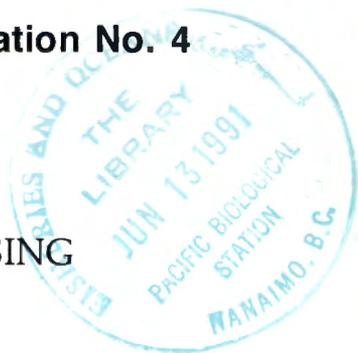


C-1

Fishing for Quality — Publication No. 4

**HANDLING AND PROCESSING
SALT COD**



Canada

The salting process has been used for centuries to preserve fish. The production of salt cod was Newfoundland's primary industry prior to the development of frozen fish products. The increased demand for fresh frozen cod, combined with declining saltfish production, caused major reductions in the amount of saltfish marketed. Consequently, in some areas, the skills necessary to produce saltfish were almost lost. This brochure illustrates steps which should be taken to produce a high quality saltfish product.

Further information on the handling and processing of salt cod is available from:

4 Fisheries Development Division
2 Fisheries and Habitat Management
3 Department of Fisheries & Oceans
Newfoundland Region
P. O. Box 5667
St. John's, NF
A1C 5X1
(709) 772-4438

Department of Fisheries
Government of Newfoundland and Labrador
P. O. Box 8700
St. John's, NF
A1B 4J6
~~(709) 576-3786~~ (709) 729-3736

Canadian Saltfish Corporation
P. O. Box 9440
St. John's, NF
A1A 2Y3
(709) 772-6080

Newfoundland and Labrador Institute of
Fisheries and Marine Technology
Seafood Development Unit
P. O. Box 4920
St. John's, NF
A1C 5R3
(709) 778-0419



Fishing for Quality — Publication No. 4

HANDLING AND PROCESSING SALT COD

CONTENTS

- Onboard handling
- Cleaning & sanitizing vessels
- Building maintenance
- Onshore handling
- Salting
- Cleaning & sanitizing buildings
- Pink & dun fish
- Culling and grading
- Drying heavy salted fish
- Drying light salted fish
- Packaging
- Marketing
- Summary



ONBOARD HANDLING

One of the most important requirements in the production of saltfish is a supply of top quality fresh fish. All fish must be handled carefully to prevent bruising and softening of the flesh. It must be properly bled, gutted, washed, stored, and iced.

Bleeding

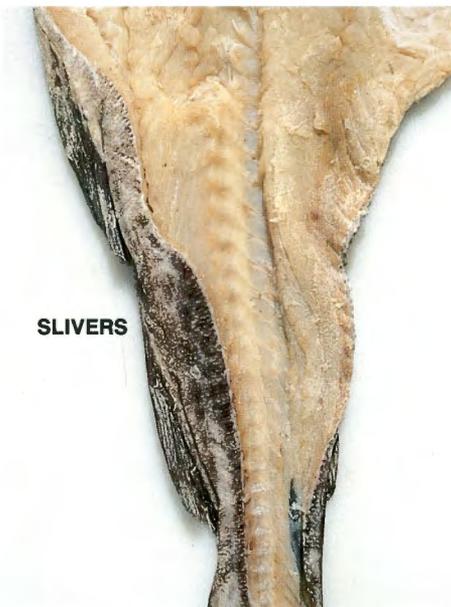
Bleeding is important because it reduces the chance of blood clotting and bruising, giving the flesh a whiter appearance than a nonbled fish. Bleeding should be carried out while the fish is still alive. To bleed cod, cut the throat forward of the heart or cut the gills. The fish must be allowed to bleed for 10-15 minutes before removing the gut. Bleeding is more effective if the fish are placed in water.



Fishermen can bleed fish by cutting the gills (top) or by cutting the throat (bottom)

Gutting

When gutting fish, cut the throat through to the backbone making sure to cut off the puddick or stomach, which will enable easy gut removal. The belly of the fish is then cut straight to the vent. Do not cut to one side or beyond the vent as this will cause quality problems such as "slivers". It is important that liver and all the gut material be removed as they contain a number of chemicals and bacteria which can cause spoilage.



