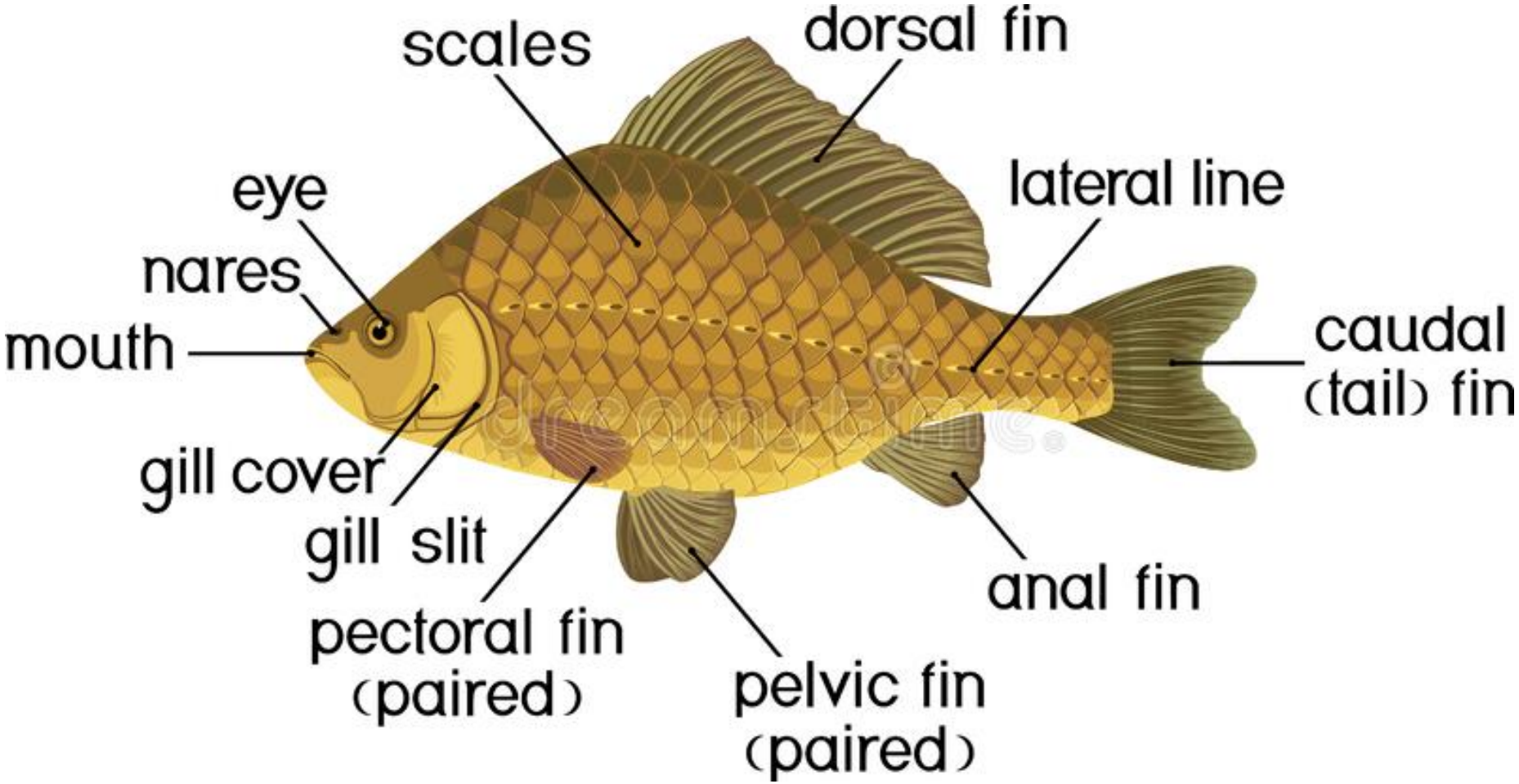
Advanced Food Process Engineering

Fish

Fish

- Fish is a **cold-blooded aquatic vertebrate breathing** by means of **gills**, with paired appendages in the form of **fins** and with a body covering **scales**
- Fish is any member of **paraphyletic group** of organisms that consist of all gill-bearing **aquatic animals**.
- Fish make up the largest of the vertebrate groups with well **over 20,000 species**. They can be found in a great variety of habitats in lakes, streams, oceans and estuaries.

Structure of Fish



Composition of fish

Constituents	Fish fillet		
	Min	Normal	Max
Water	28	66-81	96
Protein	6	16-21	28
Fat	0.4	0.2-25	67
Carbohydrate	-	<0.5	-
Minerals	0.1	1.2-1.5	1.5

Source: FAO Corporate Document Repository

Classification of Fish

- Fishes could be classified into two main ways

a. Classification of fish based on its body structure /morphology.

b. Classification based on their habitat.

