

STOCKFISH



THE CORNERSTONE OF VIKING CULTURE - A MODERN GASTRONOMIC DELIGHT

Drying is the oldest known method of preserving fish, with a history stretching back for more than a thousand years. Finds indicate that dried fish – stockfish – was exported from Norway before the Viking Era, and that it formed an important part of the Vikings’ staple diet.

Cod and stockfish provided food for the Vikings, financed their expeditions and made possible their conquests. The dried fish they carried on board made it possible to stay at sea for long periods –

With its long keeping qualities, even under varying storage conditions, as well as being a rich source of protein to supplement often unbalanced diets, stockfish has over the years gained entry to many markets. A great improvement in dietary balance in most areas today has lifted stockfish into the higher levels of gastronomy. In most markets nowadays we find stockfish on the menus of the best restaurants, or as a dish served at home to mark special occasions.



Stockfish production is an ancient Norwegian tradition.



Fresh fish straight from the sea is used for the production of stockfish.

and if they went ashore they could sell some of their stocks.

Stockfish has been mentioned many times in literature through the ages. The Italian Querini, who stranded on the Island of Røst in 1431, writes among other things: "They dry the stockfish in the wind and sun, using no salt, and as the fish contains little moisture or fat they became as dry as wood. When it is eaten, it is first beaten with an axe, and becomes stringy, like sinew. Then butter and spices are added for flavour."

Stockfish is mentioned in the annals of some of the travelers that visited the Northern Regions to write their stories. In 1607, Dithmarus Bleskenius published a narrative, in this particular case about Iceland, in which he noted that the inhabitants lived on stockfish, water and whey. He claimed that: "With no doctors or medical knowledge, many of them live for 250 years".

The drying process removes only the water content, leaving all the nutrients in the fish. This makes stockfish a highly nutritious product.

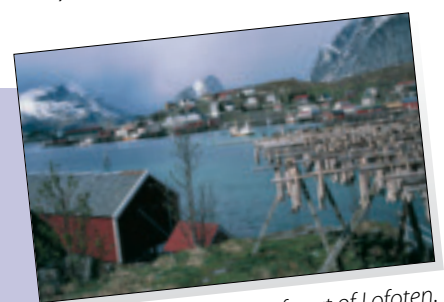
In Norway, stockfish is mostly eaten as a snack or in the form of lutefisk – lye-marinated stockfish. The stockfish culture in the fishing industry is especially strong in Lofoten, but is also well represented in Troms and Finnmark.

Professional expertise on production and quality evaluation/assurance has traditionally been passed on from generation to generation. There is little written documentation of the process.

This booklet is based on the Standard for Production (NBN 30-01) and the Branch Standard for Grading (NBS 30-01).

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View of part of Lofoten.

RAW MATERIALS FOR DRYING

Stockfish production demands first-class raw materials. Without the use of additives of any kind, the fish, assisted by only the wind and weather, must preserve itself. The slightest defect, however small, which may not even be apparent on the outside, can degrade the finished product or present the consumer with an unpleasant surprise when the stockfish is re-hydrated.

BLEEDING

As is the case for all other uses, it is important that fish that is to be dried is bled while still alive. The aim is to remove as much blood as possible from the fish while ensuring that the fish has the fastest possible demise.

Insufficient bleeding results in the flesh of the fish having a darker hue, which becomes particularly apparent when re-hydrating the stockfish. Even the freshest and finest fish can be reduced in value while still on the vessel if the fish is not bled rapidly and correctly.

GUTTING AND CLEANING

Gutting is a critical operation in the production of stockfish, and it is of prime importance that the approved method is strictly adhered to in order to ensure stockfish of the best possible quality. Fish dries from both the inside and outside, and a correct gutting incision provides good drainage from the area around the backbone, while at the same time denying access to flies.

The gutting incision must start between the pectoral fins and is led to the anal vent. In this way, the risk of breaking the side cranium is alleviated and one avoids the possibility of hollow stockfish.

