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Product Diversification and Promotion of Value Added Sea food Products

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Introduction

There has been considerable structural change in the seafood processing and export industry for the last few years. There is a growing demand for "ready to cook" or "ready to serve" type seafoods, hygienically prepared and attractively packed convenience foods to match the changing needs of urban population. The seafood processing and marketing has become competitive all over the world and exporters are switching over to value addition to increase profit. Value addition is the most talked about word in the fish processing industry because of the possibility of better realization of foreign exchange earnings and high unit value. Any additional activity that changes the nature and form of the product, and increases its sales value, is regarded as value addition. The processing of value added products require improved harvest and post harvest technology. Fish being the cheapest animal protein, diversified processing coupled with the promotion of value added products in marketing is essential to minimize post harvest losses and to obtain optimum profit.

Fish and fishery products recorded the highest increase in price both in the domestic and export markets in recent years compared to any other food items. However the growth and development of fisheries sector is currently almost entirely depending on the export market performance. Globalization has further intensified competition among countries to capture this lucrative market. Product differentiation coupled with stringent quality controls and promotion of diversified value added products might immensely help us to face this severe competition and retain our position. Further the enormous potential of our domestic demand should be explored and exploited through parallel development of internal fish marketing system for maintaining sustainable growth. In this context an overall review of marine fish marketing pattern, seafood export market structure, commercial importance of major diversified value added products, economics of value addition in the marketing process and quality control aspects to provide necessary information are discussed in detail for evolving an appropriate marketing policy.

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Materials and methods

Both primary and secondary data has been collected and utilized for the study. Data on the landing, wholesale and retail prices of all commercially important marine fish at selected major centres along the coast covering all seasons have been regularly collected by the Socio- Economic Evaluation and Technology Transfer Division (SEETTD) of Central Marine Fisheries Research Institute (CMFRI). Primary data on the composition and price structure of value added products have been further supplemented from selected medium scale processing units located in and around Cochin during November 2001- March 2002.

The secondary data from various publications of Marine Products Export Development Authority (MPEDA) , Central Institute of Fisheries Technology (CIFT), Matsyafed and Integrated Fisheries Project (IFP) are also used for the study.

Increase in domestic price and gross value of marine fish

The export of fisheries products is highly dependent on the price fluctuation and thereby the market prospects. The fishermens' share in consumers rupee is the best index to measure the efficiency of the fish marketing system. At all India level, it ranges from 30% to 68% for different varieties of marine fishes in the domestic market. The gross revenue generated from marine fisheries at landing centre level is estimated at Rs. 10,486crores during the year 1999-2000 (Table 1). At the landing centre or primary market the Crustaceans fetch about Rs. 4,733 crores, Cephalopods Rs. 781 crores, Perches

Rs. 692 crores and the remaining by other varieties. The value of fish at final sales works out to Rs.17,861 crores. The marketing margins including the marketing cost is Rs. 7,375 crores. Although the landings of shrimp contribute about 16.8 % of the total, it fetches about 46% of the gross earnings at first sales and 51.5 % of the revenue at final

Table. 1 Value of fish at first and last sales in India (1999-2000)

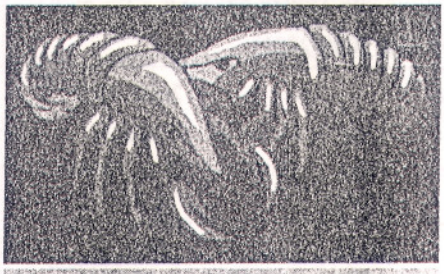
Species	Total Catch (Tonnes)	Primary market		Retail market (Domestic)	
		LP/Kg (RS)	Value (Rs. millions)	RP/Kg (RS)	Value (Rs. millions)
ELASMOBRANCHS	72963	35	2553.70	40	2918.52
EELS	9187	43	395.04	50	459.35
CATFISHES	58332	18	1049.97	31	1807.98
CLUPEIDS	647006	15	9705.09	30	19410.18
BOMBAY DUCK	97548	11	1073.02	23	2243.60
LIZARD FISHES	26714	14	373.99	27	721.28
H & FULL-BEAKS	7316	22	160.95	27	197.53
FLYING FISHES	2377	17	40.40	31	73.68
PERCHES	216216	32	6918.91	46	9945.94
GOATFISHES	15627	13	203.15	24	375.05
THREADFINS	9195	23	211.48	50	459.75
CROAKERS	180723	23	4156.63	50	9036.15
RIBBON FISHES	182386	25	4559.65	32	5836.35
CARANGIDS	110734	25	2768.35	29	3211.28
SILVERBELLIES	49384	12	592.60	25	1234.60
B.J.JUMBER	6179	40	247.16	57	352.20
POMFRETS	38171	80	3053.68	94	3588.07
MACKERELS	134556	23	3094.78	33	4440.34
SEER FISHES	50375	81	4080.37	96	4836.00
TUNNIES	54001	22	1188.02	30	1620.03
BILLFISHES	3570	16	57.12	35	124.95
BARRACUDAS	18299	29	530.67	40	731.96
MULLETS	6546	36	235.66	45	294.57
UNICORN COD	492	5	2.46	12	5.90
FLAT FISHES	52170	20	1043.40	24	1252.08
CRUSTACEANS	455144	104	47334.98	200	91028.80
CEPHALOPODS	111544	70	7808.08	85	9481.24
MISCELLANEOUS	83509	17	1419.65	35	2922.81
Total	2700264	38.83	104859.02	66.15	178610.21

