National and International Quality Standards for Fish and Fishery Products

P. T. LAKSHMANAN

Food standards have been introduced on a national/international basis to protect the consumers' health and to ensure fair practices in food trade. The formulation of standards for fish and fish products became necessary to attain a minimum standard of cleanliness and hygiene in fish handling, processing and marketing. The exporting country or company should be aware of the quality requirements of the buying nation. Standards are intended to guide and promote export or import of fishery products between countries. Since Governments of all countries are responsible for public health problems arising from the consumption of fish products, they enforce certain food laws and introduce standards. These standards fall into two main categories.

1. ***Safety standards :*** Safety standards are formulated to protect the consumer against food that are damaging to health. This ensures that reasonable standards of hygiene are practised so that fish are free of pathogens and that use of food additives are controlled and contaminants are prevented.

2. ***Composition standards :*** These standards protect the consumer against fraud by ensuring that food is unadulterated, pure and of good quality. Packages should contain the correct description, labelling, weights etc. Examples are fish pastes and fish fingers where the composition is printed on the label.

The main concern of the food laws is therefore, the safety, identification, quality, labelling and advertising of fish, both to inform and to protect the consumer and sustain a fair basis for honest trading.

In addition to these food laws, various national and international standards and codes of practices exist in order to place good quality and safe products in the market. The different standards in operation are:

1. National standards (ISI or BIS, BS, US FDA etc.)
2. International standards
   (FAO Codex Alimentarius, ISO 9000 series and HACCP)
3. Company specific standards

1. National standards

Many fish producing countries have their own standards and codes of practice for fishery products. The Indian Standards Institution ISI (renamed Bureau of Indian Standards, BIS), British Standards, BS, United States Food and Drug Administration, US FDA etc. all have brought out standards for their fish and fishery products. They govern the quality and standards of products (fish/fishery) for local consumption as well as those for export and import. In U.K., the White Fish Authority and Herring Industry Board have published model, detailed minimum standards for a range of chilled and frozen products. Codes of practices are also available relating to hygiene in the retail industry and in handling and transportation of fish. These are complemented by the British Standards Institution; 'Recommendations on cleaning in the fish industry' (BS 4259/1968).

The Food and Drug Administration (FDA) is engaged in the formulation of processing standards, in the inspection of imported products and in the public health surveillance of processing establishments. US product 'grade standards', using a three grade system have been drawn up for 15 or more major frozen products by the National Marine Fisheries Service (NMFS). Products meeting the standards after inspection are allowed to bear three descriptions (Grade A, B or Substandard) depending upon quality. In the area of processing standards, the FDA has drawn up guidelines on Good Manufacturing Practice for food in general and

two fish products in particular. Fish and fishery products exported to US must meet the requirements of FDA standards. Mandatory inspection of chilled and frozen fish landed at Japanese ports from fishing vessels is carried out by highly trained officials employed by the Food Inspection Service. The aspects included are:

i) Checking for spoilage or contamination

ii) Bacterial testing of raw shellfish

iii) Ensuring that edible fish containing poisonous organisms are identified and segregated

iv) Ensuring that adequate sanitary conditions prevail.

Detailed mandatory standards are also in force in conjunction with compulsory inspection of canned and frozen products.

Indian standards

The Bureau of Indian Standards (BIS), the erstwhile Indian Standards Institution, which started functioning in 1947, is the National Standards Organisation in India. Its principal objective is to prepare standards on national basis and promote their adoption. The Bureau has brought out over fifty standards for various fish and fishery products. These standards prescribe detailed requirements of processing, packaging and methods of analysis for evaluation of quality of the product. A list of Indian Standards for fish and fishery products is given in Annexure I and the major requirements stipulated in these standards are presented in Annexures 2, 3 and 4.