The correct head/neck incision is an important and decisive factor in achieving a quality end product when drying fish. It is especially vital that the vertebrae are cut in line with the curve of the side cranium. This means that at least one vertebra must be removed together with the head in order to ensure proper drainage of fluids that emit from along the backbone. Fish with insufficient drainage at the neck often turn sour.



Raw materials ready for gutting.



The gutting incision starts between the pectoral fins and is led to the anal vent.



Correct head removal is essential in raw materials for drying.



Perfect raw materials for drying. This cod has been properly decapitated and has no visible faults. This fish can become prime stockfish.



Correctly decapitated cod for drying.



Incorrectly decapitated cod for drying. One neck vertebrae too much.



Bloodshot cod. May become degraded stockfish.

Cod exhibiting serious damage. May become degraded stockfish.



Cod with unnecessary bludgeon damage. May become degraded stockfish.

CAREFUL PREPARATION OF RAW MATERIALS

A production process that must be carefully monitored starts ashore.

After gutting, decapitation and cleaning, the operator makes a sensory evaluation to decide to which use the fish shall be put. If it is found suitable for drying, it is thoroughly washed in seawater prior to being passed on to the production process.

TYING

Once the fish are on the production table, the operator selects two fish that are of as equal size as possible. These are tied together over the tail-fin joint with cotton yarn, hemp thread or synthetic thread that is ready-knotted and of the correct length for the fish. It is important to ensure that the fish are tied together so that they hang in the same direction. In this way, the side craniums rest against each other and hanging marks are avoided.

After tying, the fish are again rinsed in running seawater. After rinsing, the fish are transported in containers for hanging.

Lofot Cod should be hung on the same day as it is caught.

FISH SLIME

It is not customary practice to store fish that is to be hung in ice. Ice in direct contact with fish causes a change in the appearance of the finished stockfish in the form of pressure marks. These marks are described as ice burns. The Italian market, which is the main market for Lofot Cod, requires an appearance that negates the use of ice with the raw material. Another factor is that fish slime can be washed away when storing in ice. The slime found in cod helps to protect the fish against micro-organisms after hanging.

Fish can be stored in ice in regions other than Lofoten, but it is nonetheless vital that the fish is prepared as quickly as possible. Tusk and Ling should be stored longer than other fish used for stockfish production in order to allow the fish slime to dissipate. The fish slime in Tusk and Ling has the effect of darkening the skin.



The operator "matches" two fish of equal size prior to tying.



The fish are tied together at the tail joint with cotton yarn.



The fish are stored in containers between stages in the production process.



The tied fish is thoroughly rinsed in seawater prior to hanging.



Hanging of fish on stockfish racks.

Flat lofts in Lofoten.



HANGING AND AFTER-CARE

Good quality stockfish demands correct weather and temperature conditions. Nature provides optimum conditions at exactly the same time that the Winter and Spring Cod arrive at the spawning grounds. This has made the region famous for top-grade stockfish all over the world. Good quality stockfish is also produced in other parts of Norway.

Traditionally, the drying or "hanging" period in Lofoten is from early March to the middle of April. Later, the temperature in Lofoten is often too high for drying, but one can successfully dry fish in Finnmark in both April and May.

FLAT LOFTS AND DRYING RACKS

Both flat lofts and drying racks are employed in the drying of fish. Flat lofts demand greater area, while racks exploit height. No documentation exists as to which is best. Therefore, the use of various types of lofts or racks is more a matter of tradition and depends on available space than an expression of a comparative advantage.

Ties of small fish are hung on the thin end of the pole, and the larger fish are hung on the thick end.

The fish is hung well spaced to ensure sufficient airflow. It is also important that the fish does not come into contact with other fish or the boards. This can cause hanging marks that can later lead to a reduction in sales value. An inspection round is therefore carried out immediately after hanging to ensure that the fish is properly separated.

INSPECTION

When inspecting fish in lofts, one will also be able to spot any remains of guts, etc. Remains of liver can lead to a reduction of the market value of the stockfish.

One year is rarely like the next in stockfish production. This is due to the variations in climatic conditions: Temperature, sun, wind, humidity and precipitation affect the drying – and therefore the quality – of the finished product.

