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STRUCTURE AND CONCENTRATION OF INDIA'S MARINE PRODUCT EXPORTS

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ABSTRACT

Globally India is at rank fourth in fisheries production, after China, Indonesia and the United States. In terms of aquaculture India ranked third, after China and Indonesia (FAO, 2017). Indian Marine Products Export sector is registering high growth rates and plays a major role in terms of employment and food production, the later providing nutritional security. As per National Fisheries Development Board (NFDB), fisheries and aquaculture contribute over 1% to India's total GDP and just over 5% to its agricultural GDP (2018). The sector employs more than 14 million people, of which 3.9 million are fisher folk. The present study is based on the secondary data compiled from UNCOMTRADE.COM and 14 sub-categories of marine product exports considered by Directorate General of Foreign Trade (DGFT). The study focuses on analyzing the structure, growth and concentration of Marine Product Exports of India for the period 1988-89 to 2020-21. The compound annual growth rate for marine product exports is registered as 8.8 per cent during the study period 1988-89 to 2020-21. For the considered study period, the highest growth rate (33 per cent) is recorded by the sub category of Prepared or preserved Fish (HS Code 1604) and the lowest growth rate is -6.3 per cent for the sub category of Animal Products Not Elsewhere specified or Included (HS Code 0511) of India's Marine Product Exports. The concentration ratio (4) has been fluctuating from 0.87 to 0.98 for the considered study period.

***KEYWORDS**: Marine Products Exports, Concentration, Animal Products, GDP, NFDB.*

Introduction

To achieve economic development, required process of rising the standard of living and productivity in all sectors of an economy is important, which requires capital formation. To meet the increasing need for capital formation, foreign trade is one of the major factors which can provide foreign exchange (Todaro 2007). Economic development and foreign trade are intimately connected. Economists such as Prebisch, Mydral, Emmunnel, Nurkse, and others have suggested an inward-oriented approach for the development of developing countries. But economists such as J.N. Bhagwati, Kruger, Chenery, and others have recommended the export-led growth strategy (Manjappa and Hegde 1998).

Indian marine product exports were initiated since 1938. The marine product exports of India form an important item in the basket of India and the major contributor as the largest group in the agricultural exports of India. As of 2019-20, marine products with export earnings crossing 5818.88 million US$ contributed 2.1 percent of the total exports from India.

The present study attempted to analyze the growth, structure, and concentration of India's marine product exports. It has been organized into four sections. The first section deals with the review of literature. The second section discusses the database and methodology. The Third section studies the marine product export scenario. The fourth section examines the growth, structure and concentration of India's marine products exports. Fifth section deals with conclusions.

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Section I
Review of Literature

The review of relevant literature provides an overview of the work done on the concerned topic. It also helps in selecting a suitable analytical tool to analyze the data and draw relevant conclusions from it. Some of the studies are also based on individual commodity analyses of India's marine product exports.

Jalajakshmi (1994) revealed the changing pattern of shrimp exports for the period of 1971-1990 and showed the annual compound growth rate of Indian shrimp export is 5.9 percent (quantity) and 15.8 percent (value) for the considered period. **Krishnan and Sharma (1995)** showed that Japan and the USA were the major markets for Indian frozen shrimps. **Anderson and Fong (1997**) examined the growing trends in consumption with the establishment of special economic zones and related international trade agreements in the fishery sector.

Ahmed & Lorica (2002) accounted that the fishery sector possesses great potential for developing countries due to cheap labor and water resources**. Kumar (2004**) highlighted the need to maintain hygiene standards for the continuous growth of the Indian fisheries sector. **Kamat (2007)** discussed that the outcomes of WTO negotiations under the Doha round, Hong Kong development round, and the changing European Union (EU) regulations are likely to place new hurdles on the marine exports emerging from developing countries and suggested that India should maintain a quality standard for seafood.

