Ministry of Food Processing Industries
Government of India

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Reading Manual for Frozen Fish

Under PMFME Scheme

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ABBREVIATIONS & ACRONYMS

Sr: No.	Abbreviations &Acronyms	Full Forms
1.	APEDA	Agricultural and Processed Food Products Export Development Authority
2.	FAO	Food and Agriculture Organization
3.	FBO	Food Business Operator
4.	FLRS	Food Licensing and Registration System
5.	FPOs	Farmer Producer Organizations
6.	FSSAI	Food Safety and Standards Authority of India
7.	kcal	kilocalorie
8.	MoFPI	Ministry of Food Processing Industries
9.	PA	Polyamide
10.	PET	Polyesters
11.	PFA	Prevention of Food Adulteration
12.	SHGs	Self Help Groups
13.	UK	United Kingdom
14.	US	United States
15.	WVTR	Water Vapour Transmission Rate

CHAPTER 1
INTRODUCTION

1.1. Industrial Overview:

Fish

Both types of edible finfish, molluscs (e.g., clams and oysters), and crustaceans (e.g., crabs and lobsters) that share an aquatic setting are widely used to describe the term fish. Since prior to recorded history, fish from the world's aquatic and freshwater bodies have been a significant source of food for humanity. Ancient Egyptians, Greeks, and other Mediterranean cultures practiced collecting wild fish from fresh and sea waters and cultivating cultured fish in ponds. These ancient groups used primitive processing methods including sun-drying, salting, and smoking to stabilize the stock of fish. The consumption of several species of fish that are common in the world has been promoted by modern processing and preservation practices. Because of its nutritious and health benefits, seafood has become important worldwide. Almost 90 percent of marine commodity shipments are in frozen form. Shrimp, lobster, mackerel, tuna etc. are the most common products. Freezing is the process by which fresh fish and other seafood items are stored. However, only if the commodity is handled in such a way that its content is kept close to its peak freshness is this preservation technique successful.

For of category of fish species, the product types vary and unique unit operations are needed to accommodate the specific type of product. Fish is a common source of protein since fish is rich in good fats such as omega 3 and 6, and plenty of B-vitamins, in addition to being comparatively lower in calories, saturated fats and cholesterol. Reducing the risk of coronary heart disease and helping to preserve mental and sensory control is correlated with eating fish as a daily part of the diet. Fresh fish, though, are often pricey and need to be used fast, so

frozen fish or flash-frozen fish become safer alternatives. Freezing is commonly used in seafood reservations at varying temperatures. Methodologies for processing and freezing vary not only for different commodities, but for the form of commodity. In order to maintain the flavor and nutritious value of the food, the use of an effective technique is important. Proper handling and protection of the product is also necessary for compliance with the necessary quality requirements expected for the product to be sold, especially in developing countries.

1.2. Product Description:

Most of the edible fish products are derived from skeletal muscles (flesh), which account for more than 50% of the animals' total body mass. The skeletal muscles of fish are largely composed of stacks of short bundles of muscle fibers called myomeres, and are different from those of mammals and birds. Myomeres are separated by thin layers of connective tissue that are horizontal (myosepta) and vertical (myocommata). Fish muscle's distinctive structure and thin connective tissue sheaths give the meat its characteristic soft, flaky texture.
According to new research, frozen fish is just as good as fresh fish. While fresh fish can last only two or three days after being caught, according to a registered dietitian, frozen fish can last from four to six months in the freezer and still have the same health benefits. Research from Norway is exploring new methods for handling, frozen and thawing fish in order to ensure the best quality of fish throughout the year. For consumers who want to buy more affordable frozen fish, this new development is beneficial while reducing the risk of parasites that can be found in raw fish. The quality of frozen fish is affected by variables such as fish species, stress levels, pre-slaughter handling and rigor status. However, temperature management during freezing, storage, transportation and thawing are the most important factors determining the quality of frozen fish. Freezing must be fast and the temperature throughout the process must be low and constant, and during transport and storage, fluctuations must be avoided. The processing of fish into canned and frozen forms takes place mainly for export purposes. In addition, there is an increased demand in the domestic and overseas markets for processed and ready to eat marine products.

1.3. Market Potential:

The size of the frozen fish and seafood industry has the potential to rise by USD 31.76 billion in 2020-2024, and the growth momentum of the market will intensify during the forecast period due to steady year-over-year growth increases. Rohu, Catla, Mrigal are highly significant decisions among the freshwater carp fish species. There are fishes that are usually sold as whole fish.

India is the world's second largest fish producer with a harvest of about 10.8 million MT. Marine food production rate in India are currently at 23 percent. India has ample geographical opportunities suitable for both coastal and freshwater fisheries, such as long coastlines (7,517 km), abundant rivers and canals, wetlands, dams and tanks, and brackish water. Currently, the export sector is estimated at USD 5.8 Bn/ 1 Mn MT. Currently, most exports are frozen and there is enormous scope for value-added goods to be exported. The table size of rohu, catla, mrigal fish has an edible portion of 60-70 percent while carps over 3 kg have an edible portion of 75-80 percent. Freshwater carps are typically sold in an iced state and only have a quality of 7 to 10 days. In the domestic consumption and export market, there has been an increased demand for automobiles.

Andhra Pradesh, West Bengal, Gujarat, Karnataka and Kerala are the top five fishing states in India, with a combined share of about 50 percent of the overall fish production. Inland Fish Production: Andhra Pradesh, West Bengal, Uttar Pradesh, Bihar and Odisha are the top five states that contribute almost 68% to freshwater aquaculture. O Development of Marine Fish: Gujarat, Andhra Pradesh, Tamil Nadu, Maharashtra and Kerala are the top five states, contributing almost 72% of the overall production. Frozen shrimp contributes 38 percent in quantity and 65 percent in value terms to exports. India exported marine products worth USD 5.8 Bn in 2016-17. The second largest export commodity was frozen cod, representing a share of 26 percent in quantity and 12 percent in volume. Marine goods are exported throughout the country through 30 separate sea/air/land ports. In terms of export rate, Pipavav is the main port and Vizag is the major port in terms of export value.

From 2019 to 2024, the worldwide Frozen Seafood Industry is forecast to record 5.34% CAGR and hit USD 17.29 billion by the end of 2024. To maximize its shelf life by inhibiting the growth of micro-organisms, frozen seafood is stored or retained at freezing time. Frozen fish is primarily consumed in places far from the body of water. The growth of the global economy is projected to fuel continuous production and creativity in cold-chain transport.

