Seafood Safety

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Seafood Safety Norms and Marketing Management of the Marine Fisheries Sector in India

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All the developments brought about in different sectors of fishery production, processing, storage and infrastructure facilities are oriented mainly towards export markets. Commercial significance of primary markets has been mostly shifted to new urban centres. The present paper reveals the macro level market value of marine fishes at first and last sales and also gives a comparison of the price structure of marine products in domestic and export markets. It also assesses the export performance of finfish and value-added products and their multi-dimensional impact on domestic trade. The adoption of seafood safety norms in the domestic and export marketing system is also elucidated, giving special emphasis on the need for improving the quality standards maintained in the domestic markets. The policy suggestions such as need to evolve appropriate utilisation strategy for discards, promotion of product diversification, keeping good hygiene standards in domestic marketing, regulation of finfish exports to stabilize the domestic marketing system, cataloguing of pharmaceutically important marine products and promoting market prospects of commercially important non-edible products and by-products are also discussed in detail in the paper.

Keywords : Seafood marketing, export market, price structure

Fisheries play a vital role for ensuring the food security, which gains more significance in the developing countries like India, where human population is increasing and is characterized by protein malnutrition. Fisheries help in supplementing the protein food requirements at an affordable cost in addition to providing a lot of employment opportunities. There is appreciable increase in marine and inland fish production over the last three decades. However, the growth rate in the inland fish production which includes aquaculture, is far higher than the marine sector due to various reasons. The marine fisheries sector of the country is also witnessing an era of many significant strategic changes. The greater part of contribution to marine fisheries production is now-a-days attributed to mechanised

fisheries. Increased thrust on the export-oriented marketing has generated many positive and negative impacts on the entire fishing industry. All the developments brought about in different sectors of fishery production, processing, storage and infrastructure facilities are oriented mainly towards exporting industry. Maintaining high quality standards of fish in the internal distribution and marketing system is highly essential to ensure the safety standards of our products and the long term sustainable development of our sea food industry. The present study is undertaken with a view to (i) review the fish production trend and growth rate in fisheries sector; (ii) estimate the macro level market value of marine fishes at first and last sales; (iii) give a comparison of the price structure of the marine products in domestic and export markets; (iv) assess the importance of finfish and value added products in domestic and export trade; (v) discuss the extent of adoption of seafood safety norms in the domestic as well as export marketing system; (vi) and give policy suggestions for augmenting the fish marketing system in India.

Materials and Methods

Primary and secondary data were collected and analysed for the study. For the primary data, data collected by the Socio-economic Evaluation and Technology Transfer Division (SEETTD) of Central Marine Fisheries Research Institute (CMFRI) from the fish landing centres of the entire coast and selected wholesale and retail markets of India were utilized, while publications of Marine Products Export Development Authority (MPEDA), State Fisheries Departments and other relevant research results published were the secondary data used for the present analysis.

Results and Discussion

Marine fisheries sector of India

Marine fisheries in India underwent a phenomenal change during the past few decades, which has lead to the developments in marketing as well as the distributing system in addition to the enhancement taken place in the total landings. The projected requirement of the marine fish by 2020 AD is about 5.6 million t. Though culture of shrimps in coastal backwaters has progressed in early nineties, the consequent environmental degradation and the incidence of diseases resulted in a sudden decline and almost stagnant situation. The marine capture fisheries is loosing its importance during the recent years when compared to the inland sector (Table 1).