Note the "sliver" to the right of the arrow

Washing

The gutted fish must be washed in clean, cool water. Most of the bacteria associated with fish spoilage can be removed by washing thoroughly. This will help slow down spoilage.

Icing and Stowage

The washed fish should be handled carefully and stored in approved containers, after being mixed thoroughly with clean ice. Remember, shallow storage will lower the amount of pressure on the fish. Fish must always be kept cool and stored away from the sun and the weather. Insulated containers are useful for this purpose.



Proper icing and stowage are essential to quality

Offloading

Land the catch as soon as possible. The longer the fish are left unprocessed, the greater the chance of spoilage. Fish which have been stored in boxes or containers, should be unloaded in those same containers. When using netbags or buckets, make sure they are not overfilled as this causes excess pressure on the fish. Hooks, shovels, prongs, and other such instruments should be avoided as they damage the fish. Prongs must not be used at any time where approved unloading facilities are available. Once the fish have been offloaded, the vessel must be cleaned and sanitized.

CLEANING & SANITIZING VESSELS

It is important for inshore vessels to have a proper sanitization program in place. Unclean areas provide ideal conditions for spoilage bacteria which can lower fish quality. Using only clean water, wash the processing area and scrub away any slime which is present. Once the slime has been removed, the vessel can be cleaned and sanitized with an approved cleaning agent, such as those which contain chlorine or iodine. Remember to rinse thoroughly after using the approved sanitizer.

BUILDING MAINTENANCE

To help reduce the chances of fish spoilage, fishermen can make simple design changes to their "stages". Screened air vents, windows, and doorways allow good ventilation while preventing flies and rodents from entering the processing area. Covering the roof and walls of the building with a light coloured, waterproof material will reflect heat and help keep the building's temperature lower. Stages should be maintained seasonally by repairing, painting, and cleaning. Before processing begins, the entire area must be rinsed with clean water from an approved source. Under no circumstances should water used come from the area next to the stage or plant or from areas which are polluted or contaminated. Water from those areas contain high numbers of spoilage bacteria and may include disease causing organisms of public health significance.

ONSHORE HANDLING

As with onboard handling, all fish processed must be handled with care. It is important that the offloaded catch be processed without delay. Saltfish producers must continually attempt to maintain fish quality. Poor heading, splitting and washing contribute to defects which can downgrade the quality of the product.

Storage

Fish to be processed should be stored in approved boxes or containers, and should not come in direct contact with the floor. Again, the fish must be kept cool and stored away from the sun and the weather. Heat can cause texture breakdown, which results in a soft fish and off-odours. The offloaded catch must be processed quickly. If the catch has not been gutted, gutting should take place immediately.

Heading

The best method for removing the head of a fish is to "jowl" it, especially for large fish. Cut just behind the gills up each side of the collar bone towards the back of the fish. This reduces damage to the flesh and breakage along the collar bones. Do not rip the head, but gently push the body away from the head. The table edge should be thin and bevelled at the heading station. Any liver or gut material present should be removed by the header. Liver causes yellow stains on the flesh, which results in rancidity, and the gut material causes bellyburn. The headless fish is now ready to be split.



The table's bevelled edge enables easy head removal



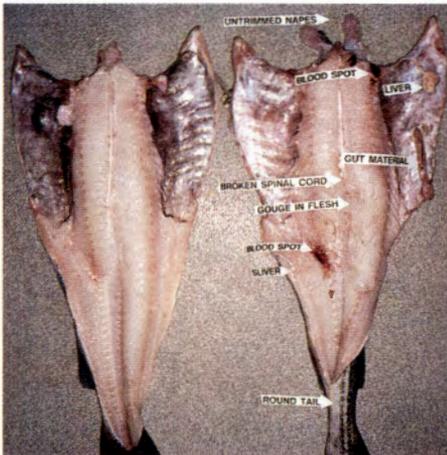
Pieces of liver on the fish result in yellow stains

Splitting

Poor splitting is a major factor in downgrading fish quality. A lot of skill is required to split cod fish properly. The fish must be split through to the tail, making sure not to cut the flesh too deep, or to gash the flesh. When removing the sound-bone, cut the backbone through the third joint behind the vent. This eliminates blood clots at that point. Careful splitting will prevent defects such as "split tails", "round tails", and "slivers" and maximize returns.



