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Dynamics of Fish Import Trade to India – Cross Sectional Analysis of Trade Quantity, Value and Policy Aspects

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Abstract

India continues to import fish and fishery products under different harmonized system (HS) codes to meet the domestic and global demand. There have been structural or compositional changes in the import items of fish and fish products during the period 2000-2019. The normalized fish trade balance for quantity and import value was in the rage of 0.92 – 0.97 during 2000-2019, which indicated that India is a fish export-oriented country. Even then, the import of fish and fishery products increased linearly during this period at a rate of 1656 tonnes in terms of quantity. India had imported 3232 tonnes of fish and fishery products worth US $4.6 Million in 2000, which increased to 39525 tonnes worth US $112 Million in 2019. The import of chilled form of fish and fishery products under the head HS-0302 decreased during the period 2000-2019, whereas the import of crustaceans under the head HS-0306 increased. But, value wise contribution from items under the head HS – 0304 increased significantly compared to the other heads. Asian countries like Bangladesh, Thailand, Indonesia, Singapore, Malaysia, Vietnam, China, Oman and UAE were the major countries exported fish and fishery products to India under different HS codes. The study highlights India's fish import policy, focusing on strict sanitary and phytosanitary requirements and a robust market intelligence system, due to high domestic market demand.

Keywords: Fish import, re-export, trade balance, regression models, correspondence analysis, trade policy

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Introduction

Fish and fishery products, being an important food item in the global food basket, play an important role in proving food and nutritional security to the global population. The estimated global fish production from both capture and aquaculture sector was 178 million tonnes with a per capita apparent consumption of 20.2 kg per year (FAO, 2020b). The Indian fish production was estimated to be 16.24 million tonnes in 2021, which was about 8% of global fish production. In the same period, India exported approximately 8.5% of total fish production worth US $7759 million to the world market, which was nearly 4% of global fish export trade value (Department of fisheries, 2022). The global fish trade plays an important role to provide economic growth and food security to several countries.

India, even though being the second largest producer of fish and one of the major exporting countries in the world, imports fish in different categories to the country to meet the demand of either domestic market or global market through processing and re-export. India imports fish in different Harmonized System (HS) codes classified mainly as live, chilled, frozen and dried forms. India has imported 3231, 17627 and 39525 tonnes of fish worth US $4.59, 56.80 and 111.84 million in live, chill, frozen and dried forms in 2000, 2010 and 2019, respectively. The growth of fish import to India is found to be increasing over the years. As a whole, India imported different commodities and services worth US $52940.25 million in the year 2000, which increased to US $350029 million in the year 2010 and to US $478884 million in the year 2019. The contribution of import of fish to the total import in the year 2000, 2010 and 2019 were 0.009%, 0.021% and 0.022% respectively which was worth US $4.59, 56.80 and 111.83 million, (https://tradestat.commerce.gov.in/eidb/default.asp). When compared to the fish export from the country, fish import contributed

0.94, 2.59 and 2.84% in quantity and 0.38, 2.66 and 1.66% in foreign exchange during 2000, 2010 and 2019, respectively. India is a net fish exporting country, earning foreign exchange many folds higher than fish import, though India continue to import fish from different sources of global fish market. In order to boost the fisheries sector through inflow of capital and technology, the Government of India allowed inflow of foreign capital through the route of Foreign Direct Investment (FDI). Similarly, Seigel (1976) stated that the primary reason for foreign direct investment (FDI) by Canada, Iceland, Mexico, and Norway in the United States is the desire to expand market opportunities for fish and fishery products. The government of India has allowed 100% FDI in the aquaculture sector in India since 2016, which also would attract investment in the fish processing industry. India also invests in the global market to import fish and fishery products subjected to trade barriers, but limited studies are available to cross evaluate the FDI and trade policy (Bellman et al., 2016).

Marine products have consistently remained a significant commodity group for India in terms of trade. The analysis of fish trade in India has been limited, with only a few studies examining the time series data. In one study, a nonparametric regression was used to calculate a compound growth rate of 6.8% for fish exports by Joshy et al. (2017). Another study by Shinoj et al. (2009) utilized the Simpson index to understand the changing patterns and composition of fish and fishery product exports. Other studies focus on estimating growth rates and forecasting exports of fish and fishery products from India, both at an item-wise and market-wise level. However, there have been few studies that have explored the status and conducted cross-sectional analyses of fish imports to India (Ravichandran & Prajneshu, 2000; Chandran, 2011). Meenakshi (2008) specifically examined the potential and barriers of fish trade, including both exports and imports, in India. This study outlined the current status of fish imports to India and discussed the trade barriers that exist in this domain. In another study, Joshy & Ashok Kumar (2017), summarized the status of chilled and frozen fish imports to India.

India's robust demand for fish and fish-based products, high price elasticity compared to other agricultural commodities (Dey et al., 2008), and underutilized processing capacity can be further utilized to improve domestic and foreign market demand for processed fish products. Facilitating import of fish and fish products to India can enhance the domestic consumption of fish, facilitate re-processing and promote aquaculture and ornamental fish culture. However, such initiatives need to be sensitive to concerns of the country in terms of food safety and bio-protection. However, studies on import of fish and fish products to India are scanty. In this regard the present study inquires the trend in fish import to India and discusses the policy implications. With this background, the present study used different statistical models and trade indices to evaluate the time series data on fish import to India in different HS codes and also to understand the diversification of global market to Indian fish import market. The study also evaluated the changes in India's fish import policy, FDI policies, quality and safety aspects, and re-export data over the years.

Materials and Methods

Secondary data on fish import in different HS codes was collected from the COMTRADE, a database (https://comtrade.un.org/) managed by United Nations, for the period 2000 to 2019. The HS code classification and description of the data used for the analysis is given in Table 1. The HS code 0301 described as live fish was not considered for computing Total Fish Import (TFI) to India in the study. The chapter 03 covers 90-95% of total import of fish and fishery products to India, and therefore, analysis of import data under the chapter 03 very closely represents total fish import to India. The re-export data was also collected from the COMTRADE database for the study.

