Table 8. Item-wise Simpson's diversity index for the value (million USD) of marine product export from India

Items	1999-00	2009-10	2019-20
Fr. Shrimp	846.62 (71)	883.03 (41)	4889.12 (73)
Fr. Fin Fish	124.53 (10)	430.94 (20)	513.6 (8
Fr. Cuttlefish	66.33 (6)	195.69 (9)	286.4 (4
Fr. Squid	68.97 (6)	132.24 (6)	314.23 (5)
Dried items	10.27 (1)	208.72 (10)	140.81 (2)
Live items	8.81 (1)	29.52 (1)	46.43 (1)
Chilled items	10.43 (1)	55.87 (3)	90.34 (1)
Others	51.9 (4)	196.84 (9)	397.77 (6)
Total	1187.86 (100)	2132.85 (100)	6678.7 (100)
Simpson diversity Index	0.47	0.76	0.45

Figures in parenthesis indicate percentage to total

Table 9. Market-wise diversity in the marine product exports quantity (t) from India

Markets	1999-00	2009-10	2019-20
Japan	66990 (20)	62690 (9)	78507 (6)
USA	36645 (11)	33444 (5)	305177 (24)
European Union	66634 (19)	164800 (24)	165773 (13)
China	107136 (31)	144290 (21)	329479 (26)
South-East Asia	38300 (11)	149353 (22)	223398 (17)
Middle East	12460 (4)	34907 (5)	57387 (4)
Others	14867 (4)	88953 (13)	129929 (10)
Total	343032 (100 %)	678437 (100 %)	1289651 (100 %)
Simpson diversity Index	0.80	0.82	0.82

Figures in the parenthesis indicate percentage to total

Table 10. Market-wise diversity in the marine product export value (million USD) from India

Country	1999-00	2009-10	2019-20
Japan	527.68 (44)	278.56 (13)	422.24 (6)
USA	180.11 (15)	213.52 (10)	2562.54 (38)
European Union	211.71 (18)	637.4 (30)	876.47 (13)
China	126.33 (11)	379.7 (18)	1374.63 (21)
South-East Asia	83.64 (7)	314.85 (15)	705.99 (11)
Middle East	25.39 (2)	117.05 (5)	297.23 (4)
Others	33 (3)	191.77 (9)	439.59 (7)
Total	1187.86 (100%)	2132.85 (100%)	6678.69 (100%)
Simpson diversity Index	0.73	0.82	0.77

Figures in parenthesis indicate percentage to total

Discussion

The findings of the study reveal a substantial increase in the total quantity of shrimp exports during the second decade, leading to an overall increase in marine product exports, as seen in Table 1. However, apart from frozen shrimp, there was no significant increase in other exported items during the same period. The introduction of high-yielding shrimp *Penaeus vannamei* in major Indian coastal states led to a trifold increase in shrimp exports, contributing to almost two-fold marine product export growth rate between the two decades, (Kumaran, *et al*., 2017). The stability of frozen shrimp exports to the US market remained high due to infrastructure investments made in hatcheries, feed mills and processing plants, leading to an increasing decadal growth trend. Nevertheless, marine product export instability was on the rise, primarily influenced by dry fish, frozen squid and finfish exports. The item-wise diversification of MPE in terms of value showed a scope for improvement, except for shrimp, which already realised high value-added exports to the USA. In the second decade, all other marine catches showed a declining trend except for shrimp, which was mainly consumed domestically due to an increase in *per capita* fish consumption. Additionally, during the first decade, finfish exports contributed almost 40% of the total marine products exported in terms of quantity, but only 15% in value terms, indicating low unit value realisation. Fish exports from India did not show a comparative advantage during the first decade, with higher instability percentages for both quantity and value. The

