



**The importance of good
onboard handling of fish**

Publisher: Matis, www.matis.is

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Printing: Pixel ehf

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Special thanks to the crew of Árni í Teigi GK and Hólmarinn SH

AVS – R&D Fund of Ministry of Fisheries and Agriculture in Iceland subsidised the publication



NORA
Nordic Atlantic Cooperation





The importance of good onboard handling of fish

Food production is among the most important job sectors in the Nordic countries, with fisheries and seafood processing playing a vital role. The same basic principle applies to all food production; the quality of the end products is dependent on the quality of the raw material that they are derived from; one can't produce a good product from poor ingredients.

Fishermen in the North Atlantic have caught, bled and gutted their catches for centuries, following a know-how passed on from one generation to another. Although the fish is handled in a similar way today as it was before, we now know things that our ancestors were unaware of. In this context our knowledge on the effects of proper bleeding, washing and cooling, as well as a better understanding of microbial growth and chemical- and physiological properties of the catch have advanced. Therefore we know more today about the factors influencing shelf life and product quality.

The objective of this booklet is to describe in a simple manner good onboard handling practices for freshly caught fish and to explain why these practices are important.

The following factors are the most relevant for onboard handling of fresh fish



Bleeding: Why do we need to bleed the fish?

Blood is good nutrition for bacteria and therefore reduces the shelf life and value of the catch. It's important to bleed the fish properly to prevent blood from being retained in the flesh. To do so, it is necessary for the fish to bleed for sufficient time (15-20 minutes) in clean circulating seawater in a tub or a purpose-built bleeding tank.

Gutting: pros and cons

Gutting the fish onboard the fishing vessel immediately after it is caught has its advantages and disadvantages. This is primarily dependent on the onboard facilities to gut and clean the fish. Nutritional condition, time needed to store the catch before gutting and storage temperature are also factors that need to be considered. Gutting accelerates bleeding of the fish, but at the same time opens the way for bacteria into the flesh. Bacteria are not found in the flesh of live fish, but there are a lot of bacteria and enzymes in the intestines. It is therefore important to prevent viscera from being in contact with the fish flesh for more time than absolutely necessary.

Washing

It is important to clean the fish properly after gutting, otherwise there is a risk of it being damaged and its shelf life being reduced. Although all bacteria cannot be washed off (as would be the case of sterilization) it is important to wash the fish as well as possible. In the best possible conditions, that is if the fish has been bled, washed and cooled sufficiently, a fresh cod can be stored for up to two weeks; but if handled improperly its shelf life can be reduced by half or even more.

Cleanliness

Fish is food, so good hygiene is very important. All surfaces that come into direct contact with the catch, such as tubs, boxes, knives, conveyor belts and gutting tables need to be clean. Water used in the processing of the fish or production of ice must be of drinking water quality. Cold resistant bacteria can sometimes be found in old ice; so unused ice should be replaced with new ice before each fishing trip.

Cooling: Why?

Cooling the catch slows down bacteria growth, prolongs the time the fish is in rigor and reduces gaping in the fillets. It also increases blood flow from the capillaries after bleeding and makes the flesh consequently whiter. Last but not least cooling reduces loss of weight, as drip depends on the temperature of the flesh.

Cod is the most important demersal species in the North Atlantic when it comes to economic, social, regional and cultural importance. It lives at various depths, from a few meters down to 5-600 meters. It is caught with various fishing gear, such as bottom trawls, long line, handline, gillnets and Danish seine.

Over the past 30 years, the N-Atlantic cod catches have ranged from 800 thousand and two million tons per year, but in the sixties, the catches reached four million tons. Norway, Russia and Iceland are responsible for over 3/4th of the catch. Cod is particularly important for the coastal fleet, as it represents the mainstay of its income.

The main factors affecting quality and value of the demersal catches are:

- Species
- Natural condition
- Fishing method
- Bleeding
- Gutting
- Washing
- Cooling
- Temperature during storage
- Storage container
- Storage time
- Transfer between tubs/boxes and re-icing
- Cooling media

Beautiful cod hauled onboard a fishing vessel. The next minutes will decide how much value can be created from this fish.



The chemical composition of fish varies depending on species, time of year, maturity and other factors.

Fish fillets consist of the following four main ingredients and the ratio between them characterises each species. Fish is therefore often classified into lean (<2% fat), semi-fatty (2-10% fat) and fatty fish (>10% fat).

- Protein (14-24%)
- Fat (0.1-25%)
- Water (60-83%)
- Minerals (0.1-2%)

Natural characteristics of fish that affect onboard handling and processing can be broken into:

- Species dependant attributes
- Chemical and physical properties
- Size, condition factor and texture
- Offal rate and viscera
- Parasites

Natural characteristics depend on:

- Food supply
- Environment, such as temperature, salinity, currents, light, depth etc.
- Other species in the food web
- Human activities, such as pollution and the impact of fishing



Fish should always be bled as soon as possible. If the fish can't be gutted right away it is very important to cool it properly, for example in ice slush.