The salient features include scope of standards, terminology, grades, preparation of material, requirements, packaging and marketing, sampling and tests. The requirements of the products are:

1.	Physical aspects	-	Weight, size etc.
2.	Sensory aspects	-	Appearance, colour, texture, odour and flavour

3.	Microbiological requirements	-	Total plate count, *E. coli*, Staphylococci, Streptococci and Salmonella
4.	Chemical aspects	-	Moisture content, ash, sodium chloride, heavy metals

Fresh Fish

Under fresh fish, standards are available for pomfrets, mackerel, threadfin, seer fish etc. The formulation of the standards has been felt necessary with a view to make available fresh fish of desired quality and selecting raw material for freezing and canning purposes. It should be handled and transported under sanitary conditions, washed in water containing 5-10 ppm chlorine, precooled and iced. The material shall be clean, wholesome and fresh. It should have characteristic colour, odour, bright eyes, bright red gill, firm flesh etc. The material may also satisfy the microbiological limits.

Frozen Fish

Indian Standards are available for frozen products like shrimp, lobster tails, crab meat, cuttlefish, squid, pomfret, threadfin, mackerel, seer fish etc. The main quality requirements of the frozen products are dehydration, drained weight, size grade, discoloration, decomposition and microbiological requirements. On thawing, the product should be clean, in sound, intact, undamaged condition and free from defects. Deteriorations such as dehydration, oxidative rancidity and adverse changes in the texture shall not be present. The products shall be free from foreign matter.

Dried and cured products

Under this, standards are available for dried prawns, dried white baits, dried and laminated Bombay duck, dry salted products like mackerel, seer fish, shark, tuna, threadfin, jewfish, catfish, horse mackerel etc. The main quality requirements are:

- Material shall have characteristic dry-salted fish odour and shall not show red or pink discoloration.

- Shall be free from off-odour indicative of spoilage.
- Freedom from foreign matter.
- Freedom from excessive sand and salt.
- Freedom from insects and mite infestation and from visible fungal growth.

The moisture content, salt content and ash content are also prescribed.

The curing period is also specified. The fish while drying shall be protected against contamination from dirt, sand, flies and insects.

Standards are also available for a variety of canned products, fish meal, shark liver oil and sardine oil. In addition to these, standards are also prepared for code of practices. For instance:

- Code for hygienic conditions for fish industry (I-Pre-processing and II-Processing stage).
- Recommendations for maintenance of cleanliness in fish industry.
- Basic requirements for fresh fish stalls
- Requirements for a fish market
- Procedure for checking temperature of quick frozen foods
- Specification for master cartons for export of fishery products
- Methods of tests to achieve the various quality standards

2. International standards

a. The Codex Alimentarius Commission (Codex standards) (Joint FAO/WHO body)

The main international organization for food standards is the Codex Alimentarius Commission. The aim of the Codex is to develop food standards to be used world wide with a view to protect consumers' health and ensuring fair trade practices. These standards are used by member countries as a basis to formulate their own standards. Codex documents include provisions in respect of good hygiene, food additives, contaminants, labelling and presentation and methods of analysis and sampling.

The Codex publications are intended to guide and promote the elaboration and establishment of definitions and requirements in foods and to assist in harmonisation of trade among countries by removing technical barriers. Often they are used by member countries as a basis to formulate their own national standards.

The Commission has established various specialist committees to deal with separate areas in food industry. These are of two types:

i. Commodity Committees

eg:- Fish and fish products (Norway)
Fats and oil (UK)
Meat and meat products (W. Germany)
Poultry and poultry meat (USA)

ii. General Subject Committees

eg:- Hygiene (USA)
Labelling (Canada)
Additives (Netherlands)
Analysis and sampling (Hungary)
General principles on handling and processing (France)

The Committee on fish and fishery products holds its regular meetings in Norway. A number of standards on fishery products including the one on Quick Frozen Shrimps have been brought out by Codex.

b. The ISO 9000 series standards

The International Standards Organisation (ISO) is located in Geneva and is a federation of national standards bodies representing almost 100 countries. The ISO 9000 series based on the (BS) 5750 series were publised in 1987 aiming at providing international quality standards.