Care should be taken so that the knife does not cut through the skin of the fish in the tail area



Well split fish (left) and poorly split fish (right)

Washing

Next, the split fish should be washed in approved clean, cool water to remove excess blood and slime. A soft nylon brush can be used for washing the fish. Do not allow the fish to remain in water too long as this will cause the flesh to soften. A high quality split fish is clean, without blood clots, holes, or liver. Once clean, the fish should be salted immediately.

SALTING

Fish can be heavy or light salted by "kench curing" or "pickling".

Kench Cure

"Kench curing" is the salting of fish in piles which consist of split fish and salt placed in alternate layers.

The salting area must be clean and located apart from the actual processing area. This prevents excess water and waste material from coming in contact with the salted product. It is a good practice to place a bucket of clean water near the kench so that any blood or liver remaining on the flesh can be washed off. The floor area, on which the fish is to be placed, can be covered with a layer of clean plastic. The use of plastic salt bags is not recommended, as coloured print labelling on the outside of the bag can be transferred to the fish.

The salting area must be covered with a layer of coarse fishery salt approximately one quarter inch thick.

The fish are placed on the pile flat, nape to tail, face up, with no twists or overlapping of the flesh. Do not allow the napes or tails to stick out or overhang in the pile.



LAP TAIL

Overlapping of the flesh in the tail area results in a "lap tail" defect

Heavy salted fish

A "heavy salted" cure requires at least 55 lbs. (~ 25 kg) of salt per 100 lbs. (~ 45 kg) of split fish. When salting, the neck area of the fish and the thick middle portion receive more salt than the thin areas. Larger and thicker fish require more salt than smaller and thinner ones. Kench curing places a lot of pressure on the fish lower in the pile; therefore, the freshly completed kench should not be more than four feet (~ 1.2 metre) high.

The bulk should be sloped inward gradually towards the top so that pickle formed can drip freely over the front or face of the pile. The last layer of fish in the bulk should be completely covered with a layer of salt. Occasionally, a wet salt mixture may be placed on the front of the bulk. This prevents slime build up and ensures that the napes receive enough salt.

Fish must remain in salt for 21 days, or longer depending on the temperature, at which time it is "struck". Striking takes place faster at higher temperatures than cooler ones. When a fish is struck it means there has been adequate salt penetration and water removal from the fish. Heavy salted, kench cured fish, referred to as "saltbulk fish", once "struck" should only be removed from the pile for sale or for drying. The fish must be removed from the kench one at a time. Starting at the top, gently remove each fish, taking care not to pull or tear the flesh as it is still very delicate.



Sloping the kench inward toward the top allows the pickle to run freely over the front of the bulk



Light salted dried fish (left) heavy salted dried fish (right)



The thick middle portion of the fish must receive more salt than thin areas

Light salted fish

A light salted fish is very different from a heavy salted fish, having its own characteristic colour, flavour and odour.

Light salted cod, which is dry salted in a kench, is prepared for salting in the same manner as heavy salted fish; however, the salting procedure is different. The salt is spread evenly over the fish with 12-15 lbs. (- 5-7 kg) of salt used per 100 lbs. (- 45 kg) of split fish. It is extremely important that the correct amount of salt be used. Too much salt will result in a product which resembles heavy salted fish. Slack salting will result in uncharacteristic colour and spoilage. Depending on temperature, the fish must remain in salt for 5-9 days. Light salted codfish are not preserved totally by the salt; therefore, they must be dried quickly after removal from the kench.

Heavy salted pickled fish

Heavy salted pickled fish requires approximately 40 lbs. (- 18 kg) of salt per 100 lbs. (- 45 kg) of split fish. When fish are pickled, the initial preparation of the fish is the same as that for kench curing. The split fish are placed in an approved water-tight con-

tainer, and salted similarly to kench cured fish; salting heaviest on the thick portion of the flesh. Enough salt should be placed between the layers to keep the fish from sticking together. The fish will form its own pickle. The fish should be weighed down with an approved material so that the top layer is completely immersed in the pickle formed. The fish sits in this pickle for 21 days or longer, as the striking time depends on temperature. Once struck, the fish can be removed from the pickle, washed and dried. If drying is not desirable, individual fish can be sprinkled with salt and placed in a pile. Pickled fish have a whiter, thicker appearance than kench cured fish.

