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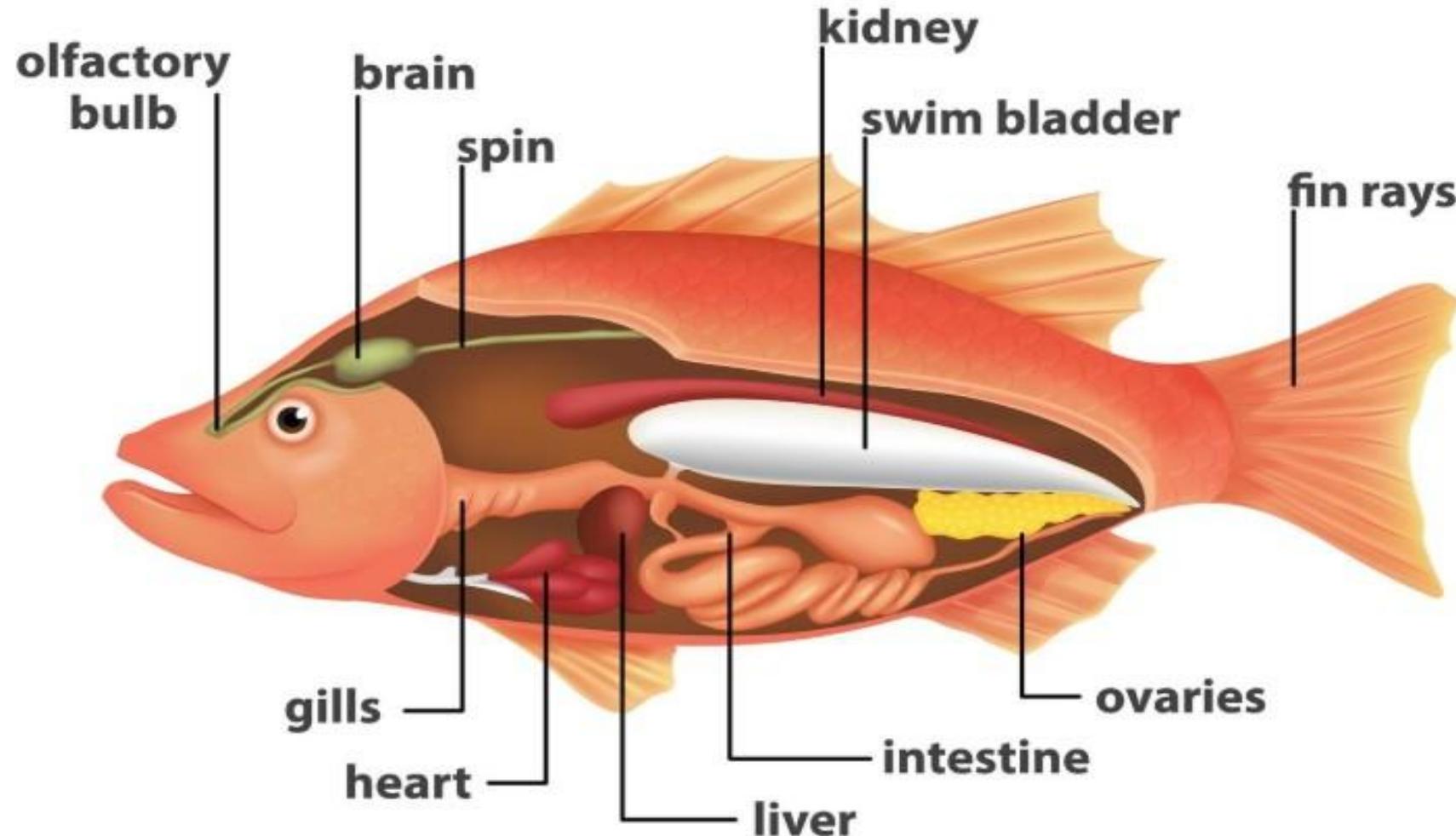