The fish is hung with the gut incision away from rain. Thus, the fish in Lofoten is hung with the belly facing North and the back South.

The drying period in Lofoten is approximately three months, depending on wind, weather and the size of the fish. In Finnmark, the fish are traditionally smaller, resulting in a shorter drying period, around 2 - 2,5 months.



Hanging fish in a loft in Lofoten.



Example of fish that are touching each other in the loft and must be separated so that side cranium lies against side cranium.



Remnants of liver that are found in the fish after drying must be removed.



On harvesting, the tying yarn is cut and the fish drops onto the bedding.



The sorter sorts the fish into as many as 20 different classes.

HARVESTING, SECONDARY DRYING, SORTING, GRADING AND PACKING

The harvesting of stockfish in Lofoten normally takes place from the middle of June, while in other parts of the country the fish is harvested as soon as it is dry. The degree of dehydration is based on a subjective evaluation, in which various methods are employed.

The fish is taken from the loft by cutting the ties with a knife. It is then taken into storage for secondary drying. The stockfish is stacked and arranged so that air can circulate freely around the individual fish. The largest fish, which require the longest drying period, are placed at the top and exterior of the stacks to ensure that secondary drying is as rapid as possible.

A properly dried fish normally has a water content of between 14 and 16 percent, but can be sold with both lower and higher water content.

Sorting and grading is carried out in accordance with a branch standard, *Sorting and Grading of Stockfish*, (NBS 30-01).

"Vrakeren" – the "discarder" or "sorter" responsible for selection – is highly experienced in stockfish production and has often gained experience over the course of many years through

working together with older and experienced sorters. He makes a subjective evaluation and sorts the fish in up to 20 classes for Lofot Cod and 10 classes for other stockfish produced from cod. Length, thickness, weight and qualitative features all contribute to determining to which class the stockfish belongs.

The sorter makes a sensory evaluation of the fish and must often open the fish at the neck in order to check the aroma to determine the quality of the fish.

As sorting and grading is done by subjective evaluation by the individual sorter, there may be variations within the individual classes from different producers. However, all fish in a single bundle shall be of the same standard and quality.

Stockfish is packed in bundles of 25, 45 or 50 kilos, dependent on the target market. Hydraulic presses are used to compress the fish together and the bundles are held together with metal wire ties. The bundles are later sewn into jute sacking.

The fish is bundled with either the belly or back outwards, depending on the market for which it is destined.



In many cases, the sorter must use his nose to determine the correct quality of the fish.



After harvesting, the fish is taken to storage and secondary drying.



Stockfish of the same quality is stacked for pressing.



A hydraulic press is used to compress the bundles together.



Stockfish of the same quality bundled together with wire.



A stockfish bundle sewn into jute sacking and ready for export.

SORTING AND GRADING

PRIME GRADE

Ragno	This is the best quality. The fish shall be of the leanest type, free from faults and blemishes and over 60 cm.
Westre Magro - WM <i>(Thin Westre)</i>	Thin and lean class without any sign of plumpness. Must have colour. Comes in three size grades: 60/80 cm, 50/60 cm and 40/50 cm.
Westre Demi Magro - WDM <i>(Half-thin Westre)</i>	The same quality requirements as for WM, but may be plumper along one side of the neck and down to the anal cavity, or show some plumpness on both sides. Comes in two size grades: 60/80 cm and 50/60 cm.
Grand Premier - GP	A special class that must have colour. Can be described as a slim Bremer.
Lub	Some blemishes are acceptable. Size: 30 – 45 per 50 kg.
Bremer - BR	Plump type. Size: 40 – 55 per 50 kg.
Hollender - HO <i>(Standard Hollender)</i>	Plump type. Size: 58 – 63 per 50 kg.
Westre Courant - WC <i>(Standard Westre)</i>	Plump, strong and must have colour. Size: 70 - 80 per 50 kg.
Westre Ancona - WA	Fish of same type and quality as WM or WDM, too plump to meet classification for these types. Small blemishes are acceptable. Sizes: 70 – 78 per 50 kg.
Westre Piccolo - WP <i>(Small Westre)</i>	Must have colour. Size: 100 – 120 per 50 kg.
	Fish that are smaller than Westre Piccolo and Westre Magro 40/50 are sold as both Westre Piccolo Piccolo (with number quoted), or as Lofoten 1/2 (100 – 200 grams per fish).