Sathianandan (2011) laid stress on monitoring the harvest of different marine fishery resources for planning and implementing policies for sustained production from the sea. **David (2012)** investigated that the export of chilled fish was a major export from a group of chilled items, but recommended that the measures should be taken up to boost exports of chilled fish. **Das (2013)** pointed out that India's marine exports were mainly focused on countries that fall into a less desirable category, which affected export performance. **Lakshmi (2017)** showed that it was only since 1961 the export of dried marine products was overtaken by the export of frozen items, which led to a steady increase in export earnings. **Schmldt (2015)** identified current and emerging fisheries trade issues such as changing sea temperature from climate-warming greenhouse gases to change the distribution and productivity of fish stocks. **Fayaz (2020)** laid that a reasonable share of Indian fish exports goes to the USA and the Japanese market has declined. **Nisar (2020)** studied the comparative advantage of Indian Seafood exports in the USA market. The fishes were grouped under live fish, fried chilled fish, frozen fish, frozen fillet meat mince, fish cured smoked fish meal, crustaceans, and mollusks.

Section II
Database and Methodology

- **Data Sources**

The present study analyzed from the sources of secondary data for the period 1988-89 to 2020-21 which has been compiled from the publications of Marine Product Export Development Authority (MPEDA). Total Marine product Export data, as well as product-wise export data concerning India and World, has been compiled from the UNCOMTRADE.Com. Gross domestic product data sets have been collected from World Bank (WITS). India exports approximately 210 types of Marine Product Exports (classified by DGFT at 8 digit HS code). Further, we grouped 210 sub-categories of Marine Products into 14 categories (thirteen at 4 digits and one at 6 digit HS code) by considering their same group at 4 digits and six-digit level of HS CODE.

Methodology

- **Growth Rates**

Growth rates are measures of the performance of economic variables. To analyze the growth, compound annual growth rates have been calculated for India's marine product exports as well as its 14 sub-categories by using an exponential growth function:

$$Y_t = ab^t e^u \quad \text{…. (1)}$$

Where Y_t = dependent variable; t = time variable; a and b = constants; e = error co-efficient; u=disturbance term

Transforming equation (1) into a linear form:

$$\text{Log } y_t = \log\alpha + t\log b + u\log e \quad \text{…. (2)}$$

The growth rate (r) has been calculated with the help of the estimated value of regression coefficient 'b' as follows:

r (%) = ($\hat{b}$ -1)*10 ….(3)

Where $\hat{b}$ = the estimated value of 'b'

Growth rates have been calculated for marine product exports and its sub-categories during the considered period 1988-89 to 2020-21.

- **Structure Of India's Marine Product Exports**

The present study analyzed the structure of India's Marine Products Exports by considering selected points of study period (1988-89, 1991-92, 1995-96, 2000-01, 2005-06, 2010-11, 2015-16, 2018-19, 2019-20, 2020-21) and following shares have been calculated.

- The share of Marine Product Exports in India's Total Exports and GDP.
- The share of sub-categories of Marine Product exports in Total Marine Product Exports.
- The share of sub-categories of Marine Product Exports in Total Exports.

- **The Concentration of India's Marine Product Exports**

Commodity concentration aims to determine if total marine product exports are dominated by a small number of leading marine product exports categories. The most popular index is the concentration ratio, which calculates the share of top categories.

Let 'm' represent the number of commodities and Q_{it} denote the exports of ith commodity during time t. Then the sum of Q_{it} from 1 to m will be Q_t and the share of each commodity (P_{it}) in total marine product exports for year t, would be expressed as:

$$P_{it} = \frac{Q_{it}}{Q_t}$$

Where Pit = percentage share of each commodity in exports for the year t

i = 1, 2, 3 … m

and t = 1, 2, 3 ……T

In our study, m is equal to 14 and T is equal to 33. All the concentration measures can be classified into three groups.

The first group includes Concentration Ratio which is a discrete measure and takes the only sum of Pit's. The measure is as follows:-

- **Concentration Ratio (CR):** It takes into account the share of k commodities which have the highest shares in India's marine product exports. It can be denoted by CR (k) and is calculated as follows:

$$\mathrm{CR(k)t} = \sum_{i=1}^{m} P_{it} \quad , k < m$$

The most common measure used by researchers is CR (4). The selection of k, however, is arbitrary.