# Fish pre-processing





# INTERNAL ANATOMY OF A FISH

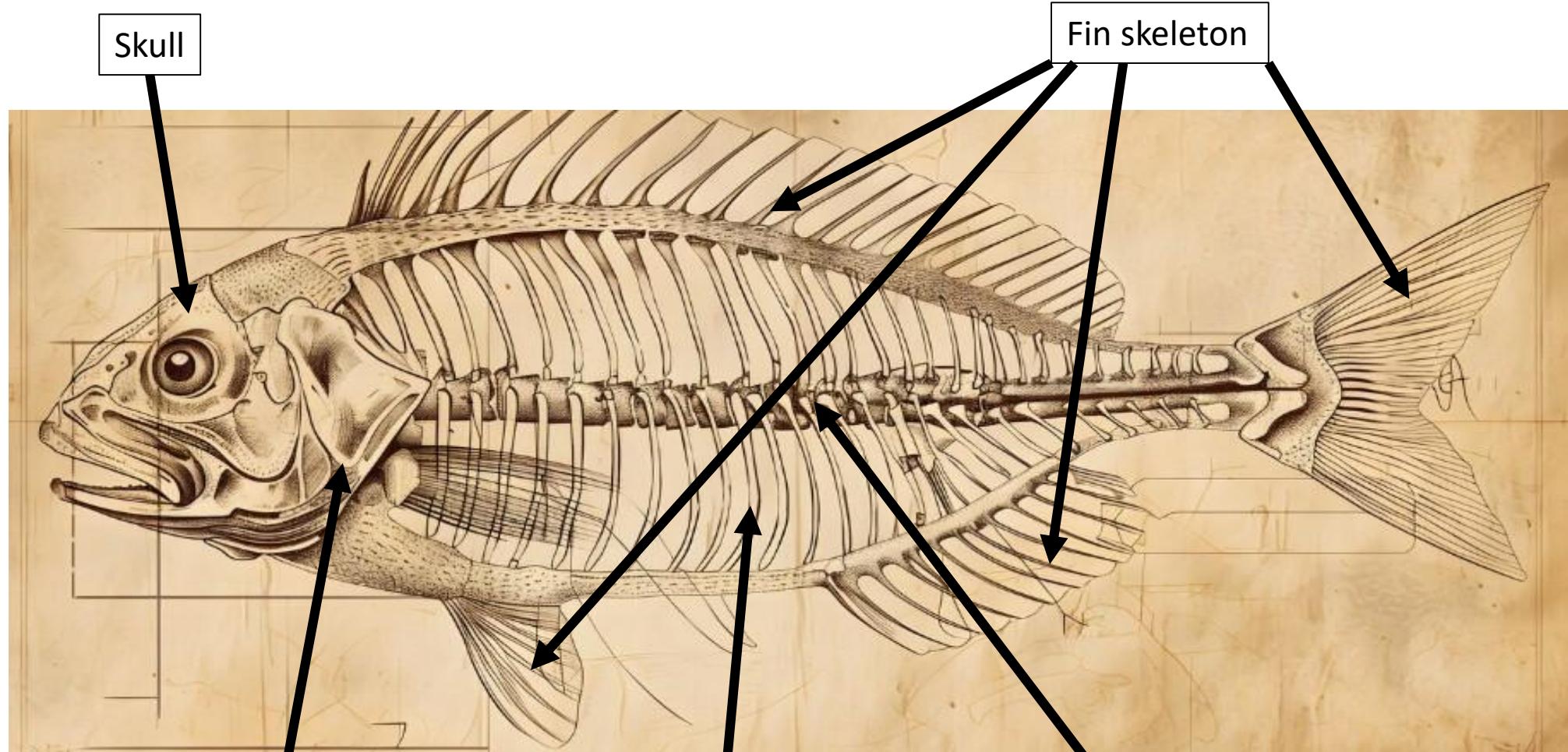




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Opercula (gill covers)