Linear, Polynomial and exponential regression models given in Equations (1), (2) and (3), respectively were fitted to the time series data using ordinary least square (OLS) method using SAS 9.3.

$$Y_t = \beta_0+\beta t+e_t, \quad \text{.....(1)}$$

$$Y_t = \beta_0+\sum_i \beta_i t^i+e_t, \ i=1,2, \quad \text{.....(2)}$$

$$Y_t = \beta_0 \exp(\beta t) + e_t, \quad \text{.....(3),}$$

where Y_t is the fish import in different HS codes, t is the time (year), β_0 is the intercept, β is the regression coefficient and e_t is the error terms assumed independently and identically distributed with mean 0 and constant variance. The parameters of regression models were estimated by OLS

Table 1. HS codes and description of fish commodities import to India

HS codes	Item Description
0301	Live fish
0302	Fish, fresh or chilled, excluding fish fillets and other fish meat of heading 0304 Salmonidae, excluding livers and roes:
0303	Fish, frozen, excluding fish fillets and other fish meat of heading No.0304 ,Pacific salmon (Oncorhynchus nerka, Oncorhynchus gorbuscha, Oncorhynchus keta, Oncorhynchus tschawytscha, Oncorhynchus kisutch, Oncorhynchus masou and Oncorhynchus rhodurus), excluding livers and roes:
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, whether in shell or not, live, fresh, chilled, frozen, dried, salted or in brine; crustaceans, in shell, cooked by steaming or by boiling in water, whether or not chilled, frozen, dried, salted or in brine; flours, meals and pellets, of crustaceans, fit for human consumption
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
0308	Aquatic invertebrates, other than crustaceans and molluscs; live, fresh, chilled, frozen, dried, salted or in brine, smoked, whether or not cooked before or during the smoking process; flours, meals, and pellets, fit for human consumption

method. The goodness of fit of the models was assessed by coefficient of determination (R^2) and root mean square (RMSE). The model with the highest R^2 and the smallest RMSE values was selected (Montgomery et al., 2015). The estimated regression coefficients were used to explain the growth rate of fish import. Standardized regression coefficient was computed by multiplying the linear regression coefficient with standard deviation (S_t)of the independent variable and dividing with standard deviation (S_Y) of the dependent variable to directly quantify the sensitivity of the fitted model, i.e. $\beta^*(St/S_Y)$.

Normalized trade balance index for fish import was computed against fish export to see the performance of fish import trade using Equation (4)

$$Z_t = (E_t-I_t)/(E_t+I_t),\ -1\leq Z_t\leq 1 \quad .....(4)$$

where Z_t is the normalized trade balance at time t, E_t is fish export quantity or value and I_t is fish import quantity or value at time t.

The proportional contribution of import quantity and value to the total fish import (TFI) quantity and value was computed using the Equations (5) and (6), respectively for each commodity excluding live fish imported under the head HS – 0301.

$$PoQ_{ij} = Q_{ij}/TFI_i \quad .....(5),$$

$$PoV_{ij} = V_{ij}/TFI_i \quad .....(6),$$

where PoQ_{ij} and PoV_{ij} are the proportion of quantity and value of j^{th} commodity imported in the i^{th} year, Q_{ij} and V_{ij} are the quantity and value of j^{th} commodity imported in the i^{th} year, TFI_i is the total fish import (quantity) of all the commodities in the i^{th} year and TIV_i total import value of all the commodities in the i^{th} year.

The major countries who export products to India were ranked based on their quantity wise contribution to the import of particular commodity under each HS code. The percentage contribution of each country was computed and presented for both import quantity and value in the study.

Correspondence analysis was performed to quantify the association between year wise and country wise fish import to India under each HS codes. This would help to identify the structural changes happening in the major fish importing countries over the years.

Let **Y** be the matrix with y_{ij} as the quantity of fish imported inith year from j^{th} country and N be the

grand total of the data matrix **Y.** The correspondence matrix $\mathbf{P} = \{p_{ij}\}$ is obtained by dividing each element of **Y** by N.

That is

$$\mathbf{P}_{(ixj)} = (1/N)\mathbf{Y}_{(ixj)} \text{ or } p_{ij} = y_{ij} / N,\ i = 1,2, \ldots, \ldots \ldots (7)$$

The expected correspondence matrix $\widehat{\mathbf{P}} = \widehat{p}_{ij}$ is obtained by minimizing the weighted sums of squares between **P** and $\widehat{\mathbf{P}}$, i.e.

$$\Sigma_{i=1}\Sigma_{j=1}\left(\frac{p_{ij}\,\widehat{p}_{ij}}{r_j c_j}\right) = \text{tr}\left[\mathbf{D}_r^{-1/2}(\mathbf{P}-\widehat{\mathbf{P}})\mathbf{D}_c^{-1/2})(\mathbf{D}_c^{-1/2}(\mathbf{P}-\widehat{\mathbf{P}})\mathbf{D}_c^{-1/2})\right]$$

,where

$$r_i = \sum_{j=1} p_{ij} = \sum_{j=1} y_{ij}/N \text{ or } \mathbf{r}_{(ix1)} = \mathbf{P}_{(ixj)}\mathbf{1}_{(jx1)}, \mathbf{1}_{(jx1)}$$

is column vector of 1

$$c_j = \sum_{i=1} p_{ij} = \sum_{i=1} y_{ij}/N \text{ or } \mathbf{c}_{(jx1)} = \mathbf{P}_{(jxj)}\mathbf{1}_{(ix1)}, \mathbf{1}_{(ix1)}$$

is column vector of 1

$\mathbf{D}_r = \text{diag}(r_1, r_2, \ldots r_i, \ldots)$ and $\mathbf{D}_c = \text{diag}(c_1, c_2, \ldots c_j, \ldots)$

This correspondence matrix was used to compute the chi-square statistic for explaining the amount of variability explained while reducing the dimension of the data matrix. The first two components, which explained the maximum variability in the data was used to draw biplot of correspondence analysis to see the association and structural changes between year and country wise fish import to India. The details of correspondence analysis is given in Greenacre (2017).

India's export import (EXIM) policy with respect to Fish and Fish Products (FFPs) were focused more on the prospect of exports to leverage fast growth of fisheries sector. In FFPs, India traditionally had advantages due to the availability vast resources in terms of areas under Exclusive Economic Zone (EEZ), inland waters and low resource intensity in production. Indian trade policy with respect to imports have been evolved on the basis of three considerations: meeting the domestic demand, supply of raw material for fish processing industry so that it can be re-exported and protecting Indian seafood processing industry from high competition from other countries (FAO, 2020a). In tune with this background, India has undertaken a calibrated approach towards fish imports, mostly on a case-by-case basis, than adopting a one-fit-for-all policy. Therefore, some commodities are permitted to import to India freely, some are restricted and some are totally prohibited. Hence, the existing policy conditions were reviewed and analyzed descriptively.

Results and Discussion

In various HS code categories, India imported 3231–39525 tonnes of fish worth US $4.6–111.8 million between 2000 and 2019. Value and quantity increased at rates of 24.36% and 12.23%, respectively. Current import data indicates that live fish imported under the HS code 0301 accounted for only 1.65% of total fish imported into India; this amount was not factored into the calculation of total fish imports into India. In terms of both quantity and value, Figure 1 shows India's total fish import (TFI). Over the years, a linear increase in both quantity and trade value was observed. Simple linear regression given in Equation (1) with auto-correlated errors was fitted to the data with an R^2 value of 0.88 and RMSE value of 4061. The estimated growth rate was 1656 tonnes per year (Fig. 1). The maximum value of imports for 28100 tonnes in 2011 was found to be worth US $112.37 million.

