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Preface pg.2

Due to the diminishing resources of fat herring and the changing and more stringent requirements to salt herring posed by the consumer and the markets, it is necessary to utilize the limited quantities of suitable fat herring that are being caught by producing products of high value.

A small publication on the processing of fat herring was last published in 1957. (Directorate of Fisheries, Small Publication No. 3, 1957). This publication, which was received with great interest by fishermen, processors and exporters is now out of print. Since there still appears to be a demand for such a guide, the Directorate of Fisheries has reprinted this publication. Certain changes and additions have been made in the new edition. This guide is not intended to be all inclusive, but it is hoped that it will be useful, especially for those that have not had an opportunity to obtain practical experience in the processing of fat herring.

Directorate of Fisheries, Bergen, January 1974

Knut Vartdal
(Director of Fisheries)

Sigmund Skilbrei
(Chief Inspector)

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The Importance of Quality

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The Norwegian fat herring is one of our most nutritious species of fish. It is in addition considered to be a delicacy, not only in our country, but also in markets abroad.

It is of the greatest importance that the quality of the herring and the processing methods appeal to the consumer so that all marketing opportunities can be utilized.

One must be observant of the fact that we have competition from other countries, not only in the export markets, but also on the domestic market where Dutch salt herring has captured a considerable part of the sales. The Dutch herring is delivered both as matjes cured and

as ordinary salted herring, but the latter is also more lightly salted than the heavily salted Norwegian fat herring. Since both these herring types have been of consistent good quality and packaged in convenient attractive packages, Dutch herring was for a while preferred to the usual Norwegian type of cured fat herring.

In order for the quality of salt herring to be uniform and be kept at a high level, there are strict requirements aimed at fishermen, processors and exporters regarding correct handling. Official inspection of all salt herring to be exported or sold domestically is required; see "Instruction for inspection of salted herring", January 10, 1952 with later revisions.

Herring for salting

When preparing any first quality product, it is of the greatest importance that the raw material is the very best. This rule also applies fully to herring raw material, regardless of the final method of utilization.

Fat herring that are to be processed as salt herring must be pg.5 handled with the greatest of care from the moment they are taken from the sea, and it is of decided importance that the fishermen carefully follow these main rules:

Gillnet herring must be freed from the nets while they are being hauled. Herring from nets having been set for longer periods must not be used for salting.

Seined herring must be kept alive in the seine until free of feed. The herring must not be squeezed so hard in the seine that they are damaged and they must be taken up carefully with a small net (bag) in order to prevent internal blood spots caused by hits or falls (bruising).

Regardless of the catching method used, the herring must be placed in ½ boxes as soon as possible and should be placed under deck or be shaded so that they are not directly exposed to weather and wind. Ice should be used in warmer weather.

Herring that have been banged around or subjected to pressure will develop blood spots in the flesh. This will result in a darkening of the flesh in the salted herring and therefore a less attractive product. The quality of the herring will therefore be somewhat lowered. Discard herring that have died in the seine, been damaged or walked on. The catch must be delivered as soon as possible to a processor.

It is the responsibility of the processor to determine in each case if the herring are suitable for salting. If they are, it is first and foremost in his own interest to process the catch properly and professionally.

It is important that the herring are kept cool and moist until being salted. Sun and wind dried herring will yield a poor product and must not be salted. The same applies to herring that have been exposed to freezing temperatures. During processing ashore or on board vessels the processor must, as much as possible, avoid having the herring unnecessarily exposed to weather and wind.

The general rule is that all fat herring should be cut before being salted. If the fish have feed in the stomach, they must be gibbed (gills and stomach removed) or nobbed (head and stomach removed). (In both cases the gonads and a small part of the pyloric caecae are left in the fish). Herring that have been cut, gibbed or nobbed after salting will not be approved by the Inspection for sale as regular salted herring.

Fat herring of sizes 17/20 and 20/25 per kg. after salt curing pg.6 can be salted round, if stomachs contain no feed.

Herring of this size can be cut or processed by other methods after having been salted.

