Research Article

Export performance of chilled fish from India

■ **J. DAVID, V.N. NAYAK AND G.S. MAHADEVAIAH**

SUMMARY : Chilled fish is one of the largest export products among chilled items, one of the 12 major export item groups of marine products from India. The export performance of chilled fish in the post liberalisation period 1995-2008 was analysed by studying the graphical trend, percentage contribution, compound growth rate analysis, instability index and direction of trade. The decline of Singapore as the bulk purchaser, the emergence of a number of smaller markets, and the increase in total export quantities were the dominant features of the trade in chilled fish. Growth rate of Singapore in export quantity and export real value was negative and was significant. Growth of Thailand in export quantity and value was moderate and significant. Stability in export quantity was lower for U.A.E., higher for Canada and moderate for Singapore, Thailand and Hong Kong. Considering direction of trade, Thailand showed only a moderate probability (0.3690) of market retention while Singapore had probability of becoming unstable.

BACKGROUND AND OBJECTIVES

Chilled seafoods are the natural second preference, after fresh seafoods, of consumers in all countries. Chilled seafood items are ofter labelled as never frozen to state that these products are not previously 'frozen products' now thawed for sale. These products are closest in freshness and quality to landed catch. They are also the lowest by way of cost of production. However, their method of preparation and holding necessitates that they are dispatched by the fastest transport, which most times means air transport - the costliest - thereby adding to the final cost of product. The realization that fresh/chilled seafood was a profitable cargo for airlines, their competition and consequent cheaper freight rates, coupled with high frequency of operation of wide body passenger-cargo jets with non stop flights to distant places made air shipment of fresh/chilled seafood economical.

These developments in aviation, the advent of liberalization, and the improvements in packaging and transportation of fish have now made chilled/fresh seafood items a familiar item in food outlets world wide. The items are generally chilled in ice after catch, washed and packed after landing at a fish processing centre. The recommended practice is to pre chill fish (0^0C) and then pack in layers with gel ice packs in polythene bags which are then sealed within tight fitting (wet-lock) 3.8 inch styrofoam boxes. The lids of the boxes are sealed with tape to prevent leakagae and the boxes strapped for handling. Styrofoam boxes of about 50-55 kg capacity that will hold 25-30 kg fish with ice are used. Crushed ice, flake ice and other forms of wet ice were used where, gel ice was too expensive, and if acceptable to the carrier. Dry ice may also be used but was costly and needed to be declared to the carrier. These boxes can maintain fish quality and temperature for 21 hrs, but may be extended to as long as 48 hrs when kept and transported under low temperature condition (below +5^0C). Cold chain facilities are required to maintain safety and quality of seafood. The fishes may be re-iced after receiving to maintain temperature and quality. A questionable practice by some operators to maintain quality is for fish to be frozen and then packed in ice so that the fish is in chilled condition

Author for correspondence :

J. DAVID
Department of Marine Biology, Karnataka University Post-Graduate Centre, Kodibag, KARWAR (KARNATAKA) INDIA
Email: jamesdavid2005@yahoo.co.in

See end of the article for authors' affiliations

on arrival.

Chilled seafood items are sent from India to countries as far as Japan in the east and U.S.A in the west, and to Russia in the north and Australia in the south which is an indication of their demand and preference. The U.K., Spain, France and Germany are some of the major EU countries where chilled seafood from India are sent. The shipments are mostly sent by air and each airline and importing country has their own guidelines and regulations to be adhered, as for example found in APEC (1999). In India, the Export Council of India (EIC) issues the guidelines and regulations, and a certificate from its organ - the Export Inspection Agency (EIA) is a requirement for shipment (EIC 2012 a and EIC 2012 b).

Chilled fish export item refers to a group of various high value fish packed in ice for transport immediately after landing. Varieties of fish such as snappers, reef cod and similar high value fishes exported in chilled form are tracked separately by MPEDA. The export performance of chilled fish in the post liberalisation period 1995-2008 was analysed by studying the graphical trend, percentage contribution, compound growth rate analysis, instability index, and direction of trade.

