

2.7 SALTED FISH

Barrel	a cylindrical container made from wood or plastic with a lid for water-tight closure
Black membrane	parietal peritoneum, the pigmented lining of the abdominal cavity
Brine	solution of salt in water;
Brine Injection	is the process for injecting brine directly into the fish flesh;
Brining	means the process of placing fish in brine for a period of sufficient length for the fish tissue to absorb a specific quantity of salt;
Dry-Salting	is the process of mixing fish with suitable salt and stacking the fish in such a manner that the resulting brine drains away;
Dun	a discoloration and a development of the mould <i>Sporendonema epizoum</i> which affect the fish surface and make it look like peppered. The fish flesh is unaffected;
Fatty Fish	is fish in which the main reserves of fat are in the body tissue [and the fat content is more than 2% ??]
Gibbing	the process of removing the gills, long gut and stomach from fatty fish, such as herring, by inserting a knife or using hands at the gills; the milt or roe and some of the pyloric caeca are left in the fish;
Heavily Salted Fish	the salt content of the fish muscle is above 20 g/100 g water phase; NOTE: NOT USED IN TEXT
Medium Salted Fish	the salt content of the fish muscle is above 10 g/100 g water phase or is lower or equal to 20 g salt/100 g water phase; NOTE: NOT USED IN TEXT
Lean Fish (White Fish)	is fish in which the main reserves of fat are in the liver [and less than 2 % fat in the body tissue]]
Lightly Salted Fish	the salt content of the fish muscle is above 4 g/100 g water phase or is lower or equal to 10 g salt/100 g water phase; NOTE: NOT USED IN TEXT?
Maturing	the process from salting until the fish is salt-matured
Nobbing	removing the head and gut from fatty fish, such as herring, in one operation by partially severing the head and pulling the head away together with attached gut, the roe or milt is left in;
Pickle	brine which may contain vinegar and spices;
Pickling	is the process whereby primary fatty fish is mixed with suitable salt which may contain vinegar and spices and stored in watertight containers under the resultant pickle which forms by solution of salt in the water extracted from the fish tissue. Pickle may be added to the container. Pickled products will always remain in a brine solution.
Pink	a discoloration caused by red halophilic bacteria which damages the fish flesh
Salt	is a crystalline product consisting predominantly of sodium chloride. It is obtained from the sea, from underground rock salt deposits or from vacuum processed and refined brine;
Salt Cured Fish	means fish that is preserved with salt; NOTE NOT USED IN TEXT
Salt-Matured Fish	means salted fish that has an appearance, consistency and flavour characteristic of the final product;
Salted Fish /Salted Fillet	fish /fillets which have been treated by either brining, brine injection, dry-salting, pickling or wet-salting or a combination of these;
Saturated	the water phase of the fish muscle is saturated with salt (26,4 g salt/100g water phase);
Split Fish	fish that have been cut open from throat or nape to the tail, with gills, guts, roe or milt removed. Head and whole or part of backbone may be left in or removed;

**Stacking
(restacking)**

laying fish in piles with salt spread evenly on the surface

**Very Lightly Salted
Fish**

the salt content of the fish muscle is 4g/100g or less in the water phase **NOT: NOT USED
IN TEXT**

Wet-Salting

is the process whereby primary lean fish is mixed with suitable salt and stored in watertight containers under the resultant brine which forms by solution of salt in the water extracted from the fish tissue. Brine may be added to the container. The fish can be removed from the container and stacked so that the brine drains away.

SECTION 11 - PROCESSING OF SALTED FISH

In the context of recognising controls at individual processing steps, this section provides examples of potential hazards and defects and describes technological guidelines, which can be used to develop control measures and corrective action. At a particular step only the hazards and defects, which are likely to be introduced or controlled at that step, are listed. It should be recognised that in preparing a HACCP and/or DAP plan it is essential to consult Section 5 which provides guidance for the application of the principles of HACCP and DAP analysis. However, within the scope of this Code of Practice it is not possible to give details of critical limits, monitoring, record keeping and verification for each of the steps since these are specific to particular hazards and defects.