- **Hirschman- Herfindahl Index (HHI):** This is a summary measure that takes into consideration the shares of all the commodities. It is calculated by the sum of squares of shares of all commodities weighted by themselves and can be denoted as follows:

$$\mathrm{HHI_t} = \sum_{i=1}^{m} P_{it}^2$$

The HHI index value can vary between 1/m and 1; the former being the case where all shares of commodities or Pit's are equal, the latter being the case where there is only one P_{it}, i.e. $Q_{it} = Q_t$ (1).

The third group of concentration measures combines the features of both Discrete and Summary measures.

- **Comprehensive Measure of Concentration (CCI):** It takes into account the commodity having the largest share in India's marine product exports in a discrete manner and of the other commodities in a weighted form conforming to other summary measures of concentration. Pit in decreasing order but its main focus is the largest Pit, P1t according to this ordering. The remaining pits are used to adjust P1t.

$$CCI_t = P_{1t} \sum_{i=2}^{m} P_{it}^2 \left[1 + (1 - P_{it})\right]$$

The concentration ratio measures denoted by CR (4) for marine product exports are calculated for the study period. After this, the number of years that a commodity has a share in the concentration ratio (4) is found and commodities are ranked accordingly. The maximum value that a commodity can take is 33 as the study period covered 33 years and the minimum value is zero.

Section III
India's Marine Product Export Scenario

Before analyzing the structure, in the present paper, we tried to analyze its important aspects by considering share of total exports in GDP, share of marine product exports in GDP, percentage change in marine product exports and the percentage share of marine product exports in total exports. The marine product exports are increasing with minor fluctuations. The share of total exports in GDP measures the relative contribution of exports in GDP given the country's income. Export GDP ratio shows a continuous increase

Table 1: India's Marine Product Exports Share in GDP and Total Exports

Years	Marine Product Export/GDP*100	Total Exports / GDP*100	% Change In Marine Product Export	% Share Of Marine Product Export In Total Export
1988-89	0.146	4.68	_	3.11
1991-92	0.217	6.63	10.93	3.28
1995-96	0.280	8.80	-10.55	3.18
2000-01	0.297	9.04	16.93	3.28
2005-06	0.198	12.23	29.24	1.62
2010-11	0.148	13.15	52.40	1.12
2015-16	0.232	12.57	-12.98	1.84
2018-19	0.257	11.94	-3.41	2.15
2019-20	0.239	11.26	-1.12	2.12
2020-21	0.222	10.50	-15.13	2.11

Source: Author's Calculation

from the year 1988-89 (4.6%) to 2010-11 (13.15%) except a slight decline in years 2014-15 to 2020-21.The change in percentage share of marine product exports was higher than 15 per cent for the years 2000-01, 2005-06, 2010-11, whereas it is negative for the year 1995-96 [The decline in Indian Exports during 1995-96 was mainly due to falling in the growth rate of volumes (Economic Survey 1996-97:91)], 2015-16 [The depreciation of euro, weaker economic condition in China and devaluation of yen contributed to the decline in exports (MPEDA)], 2018-19 to 2020-21 due to the global recession. The share of marine products in GDP fluctuated between 0.1 to 0.2 percent during the study period. The share of Marine Product Exports in total exports continued remained around 3% for the years 1988-89 to 2000-01. Thereafter, this share in Total exports declined and remained around 1 to 2 %. In the study period 1991-92 to 2019-2020, the maximum percentage share of Marine Product in Total Exports is recorded for the year 1991-91 and 2000-01 (3.28 %) and lowest is 1.12% for the year 2010-11.

Section IV
Growth of India's Marine Product Exports

The compound annual growth of India's total exports, total marine product exports, and its sub-categories for the study period shown in table 2. India's total exports and marine product exports grew at the rate of 17 per cent and 8.8 per cent respectively, during the study period 1988-89 to 2020-21.