SECOND GRADE

Italia Grande - IG <i>(Large Italian)</i>	Size: 55 – 60 per 50 kg.
Italia Grande Magro - IGM <i>(Large Slim Italian)</i>	A slimmer type with same size and class as IG.
Italia Medio - IM <i>(Medium Italian)</i>	As IG, but smaller. Sizes: 70 – 80 per 50 kg.
Italia Medio Magro - IMM <i>(Medium Slim Italian)</i>	A slim IM or second-grade WM 50/60. Size: 50 - 60 per 50 kg.
Italia Piccolo - IP <i>(Small Italian)</i>	Second-grade WP. Size: 100 – 120 per 50 kg.

PRIME AND SECOND-GRADE FISH



Common for all stockfish are the sorting and grading criteria: Size, appearance and a number of qualitative properties that together decide the quality of the product.

There are two main grades for most species of fish: Prime and Second.

Prime fish is the highest grade and for all intents and purposes shall be free from blemishes or faults, depending on its class. Second-grade fish may have small, but not serious, blemishes.

Lofot Stockfish of a lower grade than second is sorted as Tipo B or African goods for the African market.

SLIM AND PLUMP FISH



The choice of plump and slim qualities of stockfish is a central factor in the sorting and grading of stockfish. This is a matter of preference in the various target markets and the different manners in which the end product is used. Some markets prefer slimmer fish and prepare the fish by rolling or malleting prior to re-hydration. Other markets prefer a plumper and stronger grade of stockfish, as they re-hydrate the fish whole.

SIZES



Size is a central criteria in stockfish sorting and grading, and is determined by length, weight and the number of fish per given weight, the so-called weight number. The illustration shows the so-called stockfish, which stretches from the centre of the curve at the side cranium to the end near the tailfin area.

PRIME FISH



PRIME FISH

A prime fish is of the highest quality. There are variations in the different classes, but the norm is that they shall be free from blemishes and faults. Further, the skin shall have an attractive appearance and the flesh of the fish shall exhibit a good colour.

In addition to optimum climatic conditions, prime fish also demands first-class handling in all stages of production from raw material to finished product. Only then will it achieve the best possible price in the best paying markets.

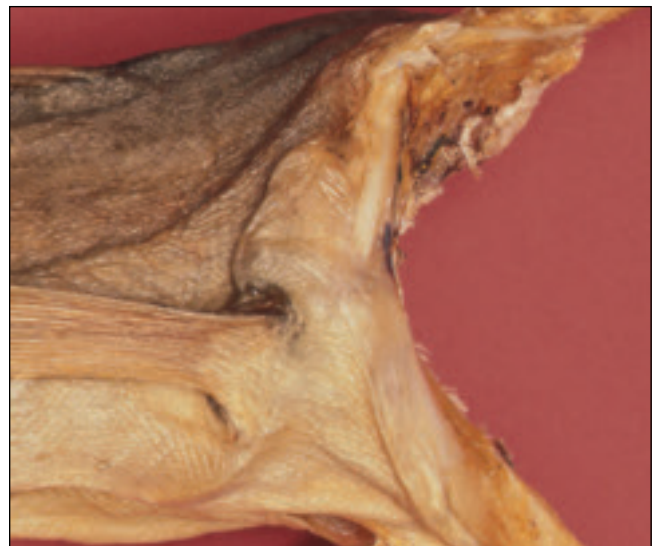
FEATURES OF PRIME FISH:

- Natural shape and open belly
- Clean in neck and belly
- No indication of dewing
- No hanging marks
- No frost damage
- No mildew



Good skin colour, no tendency to dewing.