Consumers are now switching from packaged food to frozen foods due to growing health consciousness, which is projected to foster the development of the global economy. In addition, the growing practice of eating seafood as a supplement for red meat is projected to drive the development of the world market for frozen seafood. Asia-Pacific is expected to rise at the highest CAGR level in the global frozen market due to developing demand for seafood due to a rapidly expanding population. In addition, the demand for a different form of seafood from non-coastal areas is expected to drive the development of the region's frozen seafood industry.[i]

Global Market, by Region

- Asia-Pacific
  - Japan
  - China
  - India
  - Australia and New Zealand
  - Rest of Asia-Pacific

- Intended Audience
  - Processors of frozen seafood
  - Traders and distributors of frozen seafood
  - Research and development institutes
  - Potential investors
  - Raw material suppliers
  - Nationalized laboratories

1.4. Raw Material Description:

A wide variety of fish and shellfish suitable for canning are available. For canning/frozen packing, sardines, mackerel, tuna, seer fish and shellfish such as shrimp, clam, oyster, mussel, crab etc. are appropriate. Raw material processing involves de-scaling, beheading, gutting, fine reduction, tail removal and cutting into small parts, etc.

- Proper dressing with potable water and extensive cleaning.
- Holding the icing properly.

The yield is influenced by the ratio between the edible and the inedible parts of the fish, and the technical value of the fish is a deciding factor. This ratio is species-dependent. In the Salmonidae family, it is the most favourable, amounting to about 75 percent of the weight. This parameter varies from 50 to 60% for most fish species. The yield is less than 50 percent in the case of perch and most of the family of Cyprinid.

During some growth cycles and annual spawning or migration periods, the composition of fish can differ considerably, particularly in their fat content. Moreover, the composition of captive-bred fish (i.e. aquaculture fish) will vary based on their artificial diet.

Fish are cold-blooded animals, with fins and a backbone. Many fish breathe with gills and have scales. About 480 million years ago, 22,000 species of fish started to evolve. The largemouth bass shown above has the usual (fusiform) torpedo-like appearance shared with many fish.

Water, protein, lipids (fat or oil) and ash are the four main components of the edible part of the fish (minerals). The analysis is also referred to as 'proximate analysis' for these four essential constituents of fish muscle. While proximate composition data is important for many applications and research on these lines was undertaken from as early as the 1880s, it is difficult to obtain accurate data on the proximate composition of most fish species. The percentage composition of the four main fish elements, i.e. The proximate composition is classified as water, carbohydrate, lipids and ash (minerals) (it may be noted that the term does not indicate any degree of inaccuracy in the analysis). In most cases, these four elements account for about 96-98 percent of total tissue constituents.

- Fins: Fins are appendages used to hold position, pass, steer and avoid by the fish. These are either single fins, such as the dorsal (back) fins, caudal (tail) fin and anal fin, along the centreline of the fish, or paired fins, which include the pectoral (chest) and pelvic (hip) fins.
- Scales- In most bony fish, the scales—most non-gar freshwater fish with ganoid scales and catfish without scales—are either ctenoid or cycloid. Ctenoid scales have jagged margins, and smooth rounded edges have cycloid ones.
- Gills: The gills are the fish's respiratory apparatus and are extremely vascularized, giving them their vivid red appearance.
- Eyes- Colour can be sensed by fish. Because of the refractive index of water, the eyes of fish are more oval than in mammals and focus is done by pushing the lens in and out, not distorting it as in mammals.

- Nares- To detect odours in water, paired nostrils, or nares, in fish are used and can be very sensitive. Eels and catfish have senses of smell that are especially well established.
- Mouth: The shape of the mouth is a clear clue to what fish are eating. The larger it is, the greater the prey that it can consume. Fish have a sense of taste and, if they are not obvious prey objects, can sample things to taste them before swallowing.
- Lateral Line- The lateral line is a sensory organ composed of fluid-filled sacs with hair-like sensory instruments that, through a series of pores, are exposed to the water, forming a line down the fish's side. Water currents, vibration and acceleration in the water are mainly felt by the lateral line.

1.5. Types of Raw Material

As long as the history of mankind goes, fish has become an important part of our diet. With 97% of the world under water, fish have always been a great source of food for humans as well as wildlife. The wide variety, simple availability and nutritional quality of fish and a host of other factors make fish a success around the world.

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10 majorly consumed fishes in India are:

- Rawas- Rawas is an edible fish that is one of the most loved and common. Rawas is commonly available in India and is popular for its mild flavoured pink to orange beef. Specifically, it is an oily fish, which means that about half of its body consists of oil. A salmon fillet is said to have about 30 per cent of the fat, and is a boneless slice of fish. However, this oil, which contains Omega 3, Vitamin A, and Vitamin D, is perfect for your skin.
- Katla (Indian Carp or Bengal Carp): Katla is a freshwater fish and is primarily found in Assam and North India's lakes and rivers. Up to 2 kg can be measured by a fully-grown trout. It is oily again, a very commonly eaten fish. Fish is a rich source of protein and essential fatty acids. Katla has a reasonably decent omega-6 to omega-3 ratio, which is 0.7. There is a moderate amount of mercury in this species, which is healthy enough to consume.
- Rohu a Rohu (Rohu or Carpo Fish)- Rohu, a member of the Carp tribe, is a freshwater fish. The fish are primarily available in Northern and Central India, respectively. The fish

weights up to 2 kilograms on average and is mainly eaten for meat. It's high in Omega Fatty acids again.

- The Bangda (Indian Mackerel)- The Indian Mackerel, also known as Bangda, belongs to the list of Indian staple fishes. It is a saltwater fish that is present in the surrounding seas and the Indian Oceans. The fish is fatty and is thus a perfect source of Omega 3 and protein.
- Rani-Rani (Pink Pearch): In India, rani is a very popular freshwater fish. The fish is pink, tiny in size and mild in taste. Since it only has 5 percent body fat, the fish is referred to as lean fish. If your only purpose is to provide protein, then this fish is a perfect choice.
- Surmai (Seer Fish/King Fish)- The fish is both incredibly popular and costly. In South and Central India, it is the most common. The fish is pink, the mackerel is categorically thin in Surmai and is high in calcium, omega 3 and other vitamins.
- Pomfret: Pomfret is an exotic fish in India that is greatly enjoyed. It belongs to the genus of butterfish found widely in South Asia, including the Indian Ocean. The fish is not fatty and has exceptionally tasty white meat. There is a common silver, white and black pomfret in India.
- Hilsa: Bangladesh's National Tuna. In Odisha, West Bengal, Assam and Andhra Pradesh, Hilsa is very popular. It has a high Omega 6 to Omega 3 ratio, which is 0.1. This tasty fish has meat that's tender.
- Kekda: Kekda is not a fish but a seafood that is really nutritious. As safe as other oily fish, crab meat is. It is also abundant in selenium, which decreases mercury's harmful effects.
- Jhinga (Prawns and Shrimps): You will find both prawns and shrimps in sea water as well as in fresh water. They're both nearly similar in flavour. As prawns are larger than shrimps, they actually range in size.

