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## Ornamental Fish Exports from India: Performance, Competitiveness and Determinants

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### ABSTRACT

Ornamental fish production globally is a multibillion dollar industry. The present study appraises the performance, competitiveness and determinants of ornamental fish exports notably from India during 1991-2009 using parameters viz., Export Competitiveness Index (XCI), Constant Market Share Analysis (CMS) and Revealed Comparative Advantage (RCA). The XCI delineates the changes in market share of different countries for ornamental fish exports and it was around one for most of the years suggesting that Indian ornamental fish exports were competitive. The RCA was used to outline the export competitiveness and CMS to identify specific markets and identify realistic competitiveness for Indian ornamental fish exports. The results suggest that India has made tremendous progress in the export of ornamental fish. The major export destination for Indian ornamental fish was Singapore followed by Japan, USA, Malaysia and Germany. CMS analysis revealed that exports were in fact more competitive in USA in contrast to major export destinations namely Singapore and others. However, in order to keep abreast with current development trend of world ornamental fish trade there is urgent need to augment and drive India's competitiveness conspicuously by manifold increase in ornamental fish production, diversification of species cultured, innovative marketing and institutional arrangements.

**Keywords:** Ornamental fish, Export Competitiveness, Revealed Comparative Advantage, Constant Market Share.

### 1. Introduction

Ornamental fish production globally is a multibillion dollar industry. Since 1985 the value of international trade in exports of ornamentals has increased at an average growth rate of approximately 14 percent per year<sup>[3]</sup>. Ornamental fish keeping was initially considered as one of the attractive hobbies practised in the developed countries but recently it is gaining impetus in developing countries too as they now contribute for about two thirds of the total export value<sup>[7]</sup>. Overall it is the growing interest in aquarium fishes that has resulted in steady increase in aquarium fish trade globally. The whole industry, when non-exported product, wages, retail sales including accessories and fish feed are considered, has been estimated to be worth around US\$15 billion<sup>[3]</sup>. Around 2000 species and millions of specimens are traded annually in the ornamental fish trade but only some 30-35 species of fresh water fish dominate the market<sup>[5]</sup>.

In India Aquarium hobby is nearly 70 years old and dates back to pre-independence era<sup>[1]</sup>. India's overall ornamental fish trade was about 1.06 million US\$ during year 2009<sup>[14]</sup>. India possesses rich resources viz., the lagoons and coral reefs of Lakshadweep and Minicoy islands, Andaman and Nicobar islands, Okha- pin tan, Gulf of Kutch complex, Coast of Kerala, Cape Comorin, Gulf of Mannar and Palk bay are abound with highly attractive and varied species of ornamental fishes. India has recorded at least 150 commercially important ornamental fish species and trade mainly indigenous freshwater species collected from rivers<sup>[6]</sup>. Prominent among the fresh water Indian ornamentals are Loaches, Eels, Barbs, Catfish, and Goby<sup>[1]</sup>. About 90 percent of ornamental fish is traded from Kolkata port followed by 8 percent from Mumbai and 2 percent from Chennai<sup>[4]</sup>.

India's share to global ornamental fish trade is less than 1 percent but still she is projected as a "sleeping giant" because of yet untapped potential resources<sup>[10]</sup>. However India's marginal position is likely to change as trade is gradually increasing<sup>[4]</sup>. At this moment it is

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appropriate to delineate India's position and competitiveness in emerging world market of ornamental fishes. The study was thus undertaken to study the competitiveness of Indian ornamental fishes in growing international market.

**2. Materials and methods**

**2.1. Data**

The data regarding total trade of India and world were collected from WTO statistical data base published by World Trade Organisation (WTO). Data on ornamental fish trade was collected from United Nations Commodity Trade Statistics data base (UN COMTRADE) produced by United Nations statistical office. All the values of export and imports have been referred in US dollars to net out the effects of changes in

$$\begin{aligned} & \text{Changes in world market share} \\ &= \frac{\text{Country's export of product p at time t/World exports}}{\text{Country's export of product p at time t - 1/World exports of product at time , t - 1}} \end{aligned}$$

**2.3. Revealed Comparative Advantage (RCA)**

The Balassa index known as 'Revealed Comparative Advantage' (RCA), attempts to identify product groups where the target country has obviously an advantage in international export competitiveness [2]. RCA has emerged as one of the most important measure of export competitiveness. Therefore this study also makes use of RCA to know the export competitiveness of Indian ornamental fish in International market and is represented as follows:

$$RCA = \frac{\text{Ornamental fish exports of India} \div \text{total exports of India}}{\text{World ornamental fish exports} \div \text{world total exports}}$$

Vollrath [15] offered three alternative specifications/measures of RCA which are Relative Export Advantage (RXA), Relative Import Advantage (RMA) and Relative Trade Advantage (RTA). The RXA is same as Balassa's RCA measure and the other two that is RMA and RTA are used to find out the relative import (dis)advantage and net trade (dis) advantage respectively.