Ribs

Spine



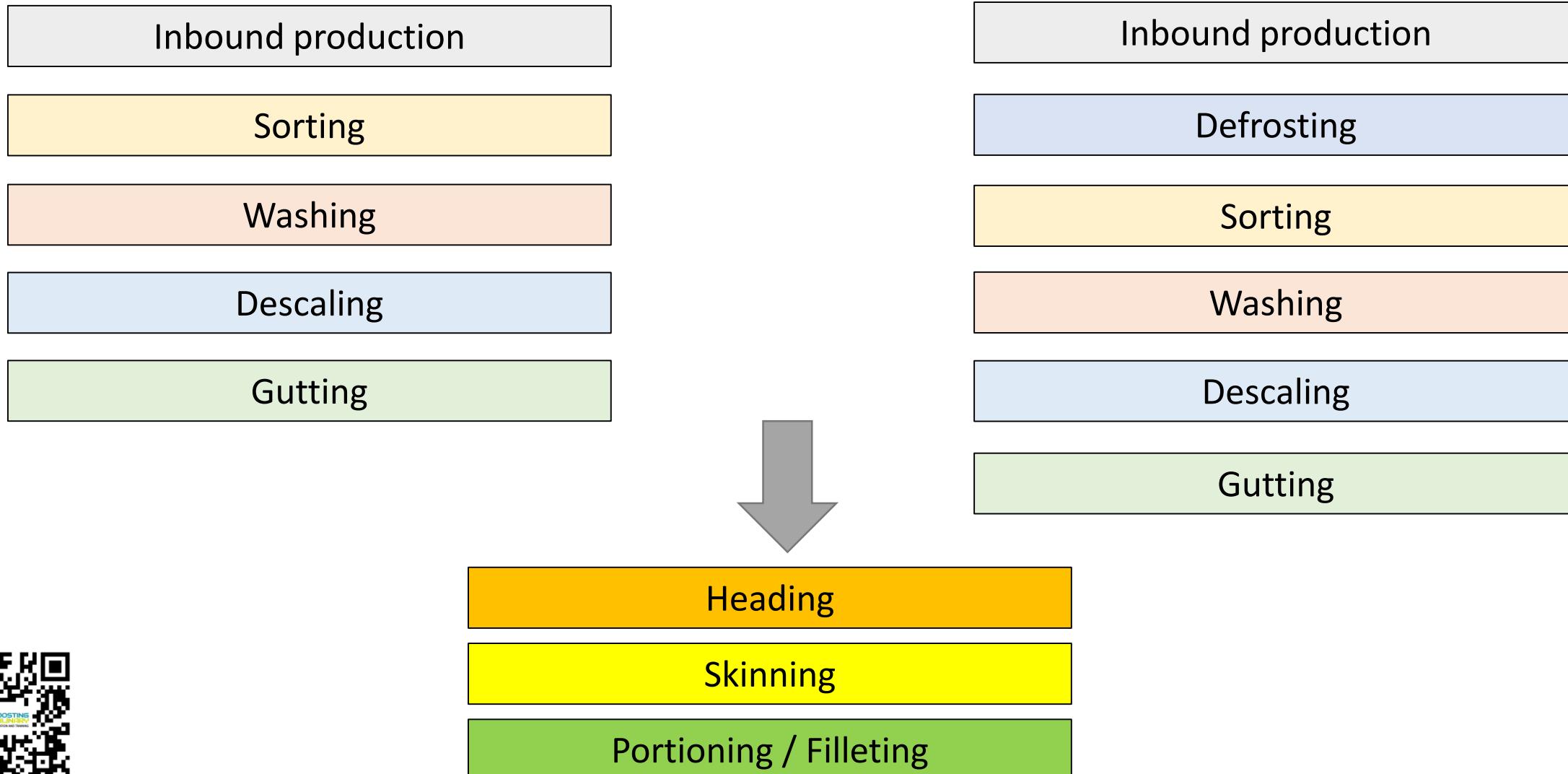
Fish meat, skin, liver, roe, milt are used for food, but bones, scales, and digestive organs are not edible