The amount and value of fish and fishery products that were re-exported from India under different HS codes was extremely small in comparison to fish imports into the country. At any reporting point between 2000 and 2019, India has only re-exported less than 4% and 10%, respectively, of the total quantity and value of fish imported (Fig. 2b). During this time, India re-exported only 15–1000 tonnes of fish and fisheries worth for US $0.11–5.28 million. This suggests that the majority of imported fish and fisheries products are either used or consumed

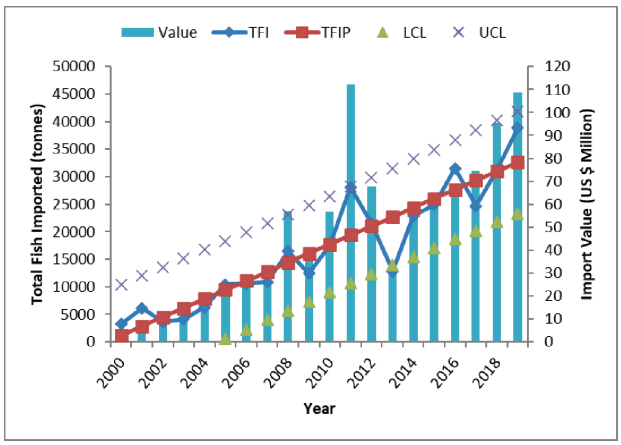

Fig. 1. Total fish import (TFI) to India vs predicted (TFIP) with UCL and LCL

UCL - upper control limits; LCL - lower control limits

domestically. Fish and fishery products were re-exported in greater quantity and value up until 2016, after which it reduced in the year 2017, 2018 and 2019 (Fig. 2a).

Fresh or chilled fish, excluding fish fillets, under the head HS -0302 contributed the most in terms of quantity to the TFI in 2000 (72%), followed by HS -0307 (22%). HS-0308 received the least amount of contributions, followed by HS-0304, HS-0305, HS-0306, and HS-0303, with 0, 0.005, 0.25, 0.57, and 5.40 percent, in that order. Over time, India's imports of fish have undergone compositional changes. Fresh, chilled, or frozen fish fillets and other fish meat (whether or not minced) under HS - 0304 accounted for 44% of all fish imports in 2019, with fish items under HS - 0303 coming in second with 24%. Fish items under HS -0302 were found to have a sharp decline in contribution, falling to 17% and ranking third. Between 2000 and 2019, the amount of frozen fish imported under HS -0303 increased linearly, while the amount of molluscs imported under HS -0307 decreased from 21% to 3%. Fish items under HS-0308 continued to contribute the least to the TFI in 2019, coming in at 0.001%. The proportional quantity and value-wise contribution of fish import under various HS codes over the years is shown in Figs. 3a and 3b, respectively. Fish items classified under HS-0306 made up the largest 32 percentage of the total foreign exchange in 2019; and were followed by items classified under HS-0304. Crustaceans accounted for the largest amount of foreign exchange spent on imports, despite the fact that HS-0306 items ranked fourth in terms of quantity imported. This shows that, similar to export, the highest foreign exchange was spent on the import of crustaceans under HS-0306. Fresh or chilled fish, excluding fish fillets, under HS-0302 had a maxi-

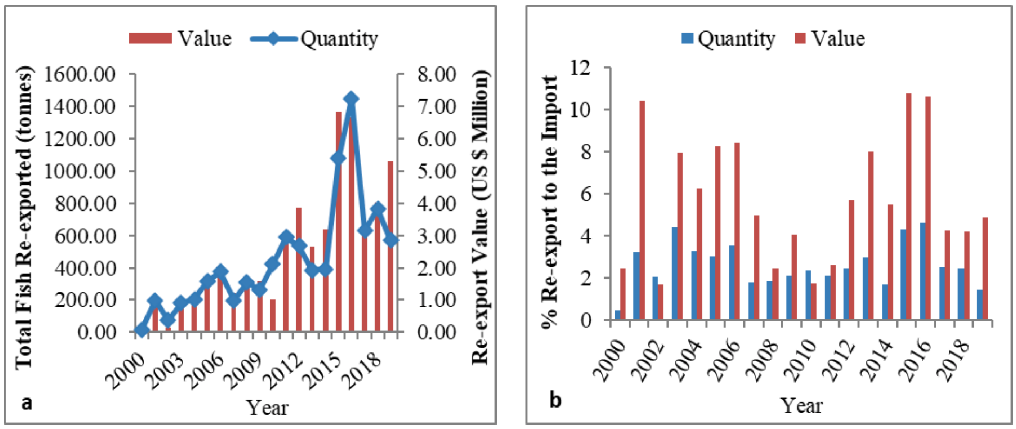

Fig. 2. Re-export of fish from India and % contribution to total fish import

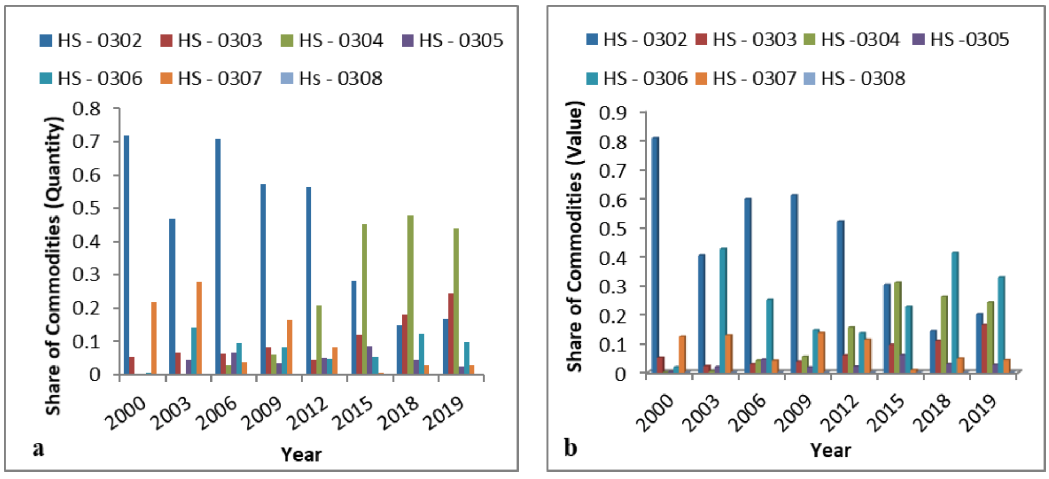

Fig. 3. Propositional contribution (quantity & value) of fish import under different HS codes

mum value-wise contribution of 80% in 2000. However, this contribution began to decline over time and was only third in value in 2019 behind HS-0304. This might be the result of a rise in fish imported under HS-0304 and a decrease in fish imported under HS-0302 over this time frame. Between 2000 and 2019, the value of imported frozen fish (HS – 0303) increased from 5% to 16%, in line with the observed increase in import quantity during the same period.

Normalized trade balance between fish import and export was computed at each year using the formula given in Equation (4). When compared to exports, import trade was found to be very marginal in terms of both quantity and value. Throughout the study period, the fish trade balance remained positive (> 0.90), indicating that fish exports exceeded fish imports. The normalized trade balance for the years 2000–2019 is given in Fig. 4. It could be inferred from the figure that India is still a fish export-oriented country than fish import.