LP/Kg - Landing Centre price per Kg
RP/Kg - Retail price per Kg
Source1 : ANNUAL REPORT(2000-2001),CMFRI
Source2 : SEETTD,CMFRI

stage. The export demand of cephalopods led to its two-fold increase in landings during the last decade due to targeted fishing. In spite of cephalopod landings being only 0.64% of the total, the gross earnings realised is 7% at first sales and, 5.1% at last sales. In general, the price spread of the marine fishes as a whole comes to about 42 percent, which includes the marketing costs.

Status of seafood exports from India vis-à-vis value added products

Seafood exports alone constitute about 3.14% of the gross export earnings of our country. During 2000-2001, India's seafood export earnings have crossed Rs.6400 crores. Though there has been an increase in terms of total quantity of seafood exported and value realized, there was an overall decline in unit value realized per kg during the last few years. This is mainly due to the change in product composition with an increasing trend in finfish component, which fetch comparatively lesser prices. Maximum unit value of Rs.152.74 Kg for our marine product exports was realized during 1998-1999, in spite of a drastic decline in the quantity of total exports (Table 2).



India is the largest supplier of shrimp to Japan in terms of volume during 1999-2000. The export of frozen fish has decreased by 5.21% in quantity and 23.64% in value than the previous year.

The leading markets for our seafood products are Japan, member countries of European Union, USA, China, South East Asia and the Middle East countries. The export pattern of marine products to different countries and the unit value realised by different countries from the seafood export is given in Table-3.

India is the largest supplier of shrimp to Japan in terms of volume during 1999-2000. The export of frozen fish has decreased by 5.21% in quantity and 23.64% in value than the previous year, whereas items like *surimi* and seafood mix have registered a considerable growth. Though export to Japan was steady for the last few years, the signs of decline were witnessed from 1998; which was to the tune of 0.43% in quantity and 3.83% in terms of forex earnings (Anon, 2001). The increase in demand for cephalopods in European market due to the low *Loligo* catch world over led to diversions of cargo to European market by Indian exporters

European Union is the second largest market for our marine products. During 1999-2000 there was a considerable increase in export to Europe. The European Union together lifted 65,402 tonnes of marine products valued Rs.905.56 crores during this year. During 1999-2000, export to USA has also increased considerably, especially in terms of value. USA used to be the largest importer of peeled products of shrimp. But there has been a shift to the high priced items like headless and

Table 2. Export growth of marine products from India (1995-96 to 2000-2001)

Year	Quantity (Tonnes)	Value (Rs. crores)	Unit value (Rs /kg.)
1995-96	296277	3501.11	118.17
1996-97	378199	4121.36	108.97
1997-98	385818	4697.48	121.75
1998-99	302934	4626.87	152.74
1999-00	343031	5116.67	149.16
2000-01	440473	6443.89	146.29

Source: MPEDA, Cochin.

Table 3: Average Unit value of Indian seafood exports in different countries

Market	2000-2001		1999-2000	
	Unit value (Rs/Kg)	% Export	Unit value (Rs/Kg)	% Export
Japan	371.16	Q 15.7 V 39.7	339.27	Q 2.98 V 12.65
USA	278.9	Q 9.5 V 18.1	211.58	Q 13.92 V 50.18
EU	148.97	Q 15.6 V 15.9	138.5	Q 6.55 V 5.24
China	45.2	Q 41.5 V 12.8	50.8	Q 70.60 V 51.90
Others	110.86	Q 17.8 V 13.4	92.5	Q 23.96 V 48.82
Total	146.3	Q 100.0 V 100.0	149.16	Q 100.00 V 100.00

Table-4: Unit value realized from the export of marine products (1999-2000 and 2000-2001)

Items	1999-2000			2000-2001		
	Quantity (Tonnes)	Value (Rs.Crores)	Unit Value (Rs/Kg)	Quantity (Tonnes)	Value (Rs.Crores)	Unit Value (Rs/Kg)
Shrimp	110275	3645.00	330.56	111874	4481.51	400.59
Fish	131304	537.00	40.92	212903	874.91	41.09
Squid	34918	297.00	84.99	37628	324.43	86.23
Cuttle fish	32799	286.00	87.26	33677	288.99	85.81
Others	33735	352.00	104.07	44391	474.05	106.79
Total	343031	5116	149.16	440473	6443.89	146.29

Source: MPEDA, Cochin.

head on shrimp. The South East Asian countries including China are the largest market for our marine products during 1999-2000, showing a growth of 26.7% by volume and 19.42% in value over the previous year.

Though the export of Indian marine products to Middle East has been growing for the past few years, there was a decline to the tune of 23.16% in volume and 22.21% in value during 1999-2000 than the previous year. A drastic decline in export to countries especially UAE and Bahrain due to the fall in purchasing power of people and the market expansion to Canary Islands, West Indies, Argentina, Democratic Republic of Korea and Brunei is significant development during this period.