Under: Open and clean belly. Right: Neat and clean around neck.



SECOND-GRADE FISH



SECOND-GRADE FISH

A second-grade fish may have some blemishes or faults, and does not have to have a perfect appearance. Second-grade fish are not the lowest quality class and cannot therefore have serious blemishes or faults. A second-grade fish demands proper handling and good climatic conditions. Less than perfect raw materials or raw materials that have not been properly treated often result in a second-grade product.

FEATURES OF SECOND-GRADE FISH:

- May have some coating in belly region
- May have partly closed belly
- May show some frost damage, but not so bad that one cannot see the undamaged flesh near the backbone
- May contain a little blood or bloodstains
- Some mildew is acceptable
- Must not have hooking or bludgeon marks, cuts and sores, or liver remains

Partly closed belly.



Undamaged flesh easily visible in neck region.



Some mildew and fish slime on skin.





FROST DAMAGE

If the fish has been exposed to frost, especially during the early stages of the drying process, experienced stockfish sorters can detect this from the appearance of the exterior. An incision through the fish makes this more apparent to everyone. The fish on the left has only been lightly exposed to frost during the drying process, and one can clearly see a dark and compact fish. A small porous area can be seen at the top of the dorsal area only. The fish on the right shows extreme frost damage and is completely porous on the inside. The frost-damaged fish must be sold in the market place for a different purpose than re-hydration and preparation. The dark fish will be pure white when re-hydrated, while the light stockfish will assume a reddish colour when re-hydrated.

COLOUR CAN BE THE DECIDING FACTOR

In many instances, the colour of the visible flesh can be an indication of whether the fish is of prime or secondary quality. The illustration on the left shows light, good quality and fresh flesh in this fish. On the right, the flesh is dark and shows clear signs of blood.



OTHER STOCKFISH



Prime Rotskjær cod



Other round Cod

ROTSKJÆR (SPLIT)

Rotskjær is gutted, decapitated fish that is cut along the backbone but still joined together at the tail joint. Approximately two-thirds of the backbone, starting from the neck, has been removed. The rearmost section of the backbone remains attached to one-half of the fish.

Prime and Secondary Rotskjær cod is sorted using the same criteria used for round fish. Rotskjær cod that does not meet the required standards for classification as Prime or Secondary is classed as "Other Rotskjær cod".

Rotskjær cod is sorted in lengths of \pm 50 cm, 50/60 cm and 60+ cm. Other Rotskjær cod is sorted in lengths of 20/50 cm, 30/50 cm, 50/70 cm and 70/+ cm.

OTHER ROUND COD

Round Cod that does not meet the standards for Prime or Second Grades is sorted as either Tipo B for Italy or as Africa goods.

The different markets have their own ideas as to the acceptability of such fish. The fish shall naturally be of a good standard and suitable for human consumption.

Other round cod is sorted in lengths 20/40 cm, 30/50 cm and 50/70 cm, 70/90 cm, and 90+ cm. For the Italian market, Tipo B is sorted by pieces/weight. For Tipo B IM this is 75 – 80 per 50 kg. For Tipo B IG it is 55 – 60 per 50 kg.

BOKNAFISK

Boknafisk is a stockfish product in which the drying process is halted after two to four weeks.

The water content of Boknafisk is higher than in standard stockfish. In order to conserve the fish, and to avoid further dehydration, it is customary to freeze Boknafisk.

ARTIFICIALLY-DRIED FILLETS

Fillets are fish portions obtained by gutting, heading, cutting the fish along the backbone and removing the backbone. Fillets for drying normally have the cranium and neck bones removed together with fins and any bones attached thereto.

Drying is carried out in drying tunnels using hot air.

Dried fillets are usually produced from Ling, although some Saithe and Cod is used.

Artificially-dried fillets are sorted in lengths of \pm 50 cm, 50/60 cm, 60/70 cm and 70+ cm.