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CHAPTER 2
PROCESS & MACHINERY REQUIREMENT

2.1. Raw Material Aspects:

During some growth cycles and annual spawning or migration periods, the composition of fish can differ considerably, particularly in their fat content. Moreover, the composition of captive-bred fish (i.e. aquaculture fish) will vary based on their artificial diet. Fish freezing is a preservation process. In this process, fish tissue and fishery products are converted into ice within the water at a lower temperature. This technique boosts the shelf life of fish and fish products. This approach is used internationally to monitor the quality of fish and fish items at the time of conservation. There are many ways in which fish can be frozen, but both need specialized equipment to affect the necessary rapid temperature drop and adequately decrease the core temperature to ensure that the commodity can be safely stored in cold storage. If unfrozen fish are merely positioned in a cold store running at -300c, the temperature will decrease rapidly enough and the result will be frozen fish of poor quality; cold stores are built to keep fish already frozen at low temperatures.

2.2. Source of Raw Material

Indian rivers are the primary source of food for the irrigation scheme, drinking water and fish. There is a list of freshwater fish present in Indian rivers, with Rohu, Katla, Mahseer, Magur and Vaam being some of India's most common names for freshwater fish. As the primary target species for culture, a mixture of Indian main carps, including catla (Labeo catla), rohu (Labeo rohita) and mrigala (Cirrhinus mrigala) were used, as well as a few Chinese carp species such as silver carp (Hypophthalmichthys molitrix), grass carp (Ctenopharyngodon idella) and sometimes common carp species (Cyprinus carpio). The very high degree of technologies developed for induced carp breeding and the surplus of agri-based by-products used as supplementary feed have resulted in the country's rapid growth of freshwater aquaculture.

- Katla or Catla, also referred to as the big Indian carp, is widely found in Indian rivers and lakes and is one of the most popular freshwater fish species. The most important aquacultural freshwater fish in India are catla, roho labeo and mrigal carp.

- Mrigal carp is another common food fish and an important freshwater aquaculture species, only surviving in the Cauvery River wild population.
- A significant game fish, popular freshwater sport, and food fish, Tor tor is commonly referred to as the mahseer and Golden mahseer. Mahseer was located in Wayanad, the River Kali, the River Sarda, and the Rivers of the Himalayas.
- Ilish or hilsa shad, common in India, particularly West Bengal, Odisha, Tripura, Assam and Andhra Pradesh, is a freshwater and brackish water fish. In Andhra Pradesh and Bengal, fish is a common snack.
- Of all the varieties of common fish found in India, the Godavari River Pulasa fish in Andhra Pradesh is the tastiest and most expensive. The name of this fish genus is also known as hilsa, Ilish, and hilsa shad. In Andhra Pradesh, there is a saying that Pustelu ammi ayina Pulasa tinocchu suggests, by even selling the Mangalsutra, it is worth eating Pulasa Fish.
- Often known as the Gangetic Ailia, Kajuli is mainly found in large rivers and associated water bodies. This is an important species for local commercial fish.
- Tengra or Tengna is a small catfish and one of the tasty fishes in Tangra Macher Jhal's Bengali recipes. Tengra fish are primarily found in the Bihar, Odisha, Chhattisgarh and Bengal rivers of the Indian state.

Total fish production in India is estimated at 6.24 million metric tons (MMT) in 2018, which is equivalent to two-thirds of the country's total fish production from both sources of catch and cultivation. As marine finfish production is rarely performed on a wide scale, development in the fish farming sector is mainly due to the freshwater aquaculture sector. Of the total animal protein eaten in India, approximately 12.8 percent comes from freshwater fish.

2.3. Technologies:

Direct and indirect systems

The refrigerant absorbs heat directly from the material to be cooled inside the direct expansion device. The refrigerant consumes the heat that the brine absorbs from the substance to be cooled inside the indirect or brine method. In industrial freezing practices, all of these devices are widely employed. Freezing strategies are grouped widely into:

- Air-Freezing is the most popular medium for freezing. There are two kinds of air freezing mechanisms - still air freezing and induced air freezing.

- Freezing in still air: The freezer consists of an enclosed space or a cabinet held at -28 to -45oC. Packaged or otherwise put in aluminum trays, fish is held on shelves consisting of pipes or coils from which the refrigerant is pumped. The time needed to freeze could be 12 hours or longer. The least expensive method of freezing is to freeze in still air; however, the slowest method is welding.
- Air Blast Freezer-The air blast freezer consists of a tunnel or insulated space. Air is cooled by blowing a ventilator into the cooling coil of the cooling system. Cold air flows over the frozen fish and takes up the heat from the food, the freezer walls, etc. Hold the temperature at -35 to -40oC.
- Continuous air blast freezer-This is an enhancement to the air blast freezer where a conveyor belt is used to transfer the fish around the space or tunnel continuously. It is possible to change the speed of the conveyor to accommodate the type of fish to be frozen. Air flow may either be countercurrent to the material's movement or around the belt. The air velocity, sustained at 150-300 m/sec, makes intimate contact with the fish and easily freezes. Freezing is easier and, in shorter times, any form of fish can be frozen in large amounts. An example is spiral belt freezers.
- Fluidized Bed Freezing-Fluidized bed freezer is a continuous belt freezer improvement. Fluidization is a way of preserving partly assisted stable particles in an increasing column of cold air. In an outward stream of cold air at a velocity adequate to float the particles in the cold air, the particles kept on a mesh are independently suspended. Each molecule is surrounded by air and is isolated from each other and left suspended. Freezing is quick, as between the cold air and the product, the best possible heat transfer is ensured. 120m/min air velocity. And for fluidized bed freezing, operating temperatures of -35 to -40 o c are popular. This is most fitting for small and standardized items such as shrimp, small fish, etc.

Indirect Contact Freezing

By holding it in contact with a metal surface which is cooled by a refrigerant, indirect contact freezing can be described as freezing a substance. The horizontal plate freezers and the vertical plate freezers come in two styles.

- Horizontal plate Freezer: There are 15-20 plates in these freezers in total. The substance to be frozen, stored in metal freezing trays, is loaded between the freezing plates and held under low hydraulic pressure in near contact with the top and bottom plates to ensure

optimum heat exchange. The freezing trays are often protected with closely fitted lids to help provide contact at the top with the freezing plates. Hold the temperature between -35 and -40oC. The fish will freeze within 2-2.5 hours.