Export structure of marine products

In terms of value, frozen shrimp occupies the prime position, and in terms of volume frozen finfish is in top position. Finfishes constitutes about 38% of export quantity as against 32% by shrimp. But shrimp fetches almost 71% of our seafood export earnings..

Table: 5. Shrimp exports in different forms during 1999-2000

Item	Quantity (Tonnes)	Value (Rs. in crores)	Unit Value Rs/Kg
Live	15	0.23	153.33
Chilled	71	2.85	401.41
Dried	203	0.66	32.51
Frozen	110275	3645.22	330.56

Source: MPEDA, Cochin.

Table-6:- Major markets for frozen shrimp and unit value (1999-2000)

Market	% Share on total shrimp export		Unit Value (Rs/Kg)
	Quantity	Value	
Japan	47.10	56.87	399.08
EU	19.7	14.4	241.66
USA	19.4	17.39	296.26
S.E. Asia	8.54	7.95	307.79
Others	5.26	3.39	213.27
Total	100	100	330.56

Source: MPEDA, Cochin.

The comparison of unit value realized from the export of different marine products during 1999-2000 and 2000-2001 (Table -4) also indicates the high price structure of shrimp.

It is very clear that unit value realized from shrimp has gone up during last year compared to previous year though there is a slight reduction in unit value realized from the total seafood exports.During 1999-2000 the export of frozen shrimp increased by 7.60% in quantity and 8.98% in value. India could retain its position of the major supplier of shrimp to Japanese market. However the export to USA has also increased both in terms of quantity and value. The total quantity of shrimp exported to USA was 21,391 tonnes, fetching Rs.633.73 crores. The third largest market for our shrimp is the member countries of Europe.

Shrimp is mainly exported in four forms mainly live, chilled, dried and frozen. (Table-5)

Although the unit value realization from chilled shrimp is more, hardly 71 tonnes could be exported due to limited facilities available in the country. The dried shrimp export has shown a drastic decline over the years. During 1999-2000 only about 203 tonnes were exported fetching the export value of 32.51 per Kg. However the marketability of dried shrimps witnessed tremendous growth in the internal marketing system during the last two decades. It is readily available in our super markets commanding a better demand and price.

On examining the market price, for frozen shrimp, it was found that unit value realized from Japan is much higher compared to other exporting countries (Table-6).

From India, Shrimp is mainly exported in block frozen form (92.93%). IQF shrimps are also fetching up demand in overseas market. Nowadays the technology of producing block frozen product is considered obsolete

because such packs do not allow direct retail trade. The ultimate consumer finds difficulty in exhausting 2Kg block at a stretch. Our products, thus in most cases, are converted into small consumer packs resulting in double freezing.

The most obvious disadvantage of bulk pack is that when once the product reaches the importer, its identity will be lost and in most cases the ultimate consumer will know very little regarding the origin of the product. Besides, even though, the costs of production of bulk packages appear to be cheap because of simple nature of technology involved, the total cost of the product will be more because of certain unavoidable losses such as the inclusion of printed waxed interlocking board cartons, one for each unit and ten for one master carton usually. India is actually concentrating on the export of shrimp. So whatever value addition efforts started recently have been concentrated mostly on shrimp based products. But product diversification is essential to develop our export market. The cost of value addition is comparatively very high in most of our importing countries. The high cost of raw material and labor in these countries attracts the importers to India for buying value added products.The second largest item contributing to our export earnings is frozen finfish. It contributes 38.28% in volume and 10.50% of value in export earnings. Ribbonfish contributes 30.14% of total frozen finfish exports. Pomfrets contribute 24.42% of total finfish exports. China is the largest importer of frozen finfish - mainly low value fish like ribbon fish and croakers from India. They make value added products from these low-value fishes and increase its value several folds before selling the product to the actual consumers.

Table -9: - Average export and domestic price of selected varieties of fishes (2000-2001)

Item	Export Market (Rs/Kg)	Domestic Market (Rs/Kg)
Mackerel	28.35	33
King Fish	63.66	96
Reef Cod	52.33	29
Snapper	58.45	46
Fresh water fish	51.99	60
Skipjack Tuna	24.91	30
Big eye tuna	22.44	30
Sardine	42.19	30
Crocker	27.27	50
Pomfret white	165.32	94
Sharks	41.16	40

Source: 1.MPEDA,Cochin. 2.SEETTD,CMFRI,Kochi

Finfish is exported in different forms such as live, chilled/fresh and frozen. Finfish constitutes 90% of our total marine landings. The finfish exports contribute about 13.5% of our export earnings. The unit value realized by the export of finfish in different forms is given in Table -7.

The Table-8 clearly shows that the unit value realized from shark fin rays and shark fins is much higher compared to any other product in dry form.