RESOURCES AND METHODS

Secondary data was used in the present study. The data on destination-wise export quantity and value of chilled fish was compiled from the publication "Statistics of Marine Products Exports" for several years, published by the Marine Products Export Development Authority (MPEDA), (Ministry of Commerce and Industry, Government of India,) Kochi. The export real values were obtained by deflating nominal values by the wholesale price index. Data was available for the post liberalisation period 1995-2008 and analysis was conducted for the following:

Graphical trend in export quantity and export value:

A graphical plot of the export quantity and export value against time (years) for the leading countries was used to ascertain the general trend in export of chilled fish. The graphical trend of chilled fish against the parent major export item group chilled items was also examined.

Percentage contribution to export quantity and export value:

The simple average of the export quantity and value for the time periods considered for chilled fish was used to get the share percentage of the leading countries exported to. The total period 1995-2008 was considered as post lib period and the period 2004-2008 as the recent period. The share of chilled fish to the parent major export item group of chilled Items was also examined.

Compound growth rate in export quantity and export value:

The growth of exports to the 12 major export item groups was analyzed using the exponential growth function of the form,

$$Y = ab^t e^u \qquad \text{......(1)}$$

where, y = dependent variable for which growth rate is to be estimated (quantity exported and value realized); a = intercept; b = regression coefficient; t = time variable; e = error co-efficient, and u = disturbance term.

The compound growth rate was obtained from the logarithmic form of the equation (1) as follows:

$$\text{Log } y = \text{Log } a + t \text{ Log } b \qquad \text{......(2)}$$

Thus, the per cent compound growth rate (g) was computed using the relationship:

$$g = (\text{Antilog of } b - 1) \times 100 \qquad \text{.......(3)}$$

A total of forty seven countries had a record of purchase of chilled fish between 1995 and 2008. Thirteen countries were identified as large and regular buyers and selected for analysis.

Instability index in export quantity and export value:

In order to study the variability in the export quantity and export value of Chilled Fish exported over the years, an index of instability was developed as a measure of variability. The formula suggested by Cuddy and Della Valle (1978) was used to compute the degree of variation around the trend, *i.e.*, the co-efficient of variation was multiplied by the square root of the difference between the unity and coefficient of multiple determinations (R^2) to obtain the instability index.

$$\text{Index instability} = \frac{\text{Standard deviation } (\dagger)}{\text{Mean } (X)} \times 100 \times \sqrt{1 - R^2} \quad \text{..(4)}$$

where, R^2 = Co-efficient of determination

A high degree of instability index signifies large variations in the export of chilled fish. The same thirteen countries selected for growth rate study were analysed for instability.

Direction of trade in export quantity for the period 2004-2008:

In the present study, the changes in the export of chilled fish to different countries were analyzed by employing a first order finite Markov chain model which captures the net effect in changes in the exports of the marine product over a period of time. Markov chain analysis involves developing a transitional probability matrix 'P' which is central to the method. The matrix has elements, P_{ij}, which indicate the probability of exports switching from country 'i' to country 'j' over time. The diagonal element P_{ij}, where, i=j, measures the probability of a country retaining its market share or in other words the loyalty of an importing country to a particular country's exports.

The assumption was that the average export of chilled

fish marine product from India among importing countries in any period depends only on the export in the previous period and this dependence is same among all the periods. This is algebraically expressed as:

$$E_{jt} = \sum_{j=1}^{n} [E_{it} - 1] P_{ij} + e_{jt} \qquad ...(5)$$

where,

E_{jt} = exports from India to the jth country during the year t.

E_{it-1} = exports to ith country during the period t-1.

P_{ij} = probability that the exports will shift from ith country to jth country.

e_{jt} = the error term which is statistically independent of E_{it-1}

t = number of years considered for the analysis

n = number of importing countries

The transitional probabilities P_{ij} can be arranged in a (columns x rows) matrix and have the following properties:

$$\sum_{j=1}^{n} P_{ij} = 1 \text{ for all i; and } 0 = P_{ij} = 1$$

There are several approaches to estimate the transitional probabilities of the Markov chain model such as un-weighted restricted least squares, weighted restricted least squares, Bayesian maximum likelihood, unrestricted least squares, *etc.* In the present study, Minimum Absolute Deviations (MAD) estimation procedure was employed to estimate the transitional probability, which minimizes the sum of absolute deviations. The conventional linear programming technique was used, as this satisfies the properties of transitional probabilities of non-negativity restrictions and row sum constraints in estimation.