Many of the important exporters of ornamental fishes are also top importers. This is because many countries import fishes, which are reconditioned, packed and then re-exported. Thus RMA and RTA are important indicators in such scenario.

**2.4. Relative import advantage (RMA)**

Here we mainly analyse whether the focus country has any sort of import advantage in a particular product or not. RMA is measured as follows,

$$RMA_{ij} = \frac{\left(\frac{M_{ij}}{M_{it}}\right)}{\left(\frac{M_{wj}}{M_{wt}}\right)}$$

Where,

**M<sub>ij</sub>**- import quantity / value of i<sup>th</sup> country for j<sup>th</sup> commodity, **M<sub>wj</sub>** – import quantity / value of world for 'j'<sup>th</sup> commodity, **M<sub>it</sub>** total import quantity/ value of i<sup>th</sup> country and **M<sub>wt</sub>**- total import quantity/ value of world,

Similar to RCA or RXA in order to avoid the asymmetric form

exchange rate.

**2.2. Export Competitiveness Index (XCI)**

Changes in world market share were estimated to know the export competitiveness of India. Changes in world market shares of a country over time can indicate long term comparative advantage of the country. It neutralizes cyclical fluctuations to a large extent and show sustained trends in the shifting of market forces towards new centres of gravity. It is also known as export competitiveness index (XCI) [9]. If XCI is above one then it can be said that the country has competitiveness in export of that product.

The XCI is measured with the following formula:

of relative import advantage (RMA), Revealed symmetric import advantage (RSMA) was used which is as follows

$$RSMA = \frac{(RMA - 1)}{(RMA + 1)}$$

Relative Trade Advantage (RTA) considers both import as well as exports for the analysis. The countries with positive RTA reveals that the country is highly export oriented from its own resources and countries with negative RTA reveals that they import ornamental fishes from other nations and then re-export it. Country with positive RTA denotes a strong competitiveness by its own. RTA is presented as follows

$$RTA = RXA - RMA$$

Where, RXA – Relative export advantage and RMA- Relative import advantage.

**2.5. The Constant-Market-Share (CMS) analysis**

The Constant-Market-Share (CMS) analysis has become popular in applied international economics with the pioneering work of Tyszynski [13]. It is a method that disaggregates the trade data of a focus country and compares it with the trade flows of the rest of the world. The main idea underlying the constant market share analysis is that the export structure of a given country affects its global export performance, despite changes in other factors, such as those associated with competitiveness. According to the CMS method, the proportionate increase in exports of a single commodity over time can be explained in terms of three factors: the general growth of world exports to the focus destinations (Standard growth effect); the extent to which the particular market represents growing centres of demand (Market distribution effect): and finally a residual term which captures the net gain or loss in the market share presumably due to the changes in the relative price and / quality of the product (Residual effect which is also termed as 'competitiveness'), not to mention the marketing effect or skill of the exporters. The CMS model [11] is as follows:

$$\Delta H = [S^0 i \Delta W_i] + [(\sum_j S^0 i, j \Delta W_{i, j}) - (S^0 i \Delta W_i)] + [\sum_j W^1 i, j \Delta S_{i, j}]$$

Where,  $\Delta H$  – change in total exports of commodity ‘i’, between time 1 and time 0;

$S^0 i$  –India’s share in total world exports of commodity ‘i’, in time 0.

$\Delta W_i$  – change in world total exports of commodity ‘i’, between time 1 and 0;

$S^0 i, j$  – India’s share in total exports of commodity ‘i’ to country j, in time 0;

$\Delta W_{i, j}$  - change in world exports of commodity ‘i’ to country j, between time 1 and 0.

$W^1 i, j$ - total exports of commodity ‘i’ to country j, in time 1;

$\Delta S_{i, j}$ - change in India’s share in total exports of commodity ‘i’ to Country j, between time 1 and 0.