The variety- wise unit value of different fishes exported and its corresponding value in domestic market is given in Table-9. A very interesting factor noted is that for some fishes the unit value realized from export is less than the internal retail price. This may be because of the increase in demand and consequent hike in price due to the shift in supply of some fishes for export. However the present study indicated that though some of the consum-

Table-7: Export of finfish in different forms and unit value (1999-2000)

Item / Product	Frozen	Fresh/chilled	Live	Total
Quantity (Tonnes)	131304	1867	37	133208
Value(Rs. Crores)	53734	21.61	0.61	55956
Unit value(Rs. / kg)	40.92	115.75	164.8	42.01

Source: MPEDA, Cochin.

Table-8: Quantity and Unit Value (Rs./kg) of exports in dry form during 1999-2000

Item	Quantity (Tonnes)	Value (Rs Lakhs)	%Quantity exported	Unit Value (Rs./kg)
Shrimp	203	66.32	3.94	32.65
Fish	3684	135098.00	71.43	36.67
Mussel meat	41	24.43	0.80	59.30
Shark fins	123	684.47	2.38	554.39
Fish maws	510	1383.88	9.96	271.21
Squid	218	122.77	4.23	56.31
Bombay duck	280	130.08	5.43	46.53
Sharkfin rays	4	46.95	0.08	1275.00
Shark	90	82.42	1.75	91.81

Source: MPEDA, Cochin.

Table -10: -The unit value realized by the Export of cephalopods (1999-2000)				
Item / Product	Squid	Cuttle Fish	Octopus	Total
Quantity (Tonnes)	34918	32799	5034	72751
Value (Rs.Crores)	296.80	286.22	26.38	609.4
Unit Value (Rs/Kg)	85.00	87.26	52.41	83.77

Source: MPEDA, Cochin.

ers in our country are willing to pay on par with exports price for certain varieties, they are not available at the right place at the right time in the domestic marketing system.

During 1999-2000, the overall export of cephalopods showed an increase of 5% by volume and 9.92% by value. Among cephalopods, export of cuttlefish declined by 5.18% while that of squid increased by 8.26%. The European union was the major importer of cephalopods from India. 53% of total cephalopods from India is exported to European Union.Cephalopods are the third largest product group with a share of 21.21% in volume and 11.91% in value in our exports. Both the squid and cuttlefishes contribute almost equally in our exports (Table-10). During 1999-2000 squid became the major item among the cephalopods with a share of 48% in volume and 48.7% in value. Cuttle fish constituted 45.08% in volume and 46.97% in value. It is seen that the exports of cephopods have registered a steady growth till 1995-96 and afterwards almost stagnant. The share of cephalopods in the total export declined considerably due to poor landings.

Further in fillet form both Squid and Cuttle fish fetch more export value. Hence exports of cephalopods should be made as far as possible in fillet form to reap the benefits of higher consumer preference and consequent comparative marketing advantage.

Table-11: Quantity and value of various items of lobsters in export market (1999 –2000)			
Item	Quantity (MT)	Value (Lakhs)	Unit Value (Rs/Kg)
Frozen rock lobsters	163	580.86	356
Sand lobster tail	64	199.59	311
Whole cooked	945	4584.68	485
Deep sea lobster	363	2043.56	563
Lobster Meat	35	146.41	563
Total	1570	7551.1	481

Source: MPEDA, Cochin.

Table-12: -Export price structure of crab and major importing countries		
Product	Unit value (Rs/kg)	Major importing countries
Cut swimming crab	116.49	S. Africa, Canada, USA, Republic of Korea, Japan, UAE, Europe
Frozen Whole Crab	84.45	Republic of Korea, Japan, Auatraila
Soft Shell Crab	410.51	USA, New Zealand, UK
Pasteurized Crab	390.84	USA, Thailand, Japan, UK
Frozen raw crab claws	90.97	Australia, Portugal

Source:MPEDA,Cochin.

Lobsters command highest unit price in the export market ranging from Rs.312 to Rs.563 per Kg for its different forms (Table.11). However maximum quantity of lobsters are exported in cooked whole form (62.5 %) fetching almost 61% of the gross forex earnings from lobsters.

The value of main items of crab and major importing countries are given in Table-12. Republic of Korea is the largest importer of frozen crab.The frozen crab fetches the minimum unit value of Rs.84.45 per Kg and soft shell crab earns maximum price of Rs.410.51 per kg.

Diversified Value added products

The Marine Products Export Development Authority has listed about 65 value added products, suitable both for export and domestic markets. Product diversification always promote price discrimination and enable us to realise maximum forex earnings. It further helps us to enhance the employment opportunities of coastal rural women.

The emergence of value added products are accelerated by the current demand pattern of the major seafood markets in exporting countries. People have become more selective in their food choice and they are ready to spend more for food. All over the world, the tendency now is to take convenience foods such as assemble meals rather than preparing from basic ingredients. Heat and eat type of value added products have got considerable demand at retail level to the consumers who resist seafood because of its smell and cumbersome way of cleaning and cooking it.

Besides exports the internal demand for value added product is increasing in India. The introduction of microwave oven also helped to pick up markets for value added products (Garthwaite, 1997). Today the affluent society has started switching over to

value added products. Such a change is due to the result of fast-food concept and general trend to move from deep fry to ovenable packets. Some diversified seafood products, which are of recent origin and have commercial acceptance both in export and domestic market and their composition and pattern of preparation is discussed below.