Table 1. Marine and inland fish Production in India

Year	Marine production ($x10^5$ t)	% contribution	Inland production ($x10^5$ t)	% contribution	Total Production ($x10^5$ t)	Growth rate
1950-51	5.34	71	2.18	29	7.52	-
1960-61	8.80	76	2.80	24	11.60	54.25
1970-71	10.86	62	6.70	38	17.56	51.37
1980-81	15.55	64	8.87	36	24.42	39
1990-91	23.00	60	15.36	40	38.36	57
1991-92	23.47	58	17.10	42	40.57	8.3
1992-93	25.76	59	17.89	41	43.65	5
1993-94	26.49	57	19.95	43	46.44	6.4
1994-95	26.92	56	20.97	44	47.89	3.12
1995-96	27.07	55	22.42	45	49.49	3.34
1996-97	29.67	55.47	23.81	44.52	53.48	8
1997-98	29.25	54.54	24.38	45.45	53.63	0.28
1998-99	25.96	49.33	25.66	48.76	52.62	-1.8
1999-00	28.33	50.1	28.23	49.9	56.56	7.67

Source: Dept. of Animal Husbandry, Ministry of Agriculture, New Delhi; CMFRI, Cochin

It is clear from the Table 1 that the increase in marine landings for the last one decade (1990-2000) is $5.33x10^5$ t, which is comparatively much lower than the increase in the inland production of $12.87x10^5$ t during the same period. The contribution of marine landings to the total fish production in the country, which was 60% in 1990-91, has come down to 50% during 1999-2000, showing steady increase in the share of inland production. There is a steady increase in inland fish production as against more or less stagnant production in marine sector. Another interesting feature is that the per capita production of fishing units and labour in marine fisheries is showing a declining trend over the years.

Gross value of marine fish at first and last sales

The fisheries production is highly dependent on the price fluctuation and thereby the market prospects of fish and fishery products. The fisherman's share in consumer's 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 (Deveraj *et al.*, 1998). The price spread was maximum in the case of

crustaceans (Rs. 96.kg^{-1}), croakers and threadfins (Rs. 27.kg^{-1}), while it was poor in the case of elasmobranchs, carangids (Rs. 4.kg^{-1}) and flat fishes (Rs. 5.kg^{-1}) (Table 2). The gross revenue generated from marine fisheries at landing centre level is estimated at Rs. 104810 million during the year 2000. At the landing centre or primary market the crustaceans fetch about Rs. 47310 million, cephalopods Rs. 7810 million, perches Rs. 6920 million and the remaining by other varieties. The value of fish at final sales works out to

Table 2. Value of fish at first and last sales in India (Year 2000)

Species	Total catch (t)	Landing price kg^{-1} (Rs.)	Value (Rs.x10^6)	Retail price kg^{-1} (Rs.)	Value (Rs.x10^6)
Elasmobranchs	72963	35	2553.705	40	2918.52
Eels	9187	43	395.041	50	459.35
Catfishes	58332	18	1049.976	31	1807.982
Clupeids	647016	15	9705.24	30	19410.48
Bombay duck	97548	11	1073.028	23	2243.604
Lizard fishes	26714	14	373.996	27	721.278
Half-beaks & full-beaks	7316	22	160.952	27	197.532
Flying fishes	2377	17	40.409	31	73.687
Perches	216216	32	6918.912	46	9945.936
Goat fishes	15627	13	203.151	24	375.048
Threadfins	9195	23	211.485	50	459.75
Croakers	180723	23	4156.629	50	9036.15
Ribbon fishes	182386	25	4559.65	32	5836.352
Carangids	110734	25	2768.35	29	3211.286
Silver bellies	49384	12	592.60	25	1234.60
Big jawed jumper	6179	40	247.16	57	352.203
Pomfrets	38171	80	3053.68	94	3588.074
Mackerels	134556	23	3094.788	33	4440.348
Seer fishes	50375	81	4080.375	96	4836
Tunnies	54001	22	1188.022	30	1620.03
Bill fishes	3570	16	57.12	35	124.95
Barracudas	18299	29	530.671	40	731.96
Mullets	6546	36	235.656	45	294.57
Unicorn cod	492	5	2.46	12	5.904
Flat fishes	52170	20	1043.4	24	1252.08
Crustaceans	454933	104	47313.032	200	90986.6
Cephalopods	111523	70	7806.61	85	9479.45
Miscellaneous fishes	82387	17	1400.57	35	2883.55
Total	**2699622**	**39**	**104819.668**	**67**	**181527.274**

Source: SEETTD, CMFRI

Rs. 181520 million. The marketing margin including the marketing cost is Rs. 76710 million. Although the landings of shrimps contribute about 16.85% of the total, it fetches about 46% of the gross earnings at first sales and 51.5% of the revenue at final stage. The export demand of cephalopods led to 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% which includes the marketing costs.