The linear programming formulation is stated as

Min OP* + Ie

subject to: XP* + V = Y; and GP* = 1 and P* = 0

where,

0 - is the vector of zeroes,

P* - is the vector in which probability P_{ij} are arranged.

I - is an appropriately dimensioned vector of areas.

e - is a vector of absolute errors.

Y - is the vector of export to each country.

X - is the block diagonal matrix of lagged values of Y

V - is the vector of errors

G - is the grouping matrix to add the row elements of P arranged in P* to unity.

Direction of trade was examined only for the variable export quantity using the annual data of chilled fish exports. Direction of trade analysis was conducted for 12 selected countries for 5-year term in the post-lib 2004-2008 period. The major importing countries considered were selected based on average export quantity for the period under study. Based on this average, the top twelve purchasing countries for the stated period were selected and arranged in descending order of tonnage purchased. Of the 13 major buyers, Japan, Maldives and Oman/Muscat were excluded from analysis of direction of trade, and the minor markets of Taiwan and France with larger purchases in the period 2005-2008 were included for a total of twelve countries. Eleven countries made no purchase between 2004 and 2008. Twenty four minor countries were grouped as 'others countries'.

OBSERVATIONS AND ANALYSIS

The results obtained from the present investigation have been discussed in the following sub heads:

Graphical trend in export quantity and export value:

The decline of Singapore as the bulk purchaser, the emergence of a number of smaller markets, and the increase in total quantities are the dominant features of the trade in chilled fish as revealed by the graphical trend (Fig. 1 a). Singapore was the dominant country till 2003 buying the bulk of the production of chilled fish. Singapore had a maximum purchase of 878.9 tons for the maximum nominal value of Rs.176.9 millions in 2001, which was also the maximum for any country. Export quantity to Singapore then declined to 18.5 tons in the year 2004 and was only 51.1 tons in 2008. The rise in exports to Thailand and fall from 2006 is another striking feature. The revival of Taiwan market from the year 2006 offset the fall of exports to Singapore and Thailand. Taiwan was a large buyer over the period 2004-2008 with maximum export quantity of 325.5 tons and nominal export value of Rs.71.9 millions in 2008. Russia, France. Turkey and Sri Lanka were important minor buyers for the period. Thailand steadily increased purchases till 2007, when Canada has taken over. After 2004, India had almost lost the Singapore market. Total quantities increased over the period but fell over the period 2006-2008 the decline being marginal from its maximum of 2,809.3 tons in year 2007. The trend in export real value can be seen in Fig. 1 b, the pattern being similar to that in export quantity.

Percentage contribution to export quantity and export value:

The results of percentage contribution analysis revealed that in the post lib period, Singapore took a quarter share (25%) of the production in export quantity, with a smaller share being taken by Thailand (14%) (Fig. 3). Smaller market shares were taken by Hong Kong (9%), U.A.E., (8.3%), Canada (7.9%) and Switzerland (7%). The U.K., Kuwait, Germany, Japan, Malaysia, Maldives, Oman/Muscat were comparatively minor markets. Considering recent period 2004-2008 alone, the share of Singapore has declined drastically in quantity (4.9%) and value, the position being taken by Thailand (18%) and Canada
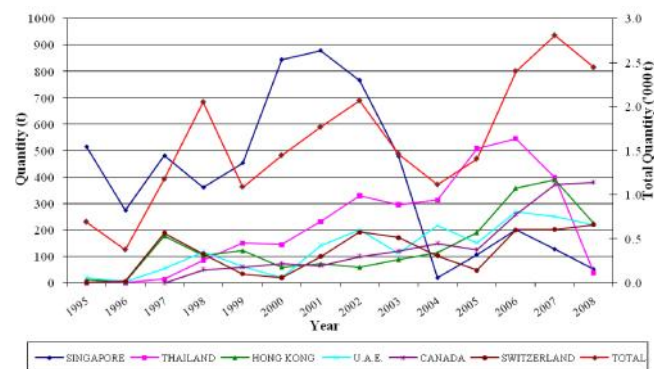
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Table 1 : Chilled fish: growth rate and instability index for export quantity (kg) and export value (Rs.) for the post lib period 1995-2008