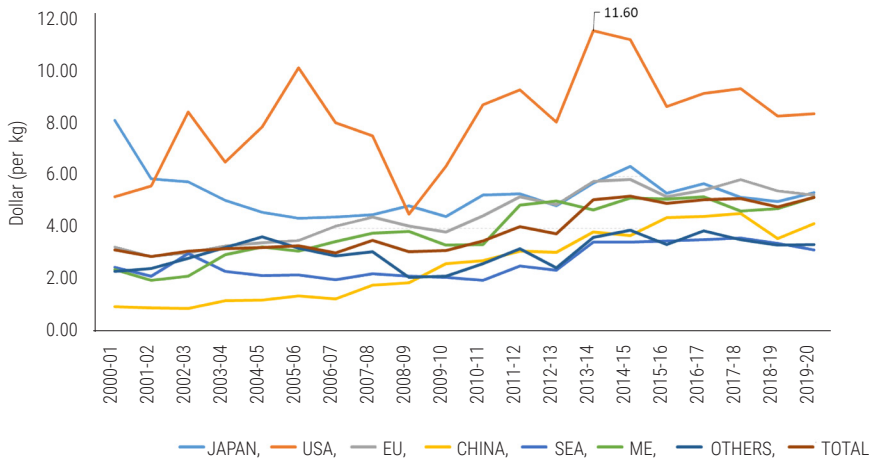

Fig. 2. Market-wise unit value realisation of marine product exports from India during 2000-01 to 2019-20

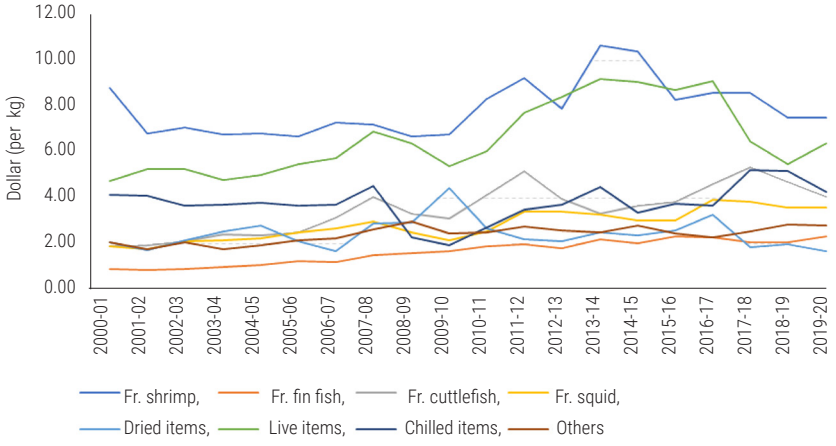

Fig. 3. Item-wise unit price realisation of marine product export from India during 2000-01 to 2019-20

study attributes the variance in marine product export performance to several factors such as declining fish catch and aquaculture production, climate-related challenges, rising input costs, disease spread, exchange rate policies, higher rejection rates due to sanitary and phytosanitary (SPS) measures. Additionally, import duties imposed by the importing countries, lack of subsidies for adopting new technologies, and increasing competition at global level, and rising domestic *per capita* consumption, further contribute to this variance. The regions with the highest performance in terms of overall growth rate in terms of marine product exports were South-East Asia, the USA and Middle East countries (Table 5).

Shrimp is a highly profitable crustacean farmed globally, particularly in India, where it serves as a major export and a key source of foreign exchange, both in terms of quantity and value. . The growth rate of shrimp exports has been steady over the past two decades, with little instability. The focus has been on diversifying the product profile to improve unit value realisation and expand the consumer base. There is room for further improvement in the quality of shrimp-based products by adopting advanced technologies. This would to strengthen existing seafood processing industries in coastal states, leading to increased income and employment opportunities.

Over the past two decades, the overall growth rate of marine product exports has been 7.13%, with dry fish exhibiting the highest growth rate at 15.34%. Among the destinations for Indian marine product exports, the SEA has registered the highest growth rate at 16.05%. However, there has been an increase in export instability for all items except frozen shrimp due to increased demand for shrimp in the export market, particularly in the USA. The Simpson's diversity index indicates significant diversification, both item-wise and market-wise quantities of marine products export basket, reaching about 70%. Nevertheless, there is scope to diversify both products and markets. Despite the growth in exports, the diversity index for item-wise marine product export has declined significantly in terms of both quantity and value. While marine catches have stagnated, aquaculture production is expected to continue rising. However, the government must regulate aquaculture production and reform shrimp farming practices to mitigate the environmental impact of intensive shrimp farming activities in coastal areas, even though shrimp export remain a major driving force of Indian marine products export value.

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