Table 3. Wholesale price (Rs. kg^{-1}) behaviour of selected varieties of marine fishes (1973-74 to 2000-01)

Fish	1973-74	1984-85	1989-90	1993-94	2000-01
Seer fish	4.00	19.00	28.90	58.00	83.00
Pomfret	2.00	17.50	15.20	35.00	78.00
Tuna	2.00	10.00	13.45	30.00	21.00
Shark	1.50	11.25	13.85	26.00	37.00
Mackerel	2.00	6.25	9.00	23.00	28.00
Sardine	1.00	4.00	6.90	13.00	23.00
Ribbon fish	2.00	5.00	6.15	10.00	20.00

Source: SEETTD, CMFRI, Cochin

Price behaviour of marine fish

The price of fish fluctuates over a period of time, the reasons of which can be attributed to the perishable nature, uncertain production, highly inelastic supply, etc. There is a significant increase in the wholesale and retail price of fishes for the past decade especially in the case of pomfrets (80% and 68%, respectively) and seer fish (42% and 62.8%, respectively). Interestingly, in the case of tuna, the wholesale price increased by 33%, while its retail price declined by 23% (Table 4). The price rate of fishes like mackerel and oil sardine, considered as poor man's food, has increased at a much higher rate than chicken, mutton and egg. The price factor in combination with changes in the availability and quality of fish in the domestic market has played an important role in changing the food preferences of lower, middle and upper class consumers. There is a shift in the consumer preference towards chicken and egg. The consumers in Kerala are increasingly substituting fish with beef. Field study indicated that poor consumers' first preference of animal protein remains fish, but the quantity consumed is on the decline.

Table 4. Retail price behaviour (Rs. kg^{-1}) of selected varieties marine fish in India (1973-74 to 2000-01)

Fish	1973-74	1984-85	1989-90	1993-94	2000-01
Seer fish	9.00	27.00	35.50	66.00	96.00
Pomfret	2.50	22.00	29.50	40.00	94.00
Tuna	3.00	16.50	18.50	39.00	30.00
Shark	2.50	17.00	17.00	31.00	43.00
Mackerel	3.00	9.85	12.50	25.00	33.00
Sardine	2.00	6.7	10.00	16.00	21.00
Ribbon fish	2.50	8.5	10.00	19.00	32.00

Source: SEETTD, CMFRI, Cochin

There are indicators showing gradual increase in the number of fish eaters in world population. Consequently the demand of fish and thereby the price keep continuously increasing in the domestic as well as export markets. Much advancement have been brought about in the sphere of marine fish production including new craft and gear combinations, better methods of post-harvest preservation techniques, transportation techniques, etc. In general, fish marketing has been made pragmatic enough to provide satisfaction of the existing and potential demands. Even though, the marine products export for the year 2000-01 has reached an all time record of Rs. 64430 million, the growth rate in the unit value realised declined slightly during 1999-2000 (Table 5). This is mainly due to the change in the composition of seafood exports tilting towards finfish varieties in recent years.