- Sea fish (cod, herring, tuna, dorado...)
- Freshwater fish (carp, pike, perch, tench...)
- Migratory - live in the sea, but reproduce in rivers or vice versa (salmon, sturgeon, eel, pike-perch/zander...)





## Technological scheme





# Inbound production

- Shipping documents-  
consignment note,  
certificate
- Weighing devices

SCALES		
Non-automatic		Automatic
commercial scales	hopper scales	logistics flow scales
label printing scales	platform scales	multihead weighing machine
table scales	palet scales	checkweigher
floor scales	counting scales	automatic weighing and labeling machine
autoscales		



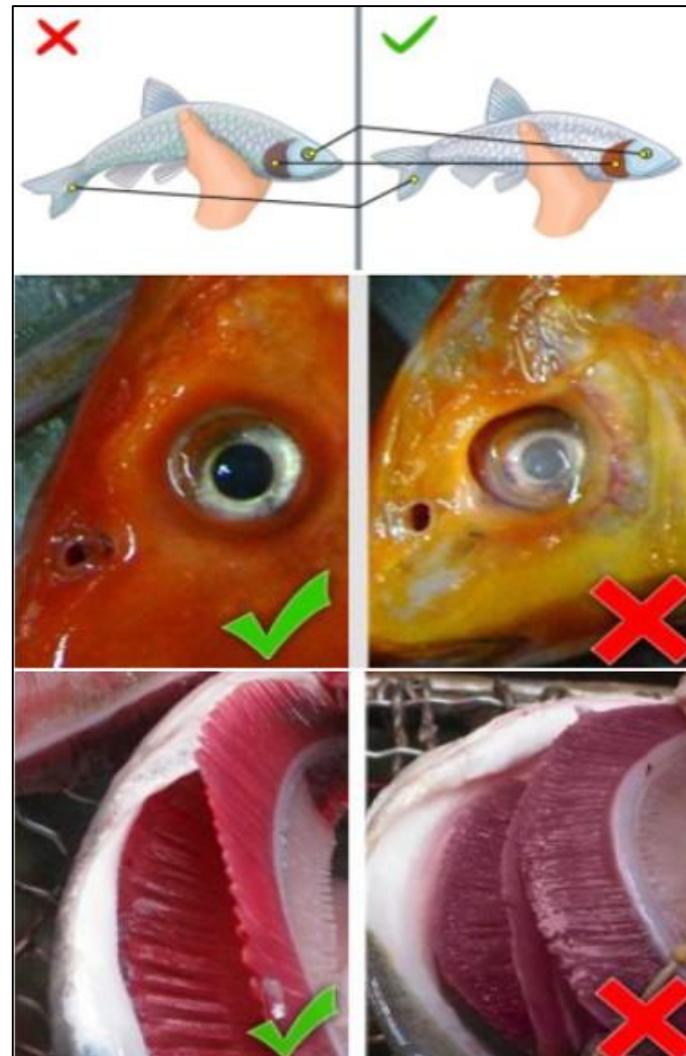


## Receiving of products, with sensory quality evaluation

evaluation of fish  
freshness

eyes

gills



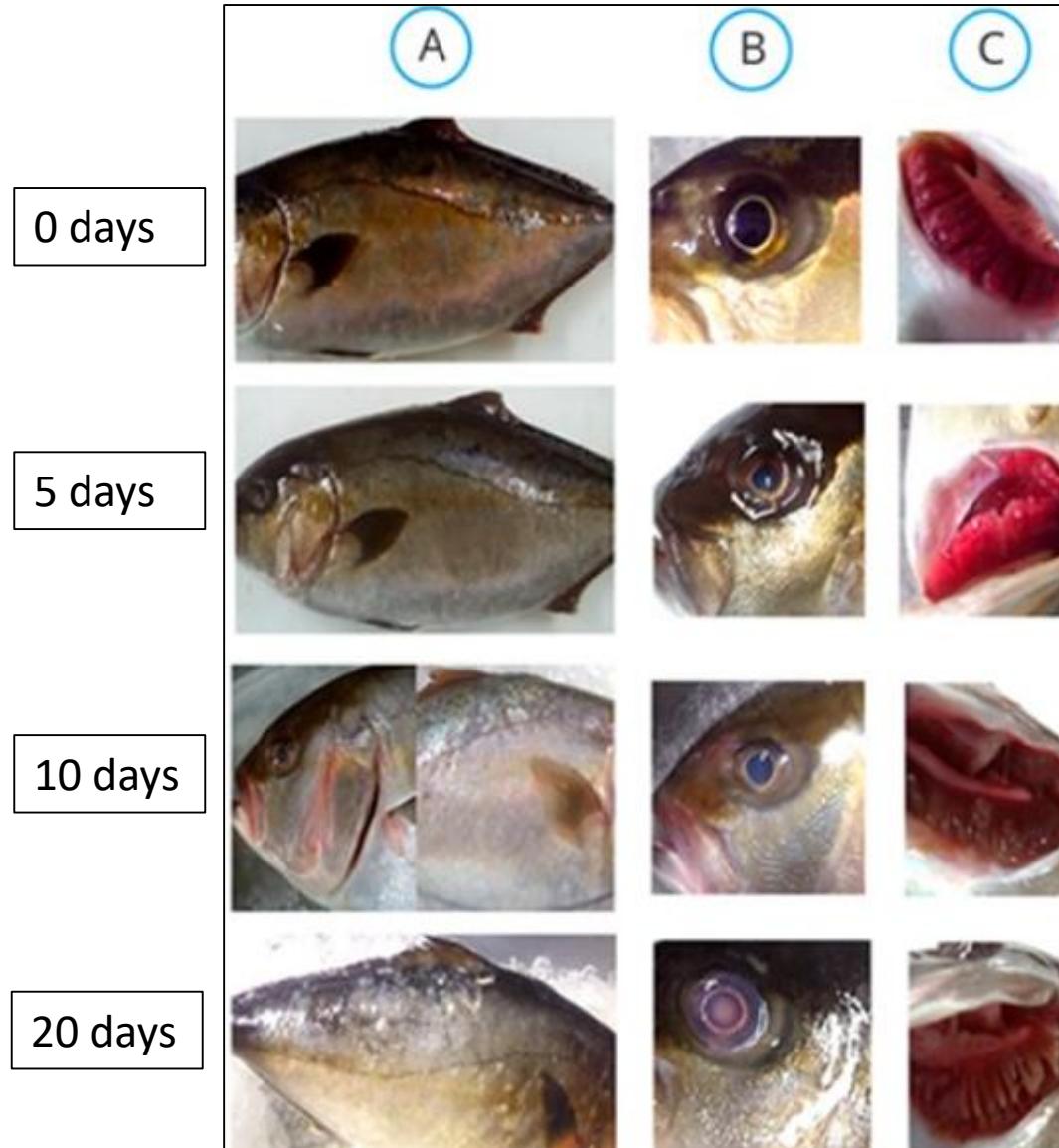
meat  
consistency

meat color  
near the spine





## Changes in fish visual appearance depending on storage duration



A - external appearance of fresh fish

B - changes in eye shape and cornea

C - changes in gill filament color





# Sorting

Fish is sorted by quality, selecting mechanically damaged and microbiologically damaged units





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# Sorting

## Sorting by species



Sorting by size, weight, dimension, so that equipment can be used in processing





# Sorting with equipment

Fish sorting can be performed manually or in a mechanized machine where rollers rotate in opposite directions, onto which fish are poured.