ISO 9000 is a series of standards applicable to any industry which aims at providing a guarantee of quality at any specified level. Quality planning and quality assurance are envisaged in ISO 9000. The producer is expected to "establish and maintain a documented quality system as a

means of ensuring that product conforms to specified requirements". The standards only guide the industry to follow a certain documentation methodology. Detailed documentation of an organisation's quality system is indeed a principal feature of the ISO 9000 standards. There are 20 elements of quality requirements in the various standards (ISO 9000 to 9004). A competent National Authority certifies the industry as conforming to the standards and subsequently audit the performance. The standard that will apply to fish production is ISO 9002 - 'Quality system - Model for quality assurance in production and installation' which give increased responsibility to the industry for self certification of quality using an established quality assurance system.

i. Requirements of ISO 9000 series

A. Health control, checks, sensory evaluation, chemical test and microbiological analysis

a. Checks on fishing vessels, landing areas
b. Pre-processing and processing establishments
c. Fulfilment of conditions for approval
d. Product handling, transportation, packing
e. Cleaning of premises
f. Hygienic conditions of workers
g. Water
h. Waste disposal
i. Product hygiene/degree of spoilage
j. Microbiological test

B. Wrapping, labelling, storage and transport

a) Packaging and labelling shall be done with approved packing materials under hygienic conditions and also in terms and regulations of each country and specification.

b) Storage shall be under controlled and specified temperature and under hygienic conditions.

c) Transportation of fishery products should also be through vehicles well cleaned and disinfected without any contamination.

c. The Hazard Analysis Critical Control Point (HACCP) System

The Hazard Analysis Critical Control Point (HACCP) concept proposed by the US FDA has been taken as a standard process control system for assuring food safety by international bodies. Canada, USA, Iceland, European Union and many other fish producing countries have taken to HACCP as a food safety standard. Now, it has been identified as the global unified quality assurance system for producing safe and better quality fish products at a global level. The FAO's Codex Alimentarius Commission has formulated guidelines for implementation of HACCP system in the food industry.

The HACCP concept offers good possibilities to secure the safe production of foods. It helps the processors perform the analysis and control the process to prevent known hazards that are likely to occur. Documentation is an important aspect of HACCP. In the United States, by implementing HACCP, the company and the FDA assure food safety and wholesomeness.

It has been recognised that end-product testing alone cannot assure seafood quality and safety. A preventive strategy based on thorough analysis of the prevailing conditions and studies on control of factors related to contamination, survival and growth of microorganisms in food at all stages of food chain comprise Hazard Analysis Critical Control Point (HACCP) approach. It aims to identify problems before they occur and establishes measures for their control at all stages in production that are critical in ensuring the safety of food. Control is proactive since remedial action is taken in advance of the development of the problem. The ICMSF (International Committee on Microbiological Specification of Foods) has given in its handbook "HACCP in Microbial Safety and Quality" (1988), a comprehensive overview of the system. This is very similar to the ISO series of standards. Details of the HACCP system are separately covered in this book.

The regulatory requirements and standards of various international bodies are given in the annexures V to XI.

3. Company specific standards : In addition to National and International standards, reputed companies specify their own standards and quality requirements for fish and fishery products.