In the above described equation, the first bracketed term is standard growth effect, second bracketed term is market distribution effect and the last bracketed term is residual effect representing competitiveness.

CMS for the present study was worked out on yearly basis. Each year and decomposition at the end of a period becomes the beginning of the next period. Then the simple average of yearly decomposition was used to represent the chosen period. The main advantage of using this method was that year chosen

at beginning of the overall period does not dominate the results.

**2.6. Export Determinants**

The factors influencing the export of ornamental fish from India were identified using Cobb-Douglas type of demand function [12] as used by Nalini and Mathura [8].

$$Y = a T^{b1} (PR)^{b2} (ER)^{b3} U$$

Where,

Y = India’s export of ornamental fish (Mt)

T = Volume of international trade in ornamental fish (Mt)

PR = Ratio of Indian export price and non-Indian international prices of ornamental fish

ER = Exchange rate (Rs/Euro)

a = Intercept

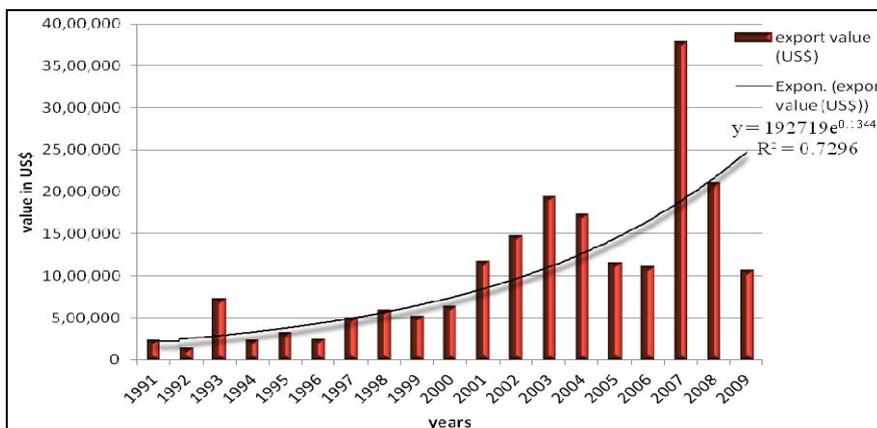
bi’ s = Elasticity of respective variables, and

Ui = Random error terms,  $u_i \sim N(0, \sigma^2 u_i)$

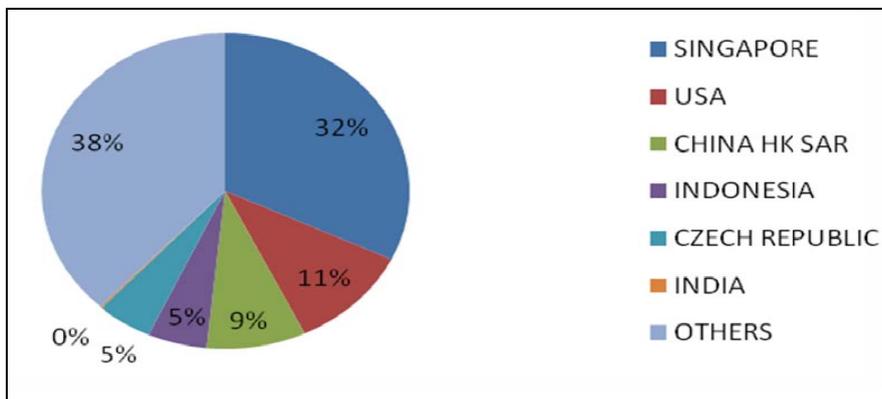
**3. Results and Discussion:**

**3.1. Export performance of Indian ornamental fishes**

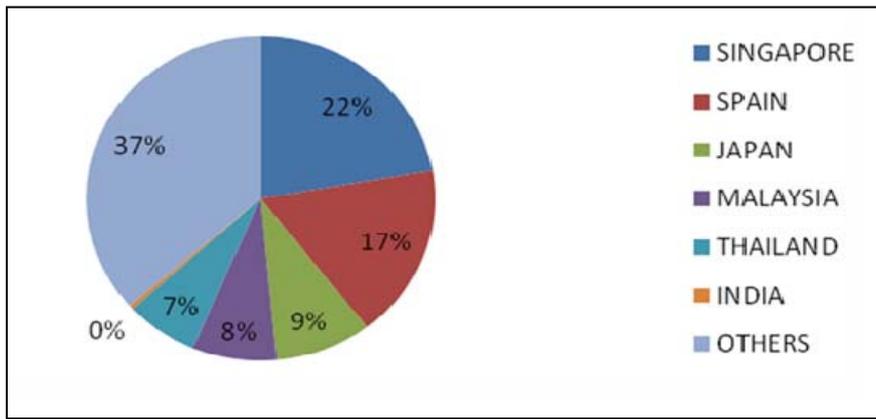
The ornamental fish exports from India showed an increasing trend and an exponential growth over the years (Fig. 1).



