XXIX.—SALTING FISH IN JUTLAND.*

By C. TROLLE.

To preserve fish by salting, two different methods may be employed, namely: Dry-salting, principally used for fish which are to be prepared as klip-fish by pressing and drying; and brine-salting in barrels, tubs, or tight boxes, which latter process produces an article that is ready for the market without any further preparation. In some parts of Norway and Scotland, however, fish which are to be dried are first laid in brine, in order to obtain (as people say) a heavier article. It is uncertain how far this is correct, but at any rate it is a saving of salt.

It is difficult to say which of the two above-mentioned methods is better suited to our circumstances on the west coast of Jutland, and which of the two products will meet with the readier sale. We can simply state that klip-fish is better known in our country, is easier to keep and to transport, and that we have already some experience in preparing klip-fish on our sandy western coast; while fish salted in barrels are liable to be damaged if the barrel should leak and some of the brine run out, which can easily happen during transportation. The raw material used in this process should be exclusively large cod and ling; while small cod, haddock, coal-fish, torsk, &c., can also be prepared as klip-fish.

Before giving a description of the method employed in salting fish, it may be interesting to make some calculations to show under what circumstances it will pay better to salt fish than to sell them fresh. As a basis for these calculations I shall use the data which I gathered during the Iceland fisheries, when I took frequent observations relative to the weight and dimensions of fish when solid, cleaned, salted, and otherwise prepared, and to the quantity of salt used. I have by these observations obtained the following averages:

From solid or "round" fish (*i. e.*, fish as they come from the water) the following percentages are taken by the process of preparation for use:

	Per cent.
(*a*) By removing the entrails (the liver takes up 1.80 per cent)	14.20
(*b*) By cutting off the heads	19.76
(*c*) By scaling the fish	5.58
(*d*) By dry-salting	23.33
(*e*) By drying	10.11
(*f*) By trimming the fish	0.95
Total	73.93

* From *Fiskeritidende*, Nos. 44, 45, Copenhagen, October 28 and November 4, 1884. Translated from the Danish by HERMAN JACOBSON.

In other words, a dried klip-fish weighs only about 26 or 27 per cent. of its weight when it came out of the sea; or 100 pounds of fish as caught make about 27 pounds of dried klip-fish. If we count 22 pounds of Liverpool salt (at $\frac{1}{2}$ cent a pound) for salting 100 pounds of solid fish, and the cost of labor in cleaning, salting, and drying at 9 cents per 100 pounds, we shall not be far out of the way when we say that the cost of preparing fish is 1 ore [100 ore=26.8 cents] per pound of its weight as solid fish, which, however, is easily made up by making proper use of livers, sounds, &c.

As the average wholesale price for klip-fish is 20 ore a pound for large codfish, and 15 ore for small codfish and haddock, the net profit would be $19\frac{3}{4}$ and $14\frac{3}{4}$ ore, respectively, per pound, while if the same fish had been sold fresh it would have fetched, respectively, 5.33 and 3.98 ore per pound. From the above it will appear that it is not profitable to prepare fish as klip-fish unless the fresh fish cannot be sold at all or must sell at prices lower than 5.33 and 3.98 ore per pound. It should be stated that in selling fresh fish on the shore the entrails are counted in when the fish are weighed; if this is not the case, 14.20 per cent. should be added to the above-named prices, so that, all the other conditions being the same, they would be 6.08 and 4.52 ore per pound.

As many small fish, especially haddock, are caught on the west coast of Jutland, where the fisheries are frequently carried on near the coast, it should be stated that the minimum dimensions of klip-fish in trade are the following: For large fish, 16 inches from the lower edge of the neck-bone to the root of the caudal fin (*a b* in Fig. 1) when prepared, which would correspond to 26 inches of a solid fish, full length (as A B in Fig. 2); and for small fish, 10 inches when prepared, and 19 inches when solid, full length.

METHOD OF PREPARING FISH.—The principal condition for obtaining a durable and good article, either of klip-fish or salt fish, is a careful and cleanly preparation of the fish in all the stages of the process from the time they are taken out of the water. The fish should be killed immediately, or at any rate soon enough to let the blood flow out freely and to prevent it from coagulating inside the fish. The fish is killed by cutting its throat close above the neck-bone. The cut should be so deep that the cervical vertebræ are cut through, as otherwise the bleeding will not be complete. If the neck-bone was not retained in the klip-fish, it would not have the necessary degree of stiffness when dried. Care should be taken not to throw the fish or to tread on them. If it hangs loosely upon the hook, and therefore has to be caught near the surface of the water with a hooked spear, the hook should, if possible, be inserted in the head; for where this is inserted the fish will have a bloody spot, which when found on the body will class it among the damaged fish. If the fish cannot be cleaned immediately, it is advisable occasionally to pour some water over it, in order to prevent the slime

and blood from adhering to it. At the very latest, the fish ought to be cleaned four hours after it has come from the water.