Light salted pickled fish

Light salted cod can be produced also through pickle curing. The amount of salt used is approximately 10 lbs. (- 4 kg) of salt per 100 lb. (- 45 kg) of fish. Remember to weigh down the fish with an approved material so that the top layer will be completely immersed in the pickle which forms. The fish sits in the pickle for approximately 4-6 days, depending on temperature. After this time they are removed, washed, and dried.



The top layer of fish is weighed down with an approved material to ensure proper curing

CLEANING AND SANITIZING BUILDINGS

Before and after any fish have been processed, the entire area must be cleaned thoroughly. All waste products must be disposed of properly. The build up of offal around the processing area provides a home for flies, maggots, bacteria and other pests. The area must be flushed thoroughly with clean water, using a deck broom or solid rubber squeegee to remove debris and offal.

When using detergents and sanitizers, make sure that they do not come in contact with the fish. All cleaning agents used must be food-approved.

PINK AND DUN FISH

Bacteria and molds, which can live in the presence of salt, are concerns to the salt fish producer. One such salt loving bacteria causes "pink fish". This spoilage can be detected by pink-coloured flesh and off-odour. Fish with this type of spoilage cannot be sold. Pink spoilage can spread rapidly throughout the whole salted catch; therefore, pink fish must be discarded immediately. The entire area must be cleaned and flushed thoroughly using fresh water and an approved sanitizer.

Another spoilage problem occurs when fish become covered with a spotted mold, ranging in colour from white to black. This mold spoilage is referred to as "dun".

Factors encouraging the growth of pink fish, dun, and sour fish are unclean processing areas, high temperatures, poor ventilation, and contaminated salt. Only clean fishery salt may be used. It must be stored in a cool area, away from direct sunlight, and left in plastic bags until needed. Salt can be used only once and any used salt must be thrown away, as it contains bacteria which can cause spoilage.

Problems such as pink fish, dun, or sour fish are not acceptable in the saltfish industry. They can be reduced by proper building construction and good sanitation and handling practices.

CULLING AND GRADING

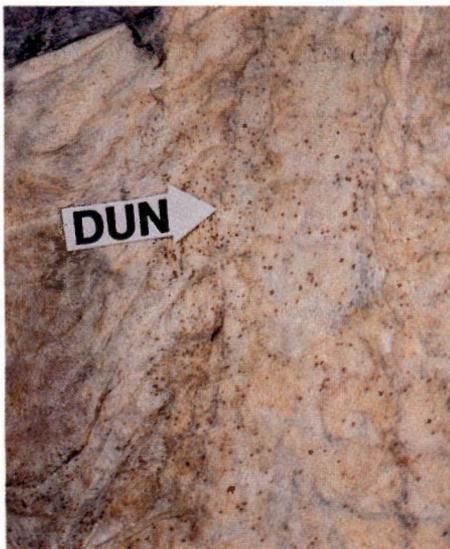
The fish are individually graded by a culler, who follows purchasing guidelines set forth by the Canadian Saltfish Corporation at the beginning of each fishing season. The buying requirements for each grade and size category are outlined — the higher the quality the higher the price. Once graded, the fish are weighed and transported to the agent's storage area. During transportation, the fish must be protected from contamination. Remember, a controlled, cool temperature will reduce spoilage.



A heavy salted dried fish showing "pink" spoilage



Individual fish must be graded according to purchasing guidelines



The spotted mold on the heavy salted dried fish is referred to as "dun"

Saltbulk fish are palletized, according to grade and size. The fish must be handled with care and recommended to be piled no more than three feet (~ 1 metre) high. The fish may be marketed as saltbulk or as dry salted fish.

DRYING HEAVY SALTED FISH

Practically all saltfish are dried by mechanical dryers; however, there is still a small amount sun dried.