Annexure - I

Indian Standards on Fish and Fisheries Products

Sl. No.	Name of specification	Specification Number and Year of publication
(1)	(2)	(3)
A. Fresh Fish		
1.	Fresh silver pomfret and brown pomfret	IS 4780 - 1968
2.	Fresh threadfin	IS 4781 - 1968
3.	Mackerel, fresh	IS 6032 - 1971
4.	Seer fish (*Scomberomorus* spp) fresh	IS 6123 - 1971
B. Frozen fish and shellfish		
5.	Frozen prawns (shrimp) - Second revision	IS 2237 - 1985
6.	Frozen froglegs	IS 2885 - 1964
7.	Frozen lobster tails	IS 3892 - 1966
8.	Frozen threadfin	IS 4796 - 1968
9.	Frozen silver pomfrets and brown pomfrets	IS 4793 - 1968
10.	Mackerel, frozen	IS 6033 - 1971
11.	Seer fish (*Scomberomorus* spp) frozen	IS 6122 - 1971
12.	Frozen cuttlefish and squid	IS 8076 - 1976
13.	Frozen minced fish meat	IS 10763 - 1983
C. Canned fish and shellfish		
14.	Pomfret canned in oil (first revision)	IS 2168 - 1971
15.	Prawns (shrimp) canned in brine (first revision)	IS 2236 - 1968
16.	Mackerel (*Rastrelliger* spp) canned in oil (second revision)	IS 2420 - 1985
17.	Mackerel (*Rastrelliger* spp) canned in brine	IS 3849 - 1966
18.	Sardines (*Sardinella* spp) canned in oil (first revision)	IS 2421 - 1971

19.	Sardines (*Sardinella* spp) canned in brine and in their juice	IS 6677 - 1972
20.	*Lactarius spp. canned in oil (first revision)*	*IS 6121 - 1985*
21.	Tuna canned in oil	IS 4304 - 1967
22.	Crab meat, canned in brine	IS 7143 - 1973
23.	Crab meat, solid packed	IS 7582 - 1975
24.	Mackerel canned in curry	IS 9312 - 1979
25.	Specification for mussels canned in oil	IS 10760 - 1983

D. Dried fish and shellfish

26.	Dried prawns (second revision)	IS 2345 - 1985
27.	Dried and laminated Bombay duck	IS 2884 - 1964
28.	Dried white baits (*Anchoviella* spp)	IS 2883 - 1985
29.	Dry salted mackerel	IS 4302 - 1967
30.	Dry salted seer fish (first revision)	IS 5198 - 1985
31.	Dry salted shark (first revision)	IS 5199 - 1985
32.	Dry salted surai (Tuna) (first revision)	IS 5736 - 1985
33.	Dry salted threadfin (Dara) and dry - salted Jew fish (Ghol) (first revision)	IS 3850 - 1973
34.	Dry salted cat fish	IS 3851 - 1966
35.	Dry salted leather jacket (*Chorinemus* spp)	IS 3852 - 1966
36.	Dry salted horse mackerel (*Caranx* spp)	IS 3853 - 1985
37.	Dry shark fin	IS 5471 - 1969
38.	Fish maws (first revision)	IS 5472 - 1985
39.	Dry salted dhoma (first revision)	IS 8836 - 1985

E. Miscellaneous

40.	Code for hygienic conditions for fish industry Part I Pre-processing stage (first revision)	IS 4303 - 1975
41.	Code of hygienic conditions for fish industry Part II Canning stage (first revision)	IS 4303 - 1975
42.	Recommendation for maintenance of cleanliness in fish industry	IS 5375 - 1970
43.	Fish meal as livestock feed (first revision)	IS 4307 - 1973
44.	Shark liver oil for veterinary use	IS 3336 - 1965

45.	Sardine oil	IS 5734 - 1970
46.	Glossary of important fish species of India	IS 7313 - 1974
47.	Basic requirements for fresh fish stalls	IS 7581 - 1975
48.	Basic requirements for a fish market	IS 8082 - 1976
49.	Procedure for checking temperature of quick frozen foods	IS 8077 - 1976
50.	Master cartons for exports of frozen seafoods and froglegs	IS 6715 - 1972
51.	Methods for sampling fish and fisheries products	IS 11427 - 1985

Annexure - II

Microbiological Requirements for Fresh and Frozen Fish and Shellfish (Bacterial count maximum/g)