**Fig 1:** Ornamental fish exports from India and trend line during 1991-2009.



**Fig 2:** Market shares of major exporters of ornamental fish 1995.



**Fig 3:** Market shares of major exporters of ornamental fish, 2009.

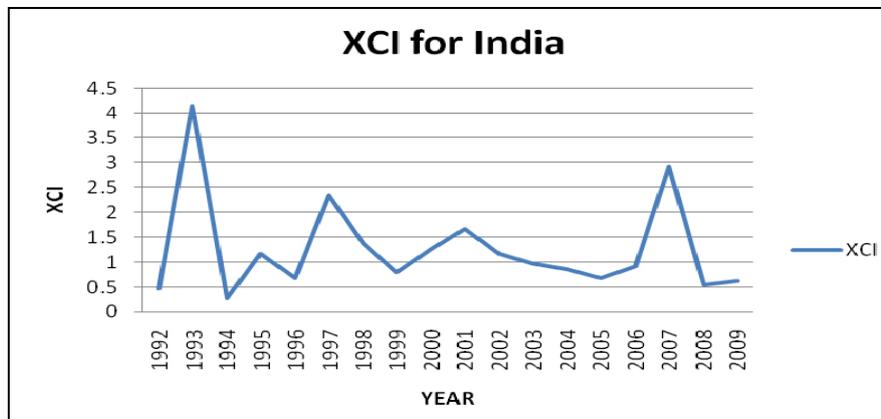
The share of India in world ornamental fish exports fluctuated and remained less than one percent for most of the years. Its share in world market ranged from 0.12 percent to 1.16 percent during 1991- 2009. India gained highest market share of 1.16 percent during the year 2007. In 2008 it had a share of 0.64 percent which again declined to 0.39 percent in 2009.

Market share of major exporters of ornamental fishes during 1995 and 2009 have been shown in Fig. 2 and 3, respectively. Singapore enjoyed the highest market share of 32 percent during 1995 followed by U.S. (11 percent), China HK SAR (9 percent), Indonesia (5 percent), Czech Republic (5 percent) and others (38 percent). In 2009, Singapore has retained the highest share (22 percent) in ornamental fish export followed by Spain (17 percent), Japan (9 percent), Malaysia (8 percent),

Thailand (7 percent) and others (37 percent). Even though Singapore remained largest exporter, its market share declined over the years from 32 percent during 1995 to 22 percent during 2009.

**3.2. Export Competitiveness**

Export Competitiveness Index (XCI) for India in ornamental fish export was estimated for the study period 1991-2009 (Fig. 4). India registered highest XCI value of 4.14 during 1994 and a rise in the value of XCI reflects consistent higher growth in ornamental fish exports in world market. The export competitiveness index for India was around 1 for most of the years, which undoubtedly proves positive export competitiveness for Indian ornamental fish over the years.