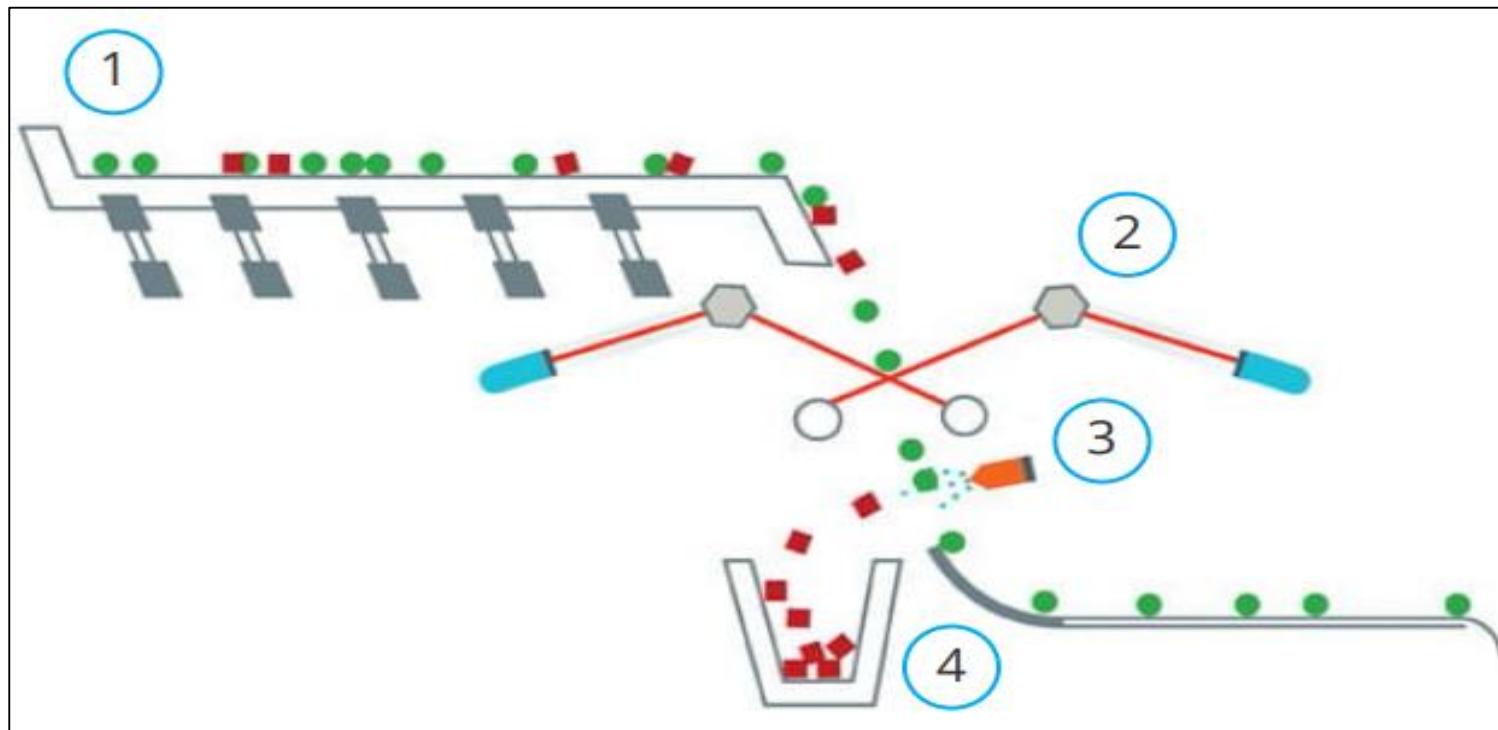
In the fish sorting machine, the distance between the rollers is adjusted, allowing smaller fish to fall through while larger ones are transported further





# Sorting with equipment

## Optical sorter



1 - product feeding  
conveyor

2 – lasers

3 - pneumatic rejection  
system for out-of-spec  
products

4 – acceptable/rejectable





# Defrosting equipment

Defrosting equipment is used for thawing frozen fish.

When thawing products, heat is most often applied to their surface layer by heating with liquid (water, brine), air (natural or forced circulation), or an air and steam mixture, which then, through heat conduction, warms the product throughout its volume.

However, it is possible to heat products directly in deeper layers, for example, in a high-frequency electric current field or by the action of radio waves, microwaves, or infrared radiation.