Salted fish and fish products should be sound and wholesome, well prepared and packaged so that they will be protected from contamination and remain attractive and safe to eat. In order to maintain the quality of fish it is important to adopt quick, careful and efficient handling procedures.

This section does not cover dried salted fish (i.e. klippfish) or dried salted fish products.

11.1 GENERAL

Refer also to Section 8.1 for general handling prior to processing and figure 11.1 for an example flow chart of a salted fish processing line.

- depending on the species for salting, fish should be completely bled as soon as practical;
- where appropriate, fresh fish intended for processing salted fish should be checked for visible parasites;
- frozen fish should not be salted before it is thoroughly thawed and inspected for suitability;
- freezing, heating or adequate combination of salt content and storage time can be used as treatment procedures for killing living parasites;
- the salt penetration will depend upon fat content, temperature, amount of salt, salt composition, brine concentration, etc.

This flow chart is for illustrative purposes only. For in-factory HACCP implementation a complete and comprehensive flow chart has to be drawn up for each process.

References correspond to relevant Sections of the Code

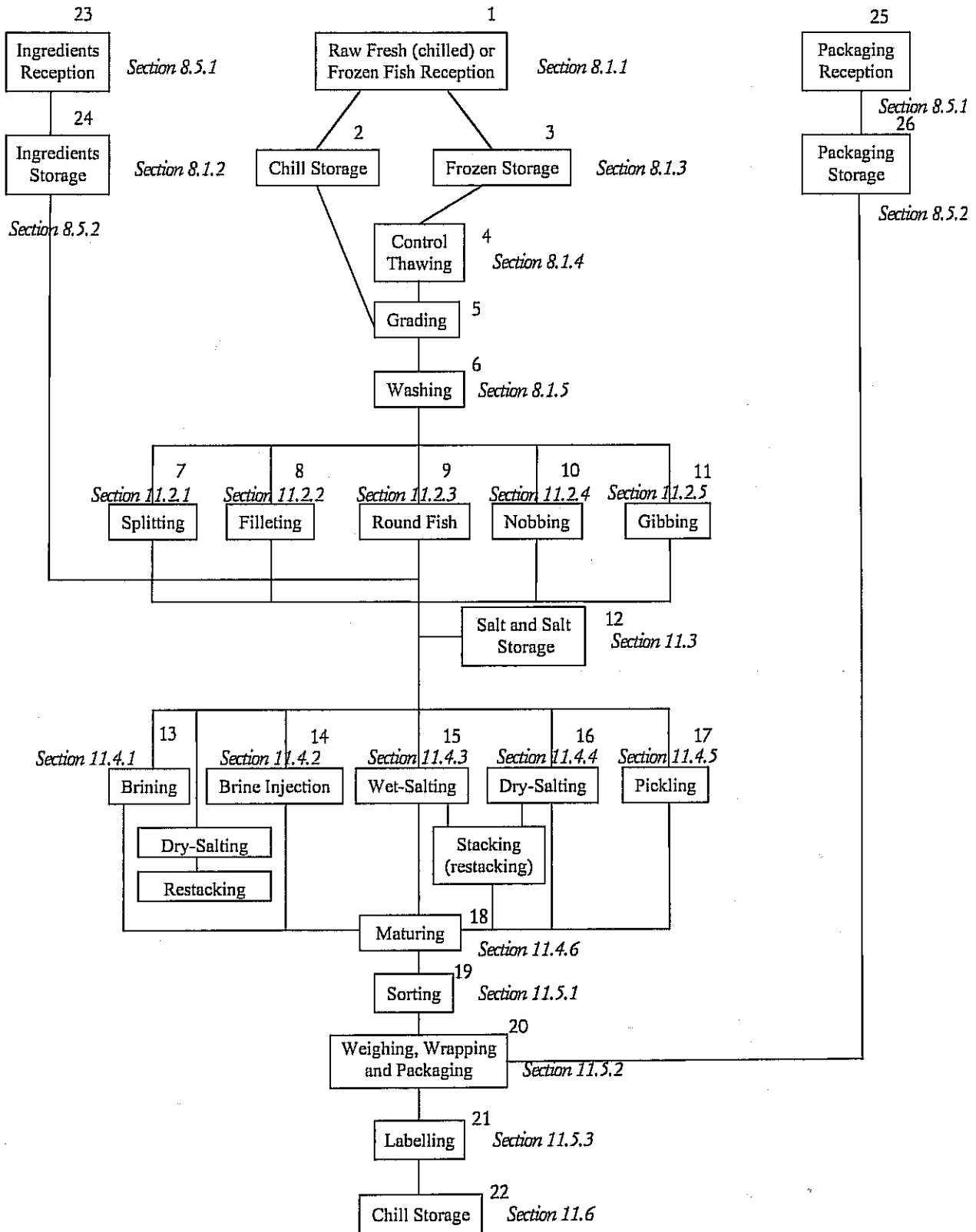


Figure 11.1 Example of flow chart of a salted fish processing line.

11.2 PREPARING FOR SALTING

11.2.1 Splitting, Washing and Rinsing (Processing Steps 7)

Potential Hazards: *Parasites, microbiological, chemical and physical contamination*

Potential Defects: *Parasites, decomposition*

Technical Guidance:

- the design of the splitting line should be continuous and sequential to permit the uniform flow without stops or slow-downs;
- fish should be split by a cut made parallel to the backbone straight down from the throat or nape to the tail and in such a way as to prevent uneven and ragged edges or a loss in recovery. If the backbone is to be removed, the fish should be split so deeply that the remains of the backbone (the tail-bone) lie free. It is important to cut the bone rather than to break it from the flesh;
- splitting of fish should be carried out expertly so that blood in nape and blood clots are removed;
- immediately after splitting, fish should be washed in plenty of running potable water or clean sea water, to remove all blood from the fish;
- all impurities, blood and livers should be removed;
- visible parasites should be removed;
- if the black membrane has to be removed than it should be done after the splitting step;