Cleaning and trimming the fish is done in the following manner:

Take hold of the fish round the snout or by the eyes with the left hand, lay its neck across the edge of the cleaning-vessel (the belly, therefore, upward), and cut off the head by a cut across the cervical vertebræ, running obliquely upward along the edge of the gill-cover (see the dotted line in Fig. 2). By inserting the point of the knife in the tail end, the belly is slit open by an upward cut through its center, the knife being carried up all the way through the gullet, midway between the ventral fins. (The double line shows the cut in profile.) The entrails are taken out, the liver and the roe being laid aside in separate vessels for special treatment. Care should be taken not to cut the gall-bladder and to remove every particle of the liver, as otherwise the fish is apt to get a yellowish color. The fish is then laid on the trimming-board, the tail turned toward the trimmer, the belly on his right-hand side. In order to cut out the backbone the point of the knife should be carefully guided along the outer edge of the backbone, and a straight clean cut should be made along the entire length of the fish from the neck along the backbone through the anus and the root of the anal fins clear to the center of the caudal fin, inserting the knife no deeper than is absolutely necessary for cutting out the backbone. The skin should not be taken off. The fish is then turned, so that the neck is toward the trimmer; by an oblique cut the backbone is cut a few vertebræ below the anus (therefore nearer to the tail); the cut should go through two vertebræ. From this cut another one is made upward toward the neck, therefore toward the trimmer, by letting the blade of the knife run closely under the still adhering lower side of the backbone, so that it can easily be torn out. By first loosening the backbone and then cutting it (one will not always be able to do this in the exact place where the backbone is loose) a piece of bone of the remaining tail-bone will then protrude, and the meat underneath it is apt to become sour in drying. The knives which are used in trimming must be sharp, so that the cuts may be even and clean. In sharpening the knife the point should be rounded off (see the dotted line in Fig. 3, which shows a good trimming knife in its natural size) so as to prevent the cut along the backbone from being so deep as to render the skin visible on the flesh side. The handles of the knife should rest easy in the hand, and the blade should not be too long. If the fish is frozen it should not be trimmed before the ice has been thawed off, which is easily done by laying the fish for a couple of hours (no longer) in a vessel with salt water, or, better still, a weak brine. Immediately after having been trimmed the fish should be put in salt, as it should not be salted when frozen.

At the same time when the fish is trimmed, it is washed; or, if there are not hands enough, immediately after it has been trimmed. The fish are washed in larger vessels (such as petroleum barrels cut in half) and

in salt water which should frequently be changed. The use of fresh water is said to make the fish slimy. With the left hand the fish is seized by the tail, and while water is constantly poured over it, the blood is pressed out from the remaining portion of the bone with the thumb, while at the same time the tail is twisted a little. With the right hand the black membrane of the stomach is removed, as well as all impurities, and particles of slime and blood. Special care should be taken to clean the neck-bone, and to brush off all slime under the pectoral and dorsal fins. To make the cleaning process easier, woolen gloves are used. Some foreign fishermen use brushes, but as the bristles easily tear the flesh, gloves are preferable, at any rate for cleaning the flesh side. It cannot be repeated too often, that the last drop of blood must come out of the bone; and in preparing brine-salted fish the Scotch cut across that part of the backbone under which the veins are hid.

In order that the water may flow off, the washed fish are laid in small piles, the skin side upward (except in the lowest layer) and the necks the same way, turned inward toward the middle of the pile, the layers of which should be arranged like rays. The piles should not be too high.

The salting should take place within 12 hours after the fish have been caught, if a first-class article is desired. If the fish are to be dry-salted, some boards are placed in a slightly inclined position, so that the brine, which contains some slime, can flow off; and these boards should be placed on stones so high that the water at the bottom of the vessel cannot reach the lowest layer of fish. On these boards enough salt is strewed barely to cover them. On these boards the fish are placed in horizontal rows across the boards (when on board a ship, across the entire breadth of the ship), alternately with the tail outside and the neck outside (as shown in Fig. 4).