Table 2: Growth Rate of India's Marine Product Exports and its Sub-Categories

HS Codes	1988-89 to 2020-21
0301	7.7
0302	10.6
0303	9.7
0304	13.2
0305	12.7
0306	7.9
0307	9.1
0508	15.2
0511	-6.3
1504	20.9
1603	11.8
1604	33
1605	29
230120	32.5
Total Marine Product Export	8.8
Total Exports	17

Source: Author's Calculation

The sub-categories of marine product fish live (HS Code 301), fish frozen (HS Code 0303), crustaceans (HS Code 0306), molluscs (HS Code 0307) showed less than 10 per cent growth rates for whole of the study period. The sub-categories fish fresh (HS Code 0302), fish fillets (HS Code 0304), fish dried, salted (HS Code 0305), coral (HS Code 0508), and aquatic invertebrates (HS Code 1603) recorded more than 10 percent growth rate. The highest growth rate (33 per cent) indicated by (HS Code 0511) and the negative growth rate (-6.3 percent) was for (HS Code 0511) for 1988-89 to 2020-21. The second highest growth was (32.5) for the sub-category (HS Code 230120). Thus the results indicate an increase in the growth rate of marine product exports and its sub-categories during 1988-89 to 2020-21.

Structure and Concentration

- **Structure of India's Marine Product Export**

The structure of an economy's trade is analyzed with the help of changes in the composition of trade over the years. The present paper aims to analyze the general trend of India's exports with special reference to Marine Product Exports by measuring the share of all sub-categories for selected years of the study period, i.e. (1988-89, 1991-92, 1995-96, 2000-01, 2005-06, 2010-11, 2015-16, 2018-19, 2019-20, and 2020-21). The sub-category crustaceans (HS Code 0306) recorded the highest share in Total Marine Product Exports as well as Total Exports for all the years with minor fluctuations. The sub-category with HS Code 0306 had the highest share (more than 80 percent) in India's Marine product Exports for 1988-89, further roughly declined recorded 42.7% in 2010-11. There are some other sub-categories of Marine Product Exports that have high shares in total Marine Product Exports like (HS Code 0307, 0303, 0304, 1605, 0302, etc). In this light, three classifications of sub-categories were made:

- **Low and Constant Marine Product Exports:** The sub-categories whose share is very low throughout the study period, described as low and constant sub-categories of total marine product exports.
- **Leading Marine Product Exports:** The exports of sub-categories whose share in total marine product export generally increased and had a higher share during the study period, described as leading sub-categories of total marine product exports.
- **Lagging Marine Product Exports:** The sub-categories whose share continuously declined during the study period were considered as lagging sub-categories of marine product export.

There are five sub-categories that are low and constant (having a share of less than 2 per cent) namely (HS Code 0301, 0305, 0508, 0511, 230120). The leading sub- categories include (HS Code 0304, 0306, 0307, and 1605). The group of lagging sub- categories of marine product exports includes (HS Code 0302, 0303, 1504, 1603, and 1604).

The share of sub-category crustaceans (HS Code 0306) in Total exports was recorded 2.51 per cent in the year 1988-89, and it became 1.14 per cent during 2020-21 and has the highest share in Total Exports. The sub-category molluscs (HS Code 0307) recorded share ranged 0.160 per cent to 0.406 per cent during the considered study period. All other sub-categories have a negligible share in Total Exports of India.

- **The Concentration of India's Marine Product Exports**

Export concentration depicts the concentration of a country's export to a small number of countries or products. A country that exports to a small number of countries has a larger export concentration index. In case a country exports to a large number of countries, it shows a lower export concentration ratio. With the help of various measures of concentration, we calculated the commodity concentration of India's Marine Product Exports.