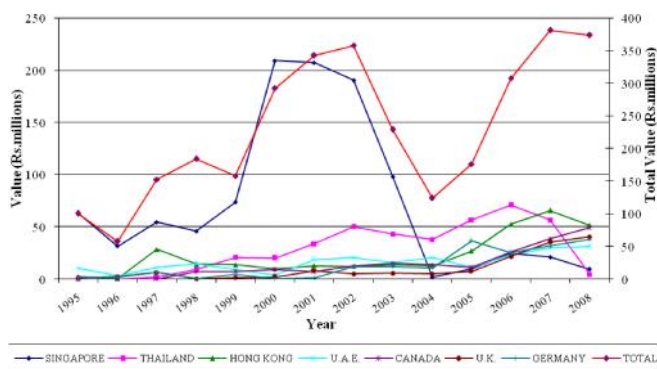| Country	Export quantity		Export real value		Export nominal value	
	Growth rate (%)	Instability index (%)	Growth rate (%)	Instability index (%)	Growth rate (%)	Instability index (%)
Singapore	-14.77**	58.49	-13.82*	6.78	-9.44NS	95.81
Thailand	55.47***	61.47	52.08***	11.69	59.82***	63.18
Hong Kong	25.23***	56.94	25.15***	4.98	31.52***	61.25
U.A.E.	25.21***	41.91	12.20***	3.03	17.91***	42.15
Canada	161.65**	81.70	106.94***	23.61	200.78**	98.77
Switzerland	27.91***	52.57	21.75***	5.49	27.93***	51.70
U.K.	30.67***	69.69	28.75***	5.00	35.30***	75.13
Kuwait	28.95***	41.50	22.19***	4.34	28.40***	61.79
Germany	33.69***	51.58	33.91***	6.35	40.72***	67.20
Japan	-9.04NS	108.75	-8.60NS	9.23	-3.96NS	109.37
Malaysia	14.29**	90.66	17.31**	5.66	23.27***	89.20
Maldives	201.35**	73.146	82.20*	37.92	287.97**	71.03
Oman/Muscat	14.96NS	120.83	6.52NS	29.95	22.44NS	130.00
Others	5.131NS	135.41	2.38NS	6.12	7.59NS	119.8
Total	9.82***	30.24	9.63***	2.17	15.21***	35.01

*, ** and *** indicate significance of values at P=0.05, 0.01 and 0.10, respectively

(13%).
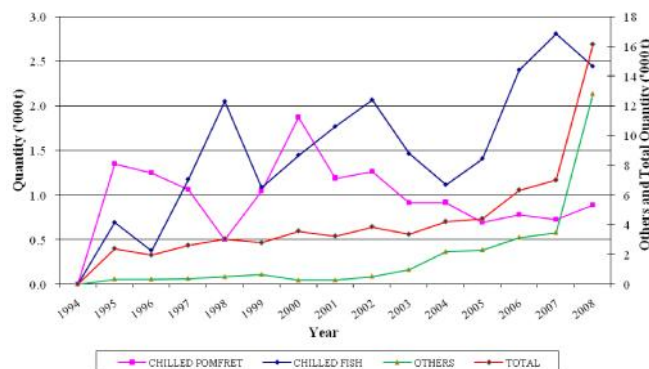
In terms of real value in the period 1995-2008, the value

realization from Singapore was relatively higher to quantity (Fig. 4). In the recent period 2004-2008, the value contribution

(a) Chilled fish : Export quantity

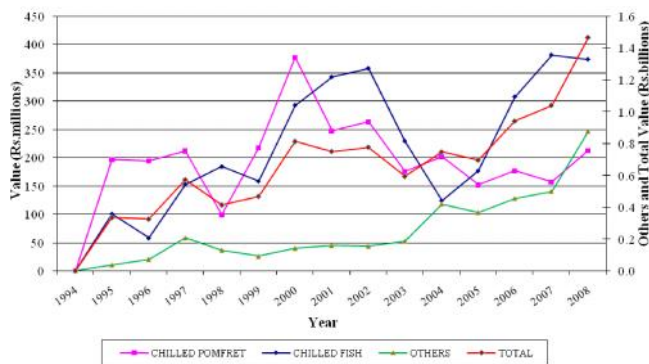

(a) Chilled items : Export quantity

(b) Chilled fish : Export real value

Fig. 1 : Chilled fish: (a) export quantity (tons) and (b) export real value (Rs.millions) for major countries for the post lib (total) period 1995-2008