11.2.2 Filleting, Skinning and Trimming (Processing Steps 8)

Refer to Section 8.1.6.

11.2.3 Round Fish (Processing Steps 9)

Refer to Section 8.1.1 – 8.1.5.

11.2.4 Nobbing (Processing Steps 10)

Potential Hazards: *Parasites, microbiological, chemical and physical contamination, histamine*

Potential Defects: *Remaining gut content (bait) and intestines other than roe or milt, decomposition*

Technical Guidance:

refer to section 11.2.1, 2nd bullet;

- after nobbing fish should be checked for remaining intestines;
- after nobbing fish should be thoroughly washed to remove blood, remaining intestines and scales if appropriate;
- depending on the vessel or processing facility product flow pattern and where a prescribed critical limit for staging time and temperature regime has been established for the control of histamine or a defect, the nobbed fish should be drained and well iced or appropriately chilled in clean containers and stored in specially designated and appropriate areas within the processing facility.

11.2.5 Gibbing (Processing Steps 11)

Potential Hazards: *Parasites, microbiological, chemical and physical contamination, histamine*

Potential Defects: *Remaining gut content (bait), decomposition*

Technical Guidance:

refer to section 11.2.1, 2nd bullet;

- after gibbing fish should be checked for correct gibbing;
- fish with incorrect gibbing should be sorted out and used for other purposes;

- after gibbing fish should be thoroughly washed to remove blood, remaining undesirable intestines, heart, etc. and scales if appropriate;
- depending on the vessel or processing facility product flow pattern and where a prescribed critical limit for staging time and temperature regime has been established for the control of histamine or a defect, the gibbed fish should be drained and well iced or appropriately chilled in clean containers and stored in specially designated and appropriate areas within the processing facility.

11.3 SALT HANDLING AND SALT REQUIREMENTS (PROCESSING STEPS 12)

11.3.1 Handling

Potential Hazards: *Biological, chemical and physical contamination*

Potential Defects: *Biological, chemical and physical contamination*

Technical Guidance:

- salt for salting of fish should be transported and stored dry and hygienically covered in salt bins, storerooms, containers or in plastic sacks;
- in order to minimise infections of salted fish the re-use of salt should be avoided;

11.3.2 Salt Requirements

Potential Hazards: *Biological, chemical and physical contamination*

Potential Defects: *Biological, chemical and physical contamination, incorrect composition*

Technical Guidance:

- the quality of salt used in salting of fish should possess an appropriate composition for the product;
- the composition of salt differs according to the origin. Mine salt and solar salt of marine origin contain several other salts like calcium sulphate, magnesium sulphate and chloride as impurities. Vacuum processed and refined salt is almost pure sodium chloride;
- a relatively pure salt is needed for the dry-salting of fatty fish but for some products the presence of small quantities of calcium salts will give the product a somewhat superior appearance. Too much calcium may reduce the rate of salt penetration to an extent that spoilage may occur;
- magnesium salts if present at too high a concentration will give rise to unpleasant bitter flavours and may cause spoilage during the salting operation;
- salt produced from marine sources may contain halophilic bacteria and mould which continue to live in the salt and dry salted fish and could contribute to spoilage;
- salt used in salt fish should be inspected to ensure that it is clean, not used before, free from foreign matter and foreign crystals, show no visible sign of contamination with dirt, oil, bilge or other extraneous materials;
- the size of the salt granules used should be carefully considered. The use of very fine salt granules could result in the formation of clusters which is not favourable for ensuring the uniform distribution of salt on the fish. The use of very coarse salt granule could result in damage to the fish flesh during salting and may reduce the rate of maturation;
- small crystals of salt should be used for dry-salting of fatty fish and large crystals for lean fish;
- salt should meet the following requirements:
 - content of iron not more than 10 mg/kg;
 - content of copper not more than 0.1 mg/kg ;
 - free from micro-organisms, which adversely affect the quality of final products;
- salt used for salted fish of family Gadidae should meet the following requirements:
 - levels of calcium salts between 0.15% and 0.35% have been found satisfactorily;
 - levels of magnesium salts if present, not more than 0.15%;
 - if the salt is not free from micro-organisms, further developing of micro-organisms would be delayed if the processes and products are kept at low temperature;

- Codex Standard for food grade salt (Codex Stan. 150-1985, Rev. 1-1997, Amend. 1-1999) applies to salt used as an ingredient of food, both for direct sale to the consumer and for food manufacture.

11.4 SALTING AND MATURING

Salted fish should be salt-matured, sound and wholesome. The fish should be free of remains of the guts, liver and other entrails.

Salting of fish either by brining, brine injection, wet-salting, dry-salting or pickling should be carried out with full understanding of their effects on the quality of the final product and should be done under strict hygienic condition.

Two particular conditions that can adversely affect the quality of salted fish are the occurrence of "pink" and "dun". Both defects can be combated by maintaining a temperature lower than 8°C. Salt produced from marine sources may contain halophilic bacteria, which continue to live in the salt and salted fish. In order to minimise infections of salted fish, previously used and/or contaminated salt should be removed from the plant.

Another adverse condition that can affect the quality of salted fish is brown (yellow) discolouration often due to rancidity caused by metal catalysts in the salt. The quality of the salt is important, low temperature should be maintained during the process and light and oxygen should be avoided.

11.4.1 Brining (Processing Steps 13)

Potential Hazards: *Microbiological pathogens, parasites, chemical and physical contamination, histamine, incorrect composition of brine*

Potential Defects: *Parasites, microbiological, chemical and physical contamination, decomposition, histamine*

Technical Guidance:

- only fresh stabilised brine should be used for the salting operations; water quality is important, potable water should be used for preparation of brine;
- the ratio of brine to fish and the concentration of the brine should be adjusted to desired product; time and temperature (<4°C) control is important if the brine concentration is lower than saturated;
- concentration of brine should be checked at regular intervals, incorrect concentration should be adjusted prior to use;

11.4.2 Brine Injection (Processing Steps 14)

Potential Hazards: *Microbiological pathogens, parasites, chemical and physical contamination, injection needle fragment, histamine, incorrect composition of brine*

Potential Defects: *Parasites, biological, chemical and physical contamination, decomposition, histamine*

Technical Guidance:

- apparatuses used for brine injection should be cleaned and disinfected at regular intervals;
- needles of apparatuses should be inspected daily for broken tips, for blocking and deflections of needles;
- brine injection devices should be operated by trained personnel only;

11.4.3 Wet-Salting (Processing Steps 15)

Potential Hazards: *Microbiological pathogens, parasites, chemical and physical contamination, histamine*