- Vertical Plate Freezer: This are most widely used to freeze sea fish. They consist of various vertical freezing plates in a container called stations that shape partitions. When each station is completed, the fish are loaded between the plates and the plates are then closed together to form fish blocks. Temperatures vary from -30 to -40oC.
- The process of the Contact plate freezer is very economical. The product's dehydration will be minimal and it will sit in uniform blocks without bulging.
- Freezer with Rotary Drum: This is a drum of refrigerated stainless steel which rotates at a pre-set speed. The frozen material is fed through a conveyor on the outside surface of the drum. By freezing the water on the material's back, it adheres directly to the surface of the drum. The frozen substance is scraped off at the end of one revolution and is passed into an electronic glazer prior to packaging. As there is no air circulation and freezing is rapid, there will be little to no weight loss during the freezing period.
- Immersion by Freezing: In this approach, freezing is done by immersion in a refrigerant that stays liquid during the process, or spraying with it. As a medium for freezing, refrigerated aqueous solutions of propylene glycol, glycerol, sodium chloride, calcium chloride and sugar and salt mixtures can be used. Immersion freezing facilitates intimate interaction with the freezing medium of each surface of the material and thereby allows very effective heat transfer.
- Freezing in brine: At -21 o c, saturated brine freezes and this is the most prevalent medium used in immersion freezing. The freezing of brine is fast and can be optimized for continuous activity. However, any salt, which depends on certain aspects, such as the temperature of the brine, the length of immersion, the fat content of the fish and the surface area, will be consumed by the fish. Through using a combination of glucose or corn syrup and salt as a fridge, the absorption of salt can be significantly decreased. The glucose-salt solution will lend the substance a safe glaze and it will thus not hold together. A significant downside of this method is degradation of the medium and resulting cross contamination of batches.
- Freezing by brine spray: The fish put in trays are sprayed with chilled brine. The heat from the fish is absorbed in 1-2 hours by the chilled brine.
- Cryogenic Freezing: Quite fast freezing is accomplished in cryogenic freezing by exposing the fish to an incredibly cold freezer undergoing a change of state, unpacked or

with a very thin box. The significant distinction between cryogenic freezing and heating for liquid immersion is the change of state in the former as heat is extracted from the body. Boiling nitrogen and boiling or sublimating carbon dioxide are the most popular food-grade cryogenic freezers. Cryogenic freezing is much quicker than freezing of the air blast or touch plate; but only marginally faster than freezing of the fluidized bed or liquid immersion. For example, in a commercial liquid nitrogen freezer, shrimp takes nine minutes to freeze, while it would be 12 minutes in a fluidized bed freezer and 1-2 hours in touch plate or air blast freezers.

- Using liquid nitrogen, freezing: When liquid nitrogen is used to freeze, liquefied nitrogen gas is poured over the substance as it goes along a conveyor belt in a tunnel. Before touching the liquid nitrogen spray, the nitrogen gas travels counter current to the action of the fish so that the fish gets pre-cooled. The substance is permitted to temper after the spray for a while when discharged from the tunnel.
- Freezing Using Liquid / Solid Carbon Dioxide: When it moves through a tube on a rotating conveyor, liquid carbon dioxide is poured over the fish. The carbon dioxide is pumped through the nozzles and the pressure is gradually lowered during spraying and about 50 percent of it instantly shifts to small particles that absorb the heat from the air and are turned to steam, resulting in the fish being easily cooled. By exposing the fish to powdered solid carbon dioxide, freezing may be carried out. Carbon dioxide freezing provides much of the benefits of liquid nitrogen freezing. However, to the point of causing undesirable swelling, unpacked foods may absorb or trap carbon dioxide.
- Freezing using refrigerant liquid: Dichlorodifluoromethane, the most popular liquid refrigerant used, is (Freon -12). Fish is conveyed to an enclosed chamber in a mesh belt. Fish is then frozen by spraying the stock with a strong Freon food grade or a mixture of initial immersion in Freon liquid accompanied by spraying with it. The vapours are obtained for re-use in both situations. The procedure has all the effects of the freezing of liquid nitrogen and the additional cost advantage. However, due to worries about the impact of Freon -12 on atmospheric ozone depletion, its use has reduced rapidly.
- Double Freezing: Protecting the fish by freezing on-board boats as the journey continues for a few weeks is a common procedure. The fish is thawed and reprocessed upon reaching the sea. Examples of double freezing are the use of fish frozen in bulk on board for further finger processing and the reprocessing of bulk frozen shrimp into IQF shrimp. Quality-wise, fish re-freezing is regarded to be unacceptable. As a fillet, lean fish suffers a loss of consistency, particularly when the texture becomes rough.

- Partial Freezing: Partial freezing or super cooling means reducing the fish's temperature to between -2 and -3 C. Approximately half of the unbound water contained in the fish would be transferred to the solid stage by cooling the fish to the temperature level. The shelf life of partly frozen fish is almost double that of ice-storage fish. Some lack of sensory efficiency, however, is experienced when the storage time stretches to five days, primarily due to temperature variations. A 0.5 C shift can be instrumental in the periodic melting and freezing of fish water and can have a significant effect on the denaturation of proteins. The shelf life of partly frozen fish would be very short if it is subsequently frozen. The preservation of a strictly constant storage temperature is very critical for avoiding loss of consistency in partially frozen fish.

2.4. Manufacturing Process:

Fish is a perishable raw material because of its chemical composition. After death, the taste and texture of fish change quickly during preservation. Thus, it is advisable to keep the fish alive as much as possible when handling freshwater fish. Quality improvement mechanisms also cover the transfer and storage/depuration of fish waiting for processing. To eliminate bacterial activities, in order to prevent undesirable enzymatic and microbiological processes, de-heading, gutting, washing and chilling should be carried out immediately on dead fish. In order to preserve shelf life, processing techniques should be implemented when fish is not sold fresh. Freezing, smoking, heat treatment may be used in these (sterilization, pasteurization, etc.).

- Immediate cooling- Fast cooling and retention of fish at temperatures between 2 and -2 °C (36 and 28 °F) occurs shortly after processing. (See Treating Harvested Fish: Chilling above.)
- Rapid freezing- Rapid temperature drop to between -2 and -7 °C (28 and 20 °F) is the secret to freezing. This temperature range illustrates the highest ice crystal forming region in the cells of the animals. If water freezes rapidly in the cells, so the ice crystals can stay small and allow the cells to experience minor damage. Slow freezing, however, results in the development of large ice crystals and the cell membranes are ruptured. The ruptured cells release water (called drip) and several compounds that provide some fish flavour characteristics when slow-frozen flesh is thawed, resulting in a dry, tasteless product. In general, fish going through the region of maximal ice crystal production in less than one hour would have minimal drip loss after thawing.