Defrosting in liquid

Defrosting in air

Defrosting in air and steam

Defrosting in an electromagnetic field





Machine for defrosting in water

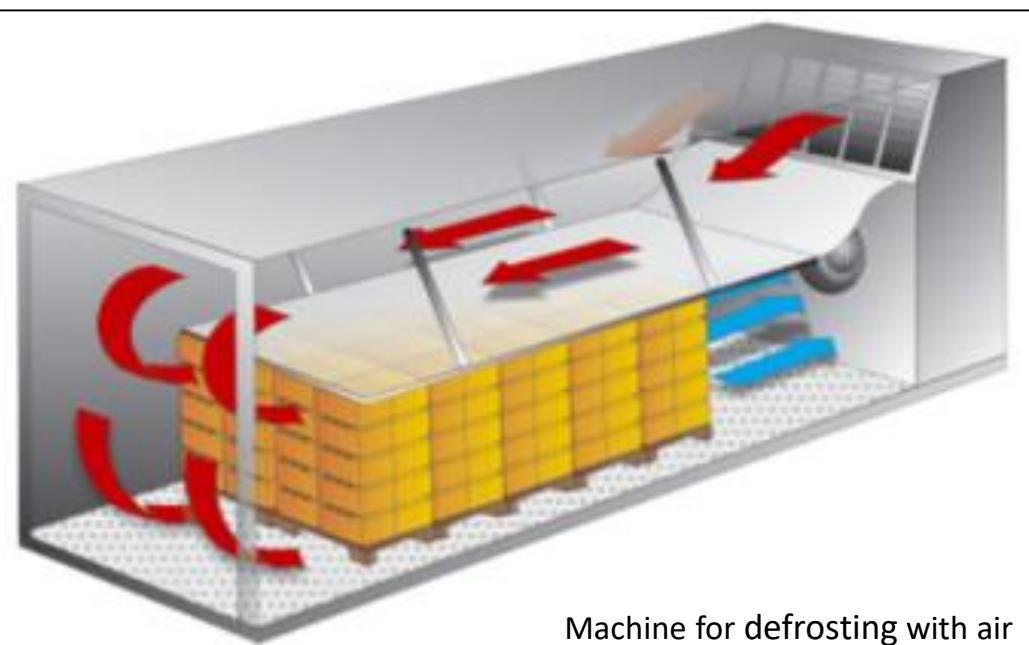


Defrosting can be considered complete when the temperature in the fish meat has reached -1 degree Celsius.

However, if industrial processing of fish is intended later, the temperature is left slightly lower so that the fish have a firmer structure.

When operating the equipment, the permissible loading quantity must be observed. Water temperature and conveyor speed must be monitored.

Fish defrosting must be stopped when the fish meat temperature reaches +4 - +7 degrees Celsius; then they must be immediately processed or moved to a cold storage room for storage until further processing.



Machine for defrosting with air





## Defrosting in air and steam

When defrosting in an air and steam environment, steam and water are injected into the chamber; in the initial phase (first two hours), maintaining +30 degrees Celsius, then for the next two hours maintaining +25 degrees, and then for another two hours maintaining +20 degrees.

The system then automatically switches to refrigeration mode.

The temperature regime is adjusted to the type and size of fish.

This method is suitable for defrosting individually quick frozen (IQF) fish. It is not suitable for defrosting fish blocks.





# Defrosting in an electromagnetic field

When defrosting in an electromagnetic field, energy of various frequencies and wavelengths—microwaves, radio waves, or infrared rays—is applied to the product.

The energy penetrates the product, and heating begins inside the product, which ensures significantly faster warming of the product and melting of ice crystals.

Microwave defrosting is very fast, however, in this process, it is very difficult to ensure a uniform temperature throughout the entire volume of the product.





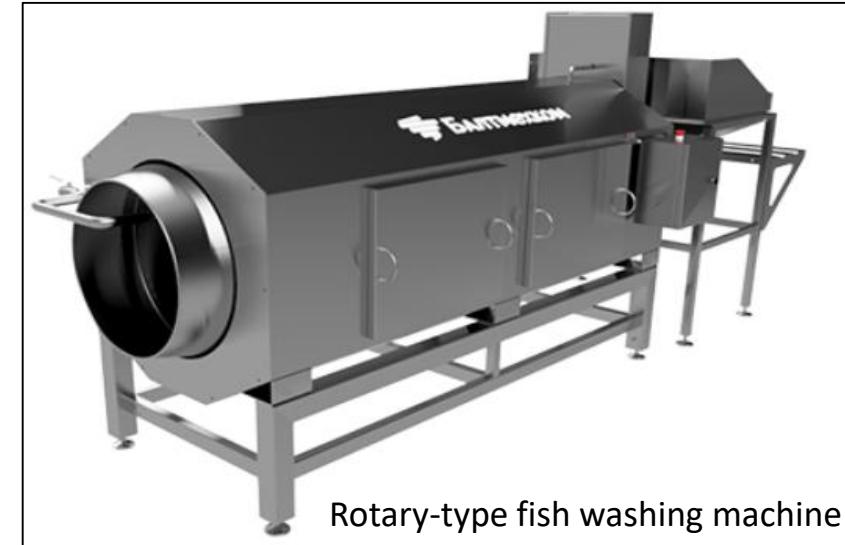
# Washing equipment

## Rotary-type fish washing machine

Rotary-type machines are used for washing fish, in which fish are fed into the central part.

The roller/cylinder is submerged in water, and inside there is a helix that pushes the fish to the other end, where they move onto an inclined conveyor belt.

There, the fish are sprayed with clean water to rinse off any adhering fish particles and to drain the water.



Rotary-type fish washing machine





# Washing equipment

## Tank-type washing machine

For washing fish and fish fillets, machines with a tank can also be used, which may be equipped with a conveyor, a compressed air supply system, nozzles for water spraying, and a water filtration system.