Cutting and Heading

For cutting ("Norwegian cutting", "ganing") an ordinary good, sharp pair of scissors ("ganesaks") are used so that the bellies of the herring are not torn. When cutting or gibbing, the herring are held in the left hand with the backs towards the palm of the hand. The cut must be large enough to expose a good part of the belly opening and at the same time the gill bone is removed so that the underside of the gills are exposed. This will promote good bleeding and the salt/brine can work more rapidly, also from the inside.

As mentioned earlier, harmful stomach contents must be removed from the herring before salting. This applies especially to gillnet and trawl-caught herring since seined herring should not be taken out of the seine until the stomachs are empty. The stomach itself and the intestines should be removed. Early in the season when the depot fat in the gut cavity is loose (soft), it is difficult to utilize by the consumer. This depot fat can therefore be removed together with the stomach content without lowering the quality of the herring.

Removal of the stomach content can be done by:

a) Gibbing ("Scottish cut")

b) Nobbing (heading and pulling out stomach)

The scissors used for gibbing are curved so that they cut behind the gill covers and follow the edge of the head under the ear bones. The

scissors can be supplied with two small spikes which grip behind the intestines or there could be cuts made in the edge of the scissors so that the intestines themselves are not cut off.

A sharp knife is used for nobbing. The herring is placed on a board, preferably with the back towards the operator and the head towards the right. At the same time as the cut is being made, the belly of the herring is squeezed so that stomach contents, stomach, intestine and any loose depot fat is squeezed out. If the herring are free of feed, they can be headed without pulling the stomach.

Instead of these manual methods, machines are now being used pg.7 for many of these operations.

Grading

The grading is carried out during the cutting operation and care must be taken to attain a completely consistent grading. Use a scale (balance) and grade according to each individual size. As known, herring are sold according to the numbers required to make up one kilo, for instance 6/8-8/10-10/12-12/14-14/16 and these numbers correspond to the marks used earlier, respectively I-II-III-IV-V.

These marks have proven to be practical and easy to scratch or mark on the barrels, and it would probably still be most practical to use them during salting instead of the usual numbers. The herring can also be graded in sizes 3/5, 4/6 or 5/7. Even if the processor considers his people to be experienced, the grading must be checked often during the production period and he must be observant of the fact that the herring will become quite a bit lighter during the salt curing. He must therefore carry out the grading so that the lot contains the

calculated number of herring per kg. when delivered. Herring that have poor storage characteristics, i.e. immatures and summer fat herring, that can easily be damaged if repacked, can be sold by the wholesaler or exporter in the original pack provided that the herring are completely evenly graded. By grading evenly the processor can be directly responsible for giving the consumer a good food herring which has not been affected by air or by wear and tear during re-grading and re-packing. Consistent grading of the herring during salting is also of the greatest importance so that all herring in a barrel are of uniform quality, since salt requirements and ripening times are different for large and small herring.

Salting and Packing in Layers

The purpose of the salting is to preserve the herring so that a good commercial product with regard to taste, texture and appearance is obtained. It is therefore of the greatest importance that the salt used is clean and unused. Sea salt has been shown to give the best quality. pg.8

In order for the salting to become as even as possible, the salt must be weighed or measured into each barrel, and care must be taken to salt evenly between each layer. The herring must be salted sufficiently, taking into account the fact that lean herring with a high water content require more salt than fat herring. For heavily salted ("skarpsalted") herring 20-22 kg. salt per 100 kg. fresh herring is normally used.

In order for the herring to keep their natural appearance as much as possible also as a finished product, it is necessary that the herring are neatly and professionally packed in the barrel.

During packing the heads shall point towards the barrel staves. Enough herring are placed in the middle so there are no openings in the layer. A couple of herring ("head herring") at each end of each layer will support the layer, give the barrel a greater net weight content and keep herring and salt in place during transport. The direction of the herring in each layer must be at right angles to the layer below and above.