(b) Chilled items : Export real value

Fig. 2 : Chilled items: (a) export quantity (tons) and (b) export real value (Rs.millions) for the total period 1994-2008

of Germany was double (10%) that taken in quantity (5%) probably due to imports of high valued fish, whereas Canada showed lower value realization.

Considering the trend and contribution in the present study, it is seen that the large market of Singapore has diminished in recent period. The major market for chilled fish was Singapore, followed by Thailand, Hong Kong and U.A.E for the total post lib period. In the recent period 2004-2008 alone, Thailand, Canada, Hong Kong and U.A.E. were the major buyers, with Singapore taking only a minor share. The maximum export quantity of chilled fish was 2,809 tons in the year 2007. The unit (nominal) value of realization was Rs.189.12 in year 2008 for chilled fish, which is low in comparison to domestic market value of high priced fish such as white pomfret and seerfish, which would have cost a minimum of Rs.350 per kg. This implies that medium value fishes in size or quality were part of the export basket of chilled fish. Total global imports of chilled fish and seafood into Singapore were about 81,357 tons in 2006 (SEAFISH, 2008). It is also well known that more than 60 per cent of India's seafood exports to South East Asia are further processed and exported. Infosa (2010) reported arrival of significant amounts of fresh/chilled (air-flown) fish to EU, imported from South Asian countries including India which had increased its exports from 517 tons

to 799 tons during 2007-08. However, the major supplier of fresh/chilled fish to EU was Norway with chiefly salmon and trout.

**Compound growth rate in export quantity and export value:**

The dominant country Singapore showed a drastic drop in growth rate of Chilled Fish in export quantity reaching a low of -14.77%. (Table 1). The next leading country Thailand showed only moderate growth (55.47%) due to fall in imports after 2006. Maldives showed the highest growth rate (201.35%), while Canada had high growth (161.65%), and modest growth was seen in Hong Kong (25.23%) and U.A.E (25.21%). The growth in total countries was low at 9.82%. Rates were significant for all except Japan, Oman/Muscat, and others.

Singapore also showed a negative growth rate (-13.82%) in export real value (Table 1). Canada (106.94%) showed the best growth rates in export real value, followed by Maldives (82.20%) and Thailand (52.08%). Rates were significant for all except for Japan, Oman/Muscat, and 'Others', similar to that for export quantity. Growth rate of chilled fish in total export real value was low (9.63%) and significant, similar to that in export quantity.
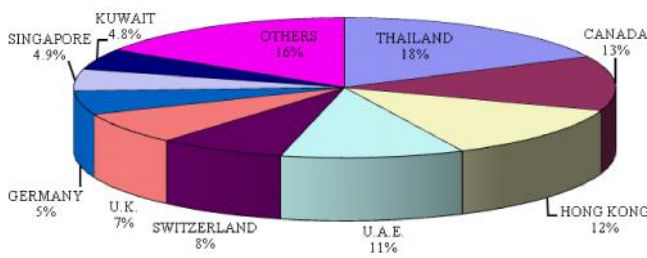
The present total quantities exported are low and measures must be taken to develop larger quantities to be
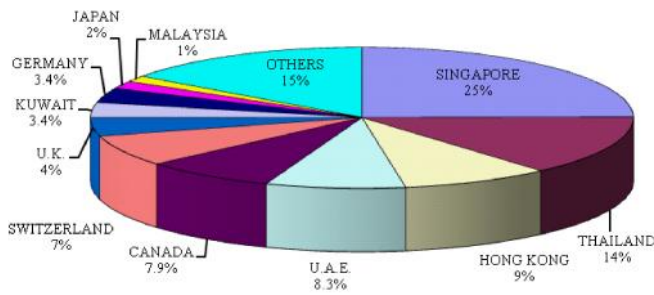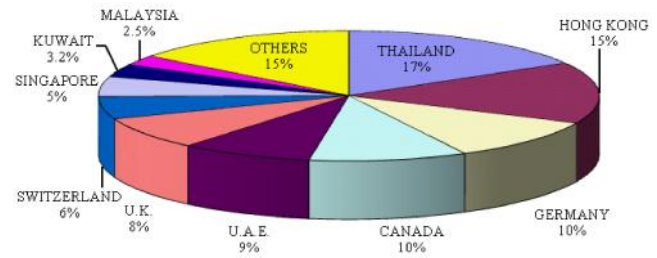