Table 5. Export growth of Indian marine products

Year	Export (t)	Unit value realisation (Rs. kg^{-1})	Growth rate in value (%)
1981-82	70105	40.80	-
1986-87	85843	53.66	31.51
1991-92	171820	80.08	49.23
1995-96	296277	108.97	36.06
1996-97	378199	108.97	0.00
1997-98	385818	121.75	11.72
1998-99	302934	152.74	25.45
1999-00	343000	149.16	-2.34

Source: MPEDA (2001)

Trends in finfish catch and export

Currently almost 20% of the marine fish production is feeding the export marketing system. Marine products export forms about 23% of the total agricultural products exports of the country. Share of the finfish in our exports has increased considerably during 2000-01, creating far-reaching implications in the price structure and availability of quality finfishes in the domestic market. The share of finfish export has increased from 28.7% (1991-92) to 35.8% (1998-99) with the maximum share being 48.47% (1997-98). The share in terms of value increased marginally during the corresponding period. The importance of finfish in Indian seafood is increasing (Tables 6 & 7). This may be because of the change in consumption pattern or consumer preference of the importers, product diversification and export promotion measures of MPEDA and other agencies.

Table 6. Finfish production and export from India 1993-2000

Year	Production (t)	Exports (t)	Percentage
1993	1823452	93219	5.11
1994	1816484	122529	6.74
1995	1790645	100093	5.58
1996	191103	173005	9.05
1997	2109345	188029	8.91
1998	2063309	108556	5.26
1999	1925299	131304	6.82
2000	2133576	212903	9.98

Source: MPEDA (2001)

Ribbon fish, pomfrets, tuna, freshwater fish and reef cods are the major finfish groups that are exported. Among them, ribbon fish ranks first in quantity and value followed by pomfrets. Though ribbon fish ranks first in volume and value, pomfrets fetch higher unit price compared to ribbon fish, tuna and freshwater fish. Maximum finfish was exported during 1997-98 forming about 48% of the total exports (Table 7). However, it has declined afterwards and again picked up during 2000-01.

Increase in finfish exports in recent years have far reaching multi–dimensional impact in domestic markets such as (i) non-availability of quality fish in domestic markets; (ii) increase in domestic price for all varieties and higher domestic price than export price for some varieties; and (iii) increasing

shift in the consumer demand towards chicken, beef and egg. Hence market promotion for finfish exports should be regulated only for those varieties which are fetching comparatively higher prices in the international market.

Table 7. Growth of finfish exports in India 1991-92 to 1999-2000

Year		Finfish export	Annual growth	Percentage growth	Share in the total seafood export (%)
1991-92	Q	49119	6779	16.01	18.7
	V	1426.6	51.84	57.08	10.41
1992-93	Q	74076	24957	50.81	35.44
	V	2221.0	79.44	55.68	12.56
1993-94	Q	93213	19137	25.83	3.21
	V	2891.2	67.02	30.18	11.5
1994-95	Q	122529	29316	31.45	39.78
	V	4465.7	157.45	54.46	12.50
1995-96	Q	100093	-22436	-18.31	33.78
	V	3722.6	-74.31	-16.64	10.63
1996-97	Q	173005	72912	72.84	45.74
	V	6369.2	264.66	71.10	15.45
1997-98	Q	188029	15024	8.68	48.74
	V	7267.3	89.81	14.10	15.47
1998-99	Q	108556	-79473	-42.27	35.80
	V	4950.3	-231.7	-31.88	10.69
1999-00	Q	131304	22748	20.96	38.28
	V	5373.4	42.31	8.55	10.50

Q: quantity in t; V: value in million; Source: MPEDA (2001)

Discards of low value fish and utilisation of byproducts

Discarding the bycatch is an evil in the marine fisheries sector, the world over. It is reported that an estimated 27 million t of bycatch is discarded annually and the shrimp trawl fisheries in the tropical seas contribute to one- third of total discards, globally (Alverson *et al.*, 1994). The discards in the Indian Ocean region accounts for 2.27 million t, forming 8.4% of global discards. This estimate suggests that discards by shrimp trawlers in India could be of the order of 0.3 million t, though precise estimates of discards are not available. There is also an urgent need to utilise the discards of finfish for human consumption. Suitable methods for onboard collection of discards and production of value added food items based on them, need to be developed and implemented.