The herring are placed in the barrel with the backs down (angled). On the top of the barrel the last layer is turned (with the backs up). With headed (nobbed) herring the salting is carried out as with cut herring, although when packing the layers of headed herring, a layer of "stave herring" must be placed next to the barrel staves so that the flesh in the cut will not touch the barrel stave.

A barrel with neatly packed herring without pressure or after-filling will contain ca. 85 kg. salt cured product, and this is considered a suitable fish pack.

If the herring are salted for further re-packing and sale in small packages or are to be sold as industrial pack, the fish can be carefully leveled in the barrels. It is important that the leveling is carried out carefully and exactly. If not serious quality defects can occur such as, spots, sour herring and un-natural shape of the herring.

During the salting the processor must daily compare the number of hektoliters (100 liters) purchased with the number of barrels of salt herring produced. Any important differences between these numbers indicate that closer control of packing and salt consumption must be carried out.

As mentioned earlier, herring free of feed of size 17/20 and 20/25 per kg. as salt cured product can be salted without having been cut. Such herring must be stirred with salt and packed in layers or leveled in the barrels with even use of salt. Lumps or layers of herring not touching the salt must not occur. pg.9

When a barrel has been filled with salt and herring, the cover is loosely placed on top.

Special Cures

Sugar salted

A herring coming under the classification of sugar salted should have a soft texture and a taste which is different from heavily salted herring. For a barrel of sugar salted herring (ca. 100 kg. fresh herring) about 14-16 kg. fine salt and ca. 7 kg. sugar should be used. Sugar and salt are well mixed before use and the herring are well stirred in the mixture. Headed (nobbed) herring are usually used for sugar curing.

Spiced cured herring

For preparing spiced cured herring, about 14 kg. fine salt, 7 kg. sugar and 1 to 1.2 kg. spices are usually used for a barrel of 100 kg. fresh herring. Salt, sugar and spices are well mixed and the herring are thoroughly stirred with the mixture. Headed (nobbed) herring are chiefly used for spiced cured herring.

The Brining

After the barrels are filled, they are usually left open (lid loosely placed on top) until the herring have given off brine. Some brine should, however, be added shortly after the salting since this

will hasten the development of brine. If the salting is carried out indoors, the barrels can be left for a few hours, perhaps overnight if conditions are especially favorable, before the tops are hammered on. If the herring have not produced sufficient brine by then, some must be added before the lids are fastened on. When the herring are fat, and especially in warm weather, the barrels should not be left open too long in order for brine to form. After contact with salt and air the fat in the herring will start to turn rancid immediately and this rancidity will increase even after brine has been added. By adding brine as the barrels are filled, air is prevented from coming in contact with the herring and rancidity can be prevented. By using this procedure the herring will also have a slightly softer texture and will better retain their natural shape.

Brine should be made from pure salt and fresh water or seawater which has not been contaminated in any way. The strength of the brine must be at least 24^{o}-25^{o} Baume for ordinary heavy salted, sugar salted and spice cured herring. The brine is made either by stirring salt and water in a barrel or container or by having the water flow through a salt barrel or a larger salt container which at all times must contain sufficient salt. The latter method is the most labor saving and the necessary brine concentration is attained more rapidly. The strength of the brine must always be measured and it is necessary for all processors to have a salinometer.

By using brine that is too weak, the herring will not attain the texture required of a properly processed product.

The Barrels

Fat herring are very sensitive with regard to absorbing odor and taste. There are many examples of herring salted in barrels, earlier used for salting fish, roe, spiced herring, etc. where both appearance and odor have been affected. Also barrels that have earlier contained salted herring and which contain some rancid fat, will taint and ruin the herring. Such herring will not be accepted by the inspection as suitable for sale.

Only new barrels or light-colored and thoroughly cleaned used barrels must therefore be used for salting. The barrels must be left standing filled with water for some time before use.

The requirements for the size and appearance have also become stricter.

