Centurion University

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Preservation of Fresh Fish and Seafood

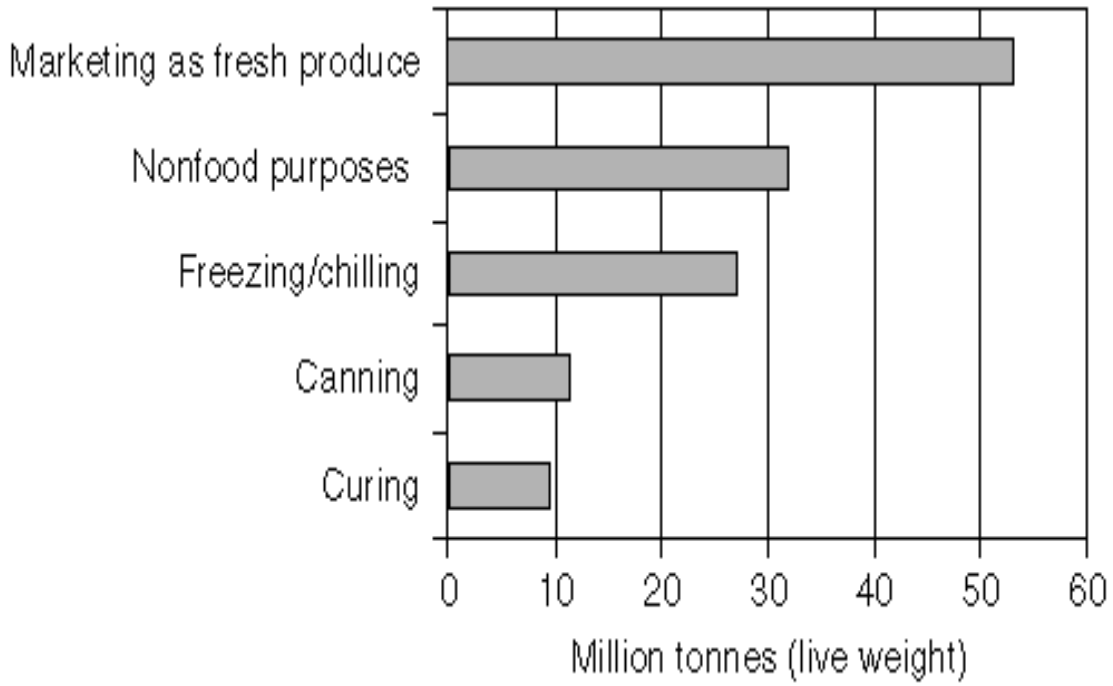
Introduction:

- The fisheries sector plays an important role
- Fisheries exports now generate more foreign exchange
- Worldwide, more than 38 million people are directly engaged in fishing and fish farming
- The influence of postharvest handling, packaging, storage, transportation, and marketing

Objectives and Scope:

- The aim of this slide is to outline and discuss the techniques and procedures for postharvest handling and preservation of fresh fish and other seafood products.

Economic Importance:



Utilization of world fisheries production (breakdown by quantity), 2002. (Adapted from C.L. Delgado et al., The Future of Fish. Issues and Trends to 2020. IFPRI, 2003, 6pp.)

Contribution of Fish to Human Nutrition:

- Fish represents a valuable source of micronutrients, minerals, essential fatty acids, and proteins in the diet of many countries. The meat of fish and seafood products contains about 80% (w/w) water, 8%–25% proteins,0.5%–30% fat, and 0.6%–1.5% mineral compounds
- Vitamins content fish provides about 84–125 kJ per capita per day

Fish and Seafood in Functional Foods:

- The presence of omega-3 polyunsaturated fatty acids restricts heart disease and Positive results were also obtained with omega-3s in relation to certain cancer-causing genes at cell level
- Products get stable incorporated with omega-3 polyunsaturated fatty acids
- threshold levels of omega-3s giving a lowering in plasma triacylglycerol (TAG) concentrations and a reduced clotting tendency of the blood were obtained via human feeding trials.

The Problem of Postharvest Losses in Fish and Seafood:

- Quantity loss

  Quantity losses (wastage) occur when fish disappears or is removed from the food chain, and this may occur due to spoillage or discard when the product is considered completely unacceptable for utilization as food and as an industrial raw material. Quantity loss may also be referred to as physical loss.

- Quality loss

  Quality loss in fresh fish occurs when the product value to the end user is compromised and downgraded due to a reduction in the attributes that are important to the end user. Quality loss often results in lower unit market price of fish product and a concomitant reduction in profits to the producer

Mechanisms and Manifestations of Spoilage in Fish and Seafood:

Several factors contribute to such spoilage in fish, including interactions between the products and handling equipment, interactions between the product and the surrounding environment and atmosphere, and the inherent self-destructive biochemical changes that take place inside the fish once it is harvested.