Fish imported under the HS code 0302, whether fresh or chilled, was fitted with a polynomial regression of order 4. The actual and anticipated values for the quantity and import value of fish imported is shown in Fig. 5a. In 2000, India imported 2327.31 tonnes of fresh or chilled fish, valued at $3.68 million US. This amount increased until 2012, at which point it decreased. In 2019, India imported fish totaling 6480.76 tonnes, valued at US $21.73 million. Bangladesh, a neighboring country, has been the main source of imports, followed by Norway, the UK, Thailand, and Japan. Fish import quantities were used to rank the major importing nations. Major importing countries were ranked based on the quantity of fish imported to India under the HS code – 0302 and the same is given in Table 2. It was noted that, throughout all of these years, Bangladesh continued to be the top-ranked nation, accounting for nearly 95% of fish imports under the HS code 0302. Fig. 6a shows the major import countries' value-wise contribution. In terms of value, Bangladesh's contribution dropped from 97 to 86% between 2000 and 2019, while Norway's and the UK's contributions rose from 0 to 12% and 0 to 1.8%, respectively, during this time. High-value fish imports, such as Atlantic salmon (*Salmo salar*) and danube samon (*Hucho hucho)* may be the reason of this. Fig. 7a shows a two-dimensional biplot of the correspondence analysis. Bangladesh remained to be the origin of the biplot over the years, indicates that the contribution of Bangladesh to the import quantity of HS – 0302 was not varying over the years.

The Exponential model in Equation (3) was used to fit frozen fish imports to India under HS code 0303, whose import value also increased exponentially. The observed and predicted values of fish imports under HS-0303 are shown in Fig. 5b. Initially, India imported 174.56 tonnes of frozen fish worth US $0.23 million, gradually increasing to 9447.65 tonnes worth US $17.75 million in 2019. Myanmar was the major country exporting frozen fish to India until 2014, after which Oman became the highest contributor. Oman, Myanmar, Indonesia, Singapore, Vietnam, UAE, and UK were the major exporters of frozen fish under HS – 0303 to India. The ranking of countries based on fish import quantity is given in Table 2.

India imported 6368.21 tonnes of frozen fish worth US $3.89 million from Oman, 1756.81 tonnes worth US $9.62 million from Myanmar, 806.24 tonnes worth 2.11 US $ million from Indonesia, 101.98 tonnes worth US $0.093 million from UAE, 93 tonnes worth US $0.079 million from Vietnam, 63.92 tonnes worth US $0.65 million from Singapore, and 2.25 tonnes worth US $0.041 million in 2019. Since 2015, import contributions from Oman have increased and reached first position in 2019, while contributions from other countries have decreased. Myanmar accounted for 18.59% of total fish import quantity in 2019, but had the highest value contribution with 54.22% compared to other major countries like Oman, which accounted for 21.92% of the import value. The value-wise contribution of major import countries under HS - 0303 is shown in Fig. 6b. The correspondence analysis biplot for

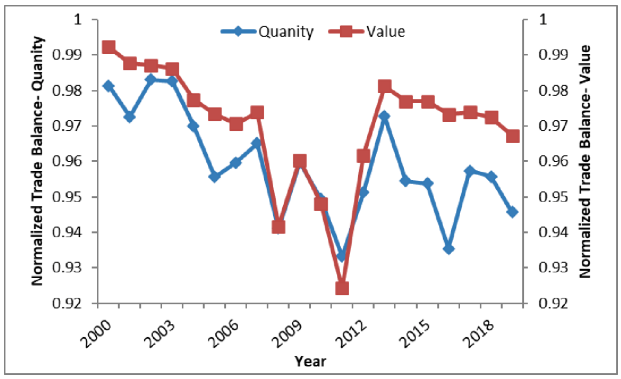

Fig. 4. Normalized fish trade balance of India (quantity and value)

frozen fish under HS - 0303 is shown in Fig.7b. The contributions of different countries to fish import to India under HS - 0303 have varied over the years. Initially, the main contributors were Myanmar, UK, Norway, Singapore, and Vietnam, but later Oman became a significant contributor, possibly due to higher production.

A quadratic model was used to analyze fish import data in the HS -0304 category. The actual and predicted values of fish imported in this category are depicted in Fig. 5c. The quantity of fish fillets imported by India has steadily increased since 2010, with a significant rise in both quantity and value.

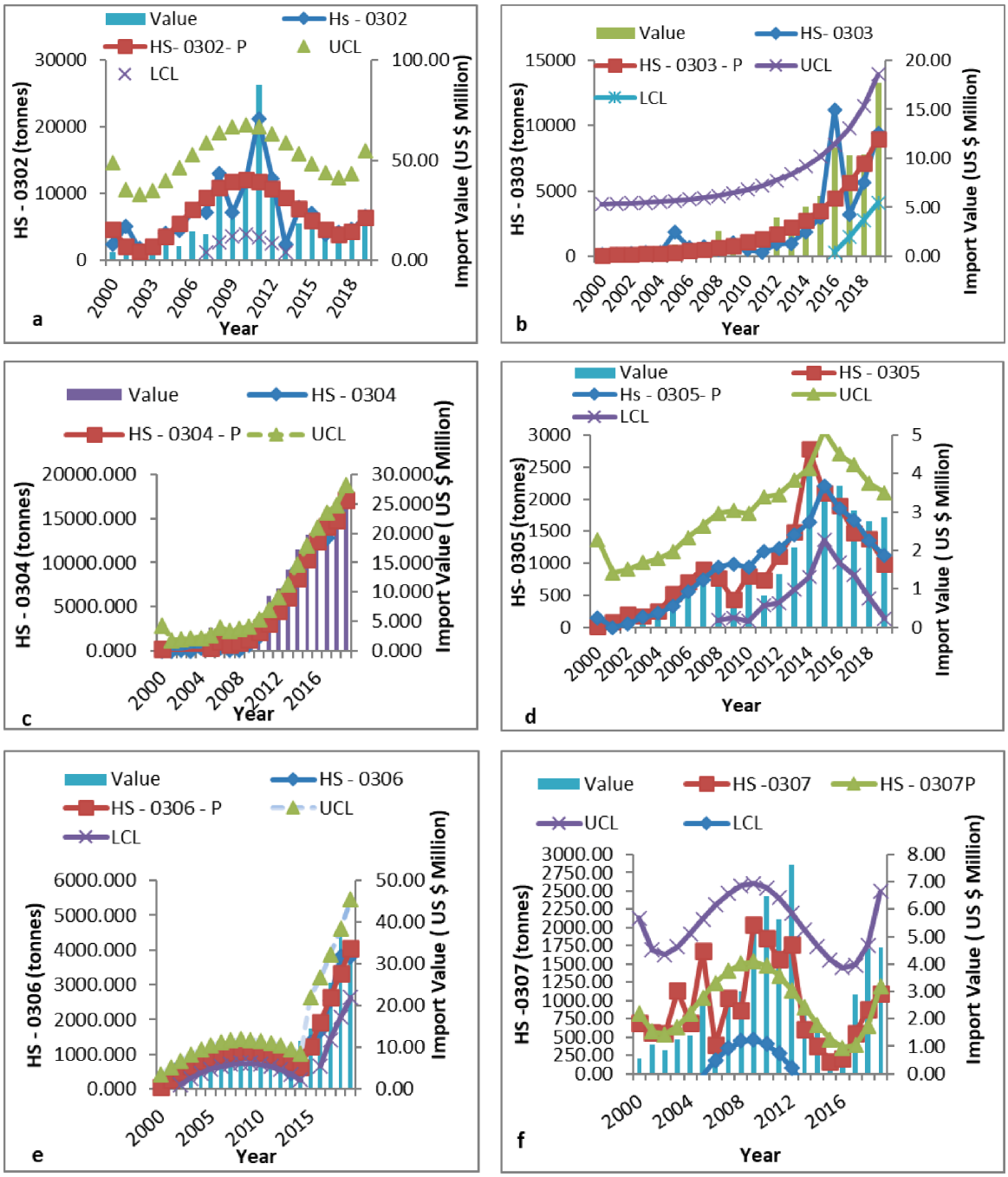

Fig. 5. Fish import quantity observed vs predicted (P) with UCL and LCL
UCL - upper control limits; LCL - lower control limits