SAITHE

Large quantities of Saithe (also known as Coalfish, Coley and, in the USA, Pollock) are dried in Norway. Saithe is a member of the Cod family and is mainly found in the North Atlantic. Saithe is common along the entire Norwegian coast, and this is where the richest Saithe fishing grounds are found. Saithe carries the Latin name *Pollachius virens*.

Important Saithe stockfish markets are: Nigeria, Switzerland and the USA. Saithe is sorted in lengths of 20/40 cm, 30/50 cm, 50/70 cm and 70+ cm.



Saithe

HADDOCK

Some Haddock is also dried in Norway. This is a member of the cod family that is found on both sides of the North Atlantic, and on the Eastern side it is found from Portugal to Iceland, Spitsbergen and Novaja Zemlja. It is common all along the Norwegian coast, but is most plentiful on the banks of Western Norway. The Latin name for Haddock is *Gadus aeglefinus*.

Important markets for stockfish of Haddock are: Nigeria, Switzerland and the USA. Haddock is sorted in lengths of 20/40 cm, 30/50 cm, 50/70 cm and 70+ cm.



Haddock

TUSK

Some Tusk is dried in Norway. Tusk is a codfish found on both sides of the Atlantic. It is widespread from Iceland and Northern Ireland to Southwest Spitsbergen and Kola. Tusk is common along the West Coast of Norway and the continental shelf. The Latin name for Tusk is *Brosme brosme*.

Nigeria is the major market for stockfish from Tusk. Tusk is sorted in lengths of 20/40 cm, 30/50 cm, 50/70 cm and 70+ cm.



Tusk

COD

The majority of Norwegian stockfish is produced from cod. Cod that is cured by drying both in Lofoten and other districts is a member of the Norwegian-Arctic Cod family that lives in the cold Polar waters of the Barents Sea and along the coast of Norway. This particular family is somewhat special in that its migratory habits take it over vast areas of the sea.

The cod reaches sexual maturity between 6 – 15 years, with most fish maturing between 8 – 10 years. This section of the stock (Winter/Spring Cod) migrates from the northern reaches of the Barents Sea to the breeding grounds stretching from off the coast of Finnmark to the waters of North-western Norway. The immature cod searches for food throughout the vast reaches of the Barents Sea and sometimes follows the Capelin on its journey to the waters off Finnmark and Troms (Capelin-Cod).

The Northern Arctic cod carries the Latin name *Gadus Morhua*.

FINNMARK FISH



Prime stockfish of the type Finnmark fish.

Stockfish production in Finnmark is based on the second largest of Norway's great fisheries, the Spring Cod Fisheries along the Coast of Finnmark. The raw materials consist mainly of Norwegian Coastal Cod, a member of the Cod family that lives its life along the coast. Part of the Finnmark fish that is used in the production of Stockfish is a member of the Norwegian-Arctic Cod family. It uses the Capelin stocks in the North as its larder, and follows the Capelin in its wanderings.



Typical Coastal Norwegian Cod that makes up the major part of stockfish production in Finnmark and Nord-Troms.

Historically, stockfish has been produced all along the coast. Troms and Finnmark have been of major importance in this regard. The number of stockfish production plants in Troms and Finnmark has been severely reduced during the past couple of decades, but the old traditions are kept alive. The importance of the Finnmark fish in national stockfish production varies from year to year.

Today there are only a few companies that produce and export Finnmark Stockfish. Often only small quantities are produced, and purchased by stockfish exporters.

A quantify of stockfish production is carried out by so-called "self-producers", fishermen that hang their catch on their own racks themselves. The fish is sold to exporters or Norwegian producers of stockfish products.

Fish is hung, or dried, both autumn and winter in Troms and Finnmark. Some of the fish is used for other purposes than those common in the traditional stockfish consumer markets.

Part of the fish dried in Finnmark and Troms is split in two and a section of the backbone is removed. This is called Rotskjær, or split, and is preferred in some markets. In addition Cod, Saithe, Haddock and Tusk are used in stockfish production.

Finnmark fish is sorted in classes Prime and Secondary according to the same criteria as used for Lofot Stockfish. The Prime and Secondary qualities are then sorted by weight, i.e. 100/200 gr, 200/400 gr, 400/600 gr, 600/800 gr, 800/1000 gr and 1000 gr+.