1. Fish balls

Mix fish mince prepared from low value fish using a mechanical meat bone separator after heading, gutting and washing thoroughly with 1% salt and 5% cornstarch. If needed spices can also be added. Prepare balls of 2-3 cm in diameter and cook in 1% brine for 5-10 minutes and cool the cooked balls after which they are battered and breaded. Pack the balls preferably in thermoformed trays as such or after frying in hot vegetable oil. The demand for fish balls is picking up in the internal marketing system and they are distributed through the chain of bakeries in the urban centers.

2. Soup powder

Fish soup powder is a speciality product containing partially hydrolyzed fish protein, carbohydrate, fat and several other seasonings including salt. It is prepared as follows. Disperse the processed fish meat in about 150 ml of water and blend the material in a waring blender. Add the fried onion, coriander, starch, sugar, pepper, ascorbic acid, carboxyl methylcellulose, and monosodium glutamate to the blended meat and again blend it till it becomes a thick fine paste. Power the whole masses in thin layer on an aluminium tray and dry it in an artificial dryer at about 70°c. Powder the dried mass; add skimmed milk powder and powder well to get a homogenous pack. The 12-micron plain polyester laminated with LDPE-HDPE co-extruded on a 90-100 micron LD/BA/nylon/BA/ prim core multi layer films are used as packaging material for soup powder.

3. Fish cutlet:

Cook fish mince for 20 minutes. Add salt and turmeric to the cooked meat and mix well. Fry chopped onions in oil and then fry it with chilly and ginger. Mix with cooked meat. Add smashed potato and spices and mix well. Shape the meat, dip in beaten eggs, and roll in bread powder and stir. Thaw and fry in oil before use. Although there was no export of fish cutlet, during 1995-2000, there is good domestic market fetching about Rs.100/ Kg. Once the shelf life of this product is increased, there is good scope for market penetration in domestic market.

Table -13: Economics of preparation of value added products from different fishes

Items	Fish cutlet *(100numbers)*	Fish rolls *(100numbers)*	Fish samosa *(100numbers)*	Fish wafer *(1 Kg)*
A.Cost of Production				
Raw material	125.00	135.00	75.00	175.00
Other ingredients	90.00	80.00	75.00	50.00
Packaging charges	65.00	50.00	50.00	50.00
Wages to labor	25.00	100.00	120.00	100.00
Other expenses	5.00	35.00	20.00	25.00
Total cost	310.00	400.00	340.00	400.00
B.Revenue&Profit(Rs/Kg)				
Cost of Production	78.00	100.00	85.00	400.00
Selling Price	100.00	125.00	110.00	500.00
Profit	22.00	25.00	25.00	100.00

The economics of cutlet preparation and some other value added products as small scale cottage industry level is given in Table -13.

4. Fish finger

Mix the meat with sufficient quantity of water containing 0.6% sodium tri polyphosphate and 1% common salt to form pasty mass of hard consistency. Spread to a thickness of ¾ cm in an Aluminum tray. Freeze at –40°C for 2 hours and then cut into 8 cm x 2 ½ cm x 3/4cm. Pack in paper cartons and keep at –15 to -20°C. Each finger should weigh about 15 gms. The unit value of fish finger is about Rs.135/Kg in the export market. Enhancement of fish finger not only promotes our forex earnings of marine products but also provide substantial employment opportunities.

5. Fish flakes

Homogenize the processed fish meat with one litre of water for ten minutes. Add the cornflower, tapioca starch, salt and water. Then blend the whole mass for one hour. Spread the homogenized mass uniformly in aluminium trays in a thin layer of 2mm thickness and cook in steam for 3-5 mts. Cool to room temperature. Cut the cooked material into desired shapes and dry under sun or in dryer to moisture content below 10%. Pack in sealed polythene bags or glass bottles and store in a cool and dry place till marketing.

6. Fillet and fillet blocks

Large sized conventional fishes could be filleted, glazed, individually frozen and wrapped. Some of these are good for skinless fillets also. In the case of small fillets where individual freezing cannot be resorted to, laminate blocks can be made for further processing into fish finger. Gutted and finless shark has unit export value of Rs. 39.37/ Kg during 1997-98. This item is mainly exported to Republic of Korea. Unit value of fish fillet is Rs. 106.94. The

Table 14: Price structure of different fish fillets in domestic and export markets

Item	Domestic market (Rs/Kg)	Export Market (Rs/Kg)
Priacanthus	20	27.27
Snapper	75	58.45
Reef cod	75	52.31
Seer fish	120	63.66

Source: 1.MPEDA,Cochin.
2.Matsyafed-Ice &Freezing plant, Kochi

demand for fish fillets in the domestic market is also showing an increasing trend. Unit value of some of the common fish fillets both in domestic and export market is given in Table- 14.

While preparing composite fillets, a number of small fillets are placed in a large fillet shaped mould and then compressed with a low-pressure ram to mould it into a single fillet piece. After freezing, battering, and breading can also be done.

7. Fish steaks

Large sized fishes could be sliced into thin steaks of uniform thickness using a power meat cutter. The steaks can be individually frozen and vacuum packed. Export market for this item is in USA, Malaysia, Belgium, France, UK and Austria. The exports of fish steaks are in an increasing trend in recent years.