Vietnam, the United States, and China were the main countries exporting fish fillets to India. Bangladesh was the top exporter till 2005 but dropped later, and notched up second place in 2019 with a sudden export of large amount of fish fillets to India, causing it to regain second place. Vietnam has consistently been the top exporter of fish fillets to India since 2010. The contribution of different countries to the total value of fish fillet imports is given in Table 2 and Fig. 6c. Vietnam's contribution declined slightly in 2019, possibly due to increased contributions from Bangladesh and the United States. The overall contribution of the countries listed in Table 2 accounted for 91.21% of the import

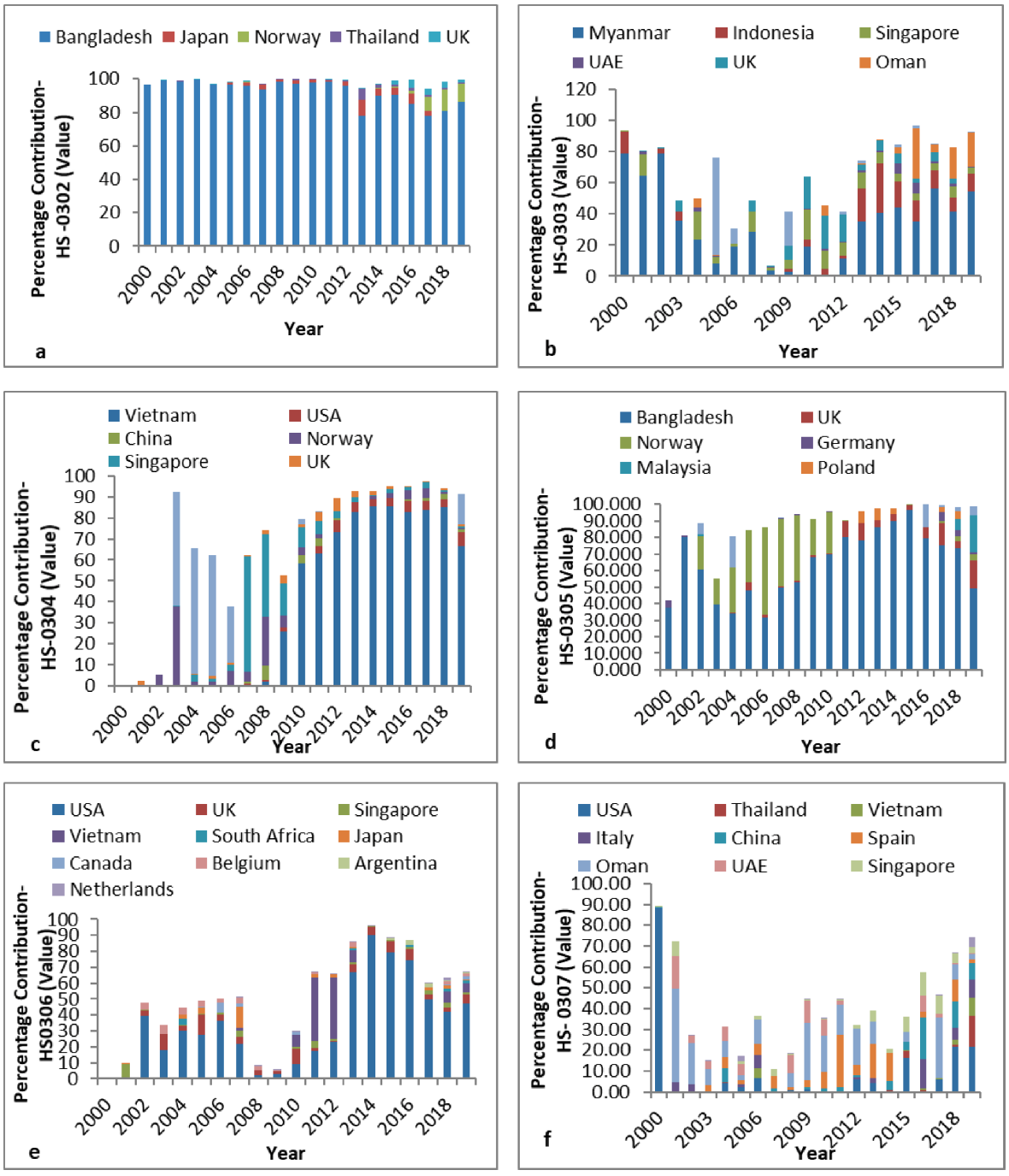

Fig. 6. Percentage contribution on value by countries on fish import to India

Table 2. Ranking of Major Import Countries to India

HS - 0301				
Countries	Year			
	2005	2010	2015	2019
Bangladesh	1 (38.15%)	(0.00%)	8 (0.00%)	1 (66.28%)
Thailand	(0.00%)	2 (13.85%)	1 (33.81%)	2 (18.09%)
Indonesia	(0.00%)	(0.00%)	2 (20.89%)	3 (6.53%)
Singapore	(0.00%)	1 (72.45%)	3 (16.19%)	4 (3.31%)
Malaysia	(0.00%)	(0.00%)	5 (8.08%)	5 (2.71%)
Srilanka	(0.00%)	(0.00%)	7 (0.48%)	6 (0.67%)
Japan	(0.00%)	(0.00%)	6 (1.51%)	7 (0.53%)
USA	(0.00%)	(0.00%)	4 (8.75%)	8 (0.00%)
HS - 0302				
Country	Year			
	2005	2010	2015	2019
Bangladesh	1 (92.6%)	1(99.80%)	1 (98.5%)	1 (95%)
Japan	2 (0.05%)	2 (0.01%)	3 (0.2%)	5 (0.01%)
Norway	3 (0.001%)	4 (0.00%)	4 (0.01%)	2 (4.07%)
Thailand	4 (0.003%)	3 (0.06 %)	5 (0.01%)	4 (0.01%)
United Kingdom	5 (0.005%)	5 (0.00%)	2 (0.60%)	3 (0.46%)
HS - 0303				
Countries	Year			
	2005	2010	2015	2019
Oman	7 (0.00%)	6 (0.00%)	3 (17.36%)	1 (67.40%)
Myanmar	2 (8.22%)	1 (67.23%)	2 (22.03%)	2 (18.59%)
Indonesia	6 (0.00%)	3 (5.59%)	5 (8.67%)	3 (8.53%)
Singapore	3 (0.61%)	4 (2.35%)	6 (1.17%)	6 (0.68%)
UAE	4 (0.06%)	5 (0.50%)	1 (29.77%)	4 (1.08%)
UK	5 (0.02%)	2 (6.91%)	7 (0.76%)	7 (0.02%)
Vietnam	1 (85.6%)	7 (0.00%)	4 (9.16%)	5 (0.98%)
HS - 0304				
Countries	Year			
	2005	2010	2015	2019
Vietnam	7 (0.003%)	1 (66.02%)	1 (96.39%)	1 (85.17%)
Bangladesh	1 (56.93%)	4 (1.83%)	7 (0.00%)	2 (8.73%)
USA	6 (0.05%)	7 (0.00%)	2 (1.93%)	3 (2.38%)
China	5 (0.06%)	2 (5.00%)	6 (0.00%)	4 (0.68%)
Norway	3 (1.94%)	5 (0.99%)	3 (0.39%)	7 (0.03%)
Singapore	2 (2.36%)	3 (2.15%)	4 (0.29%)	5 (0.21%)
UK	4 (1.30%)	6 (0.21%)	5 (0.21%)	6 (0.06%)