Barrels and other containers used for salting herring, must fill the requirements for containers that are in force for this purpose at any time. pg.11

Marking

During packing, or as the barrels are filled, the mark signifying the size of the herring must be scratched on the barrel. This can be done with a grate or similar marker on the top, upper or middle part of the barrel. At the same time the date of salting should be marked on the barrel. It is of great importance that this is done, not only for the processor but also for the buyer. As mentioned above, the herring will lighten more or less during the salting process and when the salting has been carried out over several days, there will be herring of varying weights when delivered depending upon how long they have been in

salt. In order for both processor and buyer to be fairly treated, it is necessary that herring from different days' production are weighed.

The barrels must be marked with the processor's number, mark or company name. It happens quite often that several lots of salt herring arrive at the same warehouse completely lacking marks of origin and therefore are difficult to keep apart. A processor who wants his lot to be fairly treated, must make sure that his number or company name is clearly marked on all barrels in the lot.

When seined and gillnetted herring are being processed at the same time, the barrels must be marked respectively seine or gillnet. The same must be done when salted gillnet herring and seined herring are delivered in the same shipment.

Storage

If a lot of herring is not shipped immediately after salting, but placed in storage, the barrels must be stacked so that after a few days holes can be drilled and the barrels topped up with brine without too much work. The barrels must then be rolled half over in order for pg.12 salt and brine to work evenly in the whole barrels. This is especially important on board vessels where shaking and vibration from the engine will cause the salt to slide down to the underside of the barrel. Otherwise it always applies that the herring must be stored properly in a cool place so that they are not exposed to rain, sun or heat. Leaking barrels must be stored separately and must be constantly watched and filled up with brine. The brine to be added to salted herring should be 24^{o} Baume and to sugar-, spice - and matjes cured herring 20^{o} to 22^{o} Baume. It is therefore of great importance that the barrels are kept topped up with brine at all times.

Matjes Curing of Fat Herring

In order to produce a Norwegian product of equal or better quality than the foreign matjes herring matjes curing of, for instance, fat herring has started in the last few years, and the resultant product must be said to be completely satisfactory.

Raw Material

Only herring of best quality must be used (fat herring, herring with depot fat in gut cavity) which are either without, or with undeveloped, roe and milt. A consistent size distribution of the herring during salting is of essential importance for the herring to be of uniform quality. Long and slinky, lean and damaged herring must be graded out during processing. Herring containing Limocina ("black feed") in the stomach must not be processed. This must be investigated thoroughly.

Careful handling and rapid and professional processing of the herring are absolute necessities for obtaining good results. The raw material must be carried in boxes while being transported to the processing establishment and should be iced, if necessary, and covered with tarpaulins so that the herring are not exposed to frost, rain, sun or wind. Trampling or unnecessary pressure on the herring must be avoided. Care must be taken with matjes cured herring caught early, for instance May-June quality, due to the quality and keepability of the herring. (Compare the Salt Herring Regulations.)

Processing

Herring containing feed must either be gibbed (gills removed and stomach and intestine pulled out) or nobbed (headed and stomach and

intestine pulled out). This can be carried out either by hand or with machines. If the herring have been kept in a seine and are completely free of feed, the stomach does not have to be removed.

The Salting

Suitable finely ground salt of the best quality and type with regard to rapid and effective preservation should be used for matjes cure. The quantity of salt depends on the quality and size of the herring (fat and water content), time of the year, storage conditions and storage time before the herring are sold and consumed. Herring with developed roe and milt need in general somewhat more salt than non-sexually mature herring. The final use of the product and the preference of the consumer regarding salt content and texture can also be somewhat different. It is therefore difficult to specify the exact quantity of salt that might be suitable in each case.

The quantity of salt for matjes treatment of this type is based on a brine strength of 18-22° Baume before the product is repacked and possibly new brine added with regard to the keeping ability of the herring. This brine strength corresponds to a quantity of salt of 15-16 kg. per 100 kg. fresh herring. For herring for more rapid consumption, smaller quantities of salt can possibly be used.

The salt for each barrel must be measured into a measuring vessel which is based on the weight of salt to be used per barrel. It must here be taken into consideration that various types of salt can have different weights per volume.

It is important to be accurate and use the same amounts of salt and herring per barrel in the same lot. The amount of herring per barrel

should be based on a weight of ca. 85 kg. properly packed, salt cured fish.