Sl. No.	Name of fish / shellfish	Fresh/ Frozen	SPC	*E. coli*	Coagulase positive staphylo-cocci	Faecal stepto-cocci	Salmonella
1.	Mackerel	Fresh	1,00,000	20	-	-	Nil
2.	Threadfin	Fresh	1,00,000	20	-	-	"
3.	Pomfrets	Fresh	1,00,000	20	-	-	"
4.	Mackerel	Frozen	1,00,000	10	-	-	"
5.	Threadfin	Frozen	1,00,000	10	-	-	"
6.	Pomfrets	Frozen	1,00,000	10	-	-	"
7.	Seer fish	Frozen	1,00,000	10	-	-	"
8.	Froglegs	Frozen	5,00,000	10	-	-	"
9.	Lobster tails	Frozen	5,00,000	20	100	-	"
10.	Prawns (whole & headless)	Frozen	5,00,000	20	100	100	"
11.	Prawns (peeled & deveined)	Frozen	10,00,000	20	100	100	"
12.	Prawns (cooked)	Frozen	1,00,000	Nil	100	100	"
13.	Cuttlefish	Frozen	1,00,000	10	100	-	"

Annexure - III

Quality Requirements of Canned Products

Sl.	Characteristic	Requirements for Tuna O	Prawn B	Pomf-rets O	Mack-erel B	Mack-erel O	Sardine B	Sardine O	*Lacta-rius* spp. O	Crab B
1	Can exterior	shall not be rusted, dented or bulged								
2	Vacuum in mm (min) for round cans:	100 in all cases or negative pressure in flat cans								150
3	Head space mm	5-10 in all								
4	Dried weight of the contents of the can as % of water capacity	70	64	66	65	65	70	70	65	65
5	Proportion of water in drained liquid (max)	5	-	10	-	10	-	10	10	-
6	Disintegrated portion as % of drained weight (max)	5	5	5	5	5	5	5	5	-
7	Trace elements ppm (max)	Cu 12	As 1	Pb 5	Zn 50	Sn 250		(in all cases)		
8	Can interior	Normal i.e. free from discolouration etc.								
9	Microbiological activity	Absent in all cases								

O = Oil pack B = Brine pack

Annexure - IV

Requirements for Dried Fish and ShellFish

Sl.	Characteristic	White Baits	Tuna (surai)	Prawn pulp	Dried Bombay duck	Luminated Bombay duck	Mackerel (dry silted)	(Catfish (dry salted)	Dara (dry salted)	Ghol (dry salted)	Leather jacket	Horse mackerel	Shark	Seer	Shark fin
1.	Moisture % (max)	20	35	20	15	15	35	35	45	40	40	40	40	45	10
2.	Sodium chloride % (max)	2.5	25	5	7.5	6	25	25	25	20	25	25	30	30	-
3.	Acid insoluble ash % (max)	7.0	1.5	1	1	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5

Annexure - V

Recommended microbiological limits for seafood (ICMSF, 1986)

Product	Test	Limit per gram m	or per cm2 M
Fresh and Frozen fish	APC	$5x10^5$	10^7
Cold smoked fish	*E. coli*	11	
Frozen raw Crustaceans	APC	$5x10^5$	10^7
	E. coli	11	500
Frozen cooked Crustaceans	APC	$5x10^5$	10^7
	E. coli	11	500
	S. aureus	10^3	-
Cooked, chilled Frozen crab meat	APC	10^5	10^6
	E. coli	11	500
	S. aureus	10^3	-
Fresh & Frozen Bivalve molluscs	APC	$5x10^5$	-
	E. coli	16	

APC - Aerobic Plate Count
m - Acceptable count
M - Boundary between marginally acceptable & unacceptable

Annexure - VI

EEC directive and standards

Chemical

TVB-N - Not more than 30 mg/100 g

Histamine - Out of 9 samples, average not more than 100 ppm.