Three or four rows of fish generally form a layer, which is as long as the space will permit. Several layers, one on top of the other, all with the flesh side downward and salt sprinkled on each, form a pile. The breadth of the pile (3 or 4 fish lengths) is determined by the distance to which the salter can reach, so as to spread them out evenly without treading on them. The pectoral fins should be bent over. Fish of the same layer should not cover each other in a single spot, unless this spot is well covered with salt; otherwise the fish will in these places assume a yellow color, and be classed among damaged fish. On board a vessel the height of the pile should not exceed 3 or 4 feet, before the fish have settled. If the catch has been good and therefore all the fish in the pile are soft and freshly salted, the pile is apt to be loose and may easily tumble down, whereby many fish are damaged; moreover, it is inconvenient to salt a very high pile.

In view of the limited space on board a vessel, the fish may be piled up a second time, when they may of course be piled up clear to the

deck; but this should not be done unless the fish have lain in salt at least 3 days, or 72 hours. The salt adhering to the top layer should not be shaken off; and care should be taken to salt again those fish which may need it, as will be seen from the fresh color of the flesh. The fish are piled up a second time by persons who intend to sell them in a salted condition to the curers. By piling the fish up a second time, so that all the necks are turned outward, the pile will become deeper in the center; the fish will retain more moisture and therefore weigh heavier than if they are kept constantly in the first pile, from which the brine runs off. It is evident that this method proves unprofitable to the person who is going to cure the fish, as it will have to be pressed more, and will therefore shrink during the drying process. It should also be stated that the flesh of the fish becomes whiter where it is not piled up a second time.

As regards the quantity of salt to be used for a certain number of fish, experience has shown that the less the amount of salt required for preserving the fish, the better it will be. This does not imply, however, that the salt should be used in a stinted manner. The thinner and leaner the fish, the less salt they will need; and an even layer of salt, barely covering the fish and leaving no vacant places, will be sufficient. In warm weather more salt is needed than in cold weather. Fish which are to lie in salt for some time before they are cured, must be salted more than fish which can be dried soon after the salting. It does not matter much what kind of salt is used, so it is clean, white, and even and fine-grained. It is advisable, however, to use coarser salt, in preference to the fine Liverpool salt, for fish which are to lie in salt for some time, as it does not form brine so quickly. Care should be taken that no iron articles are left lying in the salt, as the rust spots caused thereby will damage the fish. Excessive use of salt draws all the juice out of the fish, and does not increase the weight; moreover, a salt crust is apt to form on the fish during the drying, which may cause the fish to become "salt-burned." Too little salting, on the other hand, exposes the fish to the danger of decay. During the summer months, on board a fishing vessel, where some salt is always spilt and where the fish can be salted in the course of several months after they have been caught, about 300 pounds of salt should be used for 320 pounds of cured fish, or in other words 300 pounds salt for 1,200 pounds solid fish as they come out of the water. On shore hardly as much salt is needed. The Norwegians count 650 pounds salt for 1,000 pounds cured fish; but in Norway nearly all the salting is done on shore, and the fish are dried very soon after they have been salted. Fish may be salted in the open air; in that case, the pile should be under a roof of boards and be well covered with mats.

We shall now describe the drying process according to the method employed in Iceland. The most suitable place is a narrow tongue of land exposed to the air on all sides. Here a bed of stones and pebbles

is made. No sand should be underneath; so, wherever there is sand a layer of sod is spread; gravel, however, is preferable; and the place should be so arranged that the wind can strike the fish at the same time on the skin and flesh sides. Somewhat pointed stones are therefore chosen, which are laid with a small space between them. When the drying is to begin the salt fish are taken off the pile and are again washed, this time by using a brush. All loose salt, slime, and impurities, especially around the neck and back of the fins, are removed; and the fish are washed in clean water several times. The Icelanders wash the fish on the benches of a boat drifting with the tide.

After the fish have been washed they are conveyed in wheelbarrows to the drying place and laid out there in small star-shaped piles, the necks turned toward the center of the pile and the skin side upward, with the exception of the lowest layer. In this way the fish are allowed to lie until the water has run off.

When the weather is dry the fish should then be spread out as soon as possible. Each fish is spread out smoothly on the stones, the skin side downward, and so that one does not cover the other. The principal thing needed for drying is wind, and care should be taken not to expose the fish to the strong noonday heat of summer, as they are apt to become sunburnt instead of being dried. The flesh side is generally turned upward till within a few hours before the fish are piled up in the evening, when they are turned so that the skin side may also become dry. When the air is moist, as in foggy weather, there is no use in spreading out the fish. The sharp spring winds will dry the fish most rapidly; but, as a general rule, the fish are spread out every morning, are turned a few hours before evening, and are piled up for the night.