The first stage in drying heavy salted fish is to wash the fish in approved water followed by a dip in concentrated brine. Water alone would reduce the salt content of the fish. Washing the face and back of the fish removes salt particles and slime. Also any blood or liver remaining must be removed. The water used must be clean and dipping units changed frequently. The washed fish are piled on a pallet, face down, and allowed to drain for at least 24 hours. This procedure, referred to as the "water horse" or "drainage stage", reduces the moisture content of the fish before drying.

Mechanical drying

Mechanical dryers allow the drying process to continue day and night and permit standardized production of dried fish; however, if the dryer's temperature becomes too high either due to its own setting or a too high external temperature, the fish could become soft and sticky. This problem is referred to as "skin heated" fish. Once dry, the fish are palletized and stored until required for packaging or sale.



Trolley of fish in tunnel dryer

Sun drying

Sun drying demands a lot of time and is dependent on the weather. The washed fish are placed on "flakes", frames covered with nylon mesh. Most of the drying is a result of wind and not temperature. The ideal condition for outdoor drying is cool, dry weather, prevalent in late summer or early fall. Under no circumstances should wet fish be put out to dry on a hot, calm day (above 15°C) as the flesh will "sunburn", becoming soft and sticky. If the weather is not favourable for drying, heavy salted fish can remain in a pile, under controlled conditions, until the weather is suitable.

DRYING LIGHT SALTED FISH

As with heavy salted fish, the first step in drying light salted fish is to wash the fish in approved water to remove salt particles from the face and back of the fish. Remember, light salted fish are more delicate than heavy salted fish and can be damaged easily. Once washed, the fish are "water horsed" for 24 hours. This water horse period is equal to a full day drying, and greatly reduces the initial moisture content of the fish. Drying light salted cod is somewhat different than drying heavy salted fish. The drying process is not continuous whether the fish are sun cured or mechanically dried. It is important that the drying period be interrupted. The light salted fish must be removed from the drying racks and "press piled", placed one on top of the other, face down. This allows the fish to sweat and prevents its surface from crustifying. Thus, when drying is continued, moisture present can be removed more easily. Press piling may occur several times before the fish are sufficiently dry. Once dry, proper storage and handling conditions are needed to maintain a high quality light salted product.

PACKAGING

Heavy salted fish may be exported as a dried or saltbulk product; however, light salted fish are sold only in the dried state. Dried fish are usually packed in 50 lb. (25 kg), wax lined cardboard cartons.



A standard size carton of salt fish

Before packaging, all fish are sized and graded to meet individual buyer specifications and fish inspection regulations.

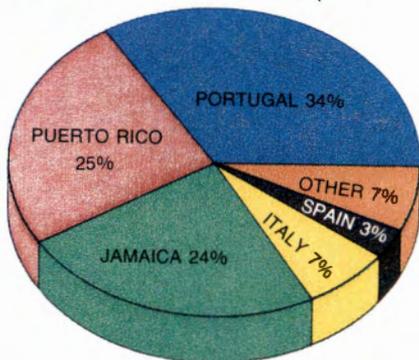


DFO officer's final inspection before export

MARKETING

The cod caught off our coast in the summer months, salted, dried, and packaged, are marketed all over the world. Traditional salt cod markets, like Portugal, still purchase large amounts. Countries such as Puerto Rico, Jamaica, Brazil, the Caribbean and others, also buy dry salted cod.

MARKET DISTRIBUTION BY POUNDS SHIPPED HEAVY SALTED DRY BASIS (1988-1989)



Salt fish is marketed in many countries.

SUMMARY

From the instant the fish are taken aboard until they are offloaded, a fisherman can use several processes to maintain a high quality product. Fish should be bled immediately, gutted, washed, stored, and iced thoroughly. Gutting may not always be possible; however, bleeding must take place to produce top quality fish. It is also important that processing areas be cleaned and sanitized regularly. Remember, cool temperatures will reduce spoilage.

All steps in the production of salt fish require good workmanship. Heading, splitting, washing, and salting require specialized skills. Each person must do the job well and work as part of a team. Good working habits will result in higher quality fish, customer satisfaction, and greater returns.



Fisheries
and Oceans

Pêches
et Océans