(a) Chilled fish : Export quantity
average post lib period 1995-2008
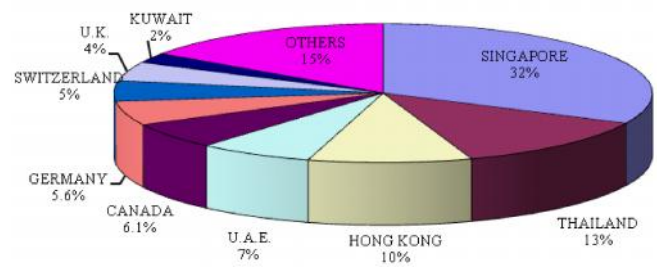
(a) Chilled fish : Export real value
average post lib period 1995-2008

(b) Chilled fish : Export quantity
average 2004-2008

(b) Chilled fish : Export real value
average 2004-2008

Fig. 3 : **Chilled fish: percentage share in export quantity (tons) for major countries for (a) post lib period 1995-2008 and (b) recent period 2004-2008**

Fig. 4 : **Chilled fish: percentage share in average export real value (Rs.millions) for major countries for the (a) post lib period 1995-2008 and (b) recent period 2004-2008**

Table 2 : Chilled fish: direction of trade – transitional probability matrix for export quantity (kg) for the post lib period 2004-2008

Country	Thailand	Canada	Hong Kong	U.A.E.	Switzerland	U.K.	Taiwan	Germany	Singapore	Kuwait	Malaysia	France	Others
Thailand	0.3690	0.0000	0.2761	0.1416	0.0000	0.0000	0.0000	0.0098	0.2009	0.0000	0.0026	0.0000	0.0000
Canada	0.0000	0.0539	0.0000	0.1781	0.0000	0.3683	0.0000	0.3997	0.0000	0.0000	0.0000	0.0000	0.0000
Hong Kong	0.0000	0.5278	0.0000	0.0000	0.0000	0.0228	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.4495
U.A.E.	0.8716	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0300	0.0983	0.0000	0.0000	0.0000	0.0000
Switzerland	0.0000	0.0000	0.3551	0.1185	0.0000	0.0000	0.0000	0.0000	0.0000	0.5264	0.0000	0.0000	0.0000
U.K.	0.0000	0.8571	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.1429	0.0000	0.0000	0.0000
Taiwan	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Germany	0.0000	0.0000	0.4444	0.3674	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.1881	0.0000	0.0000
Singapore	0.0000	0.0000	0.1043	0.0000	0.6948	0.0883	0.0000	0.0000	0.0000	0.0000	0.1126	0.0000	0.0000
Kuwait	0.0000	0.0189	0.0000	0.2912	0.5752	0.0000	0.0000	0.0984	0.0000	0.0163	0.0000	0.0000	0.0000
Malaysia	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
France	0.0000	0.0000	0.0000	0.0418	0.0000	0.9582	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Others	0.0000	0.0000	0.0000	0.0514	0.0000	0.0000	0.6712	0.0000	0.0000	0.0000	0.0000	0.2774	0.0000

shipped. Efforts must be taken to address the fall in Singapore market and to regain it. The nearby markets of Thailand in South East Asia, and U.A.E. in the Middle East may be targeted for higher sales. Thailand (Bangkok), Malaysia (Kuala Lumpur), Singapore, and Abu Dhabi and Dubai serve as regional hubs for airlines, facilitating exports.