The values in the parenthesis indicates the percentage contribution

value. The contribution of Norway in terms of quantity and value decreased over the years. The correspondence analysis biplot (Fig. 7c) shows that UAE, Norway, and Singapore were major contributors in the early years, but Vietnam has been the consistent major contributor since 2010.

A third order polynomial regression model was used to fit the fish import data under HS-0305. The model had an R2 value of 0.87 and an RMSE value of 373.23. The quantity of cured fish imported in different forms increased until 2015 and then decreased linearly (Fig. 5d). In 2000, India imported only 8.21 tonnes of cured fish, but by 2015, the quantity had increased to 2780.21 tonnes. However, it started to decrease after that. In 2018 and 2019, the import quantity fell to 1376.09 and 992.53

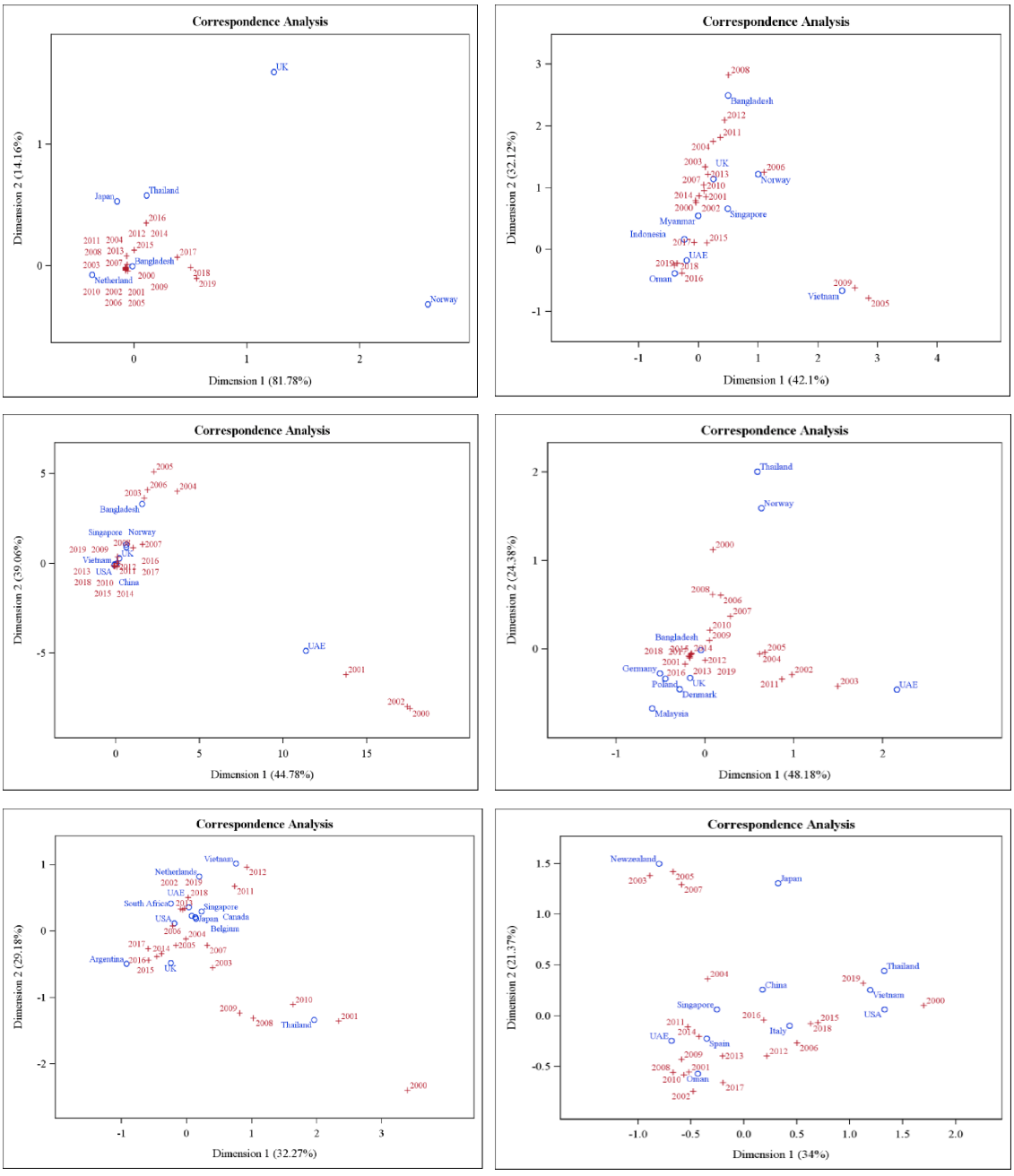

Fig. 7. Year and country wise distribution of fish import to India

tonnes, respectively. The major countries importing fish to India under HS code 0305 were Bangladesh, Malaysia, United Kingdom, Norway, Germany, Denmark, and Poland (Table 3). These countries accounted for 97.96% of the total fish imported in 2019. Bangladesh was the top importing country, followed by Norway and the United Kingdom. Malaysia became the second major importing country in 2019. India started importing cured fish from Denmark in 2016. Bangladesh remained the top country in terms of value-wise contribution on the import of cured fish. Norway, Malaysia, and the United Kingdom were also significant contributors (Fig. 6d). The biplot of correspondence analysis for understanding the variability of fish import by different countries over the years is given in Fig. 7d. The contribution of Thailand, Norway, and the UAE decreased over the years. Bangladesh remained the highest contributor among all countries which exported fish products to India.