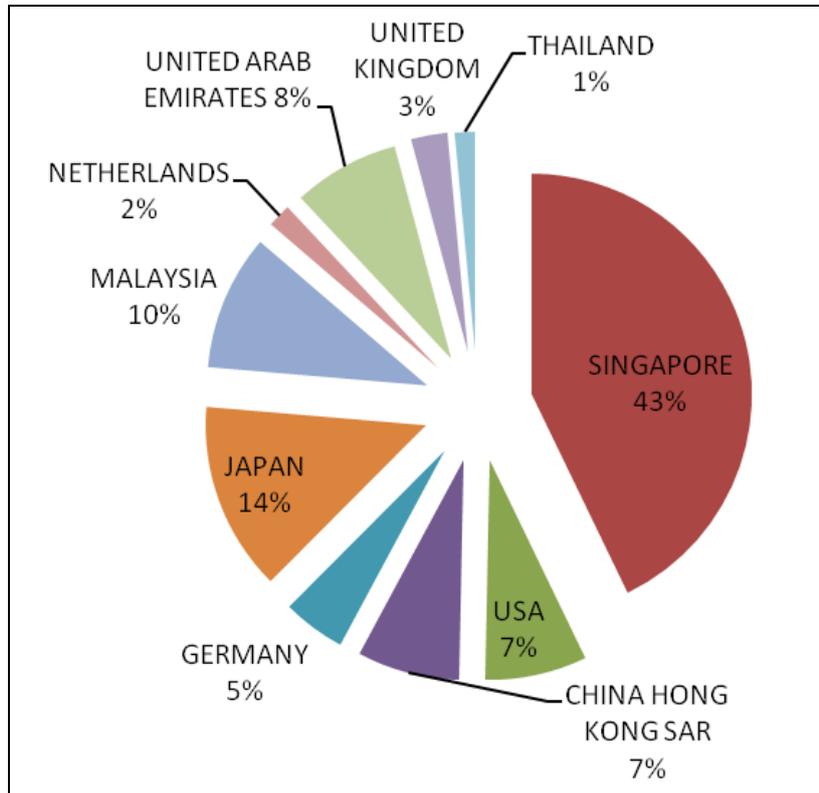


**Fig 4:** Export Competitiveness Index (XCI) 1991-2009.

**3.3. Market destination**

The major destination for export of ornamental fishes from India during 2009 was Singapore while it was Japan and Malaysia in 2003. Markets for Indian ornamental fish have never been consistent and there has been a regular fluctuation with respect to destinations since the geographical spread of the markets has exhibited an ever changing hue. Singapore, USA, China Hong Kong SAR, Malaysia and Japan were

India’s favourite top five market destinations during 2003-09 which jointly accounted for about 70 percent of total export of ornamental fishes from India (Fig. 5). Amongst them Singapore alone accounts for almost 42.85 percent of total export in ornamental fishes followed by Japan (13.88 percent) and Malaysia (9.97 percent). The USA and China Hong Kong SAR both accounted for 7.5 percent each.



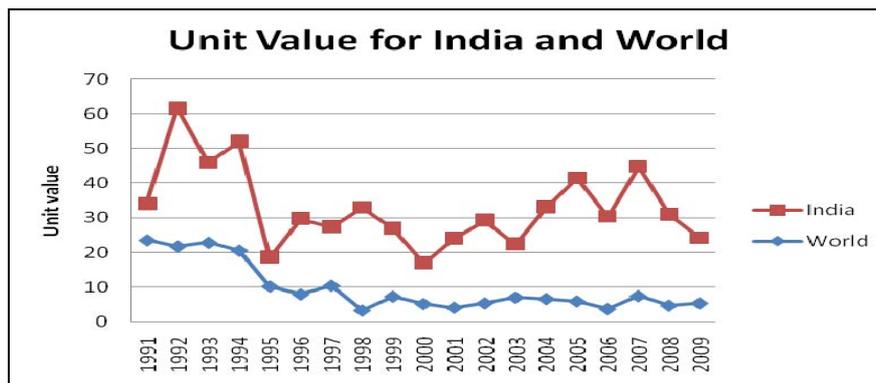
**Fig 5:** Major destinations for India’s ornamental fish exports during, 2003-2009.

**3.4. Unit Value Realisation**

In past two decades there has been a twist in unit value realisation in ornamental fish trade. The average world unit value was very high about 23.56 USD/kg in 1991 which later on decreased steeply to 5.10 USD/kg in 2000 (Fig. 6). Among the major exporters, almost all except Japan faced a decline in their unit value realisation during the period. This shows instability in supply/price of ornamental fish trade during 1991-2000.

During 2001-2009 there was less fluctuations in the unit value

realisation in ornamental fish exports as compared to earlier decade. India seems to have concentrated more on exporting high priced fishes resulting in higher value realisation even with small quantity of export. Though the quantity exported declined, the total value of export was compensated by the substantial increase in unit value (USD) realised over the years. India seems to have gained high value per unit of exported quantity in most of the years which shows the better performance of India in terms of Unit value realisation.