The utilisation of byproducts from marine fishing industry will help to reduce the wastage and at the same time will prevent degradation of the environment to a considerable extent. Currently, conversion of byproducts to fish meal and oil are mostly followed. But, in addition to these, there are other byproducts like chitin and its derivatives, fish bones, squalene which have potential applications in various fields including drugs and pharmaceuticals. The crustacean shell wastes contain chitin, a biopolymer having use in many industries like chromatography, paper, textiles, photography, food and nutrition and agriculture. In India, around 50,000 to 60,000 t of prawn shells and head wastes are thrown out from processing industries annually. These wastes contain about 10% chitin on dry weight basis. The utilisation of shellfish and processing waste for development of byproducts will help to provide significant quantity of protein, generate more employment opportunities and get additional income for fishermen families besides reducing environmental pollution.

Infrastructure development and quality standards

The post harvest sector of the marine fisheries showed substantial growth in infrastructure facilities, expansion of internal marketing and boost in export earning. Development of infrastructure is highly significant in the development of fishery industry as the fish is highly perishable. The growth of fishery infrastructure in the processing sector of the country during 1992-2000 is shown in Table 8.

Table 8. Fishery infrastructure in India (1992-2000)

Category	1992		2000	
	Registered units	Capacity ($t.day^{-1}$)	Registered units	Capacity ($t.day^{-1}$)
Freezing plants	248	2779	394	8439
Canning plants	23	82	13	505
Ice plants	129	1894	157	3969.5
Fish meal plants	21	376	12	229
Pre-processing centres	921	2150	893	14720
Cold storages	321	49775	479	105990

Source: MPEDA (2001)

The number of cold storages and freezing plants showed a sizeable increase mainly as a result of the higher consumer preference to the frozen

fish products compared to the dried products. This has resulted in the decline of dry fish trade to a large extent. The increase in the number of cold storages, freezing plants, insulated vans for transportation of fish, etc., improved the distribution and marketing system, the benefits of which are enjoyed mainly by the export industry. The consequence of this marginalisation of the domestic marketing system is experienced at various levels by different categories including the producers, wholesalers, retailers and consumers.

Ice production and the availability of ice have increased significantly in the past two decades. This is also the case with cold storage and processing facilities. Plastic crates with the comparative advantage of easy handling, standardisation in volume and effective icing has replaced bamboo baskets. Vehicles with improvement in storage facilities like puff insulated vehicles and refrigerated cargo have come into operation. The road facilities connecting coastal villages have improved. All these improvements along with improved telecommunication facilities have made it possible to move fish over long distances in a very short span of time, increasing marketability.

It is observed that about 50% of the fish landed is consumed fresh in and around producing centres, 43% in demand centres located up to a distance of 200 km from the coast and 7% goes to the centres located beyond 200 km. in the internal marketing system (Sathiadhas *et al.*,1995). The extent of spoilage of fish at the landing centres adversely affects the producers, as fish is highly perishable and supply of fish in the short run is highly inelastic. Inadequate preservation techniques at landing centres leads to a situation where a bumper catch will suddenly result in the slashing down of price to floor level which puts the fishermen in doldrums. The insufficient icing facilities in the storage spaces and transportation again results in the spoilage of fish, which ultimately makes the wholesalers as well as the retailers to sell their products at lower rates.

In the context of HACCP regulations, stringent measures have been taken to maintain quality standards as prescribed by the national advisory committee on microbiological criteria for foods. The rejection of a lot from the export market may lead to the collapse of the entire export industry. On the other hand, the hygiene standards maintained in the domestic markets is often treated as a matter of least concern. The shortage in the supply of marine fishes and the poor quality concerns in the traditional internal markets is becoming a serious problem demanding immediate attention. The inadequate infrastructure for preserving quality standards in the domestic

marketing channels forces the retail traders to sell poor quality fishes at low prices. Besides, the high demand for the quality fishes like seer fish and pomfrets in the export markets reduces the availability of these fishes in the domestic markets.