Table 5 Concentration Figures for India's Marine Product Exports

Years	CR(4)	CR(8)	HHI	CCI
1988-89	0.9677	0.9979	0.6662	0.8337
1991-92	0.9764	0.9980	0.5880	0.7957
1995-96	0.9758	0.9990	0.5025	0.7475
2000-01	0.9717	0.9971	0.5268	0.7731
2005-06	0.9403	0.9964	0.3994	0.6775
2010-11	0.8788	0.9804	0.2678	0.5811
2015-16	0.9172	0.9846	0.4581	0.6734
2018-19	0.9165	0.9910	0.4460	0.7000
2019-20	0.9234	0.9915	0.4874	0.7244
2020-21	0.9215	0.9907	0.4691	0.7127

Source: Author's Calculation

Table 5 shows the concentration figures for India's marine product exports. The comparison of concentration figures showed that the discrete concentration measures CR (4) and CR (8), give high concentration figures as compared to the HHI and CCI measures. CCI (the combination of features of both the summary measures and discrete measures) gives concentration figures which are in-between the values of discrete and summary measures.

The Concentration Ratio (4) measures the concentration of the top four sub-categories of marine product exports of India. Even though India exports nearly 14 sub-categories (thirteen 4 digit and one 6 digit HS code) of marine product exports, the major sub-categories are crustaceans moluscs**,** aquatic invertebrates, fish fillets, these main items were consisting nearly 95 Percent of total marine product earnings. The concentration figure is higher than 0.90 for all the years of study period, except the years 2010-11 (when it is 0.87). There is a continuous increase in concentration from 0.96 to 0.98 for the years 1988-89 to 1995-96. For the years 2000-01 to 2019-20, the CR (4) figures witnessed a minor decline and it was 0.92 during 2019-20. The highest figure in concentration ratio (4) was 0.98 for 1991-92 and 0.87 was the lowest figure for 2010-11. The CR (8) Concentration figures are higher than 0.98 for all the years of the study period.

Hirschman- Herfindahl Index (HHI) of concentration for marine product exports showed that the concentration figures fluctuated from 0.26 to 0.49 for the years 2010-11 to 2019-20. The HH index gave the highest figure 0.66 for the year 1988-89 and witnessed a decline for whole the study period. The HH measure provides figures fluctuating from 0.50 to 0.66 for the years 1988-89 to 2000-01. The lowest figure of this measure was 0.26 for the year 2010-11.

The concentration figures given by the CCI measure are more than 0.58 for the whole years of the study period. The highest figure of compressive measure of concentration was 0.83 for the year 1988-89 and afterward starts declining up to 0.58 for the year 2010-11. There was a slight increase in CCI measure from 0.58 to 0.71 for the last years of the study period.

Table 6: Frequency of Commodities

Sr. No.	HS CODES	CR (4)
1	0306	33
2	0303	33
3	0307	33
4	0304	18
5	1605	11
6	0511	1

Source: Authors' calculations.

Table 6 showed the frequency of sub-categories of marine product export dominating the concentration ratio CR (4). The table describes the top four categories of marine product exports listed on the top four positions.

Table 7: Position-Wise Numbers of Years for Top Four Commodities as Per Cr (4)

Hs Codes	First Position	Second Position	Third Position	Fourth Position
0306	1987-88 to 2019-20 (33 years)	–	–	–
0303	–	1993-94 to 2014-15 (21 years except 2003-04)	1987-88 to 1992-93 (6 years) 2015-16 to 2018-19 (4 years) 2003-04 (1 year)	2019-20 (1 year)
0307	–	1987-88 to 1992-93 (6 years) 2003-04 (1 year) 2015-16 to 2019-20 (4 years)	1993-94 to 2014-15 (21 years) 2019-20 (1 year)	–
0304	–	–	–	1987-88 (1 year) 1989-90 to 2001-02 (13 years) 2010-11 to 2013-14 (4 year)
1605	–	2019-20 (1 year)	–	2002-03 to 2009-10(5years) 2014-15 to 2018-19 (5 years)
0511	–	–	1988-89 (1 year)	–

Source: Author's calculations

The sub-category of marine product exports with HS Code 0306 is registered with the first position for the whole study period. The sub-category with HS Code 0303 is registered with the second position for the 21 years, whereas it also remained at third position for 11 years and with the fourth position for 2019-20. The sub-category with HS Code 0307 remained at third position (1993-94 to 2014-15) for 21 years of the study period. The sub-category with HS code 0304 recorded maximum years 1989-90 to 2001-02 (i.e., 13 years), 2011-11 to 2013-14 (4 years), and 1988-89 (1 year) with the fourth position. The exports of sub-category with HS Code 1605 were at the second position for one year (2019-20) and the fourth position for 10 years from 2002-03 to 2009-10 and 2014-15 to 2018-19. The sub-category with HS Code 0511 was recorded at the third position for 1988-89 (one year only).