- Freezing- Among the various preservation processes used to preserve seafood, the taste and consistency of fresh fish can only be retained by freezing. The biochemical processes in fish flesh are significantly reduced or interrupted by freezing. For example, enzymes do not react to soften and degrade the flesh in the absence of free water. Immediate cooling and holding, quick freezing, and cold storage are the three stages for freezing fish. When fish are frozen poorly, leading to enzymatic deterioration, texture changes, and dehydration, structural integrity can be damaged.
- Freezer Chamber- In order to preserve a long shelf life and ensure consistency, fish must be preserved at a steady temperature of -23 ° C (-10 ° F) or below when frozen. Water is a major part of fresh seafood (e.g., oysters are more than 80 percent water). Since water in fish contains several dissolved compounds, at the freezing point of pure water, it does not freeze evenly. The free water in fish instead freezes over a large range, starting at around -2 °C (28 °F). Until the substance exceeds a temperature of approximately -40 °C (-40 °F), the sum of residual free water declines. Fish kept below that temperature can be preserved for an infinite time and packed so as not to allow water depletion by sublimation. Unfortunately, because of the enormous variation in energy prices, there are comparatively few commercial freezers capable of keeping fish at -40 °. Therefore, fish are usually preserved at -18 to -29 °C (0 to -20 °F), resulting in a variable shelf life of only a few weeks and almost one year.

2.5. Flow Chart:

Steps	**Machine Name**	**Description**	**Machine Image.**
Packaging	Vaccum Packaging Machine	The Fish Vacuum Packing System extracts and seals air from the pouch in an airtight way. Vacuum packing increases the shelf-life and helps maintain the product's consistency.	
Freezing	Blast Freezer-	For deep freezing fillets of cod, air blast freezers are also used. On their travel into the tube, the fillets lie on a conveyor belt and freeze.	

Storage	Freezer/cold storage	A plant for the refrigeration, freezing and cold handling of perishable foodstuffs and other perishables.	

2.6. Additional Machine & Equipment:

MACHINE AND EQUIPMENTS	USES	PICTURE
Gutting machines	Gutting machines reduce the amount of waste by basically gutting all forms of fish with extremely high accuracy, leading to a decline in the cost of processing. The guts are sucked out with the aid of a vacuum when the fish is gutted and sliced. Problems involving knife sharpening as a result of stones eaten by fish are thereby avoided.	
Washmaster	For initial cleaning, rinsing during processing or final washing before packaging, Wash master may be used. Wash master is available as a 2-chamber device, meaning that some of the water can be reused while the second chamber still has fresh water.	
Scalemaster	The Scale master unit is mounted on a rigid spring suspension frame in order to change the size of the fish. The fish is kept in place by tight connections during the decaling process-it is necessary to maintain the fish in place to ensure a successful decaling. The	

	tightening of the ties is performed pneumatically and it is easy to seamlessly change the tightening process. The links can be cut for better cleaning of both the ties and the unit in a minute.	

2.7. General Failures & Remedies:

S. No.	General Failures	Remedies
1.	Ball bearing failure of various machine	1. Proper periodic lubrication of all bearings in various machines. 2. Regular replacement of all bearing to prevent critical failures.
2.	Power Drive Overload	1. Ensure proper weighing & metering specially in case of semi-automatic plant. 2. Install warning sensor in buffer region of loading capacity to ensure efficient operation.
3.	Mechanical Key Failure	1. Ensure that mechanical keys are replaced as per there pre-defined operational life. 2. Prevent Overloading.
4.	Loss of Interface	1. This problem is dominant in newly established automatic plant, one must learn to maintain rules in plant & ensure no employee goes near transmission lines, unless authorised. 2. Provide proper physical shielding for the connections.

2.8. Nutritional Information:

The information below shows the composition of the nutrients of various fish species.

- The Proteins- An outstanding source of high-quality protein is fish. Owing to their high-water volume, mollusks are typically lower in protein compared with fin fish and crustaceans. Sarcoplasmic proteins (e.g., enzymes and myoglobin), contractile or myofibrillary proteins (e.g., actin and myosin), and connective tissue proteins are exactly the same proteins present in fish as those contained in meat derived from other species (i.e., collagen).
- Fat- Fat is mainly liquid (i.e. fish oil) in fish and it contains a comparatively low proportion of fatty acids that are saturated. Fish belong to a particular dietary class since they include eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) omega-3 polyunsaturated fatty acids, which have been shown to safeguard against many diseases, including heart disease. The aquatic and freshwater plants on which fish feed are abundant in EPA and DHA, unlike land plants.
- Vitamins and mineral substances- Fish supplements the diet with a variety of essential vitamins and minerals. They are a healthy source of riboflavin, niacin, and thiamine in the fat-soluble vitamins A, D, E, and K, and the B vitamins. Calcium, magnesium, phosphorus and iron are found in the mineral content.
- Microbiology- Fish are highly prone to microbial pollution due to their soft tissues and the marine climate. Fish bear a heavy microbial load on the surface of their skin, in their digestive tract and in their gills at the time of harvest. Depending on the season, the species, and the natural environment, the form and number of microorganisms found in fish varies. During the harvest, storage, or distribution of the fish, additional pollution may occur. Species of Pseudomonas, Moraxella, and Acinetobacter, found primarily in marine fish, and Bacillus and Micrococcus, found in freshwater fish, are typical spoilage microorganisms in fish. Pathogenic (disease-causing) microorganisms like Salmonella and Escherichia coli can also be found in fish. For mollusks, pathogenic infection is of great concern since they are often consumed raw and as whole organisms.

2.9. Export Potential & Sales Aspect:

Factors driving the global frozen seafood industry are growing the demand for frozen seafood products globally. Manufacturers concentrate on delivering healthy offerings of items. Frozen seafood products are frozen with cryogenic technology that aims to prevent the bacterial growth of frozen seafood products. Several frozen seafood companies worldwide use cryogenic freezing equipment to retain low temperatures of solid carbon dioxide or liquid nitrogen that is specifically added to frozen seafood products. Frozen seafood items can be preserved for a long period of time with the aid of advanced freezing technologies. Most customers change their choice to frozen foods over prepared foods because the nutrients are not destroyed in frozen foods and the food items are also eaten worldwide. The consistency of the products is preserved by these frozen seafood products and is therefore mainly eaten globally. Accordingly, robust growth over the projected timeframe is anticipated in the global Frozen Seafood industry.