# Washing equipment

**Equipment that washes with water jets.**

After processing, fish fillets are washed with water jets on a processing table or in a specialized machine



Fish fillet washing machine





# Fish descaling equipment

**For descaling, rotating tools that rub off the scales are most commonly used.**

For processing a small quantity of fish, a handheld electric descaler is very convenient.

For larger volumes, specialized continuous operation machines can be used.

For skinning fish, filleting, and cutting into portion pieces, specialized equipment can be used, but this is most often done manually.



A small rotating cylinder moved by a worker





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# Fish descaling equipment



Rotating abrasive rollers placed in the bottom of the tank





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# Fish descaling equipment



Special paddles through which fish are moved





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# Fish cutting, gutting, filleting, and skinning equipment

Manually with a knife



Mechanized fish heading and filleting





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# Fish cutting, gutting, filleting, and skinning equipment

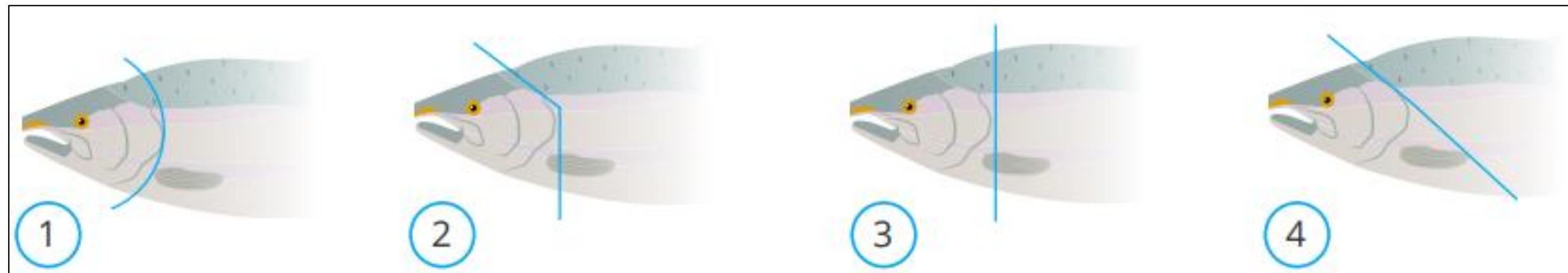


Mechanized fish heading





# Fish cutting, gutting, filleting, and skinning equipment



Types of fish heading cuts:

- 1- Circular cut
- 2- Contour cut
- 3- Straight cut
- 4- Slanted cut





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# Fish cutting, gutting, filleting, and skinning equipment