**Fig 6:** Unit value realisation for India and world during 1991-2009.

**3.5. Revealed Comparative Advantage**

India registered RCA as 1 in 2002 and its value were closer to 1 during 2001 and 2003 which later on declined to 0.4 during 2006. The RCA improved again to 1.09 during 2007 which is the highest value for India till date. In 2009, India’s RCA was 0.30 which shows the loss of its export competitiveness in the sector. RCA values for India showed a fluctuating trend (Fig. 7) that can be attributed to high dependency on wild capture

rather than culture. Fluctuations in export may also be due to overexploitation of aquatic resources, lack of expertise in breeding techniques and management and also due to poor distribution channel. Again, retailers are unaware about the breeding and culture techniques of various fishes and disease diagnostics etc. and thus they fail to satisfy the consumer requirements. Even the RSXA values for India during 1991-2009 explain the same situation.

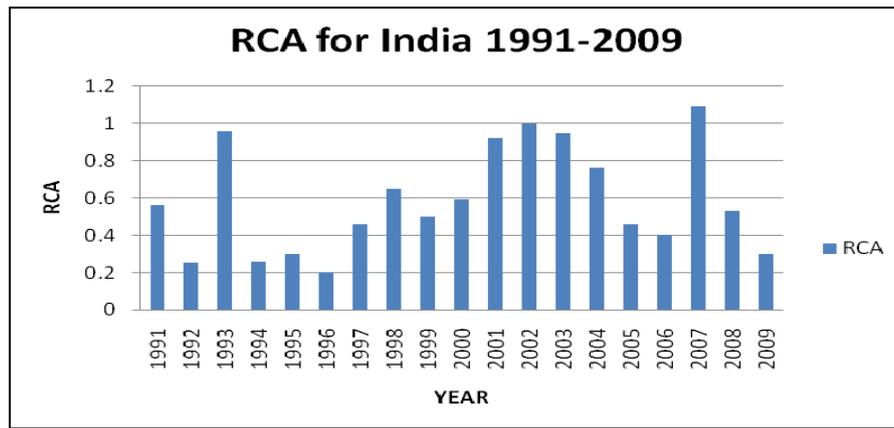


Fig 7: Revealed Comparative Advantage for India 1991-2009.

### 3.6. Relative Trade Advantage:

The relative trade advantage (RTA) for India and other countries gives a clear picture about trade competitiveness since this particular measure takes into consideration both exports as well as imports. India has a positive trade advantage but the value of advantage gained during 1991-2009 was very less (Table. 1). This indicates slow and steady movement of India in this sector. India had highest RTA of 1.09 in 2007 which later on declined to 0.53 during 2008 and to 0.30 during

2009, because of decline in export. India had a very negligible import advantage revealing that it has been gaining competitiveness but the pace of growth was very slow. Again, the fast emerging countries in ornamental fish trade like Czech Republic (5.82), Thailand (5.37), Peru (5.29), and Indonesia (4.50) had high relative trade advantage. USA being the top importer of ornamental fish had negative value for trade advantage. Thus India needs to take care of these emerging competitors in the export market.

Table 1: Relative trade advantage of India and other ornamental fish exporters (1991-2009)

Year	India	Singapore	Spain	Czech Republic	USA	Germany
1991	NA	23.73	-1.32	NA	NA	-0.66
1992	0.25	20.39	-1.33	NA	-1.30	-0.55
1993	0.08	14.33	-0.59	10.38	-0.88	-0.57
1994	0.21	13.05	-1.12	11.77	-0.57	-0.44
1995	0.28	12.05	-1.10	11.68	-0.74	-0.56
1996	0.20	10.91	0.41	11.80	-0.94	-0.70
1997	0.46	11.26	0.11	12.41	-0.89	-0.85
1998	0.65	12.39	0.45	14.64	-1.01	-0.94
1999	0.50	10.35	0.13	12.85	-0.79	-1.04
2000	0.58	10.23	0.43	13.50	-0.89	-1.07
2001	0.92	9.27	0.59	11.10	-1.04	-1.06
2002	1.00	8.45	0.87	11.03	-0.93	-1.15
2003	0.95	3.64	1.88	9.06	-1.01	-1.17
2004	0.76	4.97	2.10	7.22	-0.94	-1.01
2005	0.46	5.81	2.61	7.48	-0.98	-0.89
2006	0.40	6.44	4.25	7.59	-0.95	-0.79
2007	1.09	5.87	4.22	6.21	-0.89	-0.92
2008	0.53	6.82	4.30	6.06	-0.69	-0.77
2009	0.30	6.93	8.77	5.82	-0.70	-0.71

### 3.7. Constant Market Share Analysis

CMS analysis for India's top five ornamental fish export destinations viz., Singapore, Japan, USA, Malaysia and Germany was performed for 19 years 1991-2009 (Fig. 8). The results revealed that Indian ornamental fish was not very competitive in markets like Singapore and Malaysia which formed a bulk 56 percent for total exports