Some of these major parameters are discussed below: There are many parameters that regulate the consistency of the final product:

- Appearance: The most significant aspect of the appearance of any food is its colour, particularly when it is directly correlated with other features of food quality. Form, surface profile and clear texture are additional attributes. The appearance of food is just as important as its flavor and colour to the success of a food product.
- Taste: The sensory system, or sense of taste, is the sensory system that is partly responsible for taste sensing (flavor). Taste is the perception produced or induced when a material in the mouth, often on the tongue, chemically interacts with taste receptor cells located on taste buds in the oral cavity. Any divergence from them would result in deviation in the final dish of the different food items with their particular tastes, so it is important to preserve a uniform taste in refined food products.
- Content of Nutrition: A well-balanced ratio of the essential nutrients of carbohydrates, fats, proteins, minerals and vitamins in food or dietary supplements is a measure of the nutritious content or nutritional value as part of the consistency of the food in relation to the nutrient needs of the user. The higher the nutritional content of a food is its consistency, as appropriate ingredients have to be added to increase nutritional value along with the base ingredient.
- Shelf Life: Shelf life is the amount of time a substance can be processed without being unsafe for use, consumption, or sale. Provided a range of products with the

same nutritious quality and flavor, it comes into play after presentation, taste and nutrition, one appears to opt for the product with longer shelf life.

- The packaging: The quality of the product is often established, apart from the basics such as food grade packaging material, the form of process and technology further increases the quality of the product, such as the incorporation of anti-microbial packaging to the value of the product and hence the quality.[ii]

CHAPTER3
PACKAGING

3.1. Shelf Life of Product:

Fish freezing is a preservation process. In this process, fish tissue and fishery products are converted into ice within the water at a lower temperature. This technique boosts the shelf life of fish and fish products. This approach is used internationally to monitor the quality of fish and fish items at the time of conservation. There are many ways in which fish can be frozen, but both need specialized equipment to affect the necessary rapid temperature drop and adequately decrease the core temperature to ensure that the commodity can be safely stored in cold storage. If unfrozen fish are merely positioned in a cold store running at -300c, the temperature will decrease rapidly enough and the result will be frozen fish of poor quality; cold stores are built to keep fish already frozen at low temperatures. Any frozen fish or shellfish will be healthy indefinitely; after long storage, though, the taste and feel will fade. Freeze (0 °F / -17.8 °C or less) cooked fish for up to 3 months, for the highest consistency. Frozen raw fish is best used within 3 to 8 months; shellfish, 3 to 12 months.

The shelf life of food stored depends on these 4 main criteria:

- Temperature:

  Foods stored at room temperature or cooler (75°F/24°C or lower) will be nutritious and edible much longer than previously thought according to findings of recent scientific studies. Foods stored at 50°F to 60°F (which is optimal) will last longer than foods stored at higher temperatures. Heat absolutely destroys food and its nutritional value. Proteins break down and some vitamins will be destroyed. Taste, color, and smell of some foods may also change.

- Moisture:

  The reason long term food storage is dehydrated or freeze dried is to eliminate moisture. Too much moisture promotes an atmosphere where microorganisms can grow and chemical reaction in foods causing deterioration that ultimately can sicken us.

- Oxygen:

  Too much oxygen can deteriorate foods and promote the growth of microorganisms, especially in fats, vitamins, and food colors. That is the reason to use oxygen absorbers when dry packing your own food products.

- Light:

  Exposure to too much light can cause deterioration of foods. In particular if affects food colors, vitamin loss, fats and oils, and proteins. Keep long term food storage in low light areas for longest shelf life.

  Most expiration dates on foods in cans range from 1 to 4 years but keep the food in a cool, dark place and the cans undented and in good condition, and you can likely safely double that shelf life from 3 to up to 6 years. It shall also conform to the following standards.

3.2. Frozen Fish Packaging:

Packaging has two key purposes: enticing buyers and retaining materials. There is a wide array of packaging choices for food processing plants to pick from, but it mainly depends on the type of product they make. There are many factors that need to consider while selecting a suitable type of pack for the product:

- The product contents.
- The application of the product.
- Content stability.
- Protection from any environmental factors
- Acceptability of the pack to the customer.
- Regulatory, legal, and quality issues.

Characteristics of packaging material

- The material selected must have the following characteristics:
- Must meet tamper-resistance requirements
- Must not reactive with the product
- They must protect the preparation from environmental conditions
- Must be non-toxic
- Must not impart odour/taste to the product
- Must be FDA approved.

Classification of Freeze Food:

There are three basic classification of canned foods based on their acidity, they are classified as low acid canned food, acidified canned food and high acid canned food.

3.3. Packaging:

Popular kinds of packaging include:

- Stand-up pouches: Attention-grabbing stand-pouches provide ease, reduce the cost of shipping, and keep items new.
- Vacuum skin packaging: To enhance its visual appeal and extend its lifespan, vacuum skin packaging (VSP) forms a tight, clear film over a product**.**
- Multi-layer films: To keep the fish fresh, multi-layer films create a tight seal. The product is shown clearly by this type of packaging, and the multiple layers help protect packages from punctures and abrasions.
- Individually fast frozen (IQF) packaging: for frozen fish fillets and other frozen seafood items, IQF packaging is also used. In general, IQF is available in bag format and can come in a range of types, such as the shape of the pillow or flat bottom.
- Packaging is often an automated process involving advanced machines which fill and seal containers and bags of goods. This process reduces the need for manual labour and speeds up the packaging stage.

3.4. Material of Packaging:

- Polyethylene (PE)- The foundation of packaging films is known to be this. Since moisture is one of the main threats to the integrity of candy goods, polyethylene is of definite importance due to its low water vapor transmission. Polyethylene films are fairly free from plasticizers and other additives and are commonly used as a laminating component. Its heat seal capacity increases its worth.
- Low Density Polyethylene (LDPE) is an inexpensive material with low WVTR, but has high flavor/volatile permeability, poor fat tolerance and limpness. High-density polyethylene (HDPE) is more robust, transparent and has stronger barrier properties, but sealing requires higher temperatures. High molecular weight high-density polyethylene (HM HDPE) and linear low-density polyethylene polyethylene (LLP) are later additions

(LLDPE). HM HDPE is a film-like paper with high physical strength and barrier characteristics, but is less translucent than standard polyethylene. In twist-wrap grades, HM HDPE is available. For making bags and pouches, polyethylene films are also appropriate. Polyethylene and polyvinyl alcohol copolymers and EVOH have outstanding gas barrier properties, especially when dry.