8. Ready to serve fish curry

Fish curry in ready to consume form, packed in metal cans is a value-added product. The sardine, seer fish, mackerel, herring etc are usually used for this product. However metal cans have got some disadvantages as it can impart undesirable taste to the product on storage. Tin plate used for making cans is to be imported to India and hence it is not economic. Aluminium containers available in India are not suitable for this purpose because of poor mechanical strength and high incidence of leakage through seams. Flexible pouches now available in the country are not heat sealable. Because of some of the disadvantages for metal cans and flexible pouches, a three-layer configuration of flexible pouches based on polyester/ aluminium foil/cast polypropylene has successfully developed. The price of this item in domestic market is about Rs. 120/Kg.

9. Minced meat

Minced meat is the fish separated in comminuted form from the skin, bones, scales and fin from the fish. Minced meat can be the base material for the preparation of a number of products like fish sausage, cake, cutlets, patties, fish fingers, balls, paste, *surimi* textured products etc. This product has got domestic market. The selling price is Rs. 50/Kg. This is marketed as "Kheema" locally. Since this product is versatile, currently it has no export potential.

10. *Surimi* and extruded products

Surimi is the Japanese term for mechanically deboned fish flesh that has been washed with water and mixed with cryoprotectants for good frozen shelf life. Washing not only removes fat and undesirable matters such as blood, pigments and odoriferous substance but also increase the concentration of myofibrillar proteins, the content of which improves the gel strength and elasticity of the product. This property can be made use of in developing a variety of fabricated products like shellfish analogues. *Surimi* can also be used for making kneaded products, kamaboko product, imitiation products, sausages etc. The *surimi* has got a unit value of Rs. 68.32/Kg. Its unit value is showing an increasing trend since 1995.

11. Battered and breaded products

This is the most important class of value added product very much relished by the consumers as a convenience food. Battered and breaded products are included in the value added products because the process of coating with batter and bread crumbs to increase the bulk of the product and thereby to reduce the cost element. Batter usually consists of wheat flour and water in proportions of 1:5.5 to 1:2. The pick up of coating can be increased either by adjusting the viscosity of the batter or by repeated process of battering, and breading. According to requirement and demand, seasonings and spices can be added to the batter. The breading usually breadcrumbs, rawa or a mixture of both is used. To set the batter the product has to be flash fried. Then freeze the product immediately and held in frozen condition till it is taken out for cooking for serving.

These products have high demand in the export as well as domestic markets. The major changes likely to take place in battered and breaded products during long-term storage are desiccation, discoloration, development of rancidity etc. The products, particularity the coatings are very delicate and require protection against mechanical protection to the products. Thermoformed plastic containers are most suitable for packing such products.

Some of the most popular battered and breaded value added products having good market potential are, battered and breaded peeled shrimp, battered and breaded shrimp,fan tail battered and breaded shrimp, round tail on, battered and breaded squid rings, battered and breaded stuffed squid, battered and breaded fish fillets, battered and breaded fish fingers, battered

and breaded fish cutlets, and battered and breaded fish patties. Export of breaded shrimp during 1996-97 fetched an average unit value of Rs.200/Kg.

12. Fish sauce and fish salad

These are high value convenience foods packed in heat and eat form. Fish fillet, tuna steaks, cuttlefish tubes, squid rings, cooked shrimp and baled clams are suitable for the preparation of such products and the sauces used include lemon butter sauce, and Spanish tomato sauce.

The main ingredients used in fish salad are cooked fish, salad dressing, cooked macaroni, and small quantities of onion, capsicum, celery, pepper and limejuice. Freezing preserves these products. Since it is a heat and eat product, it is desirable to pack such products in containers that can be heated in microwave ovens. Thermoformed plastic containers are considered to be the most suitable for such products. There was an export of squid salad during 1995-96. Its unit value was Rs. 37.14/kg. Cooked salad shrimp is an export item from India, which has a unit price of Rs.215.63 per Kg.

13. IQF products

This innovation allowed the processor to supply the customer with frozen items in small ready to cook pieces instead of solid blocks, which had to be cut or thawed prior to packing or use. Other than the high initial investment cost, it also needs skilled operation and maintenance staff. This product is suitable and convenient for the growing market in semi prepared and ready to eat products. Different IQF products available in our country are, 1.Shrimp – Whole, peeled and deveined, cooked, headless shell on, Butter fly fan tail, 2.Lobster – Cooked lobsters, lobster tails, lobster meat squid- rings, tubes, 3.Cuttle fish – fillets, 4.Clam – boiled clam meat, 5.Fish fillets – skin less fillets

IQF products fetch better price than conventional block frozen materials in the foreign markets. For production of IQF products high quality raw materials should be used and the processing done under strict hygienic conditions. The products are to be packed in attractive moisture proof packing and stored at -23^0 C or below without fluctuations in storage temperature. Thermoform rays have now become an accepted packaging container for IQF products. Major market for this item is USA, Japan and European Union. The unit value of IQF shrimp, Cuttle fish and Squid are Rs. 194.41, Rs.104.04 and Rs.92.78 respectively.