Instability index in export quantity and export value:

Instability in export quantity was lowest for total countries (30.24%) (Table 1). The rest of the countries showed moderate to high instabilities. The major markets were unstable as seen in the index for Singapore (58.49%), Thailand (61.47%), Hong Kong (56.94%) and U.A.E. (41.91%). The index in quantity was higher in case of Canada (81.70%). Instability in real value was moderate only for U.A.E. (39.03%) and total countries (34.73%). Rest of the countries had high instability in real value. Though total quantities show an upward trend from 2004, the general picture is of moderate to high instability in exports. Measures to maintain regular and steady exports with long term view, avoiding wide variations over the years should be pursued.

**Direction of trade in export quantity for the period 2004-2008:**

The leading markets in the period 2004-2008 were Thailand, followed by Canada, Hong Kong, U.A.E., Switzerland and U.K. The major buyer for the total period, Singapore, was unstable in retention of market share as shown by the transisitional probability matrix (Table 2). Only Thailand showed some stability with moderate probability of market share retention (0.3690), loss to Hong Kong (0.2761) and Singapore (0.2009), but high probability of gain from U.A.E (0.8716). Canada (0.0539) and Kuwait (0.0163) were unstable with low probabilities of market retention. Taiwan had full

probability of market retention but the volumes involved were lower. The rest of the countries were totally unstable. Average quantities to Thailand were about 18 per cent (361 tons) of the period's average annual total, while that for Singapore was 5 per cent (101 tons).

Canada had probabilities of switching market share to U.K. (0.3683) and Germany (0.3997), and of market share gains from Hong Kong (0.5278) and U.K. (0.8571). Hong Kong had fair probability of switching share to Canada (0.5239) and Others (0.4495), with chance of gains from Thailand (0.2761), Switzerland (0.3551) and Germany (0.4444). Thailand had a probability of gain from U.A.E., while U.A.E. had moderate to low probability of gain from several countries. Others was unstable with probability of loss to Taiwan (0.6712) and of gain from Hong Kong (0.4495). Apart from Oman/Muscat and Russia, the important minor markets among Others for the period were Turkey and Sri Lanka. Market promotion efforts to the promising markets of Thailand, Canada, Hong Kong, Kuwait, and U.A.E. should be taken up to step up exports. Measures should also be taken to regain the market of Singapore.

**Comparison of chilled fish exports to chilled items major item group:**

The export of chilled fish was examined in relation to the parent major export group chilled items. There were 53 varieties of chilled items being exported from India in 2008 (MPEDA, 2011). There was a gradual diversification in products under this major group over the years. As many as 37 chilled items were listed in year 2005, 25 items in 2003, 19 items in 2002, 5 items in 2001and 1999, and only 1 item in 1994. The first record, and only record of export of chilled items in the pre-lib period before 1995 was of export of chilled lobster for the year 1994. There were no exports of chilled items in previous years. This
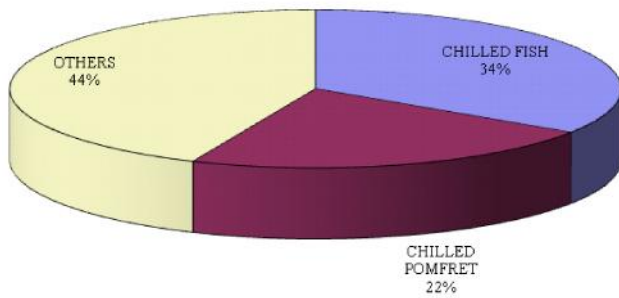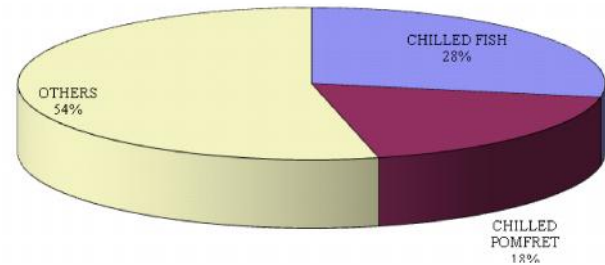
(a) Chilled items : Export quantity
average total period 1994-2008
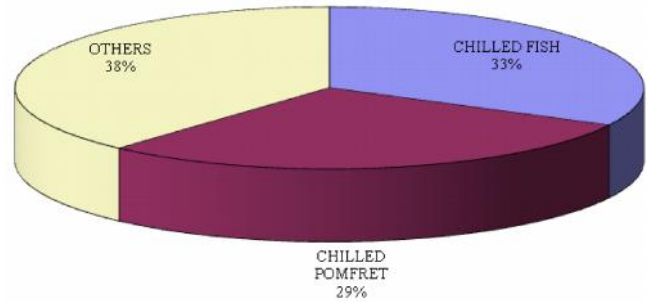
(a) Chilled items : Export real value
average period 1993-2008
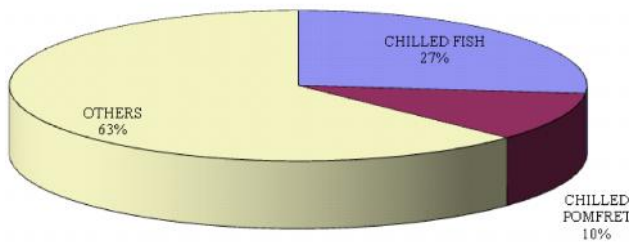
(b) Chilled items : Export quantity
average 2004-2008