Sorting stockfish (Rotskjær).



A plant for the production, sorting and export of stockfish in Nord-Troms.



Some fishermen hang their own catch and carry out the entire production process.

THE STOCKFISH MARKETS

Stockfish is Norway's oldest export article, which is why it follows that it is precisely this product that is historically interesting in relation to markets. Throughout the ages, war, peace, religion and political changes have caused upheaval and change in both the markets and the stockfish industry in Norway. In these modern times we can look back at the drama that has influenced the trade over the centuries. Changes of regimes in important markets – for example in Nigeria - can change trading patterns almost overnight.

Today Europe, and in particular Italy, has taken over as the most important markets for Norwegian stockfish. Here the demand is for a quality that it is mainly only possible to produce in Lofoten and the northernmost regions through natural air-drying.

In the 20th Century it was Africa, and in particular West Africa and Nigeria, that were the really large markets. In periods, the markets could absorb such large volumes that it formed the basis for stockfish production along the major part of the Norwegian coast.

The largest markets for Norwegian stockfish are Italy, Nigeria, Sweden, the USA and Croatia.

Italy is now the most important market for Norwegian stockfish.



ITALY

Italy now buys more than 2/3 of the Norwegian production of stockfish. However, it is not a simple matter of one single market. Stockfish is used in five main regions: Veneto, Liguria, Campania, Calabria and Sicily. Stockfish is essentially absent in other areas of Italy. There are great differences in the requirements of the market regions in Italy with regard to the type and appearance of stockfish as a raw material – and the manner in which it is prepared and served also varies greatly.

In northern Italy, the preference is for the leanest or thinnest stockfish, and is thus the type that achieves the best market price. The fish is often passed through rollers, like a mangle, or beaten with a mallet.

In southern Italy they prefer a more robust and fleshier fish. This is often re-hydrated whole and "skinned" after several days in water. Some Secondary Class fish is also sold here, as this method of re-hydration makes it possible to cut away any parts of the fish that are not fully up to standard.

Skinning stockfish after a few days in water is done with large, sharp knives and is both hard and dangerous work.



Some stockfish is sold through traditional stockfish-retailers.



OTHER MARKETS

If the Italian market is highly varied in its conception of both quality and preparation of stockfish, the situation is not better when we look at the remainder of the global stockfish market.

Africa, which for many decades has been extremely important for the export of Norwegian stockfish, first became acquainted with the fish through the British colonial engagement. The breakthrough came in the 1920's, when the British started to use stockfish as a means of payment for the raw materials they took out.

Stockfish has become the subject of a great deal of myth making in Africa, and is often used at family celebrations when fertility is on the agenda. The usual method of preparation is to cook the fish in a pot with root vegetables and perhaps some meat in a stew, where the fish is the dominant flavour and main source of protein.

Croatia has its stockfish traditions as one of the oldest markets in Central Europe. Preparation follows the Italian methods. The USA has inherited its stockfish traditions from immigrants from stockfish-consuming countries.

Stockfish, preferably on the lean side, is passed through rollers or beaten with mallets prior to re-hydration and sale.



A dish made from stockfish, ready for the table.

In Sweden and Finland, stockfish is used to make Lutefisk – stockfish re-hydrated in lye potash – as is the tradition in Norway.

The fish is re-hydrated, if possible in large soaking vats with refrigeration plants before it is sold to the consumer.



The real quality of stockfish is only revealed after re-hydration. This photograph clearly illustrates the difference.



NATURE'S WONDER

It is said to be one of nature's great wonders that the arrival of mature Spring Cod coincides with the time of year when drying conditions at Lofoten are at their best. The frost is losing its grip, and wind, rain and the sun arrive to take over the work of converting the raw cod into excellent stockfish.

In the right sequence, all kinds of weather are helpful in the processing of stockfish. The sun and wind in the right quantities aid in the drying process while moderate rainfall helps to prevent the formation of a crust on the surface of the fish.