Potential Defects: *Parasites, biological, chemical and physical contamination, decomposition, histamine*

Technical Guidance:

- fish for wet-salting should be salted and carefully arranged in the curing container such that voids channels between the fish are minimised;

- amount of salt, time and temperature should be controlled to obtain the desired product;
- when salting the fish, the salt concentration of the brine should be checked periodically with a salinometer according to specifications;
- after salting, the fish can be stacked. This should not be done before the proper salt/water balance is obtained. In case of stacking, adequate amounts of salt should be added and evenly distributed over the whole surface of the fish;
- salted fish should be stored or maintained for a sufficient period under controlled temperatures, to ensure proper curing and to prevent deterioration of the product;

11.4.4 Dry-Salting (Processing Steps 16)

Potential Hazards: *Microbiological pathogens, parasites, chemical and physical contamination, histamine*

Potential Defects: *Parasites, biological, chemical and physical contamination, decomposition, histamine*

Technical Guidance:

- fish for dry salting should be carefully arranged such that voids or channels between fish are minimised and that drainage is adequate;
- fish piles should never be placed directly on the floor or in direct contact with the wall;
- amount of salt, time and temperature should be carefully controlled to obtain the desired product. Sufficient amount of salt is important for the quality of the product;
- fish should be restacked periodically with the top of the pile going to the bottom of the new pile, and with the addition of fresh salt to ensure that sufficient salt will be present to complete the cure;
- if the fish is restacked on pallets, the pallet should be clean;
- fish should not be exposed to freezing temperatures during the salting process;
- salted fish of the Scombridae and Clupeidae families should be stored or maintained below 9° C to prevent possible scombrototoxin/histamine formation;

11.4.5 Pickling (Processing Steps 17)

Potential Hazards: *Microbiological pathogens, parasites, chemical and physical contamination, histamine*

Potential Defects: *Parasites, biological, chemical and physical contamination, decomposition, histamine*

Technical Guidance:

- the amount of salt must be adjusted to the quality of the fatty (primary) fish (fat content). Salt, sugar and spices should be weighed/measured and be evenly distributed;
- during the pickling operation all fish should be well immersed in the resulting pickle;
- fish should be allowed to settle in containers and then salt or pickle added before the container is closed;
- cured fatty fish should be kept in brine or pickle;
- fatty fish should always be covered with pickle during curing;
- pickling is primary used for fatty fish. Under certain conditions dry salting of small fatty fish, such as anchovy and small herring, may be used;

11.4.6 Maturing (Processing Steps 18)

Potential Hazards: *Microbiological pathogens, parasites, chemical and physical contamination, histamine*

Potential Defects: *Parasites, biological, chemical and physical contamination, decomposition, histamine, rancidity and discolouring of the flesh or surface*

Technical Guidance:

- maturing time depends on the fish (species, size and quality), temperature and the amount of salt absorbed by the fish tissues;
- wet-salted fish of the Gadidae family is regarded as mature after 10 to 12 days in the brine and following stacking and 7 to 10 days in piles, and for dry-salted fish after 20 to 28 days including at least one restacking, with temperature between 5°C to 8°C;
- fatty fish such as herring may be kept in a temperature range of 5°C to 10°C under the maturing period. The length of this period will vary from weeks and up to several month depending of the specific products. If the containers are to be held at lower temperatures, the maturing period will increase;
- the first part of curing period for fish of the Clupeidae and Scombridae families should be done at temperatures between 0°C and 5°C to prevent development of histamine;
- when salting fish of Scombridae and Clupeidae families, regular checks should be made of histamine content of the end product;

11.5 SORTING, WEIGHING, PACKAGING, WRAPPING AND LABELLING

Refer also to Sections 6.4.4 and 6.5.