Recent years of the study period give a clear picture about the present concentration positions commodities and by considering the whole study period, an idea about the movement of concentrated commodities to other positions can be drawn. For the study period, the top four commodities dominated but their relative positions have been shifted. The sub-category with HS Code 0306 kept the first position, and HS Code 0303 retained the second position, HS code 0307 stayed at the third position and HS Code 0304 remained at the fourth position.

Conclusion

The global marine product export market is growing significantly due to the growing demand from animal and human consumption, cosmetics, fishmeal and fish oil, bioactive compounds, pharmaceutical, marine protein, and food processing aids, and bi-products are used for valuable ornamentals. The multi-functionality of marine products in various industrial applications is an important driving factor for expanding its role in the international market. In view, a multi-faceted advantage in its production of marine products can be successfully harvested in India because of high demand in the international market.

The HS Codes 1504, 1604, 1605 and 230120 recorded higher than 15 per cent growth rate for the considered study period. Out of which only HS Code 1605 recorded high concentration. Further out of 14 sub-categories of Marine Product Exports of India, nine recorded higher than 10 per cent growth for the study period and out of nine, only two sub-categories with HS Codes 0304 and 1605 registered the concentration in the top four sub-categories with 18 and 11 years respectively. The sub-categories with

HS Codes 0306, 0303 and 0307 appeared in the top four sub-categories during all the years of the study period, and recorded 7.9 per cent, 9.7 per cent and 9.1 per cent growth rates respectively. As per results, the sub-categories with HS Codes 0303, 0304, 0306, 0307 and 1605 are contributing significantly in India's Marine Product Exports. So export marketing research must be promoted by focusing on prevailing international market situations in order to find out the consumer preference in new markets for the above-mentioned sub-categories of India's Marine Product Exports.

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Appendix

HS Codes	Commodities Name
0301	Fish; live
0302	Fish; fresh or chilled, excluding fish fillets and other fish meat of heading 0304
0303	Fish; frozen, excluding fish fillets and other fish meat of heading 0304
0304	Fish fillets and other fish meat (whether or not minced); fresh, chilled or frozen
0305	Fish, dried, salted or in brine; smoked fish, whether or not cooked before or during the smoking process; flours, meals and pellets of fish, fit for human consumption
0306	Crustaceans; in shell or not, live, fresh, chilled, frozen, dried, salted or in brine; smoked, cooked or not before or during smoking; in shell, steamed or boiled, whether or not chilled, frozen, dried, salted or in brine; edible flours, meals, pellets
0307	Molluscs; whether in shell or not, live, fresh, chilled, frozen, dried, salted or in brine; smoked molluscs, whether in shell or not, cooked or not before or during the smoking process; flours, meals and pellets of molluscs, fit for human consumption
0508	Coral and similar materials, unworked or simply prepared, shells of molluscs, crustaceans or echinoderms and cuttle-bone, not cut to shape powder and waste thereof
0511	Animal Products Not elsewhere specified /Included Animals Of Chapter 1 Or 3 Unfit For Human Consumption
1504	Fats And Oils And Their Fractions, Of Fish Or Marine Mammals, Whether Or Not Refined, But Not Chemically Modified
1603	Extracts And Juices Of Meat Fish Crustaceans Molluscs /Other Aquatic Invertebrates
1604	Prepared or preserved fish; caviar and caviar substitutes prepared from fish eggs
1605	Crustaceans, molluscs and other aquatic invertebrates, prepared or preserved
230120	Flours, meals and pellets; of fish or of crustaceans, molluscs or other aquatic invertebrates

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