(b) Chilled items : Export real value
average 2004-2008

Fig. 5 : Chilled items: percentage share in average export quantity (tons) for the (a) total period 1994-2008 and (b) recent period 2004-2008

Fig. 6 : Chilled items: percentage share in average export real value (Rs.millions) for the (a) total period 1994-2008, and (b) recent period 2004-2008

first export in 1994 of chilled lobster was to Sri Lanka, Oman/ Muscat and Kuwait of a total of 3,321 kg (nominal) valued at Rs.773,256. Chilled fish was recorded as an export item only from 1995. Chilled fish has since become a major item. Chilled pomfret was another major item of the export group chilled items.

Total exports of chilled items major group continuously increased in quantity from 1994 and reached a maximum of 16,172 tons in 2008, with a real value of Rs.1.46 billion (Fig.2). Chilled fish export was maximum at 2,809 tons in year 2007 (real) valued at Rs.381 million. Others (51 items listed as per MPEDA yearbook 2008 excluding selected items chilled fish and chilled pomfret) has increased steadily from the year 2001 to reach 12,839 tons in 2008 (real) valued at Rs.878 million.

Chilled fish contributed a third (34%) of the share to average total quantities of chilled items group, with chilled pomfret at 29 per cent and the major share from others (44%) (Figs. 5 and 6). The share of others has increased (63%) in the recent period, implying entry of new species, new products, and also diversion of raw material from present products to newer items.

Egenes *et al.* (2011) reported that in new developed practices, previously frozen fish was now the major raw material in chilled seafood in all the major British retailers, and there

was no price difference whether the fish was genuinely fresh or previously frozen. Thawed products with various labels such as refresh, "mise en frais", chilled, defrosted, "frozen from fresh" or any other fancy name given by the marketing departments were sold as chilled products. Prior to 2005, these products had been clearly labelled "fresh" or "fresh, never frozen". They reported the existence of similar mis-labelling for previously frozen Vietnamese pangasius fillets in France. In order for Indian exports to maintain achieve a high price, Chilled fish exports should be marketed under a strong brand suggesting reliability in labelling and quality.

With a view to boost the export of chilled fish items and increase its share in total exports, MPEDA provides financial assistance for creation of basic facilities (new) for chilled fish for export (MPEDA, 2008).

Conclusion:

Chilled fish is one of the diversification products produced in the post liberalisation period. Chilled fish for exports should be of prime quality, iced and packed in the shortest possible time after catch, taking utmost care for safety and quality. Efforts to regain the markets of Singapore, Thailand and Hong Kong should be taken up by investigating the causes and addressing them. The promising markets of

U.A.E., Canada, Germany, and Switzerland should be pursued. The total quantities being exported are very small and measures should be taken up to boost exports of chilled fish.

Authors' affiliations :

V.N. NAYAK, Department of Marine Biology, Karnataka University Post-Graduate Centre, Kodibag, KARWAR (KARNATAKA) INDIA

G.S. MAHADEVAIAH, Department Agricultural Economics, University of Agricultural Sciences, G.K.V.K., BENGALURU (KARNATAKA) INDIA

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