Some of the marine organisms (bivalves, crabs, croakers, etc.) are occasionally poisonous. There should be a mechanism of testing these products to assure their safety before marketing. Further, improperly preserved fishes should not be allowed to be sold by the traders. Market intelligence and vigilance in the internal markets should be strengthened by forming watch groups at community level in each panchayat/local bodies which will be entrusted the responsibility of enforcing rules to ensure minimum quality standards.

Unhygienic conditions of the retail fish shops were indicated to be making a negative impact on the regular and potential customers in small towns and rural retail outlets (Sathiadhas *et al.*, 2000). Improper preservation of fish is widely prevalent in innumerable retail markets due to negligence of putting sufficient quantity of ice. The situation has become like that even though the consumers are willing to pay for quality fishes on par with that of the export price, it is mostly not available to them.

Fisherwomen and quality concerns

Out of the 1.2 million fisherfolk in post-harvest sector of marine fisheries, women occupy a considerable proportion of more than 0.5 million. For example, in Kerala, which is a leading fishery state of the country, the entire processing sector is highly dependent on women. More than 90% of the work force in prawn peeling and 70% in the processing activities of fishery products are constituted by them (Table 9).

Table 9. Women workers engaged in post-harvest fisheries sector of Kerala

Category	Total no. of workers	No. of women workers	Percentage
Beach workers	20,843	5,612	26.92
Small-scale fish traders	67,527	20,220	29.94
Fish curers	21,103	14,028	66.47
Peeling workers	43,620	39,397	90.31
Processing plant workers	11,051	6,504	58.85
Total	1,61,144	85,761	53.22

Thus, being the major workforce in the secondary sectors like processing, pre-processing, curing, etc, the women workforce are one of the major deciding elements of the quality of the products exported from the country. Likewise, they play a pivotal role in the quality standards in the domestic marketing set up, performing the roles of small-scale fish traders, vendors, sorters, etc. Hence, the way in which the women workers perceive the need for quality maintenance carries a lot of significance. In the export oriented processing centres, the women workers are forced to follow some prescribed norms for quality maintenance, which is observed, by them for their existence in the profession. But this is not the case with domestic marketing system and campaigns especially targeted at women in fish processing and trade are required to improve quality standards in the internally marketed fish and fish products.

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. 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) quality standards like fixing limits for heavy metals and microbial limits, etc., should be imposed; (viii) bivalves as far as possible should be depurated before shucking; (ix) sun drying of fish in sandy beach should be strictly stopped and 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 - cold storage units can be established on cooperative basis or by the local bodies extending the facilities on nominal charges and (xii) educate the public as well as fisher folk about the need of seafood safety norms through proper extension strategies.

Policy implications

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 exported products.

Quite often technological advances resulting from massive research attempts may not receive appropriate support from policy makers. Though different government and non-government organisations have contributed towards formulation of fishery policy, their lop-sided approach has resulted in the total neglect of the domestic fish marketing system of the country. Hence, while formulating policy suggestions, care is to be taken to give parallel importance to the domestic fish marketing in the country. For this, necessary attention is required to (i) evolve appropriate utilisation strategy to avoid discards in the high seas which has increased in recent years due to the intensification of multi-day fishing; (ii) regulate finfish exports to stabilise the domestic marketing system - fishes which fetch comparatively higher prices in the export market than the domestic market alone should be diverted; (iii) catalogue pharmaceutically important marine products and their utilisation strategies; (iv) promote market prospects for commercially important non-edible products and byproducts (v) develop mechanisms for quality control and monitoring for the domestic marketing system; and (vi) encourage sales promotion of preserved and processed fish in the internal marketing system 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 about 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.

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