14. Accelerated freeze-dried (AFD) products: -

Freeze drying in fish preservation is a relatively recent development in fish processing and it is becoming very popular in spite of high cost of production because of several other advantages associated with the products. These products are practically devoid of moisture (<2%). The products are very fragile and can easily undergo chemical reactions with air, leading to oxidation, deterioration of colour, absorption of water etc. They are generally packed under an inert gas to exclude air and oxygen. Paper/aluminium foil/polyethylene laminates or metallised polyester/polyethylene laminated pouches are recommended for AFD products. The major markets are USA and Japan. AFD shrimp fetches a unit value of Rs. 1475.03/Kg. AFD Shrimp powder has got a unit value of Rs. 1755.03/Kg and AFD clam Rs.1077.13/ Kg.

15. Fish and shellfish pickles

Fish and shellfish pickles are a value added item, bulk of which is contributed by low value items like ginger, chilly, acetic acid etc. Fish, cut to consumable sizes and washed, is mixed with 3% salt and kept for 2 hours for drying. The salted and partially dried fish is fried in oil. Remove the fried fish from the oil. Fry the ingredients like green chillies, garlic and ginger in the remaining oil. When these ingredients are fried adequately, add chilly powder and turmeric powder and stir the mixture in low flame. After removing the mixture from the stove, add the fried fish and vinegar and mix thoroughly. To this, add boiled and cooled water adequately, then add salt and sugar and stir thoroughly. After cooling completely and allowing maturing for two days in the closed container, the pickles can be packed in sterilized glass bottles. Then these bottles should be sealed airtight. It should be ensured that a layer of oil floats on the surface of the pickle. The

Table -15: Economics of preparation of pickles from marine products (100 bottles of 250gm unit weight)

Items	Fish pickle	Prawn pickle	Mussel pickle
A.Cost of production	1875.00 (Seer fish)	2400.00	1875.00
Raw material	750.00	560.00	800.00
Other ingredients	300.00	300.00	300.00
Packaging charges	500.00	250.00	250.00
Wages to labor	150.00	60.00	100.00
Other expenses			
Total cost	3575.00	3570.00	3325.00
B.Revenue&Profit(Rs/Kg)			
Cost of Production (Rs/Kg)	144.00	144.00	132.00
Selling Price (Rs/Kg)	180.00	240.00	200.00
Profit (Rs/Kg)	36.00	96.00	68.00

product has a shelf life of 10-12 months. The fish pickle exports are mainly to Kuwait and Australia and Shrimp pickle to Srilanka, Kuwait, Australia and UK. For comparative assessment, the cost of production and profitability of preparing pickle from fish, prawn and muscle as small scale business is worked out and given in table -15.

New flexible packing materials developed for fish pickles are based on plain polyester laminated with LDPE-HDPE co-extruded film and co-extruded nylon surylyn or films of LD-BA-nylon-BA primacor. These materials are compatible with the product, can be attractively fabricated as stand up packs or pillow pouches. There is also high potential for the expansion and market penetration of these products in the internal marketing system.

16. Dry fish pickles

Fish pickles generally have high content of liquid gravy and hence pose some problems in packaging. Dry fish pickle with no gravy is easier for packaging, transportation and distribution. Fish like anchovies are generally dried and marketed which however offer a very good raw material for processing into dry pickle, which is considered a value added product. The packaging material has been identified as nylon. surlyn laminate or LD-BA-nylon-BA primacy co-extruded film which offers safe storage of the product for over a year at ambient temperature,

17. Shark fin rays

Dried shark fin is a traditional export item from India. It is mainly exported to Singapore. With the development of inexpensive and simple technology for extraction of fin rays, export of this item have picked up in recent years. Both fresh and dried fin can be used for extracting the rays. In the case of dried fins, soak the material for 2-3 days in water acidified to pH 2.5 to 5 with acetic acid also as to hydrolyze the collagen in the fins to gelatin. The softened fins

Fish pickles generally have high content of liquid gravy and hence pose some problems in packaging. Dry fish pickle with no gravy is easier for packaging, transportation and distribution.

are treated with hot 10% acetic acid at 60°C for 90 to 120 minutes depending upon their size. Utmost care should be taken during heating as otherwise the yield length and appearance of the rays will be affected due to over heating. The skin is then scrapped off and cleaned in water. The rays are then separated out manually. Wash off the excess acetic acid with water and dried in artificial dryer at 50-60°C to moisture content of 5-8%. Polyester/ polythene laminates or nylon based co-extruded films having good punctured resistance are appropriate for packing fin rays. The export value of Shark fin rays is Rs. 1275/Kg, Shark fin 554/Kg and Shark bone Rs. 135.76/Kg.

18. Squid rings

Cleaned squid tubes are cut in the form of rings, cooked for 1-2 minutes in boiling brine (3%), cooked battered, breaded and flash dried for 20 seconds. The export value of Squid rings is showing an increasing trend and its unit value has reached Rs.111.45/Kg during 1999-2000.

19. Stuffed squid

The export value of this item is showing an increasing trend and currently fetching a price of Rs. 84.75/ Kg. This is prepared from small squid tubes. The tubes are filled with stuffing mixture prepared using potato, fried onion, spices and cooked squid tentacles. The stuffed squid is then battered breaded and flash fried.