11.5.1 Sorting (Processing Steps 19)

Potential Hazards: *Unlikely*

Potential Defects: *Incorrect sorting (quality, weight, size, species, etc.)*

Technical Guidance:

- salted fish should be sorted into species, sizes and trade quality categories for the relevant market;
- loose salt should be removed from the fish before sorting and new salt should be added before packaging;

11.5.2 Weighing, Wrapping and Packaging (Processing Steps 20)

Potential Hazards: *Microbiological pathogen, biotoxins, chemical and physical contamination*

Potential Defects: *Subsequent dehydration, decomposition*

Technical Guidance:

- packaging material should be clean, sound, durable, sufficient for its intended use and of food grade material;
- barrels in which fatty fish are ready to be marketed should be clean, whole and hygienic.
- the packaging operation should be conducted to minimise the risk of contamination and decomposition;
- products should meet appropriate standards for labelling and weights;

11.5.3 Labelling (Processing Steps 21)

Refer to Section 8.2.3 and 8.5.

11.6 CHILL STORAGE (PROCESSING STEPS 22)

Potential Hazards: *Microbiological pathogens, chemical contamination, histamine*

Potential Defects: *Biological, chemical and physical contamination, decomposition, histamine, development of "pink" and "dun"*

Technical Guidance:

- salt matured fish should be stored in chill storage;
- the temperature in the chill storage should be between 1°C to 4°C;
- temperature and storage time should be monitored and recorded at regular intervals;
- the products should be handled carefully and not be over-stacked;

11.7 PACKAGING, LABELS & INGREDIENTS (PROCESSING STEPS 23, 24, 25 & 26)

Refer to Section 8.5.

APPENDIX VI - OPTIONAL FINAL PRODUCT REQUIREMENTS - SALTED FISH [TO BE COMPLETED]

These products specifications describe the optional defects for salted fish. The descriptions of optional defects will assist buyers and sellers in describing those defect provisions. These descriptions are optional and are in addition to the essential requirements prescribed in the appropriate Codex Products Standards.

1. PRODUCT DESIGNATION OF SALTED FISH OF FAMILY GADIDAE

Reference is given to Standard for Salted Fish and Dried Salted Fish of the Gadidae Family of Fishes (Codex Stan. 167-1989, Rev. 1-1995).

Produced from the following species, all belonging to the Gadidae family that have been bled, gutted, beheaded and split so that approximately two thirds of the backbone is removed, washed and 90-100 % saturated with salt.

English name	Latin name
Cod	<i>Gadus morhua</i>
Pacific cod	<i>Gadus macrocephalus</i>
Polar cod	<i>Boreogadus saida</i>
Greenland cod	<i>Gadus ogac</i>
Saithe	<i>Pollachius virens</i>
Ling	<i>Molva molva</i>
Blue ling	<i>Molva dypterygia</i>
Tusk	<i>Brosmius brosme</i>
Haddock	<i>Gadus aeglefinus</i> / <i>Melanogrammus aeglefinus</i>

Quality classification

Imperial/superior

Fish products in this trade category are made from fish that is thoroughly bled, well washed and rinsed to remove remains of blood and entrails, and with nape skin attached.

The fish is to be properly split and evenly salted, well pressed and restacked during processing. The fish is to be light-coloured and firm, and without blemishes.

This category may include fish with the following characteristics:

1. poorly bled bellies
2. small tears or longitudinal cracks
3. not properly rinsed
4. some blood clots
5. somewhat unevenly salted

When assessing fish for this category, special consideration will be given to fish that has been thoroughly bled and properly restacked during production. In this case, somewhat larger defects will be tolerated if the overall impression justifies this, particularly if the fish is light-coloured and firm.

Universal

Fish that do not meet the requirements to Imperial/Superior are to be classified as Universal.

This trade category may include fish with the following characteristics:

1. inadequately split
2. round tail
3. inadequately washed or rinsed
4. insufficient removal of backbone
5. moderate blood clot
6. major tears or longitudinal cracks
7. moderate cracking

8. minor blood, liver and/or bile stains

The fish must retain its natural shape. Disfiguring blemishes such as stains/lumps of dried blood or remains of entrails shall be removed.

Popular

Fish that does not satisfy the requirements to Universal, but which nevertheless is fit for human consumption is to be categorised as Popular. However, this trade category must not contain fish that is sour, has been exposed to contamination, has ragged bellies, bile or gut content, fish that is badly cracked/loose fleshed or visibly affected with red halophilic bacteria (pink) or heavily infested halophilic mould (dun).

2. Product designation of