After the drying process has begun the fish should be spread on two consecutive days, as they do not bear much pressure before they are about half dry. If the condition of the weather renders it necessary to keep the fish piled up for several days, they should be rearranged several times. Until the fish have become about half dry they can easily stand a little shower, but not during the last days of drying, when some sunshine is needed so the flesh may become white. If the fish are to be sheltered from a shower, they should be piled up as quickly as possible in small heaps, with the skin side upward. If the shower does not last long, it will be sufficient to turn each fish in its place; if the rain continues, however, they should be piled in larger heaps, which are covered with mats and a roof of boards.

Under favorable circumstances the fish are completely cured after having been spread four days. Between the second and third spreadings the fish are pressed for one day by being gathered in large heaps and covered with boards, on which heavy stones are placed. As a general rule, the same weight of stones is used as the weight of fish in the pile. Between the third and fourth spreadings the fish are also pressed, ac-

cording to circumstances, for one or two days. After the fish have become half dry they are always kept in press during the night. If there is a chance to sell the fish quickly, it is thought, at least in Denmark, that it is unnecessary to cure the fish so hard, and it may possibly be sufficient to press the fish during the night. In Iceland klip-fish is considered ready for the market when the flesh is so elastic that no impressions remain anywhere when the point of the finger is pressed against the fish. Salt fish and klip-fish should be stored in a dry place where there is no draft.

We will now give some information relative to the preparing of klip-fish on the west coast of Jutland, furnished by a member of the Association for the Promotion of Fisheries in Denmark:

"As soon as the fish have been landed they are cut open, carefully cleaned, and laid in large vessels with a layer of Lisbon salt between every two layers of fish; about 1,600 pounds of salt are used for every 100 codfish; and the fish remain in the salt from 6 to 8 days. They are then taken out of the salt and stacked in heaps, each holding about 100. The following day, if the weather is dry, the fish are spread out in a dry and even place in the fields, which is first covered with a thin layer of fresh straw so that the fish may not be injured by the moisture of the grass. In the course of three or four days the fish are dry enough to be piled up in heaps until the drying process proper begins. Haddock are treated in the same manner, 320 pounds of salt being used for 200 or 240 fish, according to size. Of late years klip-fish, especially cod, have found a ready sale and brought good prices. Haddock, which are generally very small, have, as salt fish, not met with a steady demand, and have frequently had to be sold fresh. It will be evident that it will not pay to salt haddock, when we state that they cost on the shore from 16 to 20 cents per 20 fish, and that it takes from 40 to 50 salt haddock to make a *lispund* [16 pounds], and that the price for cured haddock is only from 2½ to 3¼ cents a pound."

SALTING IN BRINE.—The so-called *laberdan* (brine-salted fish) is principally prepared from cod and ling. As regards the cleaning and trimming of the fish the same rules apply as have been given above; only the salting is different. In preparing this article it is still more important that the fish should be killed as soon as they come out of the water, and that the curing process should begin at once. After the fish have been trimmed and washed they are packed tightly in solid barrels, the skin side downward, the fish bent to follow the curve of the barrel and the tail bent upward. Salt is put at the bottom of the barrel and between every layer of fish. The barrel is packed so full that several layers are above the edge; the uppermost layer must be turned with the skin side upward. The fish are then allowed to stand for several days in order to settle; and when they are taken up, the slime is carefully removed with brushes, and they are salted over again in different barrels, with a fresh supply of salt. They are tightly packed and again

allowed to stand several days, when they are well pressed by means of a regular press. The barrel should be full to the brim when the lid is put on.

The quantity and quality of the salt used varies. On an average from one-fourth to two-fifths of a barrel of salt is used for one barrel of fish. Coarse kinds of salt, which do not melt so rapidly, are preferred. The number of fish in each barrel varies from 30 to 60. A barrel of fish weighs 260 pounds net, and the price varies in Holland between $9.38 and $16.08, and in England between $13.40 and $18.76.

The gullets and tongues are salted separately; and in Holland and Belgium bring 50 per cent. more than the fish. Among other products of the cod which may be used, we must mention the liver, roe, and sound.