The herring are carefully stirred with salt in a "salting trough" so that each herring has an even layer of salt on the skin. It is important that the salting is carried out exactly and carefully. In the opposite case, serious quality problems, such as marks from herring sticking together and resulting sour herring, can occur.

Packaging and Brining pg.14

The herring must be packaged professionally. If the herring are to be salted for further repacking in smaller packages on the premises or be sold as industrial pack, they can, however, be leveled carefully in the barrels.

As soon as the barrel is filled with salt and herring, some full strength brine is added in order to hasten the formation of brine. The brine is added to the barrel along the staves by inserting a stick to create an opening. This is done in order not to distrub the salt between the layers of herring.

The barrel is left standing like this for a few hours so the herring can settle. Before closing, the barrels are filled completely with brine of 24^{o} Baume.

The Barrels

The barrels must be left standing filled with water for awhile before use.

Processing Date

Processing date and herring size must be clearly marked on the barrels.

Storage and Maintenance

The product must be stored in a suitably chilled area until the salt has struck. During this storage period brine must be added as required. It must be taken into consideration that there can be various salting dates and therefore different degrees of ripeness of the herring in the lot.

As soon as the packed product is "salt struck", it must be placed in refrigerated storage at a suitable temperature where the expected storage time must be considered. Storage temperatures between +4 and +2°C (39 and 36°F) are considered to be suitable for products of normal quality and development. The temperature can be lowered to under +2 towards 0° (36 - 32°F) according to development, keepability and storage time.

It is very important that the storage temperatures are constant and not subject to temperature variations. Not more than 3 days after the product has been placed in refrigerated storage, brine should be added. This must be repeated as often as necessary. In connection with the addition of brine, make sure that the barrels on the bottom are also turned. pg.15

Brine of 22° Baumé strength can be used for the addition.

The herring must be inspected during storage to make sure that they are not becoming overripe.

Repacking, Grading During Sale

Barrels and other containers used to hold the herring when sold must fill the requirements in force at any time. Packaging of the herring from the original barrel to another container for sale (½ barrel,

¼ barrel and smaller containers) should be carried out immediately before sale when the product is ripe (soft texture and mild flavor) so that only freshly packaged products are sold. Only a quantity that can be sold quickly should be packaged at one time.

Storage of herring in consumer packages must be discouraged due to limited keeping ability and the appearance of the packages.

The herring most suitable with regard to ripeness and texture should be packaged and sold first. Spilling of brine should be avoided, and the repacked barrels must be placed on a clean and dry base so that the packages are not contaminated and soiled before being shipped.

Corresponding considerations must be taken during transportation to the dealer. During packaging in consumer packages, exact grading of the herring into the established sizes must be carried out. All herring that do not meet the quality requirements must be graded out. The herring must be packed in tight layers, bellies up with the backs up in the top layer.

During packaging the barrels must be filled with brine. The brine used must be clean (filtered through fine mesh screen).

In order to protect the herring against damage and the effect of air and to give them a cleaner (shinier) look, it is preferable to grade the herring into separate containers supplied with brine from where the herring can be packaged into the containers. The packages must be checked to make sure that the stated net weights are correct.

Marking pg.16

The packages must be clearly marked with the specifications given for this type of product, including type of herring (Norwegian fat herring - Matjes).

Inspection

The Directorate of Fisheries Inspection Service, Herring Inspection, will inspect to as great an extent as possible the herring during processing, but the final inspection of quality, packaging, grading and weight is carried out on each lot immediately before sale.

New Processing Methods

The processing methods and instructions mentioned above are of course not the only ones that will produce a good quality.

It would therefore be gratifying if the individual processor could develop more rational and time saving work methods and possibly also produce other types of herring, all within the framework of inspection regulations as they apply now. The head office or regional inspectors will be able to give advice and guidance.

All processors of salted fat herring must be thoroughly familiar with the "fat herring brochure" and "Inspection instruction for salt herring" which must be found in any establishment where salt, fat herring are processed and stored.