Singapore and Malaysia the major Indian destinations showed negative competitiveness effect, positive market effect as well as growth effect. This shows that India does not have any

competitiveness effect in these two destinations on its own but rather India's export to Singapore and Malaysia was increasing due to growth in world ornamental fish export and also due to increased demand in these two destinations. However, USA, Japan and Germany showed significant competitiveness effect. USA especially showed positive competitiveness effect with strong negative growth as well as negative market effect. The export from India to USA was mainly driven by India's competitiveness alone. Thus USA can be a major destination for Indian ornamental fishes and

requires emphasis.

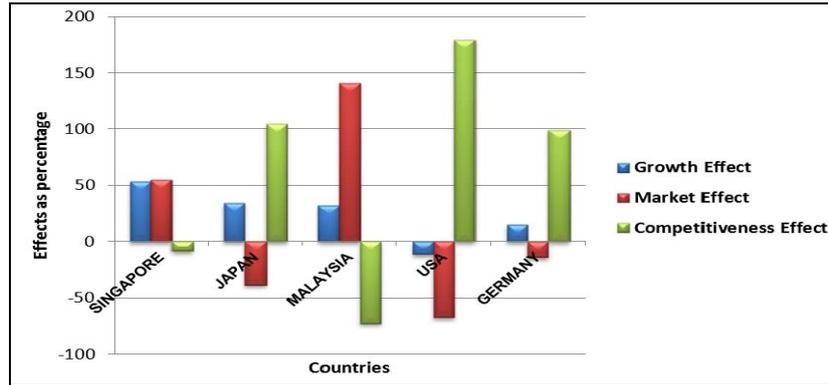


Fig 8: Constant Market Share analysis (CMS) of India’s top destinations, 1991-2009.

**3.8. Determinants of Indian ornamental fish exports:**

In order to identify the determinants of ornamental fish exports of India, regression analysis was carried out for time series data of 19 years, 1991-2009 (Table. 2). Major factors which determine ornamental fish trade from India were world volume of ornamental fish exports, world price of ornamental fish excluding India and also exchange rates (US\$/Rs.) existing during the export. These factors jointly explained 71 percent of the total variation in ornamental fish exports from India. The coefficients for all the variables except exchange rates were statistically significant. Thus exchange rate does not play any significant role in ornamental fish export from India.

Export price of Indian ornamental fish was negative which reveals that as price of Indian ornamental fish increases the export decreases and vice versa. Therefore, in order to promote trade there is a need to promote efficient production of ornamental fishes at low cost, which can be achieved by adoption of improved technologies, better management practices, new techniques for mass production of fish species, increased quality assurance as well as more investment in the sector. As world ornamental fish exports increased, Indian ornamental fish exports also increased. This again shows that world trade has significant impact on Indian ornamental fish trade.

Table 2: Determinants of Indian ornamental fish exports.

Items	Coefficients	Standard error
Constant	-10.190*	4.264
World ornamental fish exports (volume)	1.332*	0.521
Export price of Indian ornamental fish	-0.918*	0.312
World price except Indian price	1.656*	0.691
Exchange rate	2.873	1.764
Dependent Variable (Y): Indian ornamental fish exports (volume)		

\*indicates level of significance at 5 percent. R<sup>2</sup> value was 0.7.

**4. Conclusion**

The present study attempts to explain the export performance of Indian ornamental fish trade and its competitiveness in International market. The countries namely Singapore, USA, China Hong Kong SAR, Malaysia and Japan were India’s top five destinations which accounted for about 70 percent of the total export of ornamental fish from India. RCA values of India showed a fluctuating trend which may be due to high dependency on wild capture rather than culture for the export. Countries like Germany, China HK SAR had same condition like India in the previous years but now they are in far better position. The unit value realisation was high for India which shows strong sign of competitiveness existing in the sector. India has fewer imports and increasing export thus leading to positive trade advantage and is progressing consistently. Examining the top five destinations of Indian ornamental fish exports, it can be concluded that India should concentrate more on USA, Japan and Germany where it has gained a high level of export competitiveness rather than following old trend

of exporting to Singapore and Malaysia where it has lost its competitiveness. There has been significant improvement in export of ornamental fish from India and this positive development will encourage more trade, livelihood, self-employment, rural development and foreign exchange in the years to come.

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