- POLY VINYL CHLORIDE (PVC)- PVC has a low gas transmission rate and is a stiff and transparent film. It is easy to use PVC as small wraps, sacks and pouches. PVC as co-polymerised with polyvinylidene chloride is known as Saran. As it is an expensive material, it is only used to achieve barrier properties and heat saleability as a coating. For twist wraps, PVC film is also used, since it has twist retention characteristics and is excellent on high-speed machines.
- Polyesters and polyamide (PET) (PA)- The film of polyethylene terephthalate has high tensile strength, gloss and rigidity, as well as resistance to puncture. It has mild WVTR, but for volatiles and gases, it is a strong buffer. PET is usually laminated to other substrates in order to have the heat seal property. Nylons or polyamides are similar to Cat, but have high WVTR.

CHAPTER 4
FOOD SAFETY REGULATIONS AND STANDARDS OF FROZEN

4.1. Introduction to FSSAI:

The Food Safety and Standards Authority of India (FSSAI) has been established under Food Safety and Standards, 2006 which consolidates various acts & orders that have hitherto handled food-related issues in various Departments. The FSSAI is responsible for setting standards for food so that there is one body to deal with and no confusion in the minds of consumers, traders, manufacturers, and investors. The Act aims to establish a single reference point for all matters relating to food safety and standards, by moving from multi-level, multi-departmental control to a single line of command.

Highlights of the Food Safety and Standard Act, 2006-

Various central Acts like Prevention of Food Adulteration Act, 1954 , Fruit Products Order , 1955, Meat Food Products Order , 1973, Vegetable Oil Products (Control) Order, 1947,Edible Oils Packaging (Regulation)Order 1988, Solvent Extracted Oil, De- Oiled Meal and Edible Flour (Control) Order, 1967, Milk and Milk Products Order, 1992 etc will be repealed after commencement of FSS Act, 2006.

The Act also aims to establish a single reference point for all matters relating to food safety and standards, by moving from multi- level, multi- departmental control to a single line of command. To this effect, the Act establishes an independent statutory Authority – the Food Safety and Standards Authority of India with head office at Delhi. Food Safety and Standards Authority of India (FSSAI) and the State Food Safety Authorities shall enforce various provisions of the Act.

Establishment of the Authority-

Ministry of Health & Family Welfare, Government of India is the Administrative Ministry for the implementation of FSSAI. The Chairperson and Chief Executive Officer of Food Safety and Standards Authority of India (FSSAI) have already been appointed by Government of India. The Chairperson is in the rank of Secretary to Government of India.

4.2. FSSAI Registration & Licensing Process:

According to Section 31(1) of Food Safety and Standards (FSS) Act, 2006, Every Food Business Operator (FBO) in the country is required to be licensed under the Food Safety & Standards Authority of India (FSSAI).

As per FSS (Licensing & Registration) Regulations, 2011, Licenses and Registrations are granted to FBOs in a 3 tier system

- Registration - for petty FBOs with annual turnover less than Rs 12 lakhs
- State license - for medium-scale food manufacturers, processor and transporters
- Central License - for large-scale food manufacturers, processor and transporters

FSSAI registration is done online on the FSSAI website through Food Safety Compliance System (FoSCoS)

- FoSCoS has replaced the Food Licensing and Registration System (FLRS).
- Petty food business operators are required to obtain FSSAI Registration Certificate
- "Petty Food Manufacturer" means any food manufacturer, who manufactures or sells any article of food himself or a petty retailer, hawker, itinerant vendor or temporary stall holder (or) distributes foods including in any religious or social gathering except a caterer;

Or

- Other food businesses including small scale or cottage or such other industries relating to food business or tiny food businesses with an annual turnover not exceeding Rs. 12lakhs and/or whose production capacity of food (other than milk and milk products and meat and meat products) does not exceed 100 kg/ltr per day

Any person or entity that does not classify as a petty food business operator is required to obtain an FSSAI license for operating a food business in India.

FSSAI License - two types - State FSSAI License and central FSSAI License

Based on the size and nature of the business, the licensing authority would change.

- Large food manufacturer/processors/transporters and importers of food products require central FSSAI license
- Medium-sized food manufacturers, processor and transporters requires state FSSAI license.
- License period: 1 to 5 years as requested by the FBO.
- A higher fee for obtaining FSSAI license for more years.

- If a FBO has obtained the license for one or two years, renewal may be done, no later than 30 days prior to the expiry date of the license.

4.3. Food Safety & FSSAI Standards & Regulations:

2.6. Fish and Fish Products: 2.6.1 Fish and Fish Products- Frozen fish fillets or minced fish flesh or mixtures thereof are products obtained from fresh wholesome fish of any species or mixtures of species with similar-sensory properties. Fillets may be pieces of irregular size and shape with or without skin. Minced fish flesh consists of particles of skeletal muscle". and is free from bones, viscera and skin. The product may be glazed with water. The products shall conform to the following requirement: -

Particular	Characteristics	Requirements
1.	Total Volatile Base (Nitrogen)	Not more than 30 mg/ 100gm
2.	Histamine	Not more than 20 mg / 100gm

Note I: Products under article 1, 2, 3, 4 AND 5 shall be frozen in an appropriate equipment quickly to minus (-) 18º C or colder in such a way that the range of temperature of maximum crystallization is passed quickly. The quick-freezing process shall not be regarded as complete unless the product temperature has reached minus (-) 18º C or colder at the thermal centre after thermal stabilization. The product shall be kept deep frozen so as to maintain the quality during transportation, storage and sale. The entire operation including processing and packaging shall ensure minimum dehydration and oxidation. The product may contain food additives permitted in Appendix A except listed product under regulation 2.6.1 (3). The product shall conform to the microbiological requirement given in Appendix B. The products shall be free from any foreign matter and objectionable odour/flavour[iii]

Food Safety

Part I - General Hygienic and Sanitary practices to be followed by Petty Food Business Operators applying for Registration

Sanitary and hygienic requirements for food manufacturer/ processor/handler

The place where food is manufactured, processed or handled shall comply with the following requirements:

1. The premises shall be located in a sanitary place and free from filthy surroundings and shall maintain overall hygienic environment. All new units shall set up away from environmentally polluted areas.

2. The premises to conduct food business for manufacturing should have adequate space for manufacturing and storage to maintain overall hygienic environment.

3. The premises shall be clean, adequately lighted and ventilated and sufficient free space for movement.

4. Floors, Ceilings and walls must be maintained in a sound condition. They should be smooth and easy to clean with no flaking paint or plaster.