The crustaceans import data was analyzed using a piecewise polynomial regression model. A quadratic model was used for the period 2000-2013, while a simple linear regression model was used for the period 2014-2019 (Fig. 5e). The import of crustaceans increased from 2000 to 2013 and then showed a linear increase from 2014 to 2019. India imported around 1000 tonnes of crustaceans worth less than 10 US $ million annually up to 2014. In 2015, India imported 1352.08 tonnes of crustaceans worth US $14.43 US $ million. The import quantity further increased in 2018 and 2019 to 3811.24 and 3800.08 tonnes, respectively, with corresponding values of 39.25 and US $35.50 million.

The major countries exporting crustaceans to India were USA, UK, Vietnam, Canada, Singapore, and South Africa (Table 3). The quantity of items under this category imported was varied year to year and country to country. The countries all together contributed only 46.59, 25.63, 78.43 and 60.62% of total quantity of crustaceans imported in 2005, 2010, 2015 and 2019, respectively (Table 7). India imported a significant amount of crustaceans from Myanmar in 2005, but stopped importing since 2006. Thailand and Pakistan also exported crustaceans to India, but the import quantity became negligible or stopped later on. In 2010, India imported a certain quantity of crustaceans from Thailand and Pakistan. USA earns almost 50% of the import value, followed by UK and Vietnam. During the lean period of USA, Vietnam had a significant contribution. The value-wise contribution of different import countries is given in Fig. 6e. Interestingly, the major importing countries had a very low contribution in 2008 and 2009 due to the fact that major quantity of crustaceans imported was classified as areas not elsewhere specified during this period. The biplot of correspondence analysis shows the import data of crustaceans. Dimension 1 explains 32.27% and dimension 2 explains 29.18% of the variability (Fig.7e). Thailand was the major importer from 2008 to 2010, but later reduced. USA remains a significant contributor as it remained to the center of the biplot, while other countries' contributions vary over the years.

A fourth order polynomial regression model was used to fit the import data for molluscs under the head HS – 0307. The import quantity showed fluctuations from 2000 to 2012, followed by a sharp decrease from 2012 to 2015, and then an increase from 2016 to 2019. The import value followed the same trend. In 2000, India imported 830.65 tonnes worth US $0.56 million, which increased to a maximum of 2042.61 tonnes worth US $5.25 million in 2009. The highest import value was registered in 2012, with US $7.62 million for 1773.51 tonnes. However, the import quantity decreased to an all-time low of 167.41 tonnes worth US $0.56 million in 2015. The trend then changed again, with India importing 546.93, 886.85, and 1097.87 tonnes of molluscs worth 2.87, 4.58, and US $4.62 million in 2017, 2018, and 2019, respectively. The change in the trend is shown in Fig. 5f.

The major molluscs exporters to India were USA, Thailand, Vietnam, Italy, China, Spain, Oman, UAE, Singapore, and Japan. Initially, UAE, Singapore, and Vietnam were the major importers, but later USA and Thailand took over. USA's import increased from 29.26 tonnes in 2005 to 42.97 tonnes in 2015 and 268.95 tonnes in 2019, accounting for a significant percentage of the total import. Thailand and Vietnam also saw an increase in their contribution. The USA faced market challenges from Asian countries. Italy and China also increased their import, while Oman and UAE decreased. The ranking and percentage contributions are listed in Table 3. The import value contributions are shown in Fig. 6f. USA accounted for a large percentage of the import value in 2000 but decreased until 2015 and then increased to 22% in 2019. Oman was a promising importer but faced competition. Thailand earned US $0.68 million in 2019, accounting for

Table 3. Ranking of Major Import Countries to India

HS - 0305				
Countries	Year			
	2005	2010	2015	2019
Bangladesh	1 (82.94%)	1 (93.82%)	1 (99.21%)	1(90.27%)
Malaysia	6 (0.00%)	5 (0.00%)	6 (0.00%)	2 (3.68%)
United Kingdom	3 (1.19%)	3 (0.06%)	2 (0.73%)	3 (2.25%)
Denmark	7 (0.00%)	7 (0.00%)	7 (0.00%)	4 (0.95%)
Norway	2 (2.93%)	2 (4.09%)	3 (0.03%)	5 (0.56%)
Germany	4 (0.00%)	4 (0.03%)	4 (0.00%)	6 (0.20%)
Poland	5 (0.00%)	6 (0.00%)	5 (0.00%)	7 (0.04%)
HS - 0306				
Countries	Year			
	2005	2010	2015	2019
USA	1 (19.46%)	2 (7.37%)	2 (31.73%)	1 (28.68%)
UK	2 (17.32%)	1 (10.97%)	1 (39.19%)	2 (10.97%)
Singapore	6 (0.32%)	5 (0.75%)	5 (0.65%)	7 (1.39%)
Vietnam	10 (0.00%)	3 (4.79%)	8 (0.0004%)	3 (8.86%)
South Africa	9 (0.00%)	10 (0.00%)	4 (1.44%)	5 (2.73%)
Japan	3 (4.53%)	7 (0.002%)	9 (0.00%)	10 (0.69%)
Canada	5 (2.34%)	4 (1.71%)	7 (0.003%)	4 (3.33%)
Belgium	4 (2.61%)	8 (0.00%)	10 (0.00%)	6 (1.63%)
Argentina	7 (0.00%)	9 (0.00%)	3 (5.35%)	8 (1.24%)
Netherlands	8 (0.00%)	6 (0.02%)	6 (0.06%)	9 (1.10%)
HS - 0307				
Countries	Year			
	2005	2010	2015	2019
USA	3 (1.73%)	7 (0.00%)	1 (25.67%)	1 (24.50%)
Thailand	7 (0.03%)	7 (0.00%)	5 (2.12%)	2 (15.63%)
Vietnam	9 (0.00%)	7 (0.00%)	6 (0.11%)	3 (9.21%)
Italy	6 (0.95%)	7 (0.00%)	8 (0.00%)	4 (7.23%)
China	9 (0.00%)	4 (1.47%)	3 (5.97%)	5 (6.19%)
Spain	5 (1.20%)	2 (9.56%)	8 (0.00%)	6 (3.75%)
Oman	4 (1.66%)	1 (15.15%)	2 (15.77%)	7 (1.84%)
UAE	1 (5.08%)	3 (7.92%)	7 (0.00)%	8 (1.22%)
Singapore	2 (1.78%)	4 (0.16%)	4 (2.36%)	9 (0.92%)
Japan	8 (0.02%)	6 (0.0002%)	8 (0.00%)	10 (0.03%)

The values in the parenthesis indicates the percentage contribution

14.63% of the total value. The biplot in Fig.7f shows the correspondence analysis import data under HS - 0307. The scatter plot indicates that Oman and UAE contributed significantly in the initial years but later USA, Thailand, and Vietnam became major contributors.

India had not imported much items on 'aquatic invertebrates, other than crustaceans and molluscs; live, fresh, chilled, frozen, dried, salted or in brine, smoked, whether or not cooked before or during the smoking process; fish flours, meals, and pellets, fit for human consumption under the head HS – 0308. India imported 0.04, 0.107, 0.99 and 0.59 tonnes worth 0.0008, 0.0018, 0.0079 and US $0.0027 million only in 2013, 2014, 2018 and 2019, respectively. India imported items under the head HS -0308 only from Indonesia in 2013 and 2014; only from Vietnam in 2018 and 2019.