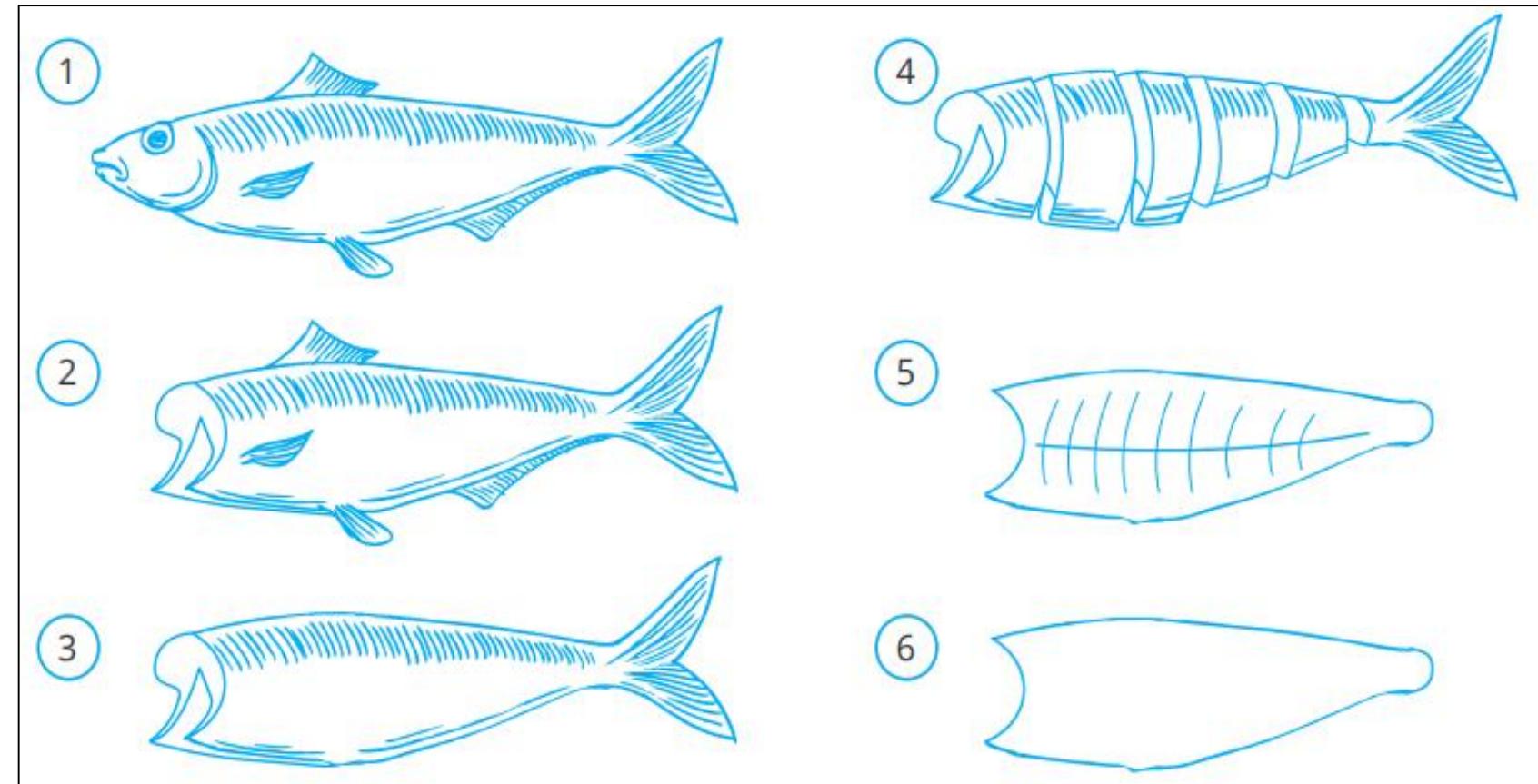
Fish skinning machine



# Fish dissection

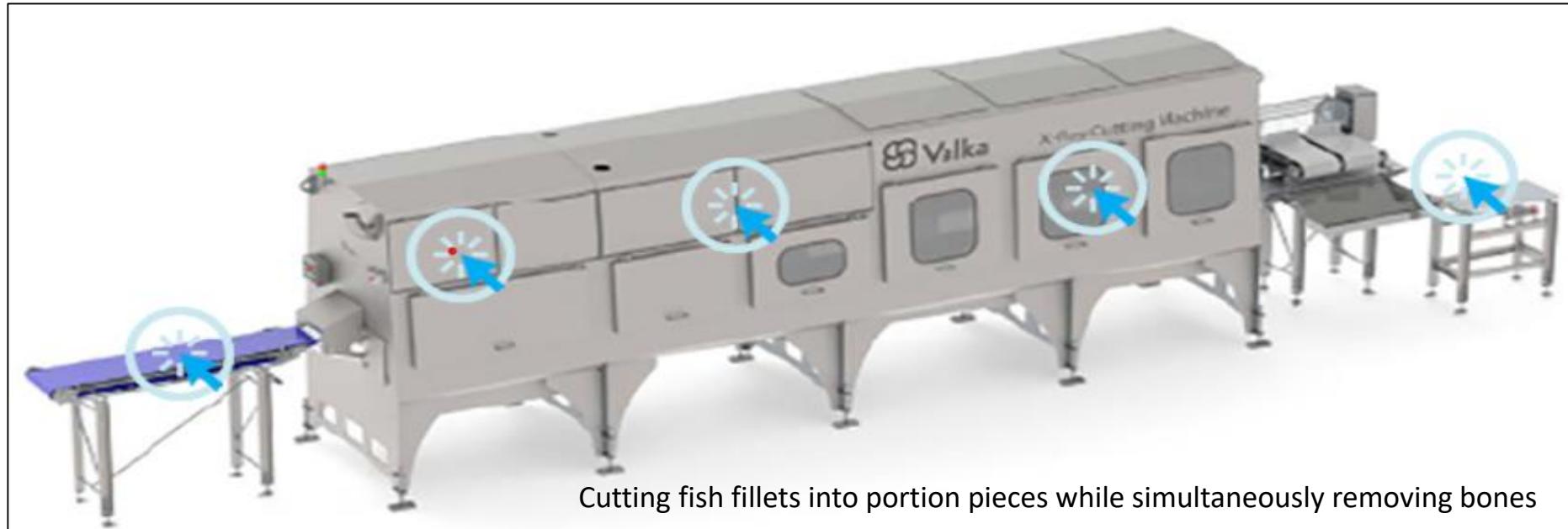
Main types of fish cuts:

- 1- Whole fish
- 2- Gutted fish without head
- 3- Gutted fish without head and fins
- 4- Fish cut into pieces after heading and evisceration
- 5- Fillet with bones
- 6- Fillet without bones





# Fish dissection



**Today, X-ray equipment is used for precise portion cutting of fish fillets.**

\*The fish surface is evaluated using video cameras and a dynamic weighing system, which determine the fillet's thickness and dimensions to obtain pieces of a specific weight.

\*The X-ray machine scans the fillets and identifies the location of bones.

\*A computer program compiles the information received from both previous devices and selects the best cutting method, which the machine then automatically performs to obtain pieces of a specific weight.





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# Good luck with your study!