Proper bleeding is crucial when handling catch from all fishing gear. This applies to all production methods. Fish must be bled as soon as possible.

Fillets from poorly bled fish become dark or reddish and are therefore not a good raw material for valuable products.

Most commercial fish species are bled by cutting the throat of the fish and through the artery leading from the heart to the gills.

Two methods are used when bleeding and gutting, either by using a table or by holding the fish up with one hand.

Opinions differ on whether it is better to bleed the fish first and allow it time to drain of blood before gutting, or if it is better to bleed and gut in the same operation. Both methods have their pros and cons. By bleeding first the time from capture to bleeding is reduced,

which means that the fish is still alive when it starts to drain of blood. That lessens the likelihood of blood remaining in the flesh. The later method ensures that viscera are removed as soon as possible and enables the catch to be properly cleaned and washed without much delay. Enzymes in the viscera accelerate spoilage if in direct contact with the fillets. Where washing facilities are lacking, it is probably best to gut the catch on shore, given that the fishing trip is short.

Best product quality can be achieved if the fish is bled alive in circulating fresh seawater.

If the catch is allowed to bleed in fresh circulating seawater for at least 15 minutes, it seems to make little difference whether the fish is bled and gutted simultaneously or in a two-stage process.

1

Bleeding on a table

It is best to bleed and gut fish on a table if space allows, especially if the fish is big. It makes the fisherman's work easier and reduces the risk of defects appearing, it for example reduces the risk of tearing the flesh along the collarbone.



2

The throat of the fish is cut all the way through the artery leading from the heart to the gills - it is important that the cut is well above the collar bone, especially with cod intended for salted fish (bacalao) processing.



3

Throat and artery have been cut, but it is also necessary to cut through the neck veins to facilitate efficient bleeding.



4

Gutting on a table

The belly has been slit all the way down to the cloaca. It is important not to cut further, as it damages the fillet and opens a way for the bacteria into the flesh.



5

When removing the abdominal viscera, care should be taken to get rid of all viscera residues. The viscera are full of enzymes and bacteria, and the fillets can also take colour from visceral residues.



6

Well gutted and cleaned fish, ready for washing and storage.



1

Bleeding “in the air”

On smaller vessels where there is no available space for a table for handling the fish, it is necessary to bleed and gut fish “in the air”. It is best to put the fish on a bracket to facilitate the job and to allow easy access to the throat of the fish. This reduces the likelihood of tearing the flesh around the collar bone.



2

Cut the throat well above the collarbone and make sure to open the arteries and neck veins.



3

Gutting “in the air”

Cut the throat carefully in order not to tear up the flesh around the collar bone. Applying this method requires special care not to tear the tissue or slit the belly too far.



4

All viscera is removed and carefully ensured that nothing is left in the abdomen.



5

All the viscera removed. Extra care is needed not to grab the collar bone, as the tissue around it may easily tear, thereby damaging the fish and opening a way for bacteria into the flesh.



6

Bleeding and gutting completed: well bled and gutted fish on the way to be washed.





Fish that is bled after death will never be as good raw material as fish bled alive. It is therefore important to bleed the fish as soon as possible after capture.

Fillets from a poorly bled fish and fish that is bled after death will be darker in colour than fillets from properly bled fish. The products will also spoil much faster because blood induces bacteria growth. Enzymes in the blood reduce the shelf life of frozen products. Poorly bled fish is not a good raw material for saltfish production, as the iron in the blood acts as catalyst on rancidity and yellow discoloration.

Factors that may affect the quality of fish.

Catching and onboard handling severely affects gaping in fillets. High temperature and rough handling increases gaping.

Gaping in the flesh can reduce the value of the fish.

Gaping may be due to natural causes and is a particular problem before and after spawning. Gaping can also be prominent when feed availability is good and the fish gains a lot of weight over a short period.

Rigor mortis.

Fish muscles are soft and elastic immediately after death. Muscles then pass through a contraction process that causes the fish to go stiff. This process is called rigor and is caused by energy depletion in the muscles.

The stiffing of the mussels usually starts at the tail.

The energy depletion begins there because of the tail splashing of the fish before death. The stiffening then moves forward; small fish enter the rigor process sooner than bigger fish.

The rigor process usually takes in excess of 24 hours to pass at 0°C.

Cod can be in rigor for 20 to 65 hours. Cooling the fish extends the rigor time significantly and thereby prolongs its shelf life.

Shelf life refers to the time that foods can be considered edible.

What essentially limits the shelf life of chilled fish is damage caused by bacteria.