Biochemical Aspects of Fresh Fish and Seafood Spoilage:

Prior to harvest, fish are protected by a skin that secretes antimicrobial compounds, such as lysozyme, and by antibodies in the blood. This self-protecting and self-regulating property is indicative of the biochemical composition of fish. For instance, lean fish contain 20% protein, less than 5% lipid, with little carbohydrate, whereas fatty fish contain 10%–30% lipid. The pH of fish flesh is neutral, and the flesh is highly buffered due to the presence of phosphates and creatine in the muscle and has a low oxidation–reduction potential. Harvesting of marine, freshwater, or aquaculture fish and other seafoods is an essential step in the delivery of desired products to the consumer. However, harvesting results in death of fish with the following consequences:

1. Cessation of energy supply for normal body function.
2. Cell membranes are no longer energized, and molecules and ions can freely diffuse.
3. Antimicrobials are no longer produced or distributed.
4. Microflora penetrates the skin from the outside surface and the flesh from the intestines and gills

Abiotic, Biotic, and Physiological Causes of Fish and Seafood Spoilage:

1. Mechanical Handling Damage

2. Environmental Factors

3. Biotic (Bacterial) Factors

4. Physiological (Internal) Factors: Lipid Oxidation and Hydrolysis

Physicochemical Manifestations of Spoilage in Fish and Seafood:

Color Changes:

Quality loss of fish muscle after harvest may take the form of color (appearance) changes. Fresh fish has a translucent appearance due to even scattering of incident light. With an increase in spoilage, there is a gradual disintegration of myofibrils, resulting in their wider and more random intracellular distribution. The fish surface then appears opaque because the incident light is unevenly scattered. Changes in fish flesh color occur during low-temperature and freezing storage. The flesh becomes yellow due to oxidation of carotenoid pigments and lipids in tissues.

Texture Changes:

Fresh fish has characteristic firmness, which can be rapidly assessed subjectively by handfeel, and objectively by instrumental test and sensory panel taste. During postharvest handling and storage, the texture of fresh fish changes from “firm” and “moist” to“mushy” and “runny.” These textural changes occur due to tissue softening as a result of myofibrillar disintegration and weakening of connective tissue.

Postharvest Treatments and Preservation of Fish and Seafood

Improvement of Harvesting and Postharvest Handling Systems:

- Improper harvesting and containerization should be avoided
- Checking of containers done regularly
- Additional awareness should be taken at catching sites.

Prestorage Treatments:

- Washing and cleaning
- Gutting and bleeding

Cold/Cool Chain Technology:

From a microbial standpoint ,it is better to store less than 0°C

Approximate Shelf Life of Selected Types of Raw Fish at Different Temperatures

Fish	Temperature (°C)	Shelf Life (Days)
Cod	0	16
	5	7
	10	4
	16	1
Herring	0	10
	5	4
Salmon	0	2
	10	5
Plaice	0	18
	10	8

Source: M. Gibson, *Shelf Life Evaluation of Foods* (C. M. D. Man and A. A. Jones, Eds.), Blackie Academic & Professional, London, 1994, p. 72.

Chemical Treatments and Use of Biopreservatives:

Chlorine and Chlorine Dioxide

- commercial chlorine dioxide killed *Escherichia coli*, *Listeria monocytogenes*
- Fish cubes treated with aqueous chlorine showed no visual changes in color. Treated solutions became lightly milky.

Hydrogen Peroxide:

- Dipping in hydrogen peroxide solution can increase the shelf life of fish. Hydrogen peroxide acts as a preservative as well as a bleaching agent, thus yielding a higher quality product with an extended shelf life.

Lactic Acid Bacteria:

- The addition of living cultures of lactic acid bacteria is used to control pathogen growth in fish. *L. monocytogenes* is difficult to control in lightly salted (6% NaCl in aqueous phase) fish products, pH 5, and storage temperature ~5°C. *L. monocytogenes* in lightly preserved *fish* products can be controlled using food-grade lactic bacteria.

The Role of Packaging Technology

- CA or MA packaging around fresh fish must also be selected to protect against adverse environmental and atmospheric condition as well as penetration of physical and chemical hazards

Irradiation Treatment

- Gamma radiation is considered an innovative and interesting method to preserve chilled, stored fish and also reduce microbial populations in fresh fish and fish products. It is noted that irradiation doses of 2–7 kGy can reduce important pathogens in food such as *Salmonella, Listeria.* Irradiation doses between 0.75 and 1.5 kGy for fresh products and cooked products and between 2 and 5 kGy for frozen foods have been recommended

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