If the liver is large and white it may be used for making medicinal codliver oil, which can easily be done without the aid of any expensive apparatus. All that is necessary is the following: Take a good-sized iron pot and have a tin kettle made measuring 2 inches less in diameter and being somewhat higher. The kettle should rest on the edge of the iron pot by means of an iron rim which entirely closes up the opening. The bottom of the kettle should be about 2 inches from the bottom of the pot. The kettle has a valve which serves to let the steam escape, and for pouring water into the pot. The space between the pot and the kettle is filled with water about two-thirds of its height. This water is made to boil and kept boiling; the temperature developed thereby in the tin kettle will be about 100 degrees Celsius. White cod-livers, which have been well washed and cut in pieces, are put into the kettle. If the livers are to produce medicinal oil, they should, however, not be more than two days old. When the liver has come to boiling, the clear white oil will float on the top, and should be skimmed off and temporarily be placed in a dry tin vessel in order to settle. The oil will begin to make its appearance in the course of a few hours, and care should be taken always to have plenty of water in the pot in order to prevent the heat from becoming too great and thus burning the liver, and to stir it often. The kettle containing the liver should not have a lid. As soon as the oil begins to turn dark, it is no longer fit for medicinal oil and should be kept separately. As soon as the clear oil has settled in the tin vessel it is poured into dry, clean tin cans, tin-lined barrels, or glass bottles. The oil should be carefully kept from all contact with the air or moisture; the corks should, therefore, be securely sealed, and the vessels containing the oil kept in a dry place.

The settlings of the livers may, by strong cooking, or by exposing them to the heat of the sun, be used for producing brown oil. This same oil may also be gained direct from the livers by simply letting them lie on frames, and decay or ferment in the heat of the sun. This oil, however, has not so strong medicinal qualities as the clear oil. If we remember that the liver is about 1.80 per cent of the weight of the

solid fish (or about 5½ per cent of the cured fish), it will be seen that it forms an important product of the fish. According to the fatness of the liver the yield of oil will vary between one-third and one-half, and will of course depend to some extent on the thoroughness of the boiling process. The general price for good codliver oil is about 13½ cents per pound.

The roes are salted in the same manner as the fish in boxes or barrels, which are perforated so that the brine can run off. The roes are then carefully packed and shipped to France and Spain, where they are used as bait in the sardine fisheries.

The sounds are cut from the backbone and scraped, and while they are still fresh they are washed and spread over boards and finally dried. There are generally from 50 to 100 sounds to a pound, which is sold at from 16 cents to 27 cents.

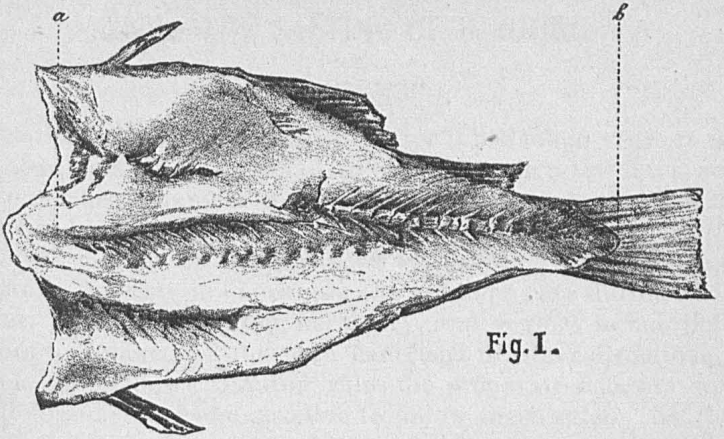

Fig. I.

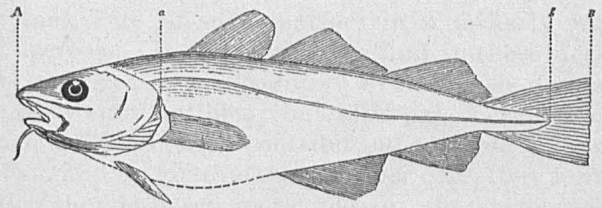

Fig. II.

Fig. III.

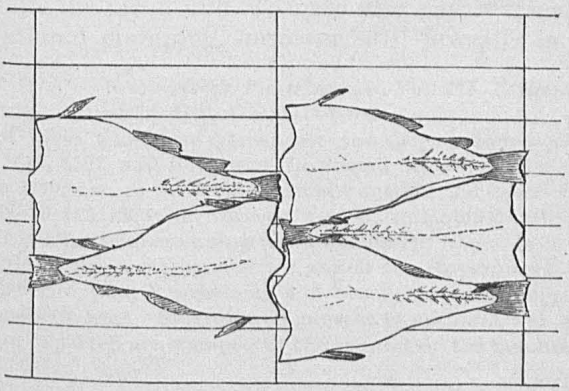

Fig. IV.