If the drying process proceeds too rapidly, especially at the start of the process, there is a risk of the fish becoming "burned". This means that the binding material in the fish forms a crust that blocks the pores. Conversely, prolonged periods of rain can lead to the fish drying too slowly, which increases the risk of souring. The ideal air temperature for natural drying of the fish lies around 5° C.

MATURING

Air drying fish is a battle between the forces of decay and those that aid in preserving the fish. There are many factors in addition to the properties and condition of the raw material that will effect the production of high quality stockfish, in relation to both appearance and taste.

Bacteria and the fish's own enzymes break down proteins, and if the fish is to attain the proper qualities, it is important that this process does not proceed too far. A maturing or fermenting process as it is normally known, must take place. The process is similar to the process used for curing meat.

The growth of micro-organisms that break down the flesh of the fish is dependent on water to develop and proliferate. Drying is therefore a method of stopping microbial development and in so doing preserving the fish. Bacterial development in fish stops when the water content falls under 15 percent.

MICRO-ORGANISMS

The majority of micro-organisms in quality raw materials is found near the surface of the fish's flesh. This area will under normal circumstances dry first, stopping microbial development. The dehydration and curing of the muscles along the backbone will take longer.

If bacteria have already attacked the flesh of the fish to be processed, micro-organisms will continue to develop as long as there is sufficient water content to support it.

If pockets of excessive dampness are left during gutting, for example under the swim-bladder, or if the gutting incision is too small, this will delay drying. At the same time, micro-organisms are provided with the opportunity to develop and this may result in damage to some areas of the fish.

SUNLIGHT HELPS

Even though the reduction of water content is the most important factor in reducing microbial action, there is a number of other factors that aid in conserving the quality of the fish. Ultra-violet light is well known as a method of killing micro-organisms. Sunlight and normal daylight contain ultra-violet light

Stockfish drying racks in Lofoten, winter and summer. To the left, ready for hanging while the picture on the right shows finished stockfish ready for harvesting.



which in all probability helps to limit the development of micro-organisms during the drying process.

Fish skin and surface slime contain an enzyme, lysozyme, that can kill micro-organisms. The enzyme, which is found in high volumes in membranes, can influence the keeping properties of the fish during the drying process.

CORRECT STORAGE

The atmosphere always contains water in varying volume, and the fish can absorb water from the atmosphere during drying. Even though microbial action has stopped as a result of the drying process, the stockfish may absorb so much water from the atmosphere that microbial development can restart. This is a particular risk under conditions of high temperature. It is therefore of prime importance that stockfish is kept dry and well ventilated when in storage.

Consignments of stockfish to tropical areas where ambient temperatures are high and humidity levels can be extremely high, are at particular risk and the quality can easily be degraded due to microbial growth.

NUTRITION VALUE OF STOCKFISH

The result of drying process is a fish concentrate. The nutrition value of one kilo stockfish is the same as approximately five kilos fresh fish. Water loss accounts for the difference, while all the goodness is retained:

Stockfish is one of the richest known sources of protein – an essential nutritional element. In addition, stockfish contains important B-vitamins – the lack of which can cause many deficiency diseases. It is also rich in iron and calcium. To this day there is no other known, high protein food product with similar properties.

NUTRITIONAL VALUE PER 100 GRAMS

Water	15 g	B-vitamins	
Calories	330 kcal (1380 kJ)	Thiamine	0,003 mg
Protein	79 g	Riboflavin	0,10 mg
Fat	1,4 g	Niacin	9,0 mg
Calcium	100 mg		
Iron	2,5 mg		

The road to stockfish in four stages.

1. Fresh fish.
2. Semi-dried fish - "Boknafisk".
3. Part-dried
4. Dry.

1



2



3



4



AGREEMENT ON QUALITY

There has been broad agreement in both the fishing and stockfish industries branch organisations on the importance of publishing a Quality Assurance Manual for the production of stockfish. This brochure is intended as an introduction to a sector of the Norwegian fishing industry rich in tradition, that still has great opportunities and potential for development.



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