5. The floor and skirted walls shall be washed as per requirement with an effective disinfectant the premises shall be kept free from all insects. No spraying shall be done during the conduct of business, but instead fly swats/ flaps should be used to kill spray flies getting into the premises. Windows, doors and other openings shall be fitted with net or screen, as appropriate to make the premise insect free The water used in the manufacturing shall be potable and if required chemical and bacteriological examination of the water shall be done at regular intervals at any recognized laboratory.

6. Continuous supply of potable water shall be ensured in the premises. In case of intermittent water supply, adequate storage arrangement for water used in food or washing shall be made.

7. Equipment and machinery when employed shall be of such design which will permit easy cleaning. Arrangements for cleaning of containers, tables, working parts of machinery, etc. shall be provided.

8. No vessel, container or other equipment, the use of which is likely to cause metallic contamination injurious to health shall be employed in the preparation, packing or storage of food. (Copper or brass vessels shall have proper lining).

9. All Equipment’s shall be kept clean, washed, dried and stacked at the close of business to ensure freedom from growth of mould/ fungi and infestation.

10. All equipment's shall be placed well away from the walls to allow proper inspection.
11. There should be efficient drainage system and there shall be adequate provisions for disposal of refuse.
12. The workers working in processing and preparation shall use clean aprons, hand gloves, and head wears.
13. Persons suffering from infectious diseases shall not be permitted to work. Any cuts or wounds shall remain covered at all time and the person should not be allowed to come in direct contact with food.
14. All food handlers shall keep their finger nails trimmed, clean and wash their hands with soap, or detergent and water before commencing work and every time after using toilet. Scratching of body parts, hair shall be avoided during food handling processes.
15. All food handlers should avoid wearing, false nails or other items or loose jewellery that might fall into food and also avoid touching their face or hair.
16. Eating, chewing, smoking, spitting and nose blowing shall be prohibited within the premises especially while handling food.
17. All articles that are stored or are intended for sale shall be fit for consumption and have proper cover to avoid contamination.
18. The vehicles used to transport foods must be maintained in good repair and kept clean.
19. Foods while in transport in packaged form or in containers shall maintain the required temperature.
20. Insecticides / disinfectants shall be kept and stored separately and `away from food manufacturing / storing/ handling areas.

4.4. Labelling Standards (Regulation 2.5 of FSS)

Labelling requirements for packaged food products as laid down in the Part 2.4 of the Prevention of Food Adulteration (PFA) Rules, 1955, and the Standards of Weights and Measures (Packaged Commodities) Rules of 1977, require that the labels contain the following information:

1. Name, trade name or description

2. Name of ingredients used in the product in descending order of their composition by weight or volume
3. Name and complete address of manufacturer/packer, importer, country of origin of the imported food (if the food article is manufactured outside India, but packed in India)
4. Nutritional Information
5. Information Relating to Food Additives, Colors and Flavors
6. Instructions for Use
7. Veg or Non-Veg Symbol
8. Net weight, number or volume of contents
9. Distinctive batch, lot or code number
10. Month and year of manufacture and packaging
11. Month and year by which the product is best consumed
12. Maximum retail price

Provided that — (i) the nutritional information may not be necessary, in case of foods such as raw agricultural commodities, like, wheat, rice, cereals, flour, spice mixes, herbs, condiments, table salt, sugar, jaggery, or non –nutritive products, like, soluble tea, coffee, soluble coffee, coffee-chicory mixture, packaged drinking water, packaged mineral water, alcoholic beverages or flour and vegetables, processed and pre-packaged assorted vegetables, flours, vegetables and products that comprise of single ingredient, pickles, papad, or foods served for immediate consumption such as served in hospitals, hotels or by food services vendors or halwais, or food shipped in bulk which is not for sale in that form to consumers.

Wherever applicable, the product label also must contain the following

The purpose of irradiation and license number in case of irradiated food. Extraneous addition of colouring material.

Non-vegetarian food – any food which contains whole or part of any animal including birds, fresh water or marine animals, eggs or product of any animal origin as an ingredient, not including milk or milk products – must have a symbol of a brown color-filled circle inside a brown square outline prominently displayed on the package, contrasting against the background on the display label in close proximity to the name or brand name of the food.

Vegetarian food must have a similar symbol of green color-filled circle inside a square with a green outline prominently displayed.

All declarations may be: Printed in English or Hindi on a label securely affixed to the package, or Made on an additional wrapper containing the imported package, or Printed on the package itself, or May be made on a card or tape affixed firmly to the package and bearing the required information prior to customs clearance.

Exporters should review the Chapter 2 of the "FSS (Packaging and Labelling) Regulation 2011" and the Compendium of Food Safety and Standards (Packaging and Labelling) Regulation before designing labels for products to be exported to India. FSSAI revised the labelling Regulation and a draft notification to that effect was published on April 11, 2018, inviting comments from WTO member countries and the comments received are under review and the publication date remains unknown.

According to the FSS Packaging and Labelling Regulation 2011, "pre-packaged" or "pre packed food" including multi-piece packages, should carry mandatory information on the label.

CHAPTER 5

OPPORTUNITIES FOR MICRO/UNORGANIZED ENTERPRISES

5.1. PM-FME Scheme:

Ministry of Food Processing Industries (MoFPI), in partnership with the States, has launched an all India centrally sponsored "PM Formalisation of Micro Food Processing Enterprises Scheme (PM FME Scheme)" for providing financial, technical and business support for up-gradation of existing micro food processing enterprises. The objectives of the scheme are:

I. Support for capital investment for up-gradation and formalization with registration for GST, FSSAI hygiene standards and Udyog Aadhar;
II. Capacity building through skill training, imparting technical knowledge on food safety, standards & hygiene and quality improvement;
III. Hand holding support for preparation of DPR, availing bank loan and up-gradation;
IV. Support to Farmer Producer Organizations (FPOs), Self Help Groups (SHGs), producers cooperatives for capital investment, common infrastructure and support branding and marketing.[iv]

Reference:

[i] https://www.technavio.com/report/frozen-fish-and-seafood-market-industry-analysis#:~:text=The%20frozen%20fish%20and%20seafood,year%2Dover%2Dyear%20growth.

[ii] https://www.doh.wa.gov/communityandenvironment/food/fish/healthbenefits#:~:text=Fish%20is%20filled%20with%20omega,part%20of%20a%20healthy%20diet.

[iii] https://www.fssai.gov.in/upload/uploadfiles/files/Food_Additives_Regulations.pdf

[iv] https://mofpi.nic.in/pmfme/docs/SchemeBrochureI.pdf