Quality control aspects in sea foods

Quality assurance in the domestic marketing channel will enable the parallel development of the internal marketing system, which is highly essential to withstand any market collapse and price crash in the export market at any point of time (Sathiadhas *et al.* 2002). Some of the simple aspects which can be easily taken care of are (i) Fish and shellfish should be preserved properly immediately after catch (ii) Ice should be prepared from good quality water and used in appropriate proportion (iii) Handling area and containers should be properly disinfected (iv) Proper drainage should be provided in markets and landing centres (v) Fish should be protected from flies, rodents, insects, birds and animals (vi) Immediately after catch, fish should be sorted species wise. Shrimps should be graded, beheaded, peeled and de-veined as soon as possible (vii) The quality standards like fixing limits for heavy metals and microbial limits *etc* should be imposed (viii) The bivalves as far as possible should be depurated before shucking (ix) Sun drying of fish in sandy beach should be strictly stopped. While salting, only good quality salt should be used. (x) Quality of fish sold in domestic market should be assured (xi) Proper cost effective preservation facilities should be provided at all retail outlets. For this, preservation or cold storage units can be established on cooperative basis or by the local bodies extending the facilities by nominal charges and (xii) Educate public as well as fisher folk about the need of seafood safety

norms through proper extension strategies.

The marketing and distribution system in the fishery sector of the country is not well equipped with quality maintenance mechanism comprising essential marketing infrastructure and proper administrative procedures. In the light of HACCP regulations, the Government as well as the industrialists has started paying proper attention to the quality standards of the export products. However quality maintenance in the internal distribution system of fresh and processed fish is also essential.

While promoting value-added products, there is a need to develop functional, cost effective and attractive packaging distinct with various types of products. The retail pack must be clear, crisp and cheap. The contents of the pack should be clearly mentioned on the pack in an attractive way. Thermoformed trays produced from material like PVC or high impact polystyrene are suitable packaging material for value added product. In the case of microwave ovenable product, the packaging material should withstand high temperature. It should be transparent. The IQF and frozen products need polyethylene bags or ethylene vinyl acetate copolymer films as primary pack and wax coated chipboard box or plastic or aluminum laminated box as master carton. When a new product is introduced the package should carry informations like instructions to prepare product, caloric value, nutritional information, dietary plans and health benefit to give confidence to the consumer.

Facility for quality checking should be provided and appropriate monitoring mechanism should be evolved to assure supply of unspoiled quality products in the domestic marketing system The sales promotion of preserved and processed fish in the internal marketing system should be encouraged by means of opening a network of fish stalls with refrigeration facilities emulating the model of retail milk distribution system.

There is no surveillance by medical authorities on the food commodities in India unlike the developed nations. Similarly there is no machinery or authority in India to test the food imports to our country. If there is no regulatory system for domestic goods it is not possible to prescribe any safety standards and enforce quality control for the same goods if they are imported. All the food items irrespective of imports or indigenous products should undergo the quality tests before its distribution and sales in the domestic marketing system. The Total Quality Management (TQM) approach should be adopted for all consumer items especially perishable products like fish.

Conclusion

The study indicated that the income generated by marine fish landings during the year 1999-2000 is Rs.10486 crores at primary market level and Rs.17861 crores at the consumer level. It is interesting to note that more than half of the income is earned by the exportable varieties of crustaceans and cephalopods. The cephalopods are channeled to the export market substantially realizing forex earnings of about Rs. 609 crores during 1999-2000 forming about 64% of the gross income generated by this resource. However although the retail value of shrimps works out to be Rs. 9102 crores, the forex earnings generated by this resource is Rs.4481 crores which is far below the potential, as it includes the aquaculture products also. The targetted fishing of high value species like shrimps in our open sea has led to the catching of enormous quantity of undersized prawns. The most advisable and viable alternative to maximise our forex earnings from our marine shrimp landings is going for the export of value added ready to eat products.

The comparative economic advantage of exporting certain items to specific countries should be fully explored. Exporting in block frozen form in bulk pack should be minimized. The PD and PUD items of shrimp products and diversified cephalopod products should preferably sent to European union as they command better price there. Exports of cephalopods should be made as far as possible in fillet forms to earn maximum earnings. The consumer preference and market advantage was fully utilized by countries like China, as it import even our products, reprocess/ and prepare value added products and earn maximum benefit through exports.

Promotion of diversified value added products not only accelerate out forex earnings in exports, but also provide a multiplier effect on employment front especially for weaker sections and womenfolk. An additional export of almost 1-lakh tonnes of value added products in our marine products could easily corner about Rs.1500 crores of forex earnings and generate regular employment opportunity of about 35,000 fisherfolk. Efforts taken by Government and non-governmental agencies to organize fisherwomen into self help groups and involving them in the preparation of value added products and marketing has brought out encouraging results. Hence appropriate training programmes in the preparation of location - oriented resource - specific value added products should be imparted to women folk and linked them with credit and marketing facilities. The promotion of consumer preference of value added products with out compromising quality standards and parellel development of internal and external marketing system would enable the long term balanced development of Indian seafood trade.