- **Classification based on morphology:**

1. Bony fish:

Are fishes that possess a bony skeleton or hard bone (made of bone). They are therefore, called bony fish. These include tilapia, cat fish etc.

2. Cartilaginous fish:

Their body frame (skeleton) is made up of a firm and elastic substance called cartilage e.g sharks, salmon, and dolphins etc.

Classification of Fish

- **Classification based on habitats:**

1. Fresh water fish:

These fishes are found in the water bodies such as lakes and rivers in which the salinity is less than 0.05%. Some freshwater fish breeds are rui, katla, mrigal etc.

2. Semi Saltwater Fish:

This types of fish lives in the estuary and bay with semi saltwater. Tangra, bhetki, gurjali etc. are semi-salt water fish.

3. Marine fish:

Fishes that are capable of living in the sea water are known as marine fish. Tropical climate is required for most of the marine fish to survive. Hilsa (ilish), rupchanda, bele etc. are saltwater fish.

Characteristics of Fresh & Spoiled Fish

	Fresh fish	Spoiled fish
Eyes	Bright, pupil black, cornea transparent	Dull, wrinkled, sunken pupil dull black, cornea opaque
Gills	Bright red, covered with clear slime; odor under gill covers fresh	Dull brown or gray, slime cloudy; odor under gill covers sour and offensive
Flesh	Firm, body is stiff, impression made by fingers do not remain; slime present is clear	Soft and flabby; impression made by fingers remains
Belly walls	Intact	Often ruptured; viscera protruding
Muscle tissue	White	Pinkish, especially around backbone
Vent	Pink, not protruding	Brown, protruding
Odor	Fresh, fishy odor	Stale, sour or putrid
Color	Bright	Faded

How long can fish be kept?

- Fresh fish will spoil very quickly.
- Once the fish has been caught, spoilage progresses rapidly.
- Spoilage depend upon the catching procedure as well as the storage condition.
- In the areas of high temperature, fish will spoil within 12 hours, which make them inconsumable.
- Thus the marketing of fish becomes difficult task because the fish should reach the consumer before the quality of fish reduces.
- Spoilage is the deterioration of food which make its taste and smell bad (sour or rotten) and makes it a carrier of disease germs.

Spoilage of fish

- Spoilage of fish is a process of deterioration in the quality of fish that changes its appearance, smell and taste.
- Fish spoilage can be caused by the breakdown of biomolecules like protein, amino acid and fats that are naturally found in the fish.
- Thus a fish can be spoiled by either **chemical** or **biological** reasons.
- In **chemical** degradation, protein, fats, amino acids etc. are decomposed whereas in **biological** degradation, microorganisms carry out the degradation.
- Other than bacterial and chemical degradation, **enzymatic and mechanical damage** are also causes of spoilage.

Fish Spoilage

- It can define as the **contamination of fish**, which results in the undesirable change in color, texture, flavor and appearance. Spoilage of fish also refers as "**Putrefaction**".
- We can characterize the spoiled fish by observing the color change, fishy smell, sliminess in the skin and scales, firmness of the flesh, discoloration of the backbone etc.
- Putrefaction is anaerobic breakdown of proteins, with the production of foul-smelling compounds such as hydrogen sulfide and amines.
- **Formula of putrefaction:**
- Protein foods + Proteolytic microorganisms = Amino acids + Ammonia + Hydrogen sulfide

How many ways fish can be spoiled?

In fish and meat the most important kinds of spoilage are:

1. Autolytic spoilage caused by enzymes
2. Microbiological spoilage caused by bacteria
3. Chemical decomposition and
4. Mechanical damage

Fish spoilage

1. Autolytic spoilage

- It refers to enzymatic degradation that results in the cell damage of fish and release of an autolytic enzyme, which degrades the cell components like proteins, fats etc. and thereby changes the flavor of fish.
- The changes in the flavor of fish can be due to the conversion of ATP to hypoxanthine and the decomposition of fish.

2. Bacterial Spoilage

- A fish acquires a load of bacteria in the gills and on the surface.
- When a fish dies, the bacteria already present in the fish attack the flesh and result in the formation of undesirable products.
- The microbial growth in fish depends on the type of water from where it caught. The bacteria cause fish spoilage by the conversion of TMAO (trimethylamine oxide) to TMA (trimethylamine), degradation of amino acid to primary amines, and degradation of urea to ammonia.

Fish spoilage

3. Chemical Spoilage

High temperature favors chemical spoilage (degradation of protein and fat). Oxidative rancidity is a common cause of chemical degradation.

4. Mechanical spoilage

Careless handling can result in

Bruised flesh: The darkening is caused by burst blood vessels

Broken skin: Bacteria to enter the flesh

Burst guts: Bacteria and enzymes to contaminate the flesh