Bacteria are a group of microscopic organisms (1/1000 mm) that are not visible to the human eye.

Bacteria are the primary cause of spoilage in fish.

Importance of washing

If the fish is not properly washed after gutting, the enzymes from the viscera will break down membranes and skin which enables bacteria to enter into the flesh.

Fish that is feeding on plankton must be washed particularly well because it has a higher number of bacteria in it.

What is sufficient washing?

It is not enough to only sprinkle the fish with seawater, as it is likely that viscera remains may be left in the abdomen.

Fish that is washed in a tub or a tank needs to stay in there for an appropriate amount of time and first-in-first-out methodology needs to be applied.

The washing tub or tank should be filled with clean circulating seawater which ensures that all viscera residues are washed away.



Bleeding tub

Fish should be allowed to bleed for 10-15 minutes in clean circulating seawater and overfilling the tub should be avoided to achieve best results.

Cleanliness

It is necessary to wash the gutting table, knives and the deck repeatedly. It reduces the risk of accidents and spoilage of raw materials.



DNG
Trolling motor

1. SPEED/THROTTLE
2. FORWARD
3. REVERSE
4. STOP
5. LOCK
6. BRAKE
7. BATTERY
8. CHARGE
9. DISCHARGE
10. BATTERY

Efficient cooling of the catch prolongs the rigor process and results in extended shelf life.

Temperature of the sea varies by season and fishing grounds.

Sea temperatures in the North-East Atlantic can vary from below zero in the winter time to almost 20°C during the summer.

Sea temperature at the south coast of Iceland is typically between 8-12°C in the summer and 2-6°C in the winter.

The need for ice varies by season:

To cool 100 kg of fish from 15°C to 0°C requires 19 kg of ice.

To cool 100 kg of fish from 10°C to 0°C requires 13 kg of ice.

To cool 100 kg of fish from 5°C to 0°C requires 6 kg of ice.

A 10-litre bucket can hold approximately 5 kg of flake-ice.

Note! When the fish has reached 0°C additional ice is needed to maintain the cooling.

Shelf life of some common species at 0°C, based on the best handling and storage:

- Cod..... 15 days
- Haddock..... 15 days
- Pollock 18 days
- Redfish..... 18 days
- Plaice 14 days



Storage

It is best to bring the fish iced on shore all year around - good cooling prolongs the shelf life for many days, thus increasing its value.



Properly iced fish - a valuable product for the market.

Ice requirement depends on sea temperature

Temperature of the sea affects how much ice is required for cooling, which means that the need for ice is dependent on seasons and fishing grounds. Common sea temperatures in the North Atlantic at summer is 10-15°C and then it requires about 15 kg of ice (approximately three 10 litre buckets) to cool 100 kg of fish to 0°C. If slurry ice is used (mixture of ice and seawater) 16 kg of ice and 15 litres of sea water is required to achieve the same results. Then, additional ice is needed to maintain the 0°C temperature.

A mobile app is now available that can estimate how much ice is needed to cool catch down to 0°C and to maintain that temperature for as many days as necessary. The app can be downloaded by scanning the QR-code with your mobile telephone.

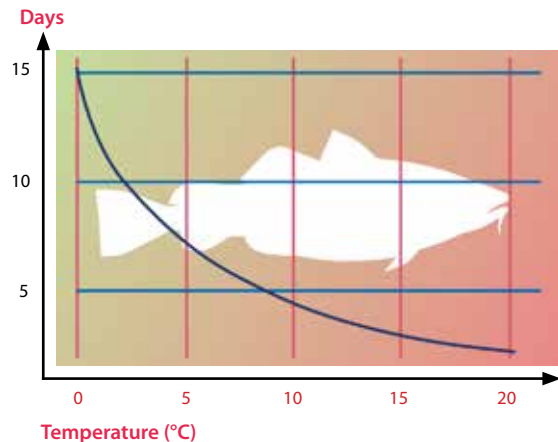


QR-code



Cooling and shelf life

Temperature is a deciding factor when it comes to shelf life of seafood products and an unbroken chill chain is required to ensure maximum shelf life. Whole gutted cod can have up to 15 days of storage at optimal conditions, but storing it at 5°C will shorten the shelf life by half.





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Other important factors that affect the quality and value of the catch

- Sorting – Sorting the catch by size and species is important. It is particularly important to separate redfish from other catch.
- Protecting the catch from direct sunlight – try covering the tubs/ boxes if the catch is kept on deck.
- Minimize harsh handling, such as throwing the fish into tubs or pouring from height between tubs during landing.
- Only gaff fish in the head – gaffing into the torso will damage the fillet and reduce shelf life.
- Use good tools - for example sharp knives and a good brush
- Fish auctioneers and fish buyers should follow up on the quality of the fish they handle and buy – buyers should notify the fishermen if the catch does not meet expectations.