- 2 samples = 100 - 200 ppm

(No sample should exceed 200 ppm: applicable to Scombroidae and Clupeidae)

Heavy metals

Mercury - 0.5 ppm

Cadmium - 0.5 ppm

Tin - 250 ppm

Parasites - No tolerance

Microbiological criteria (Cooked, ready-to-eat shrimp & crab meat)

Salmonella	-	Not to be detected in 25 g
S. aureus	-	m = 100/g; M = 1000
E. coli	-	m = 10; M = 100
Shrimp (APC) (without shell)	-	m = 50,000; M = 5,00,000
Crab meat (APC)	-	m = 1,00,000; M = 10,00,000

* FAO Fisheries Tech. Paper No. 334 (1994)
m = acceptable count
M = Boundary between marginally acceptable and unacceptable.

Annexure - VII

US FDA Regulatory Requirements

Salmonella/arizona	-	ND in 375 g
Listeria (cooked only)	-	ND
Staphylococcus aureus	-	100/g
Sulphur dioxide	-	100 ppm
Mercury	-	0.5 ppm
P.C.B.S.	-	2 ppm
DDT and its derivatives	-	5 ppm

Filth in fresh or frozen raw shrimp

A - Flies and other insects (whole or equivalent)
1. Filth insect - 2 in a sample
2. Incident insect - 3 in a sample

B. - Insect fragments
1. Filth insect fragments - 5
Fragments (excluding setae) in 2 of 6 subs
(clearly identified as parts of the filth insect)
2. Large body parts of filth insects
(ie. Thorax, abdomen) - 1 in 2 of 6 subs
3. Unidentified fragments - 15 in a sample

C - Hairs
1. Rat or mouse - 2 of any size in a sample
2. Striated but not of rat or mouse - 3 of any size in a sample

Annexure - VIII

Standards of seafoods under the Food Sanitation Law of Australia

	Criteria	Cooked shrimp	Raw frozen product
1.	Std. Plate count	1,00,000/g	Not more than 10,00,000/g
2.	*E. coli*	9/g	11/g
3.	Salmonella	ND in 25 g	ND in 25 g
4.	Coagulase + ve staphylococci	500/g	Not more than 1000/g
5.	*Vibrio parahaemolyticus*	-	Not more than 100/g

Annexure - IX

Japan	Frozen Fish and Fishery products	
Viable bacteria	-	10^5 per g
Coliforms	-	Negative
V. cholerae	-	N.D.
Sulphur dioxide	-	100 ppm
Antibiotics	-	Nil
Dieldrin	-	0.1
DDT	-	No tolerance

Annexure - X

Canadian guidelines for chemical contaminants in fish and fish products

	Contaminant	Product type	Action level
-	Mercury	All fish products (Edible weight) (Except swordfish)	0.5 ppm
-	Arsenic	Fish protein	3.5 ppm
-	Lead	Fish protein	0.5 ppm
-	Fluoride	Fish protein	150 ppm
-	2,3,7,8 TCDD (Dioxin)	All fish products	20 ppt
-	DDT and Metabolites (DDD & DDE)	All fish products	5.0 ppm

-	PCB	All fish products	2.0 ppm
-	Pyperonyl butoxide	Dried cod	1.0 ppm
-	Other agricultural chemicals or their derivatives	All fish products	0.1 ppm

Sampling

Samples to consist of a minimum of 5 units representative of the lot; analysis may be carried out on a composite of all sample units.

Criteria for action

A lot will be considered rejected if the samples value exceeds the action level; fish or fish products exceeding these guidelines may be permitted for export if they do not violate regulations of the importing country.

Based on contaminant level of edible weight.

Annexure - XI

Bacteriological guidelines of Canada for fish and fishery products

Test Organism	Product Type	No. of Sample units	Acceptance Number (c)	m/g	M/g	Criteria for action
A) *Escherichia coli*	1. Cooked products	5	1	4	40	reject if c=3 or more or if one sample exceeds M.
	2. All other types	5	2	4	40	actionable if c=3 or more, or if any one sample exceeds M.
B) Coagulase positive staphylococci	All types	5	1	1,000	10,000	reject if c=2 or more or if any one sample exceeds M.
C) Salmonella	All types	5	Absent in each 50 g sample or in pooled samples of 250 g.			reject if Salmonella is detected