India imposes non-tariff barriers for import of fish and fishery products to India. The import of fish and fishery products to India requires special import permit for each consignment as a non-tariff barrier. Import of live fish, which falls under HS code 0301 (ornamental fish, and other live fish like eel, trout, and some carps) are mostly restricted. All the items under the HS code 0302 (fish, fresh or chilled, excluding fish fillets and other fish meat of heading 0304) except shark fins are freely importable. This include Salmon (Atlantic and Pacific), trouts, flat fish, halibut, plaice, sole, tunas, herrings, sardine, anchovies, mackerel, brisling or sprats, mackerel (*Scomberscombrus, Scomberaustralasicus, Scomber japonicus*), Indian mackerels (*Rastrelliger spp.*), seerfishes (*Scomberomorus spp*.), jack and horse mackerel (*Trachurus spp.*), jacks, crevalles (*Caranx spp.*), cobia (*Rachycentron canadum*), silver pomfrets (*Pampus spp.*), Pacific saury (*Cololabissaira*), scads (*Decapterus spp.*), capelin (*Mallotusvillosus*), Sword fish (*Xiphias gladius*), marlins, sailfishes, spearfish (*Istiophoridae*), excluding edible fish offal of sub-headings, exclusing some edible fish offals. Other economically important items under this category are tilapias, catfish, carp, seabass, Hisla etc. This is the most economically important group of FFPs in terms of import value and they could turn out to be potential competitors in the domestic market. In similar lines, freely importable are all the items under HS code 0303 (fish, frozen, excluding fish fillets and other fish meat of heading 0304) except shark fins. Another commodity group having high domestic demand is fish fillets under the head HS code 0304 (fish fillets and other fish meat) and imported fish fillets are now available in many supermarkets in India. All the items under the HS code 0305 (fish, dried, salted or in brine; smoked fish), 0306 (crustaceans), 0307 (molluscs) and 0308 are also allowed to be imported freely after paying the prescribed duty.

Despite the fact that India is regarded as a net fish exporting nation, the amount and value of FFP imports increased significantly between 2000 and 2019. It's possible that Bangladesh's continued prominence in the export of fish fillets and fresh or frozen hilsa to India is a result of this. Similarly, 97% of India's imports of fresh and frozen fish came from Bangladesh, according to Shyam & Narayanakumar (2012). The proximity and cheapness of transportation are two of the main reasons that make it easier to import fish from Bangladesh into India. Furthermore, consumers in some Indian states that border Bangladesh have preferences for fish that is similar to fish produced in Bangladesh. The purpose of this section is to discuss the benefits and drawbacks of fish import trade to India, specifically focusing on value addition, re-export, domestic consumption, duty structure, and potential for foreign direct investment. Three topics are covered in detail regarding the main import policies related to fish: the import duty structure, domestic consumption, and processing and re-export.

The majority of marine products are subject to World Trade Organization (WTO) regulations, compulsory compliance requirements (CCR), and a basic duty of 30% (Trollvick, 2002). A special countervailing duty (CVD) of 5 to 10% must also be paid on certain commodities. The majority of items falling under HS Codes 0301 and 0302 are eligible for a 10% special CVD. Products who falls under the HS codes 0303, 0304, 0305, 0306, 0307, and 0308 is eligible for a special CVD of 10% and a CVD of 5%. Likewise, Bellman et al. (2016) have highlighted the part that tariff and non-tariff trade policies play in the international trade in fish and fish products. The Ministry of Commerce regulates, restricts, and forbids the import of the majority of fish products through open general licenses. Fish and marine product imports require the Department of Fisheries' Sanitary Import Permits (SIPs). SIP, however, is a certificate outlining India's hygienic standards rather than a license. Fish products may only be imported via designated seaports or airports. The Export Import Policy (EXIM) of Government of

India under its Ministry of Commerce governs and specifies the trade in fish and fishery products.

In overall, the study indicates that the quantity and value of import of fish and fishery products to India are low, both in absolute terms and as a share of export and import. This imported supply is primarily intended for domestic consumption. Additionally, Indian consumers are highly sensitive to price, and it appears that the demand for fish is influenced by both price and income levels. The per capita consumption of fish in India is notably low at 5.6 kg per person, which is significantly less than the consumption levels observed in high-income countries and various Asian nations. Specifically, the per capita consumption of fresh fish among rural consumers ranges from 2 kg per year for low-income households to 8 kg per year for high-income households (Meenakshi, 2008). Conversely, in urban areas, the lowest-income households consume approximately 3 kg of fish per year, while the wealthier group consumes around 8 kg per year. Fish accounts for only about 6% of the total household food budget in India, which is substantially lower than the percentages observed in Bangladesh (20%), Indonesia (9%), Malaysia (21%), Philippines (14%), Thailand (16%), and Vietnam (19%) (Dey et al., 2008). Notably, India's consumer expenditure share is comparable to that of China (5%). However, China is experiencing a rapid increase in demand for fish. It is expected that India will also witness an increase in fish demand due to per capita real income growth, population growth, rapid urbanization, and changing consumer preferences (Bank, 2013). Furthermore, there is a growing recognition among consumers that fish offers significant nutritional benefits, which further contributes to the demand for this commodity.

Fish imports can boost India's fish processing industry which is facing issues related to lack of raw material and high cost. Imports can help overcome this by processing domestically and re-exporting. The approach of importing, processing and re-exporting predominantly crustaceans and molluscs which represent the bulk of re-exports will require technological advancements and a stronger marketing strategy. To add more value, seafood business must adopt more sophisticated processing methods. In order to meet the ambitious goal of exporting INR 1000 billion in fish products, strict adherence to food safety and quality standards alongside investments in technology and training in workforce is needed. Success also hinges on consistent updates from advanced markets regarding the trends.

Conclusion

The total amount of fish imported into India increased linearly at a rate of 1656 tonnes during 2000-2019. In 2000, India imported 3231 tonnes of fish and fisheries products valued at US $4.6 million. By 2019, that amount had increased to US $112 million, or 39525 tonnes. In terms of quantity imported, fish items under the heads HS-0304 and HS-0305 replaced the composition of fish items under HS-0302 to the total fish import; however, the value-wise composition of import items was replaced by items under the heads HS-0306 and HS-0304. Under the heading HS - 0301, live fish imports increased exponentially, with Bangladesh, Thailand, Indonesia, and others contributing significantly to India's live fish imports. India's import policy for fish has been shaped by a variety of considerations, such as the potential for re-export, supporting domestic consumption, and safeguarding domestic industries. The demand for fish products, especially fillets, has increased due to the rapid rate of urbanization, income growth, and the emergence of a strong middle class exposed to the world markets. This is reflected in the import matrix. However, the possibility of reselling the imports as a means of production justifies Indian processing companies to invest in advanced technology, high-order processing facilities, and strict adherence to sanitary and phytosanitary standards. Further, India would need to address the skill deficits in high order processing and improve market intelligence.

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