XVI.—THE MANUFACTURE OF KLIP-FISH.*

When the Scotch, Icelandic, or Newfoundland method is spoken of, this does not imply that the greater or less excellence of the klip-fish depends principally on the method according to which it is manufactured. There are only two methods, viz., dry-salting and salting in brine. The various other so-called methods are simply variations caused by climatic and other differences; and what suits in one country may not suit in another. The main point is, that the method, no matter whether it is Norwegian, Scotch, or Icelandic, should be followed carefully in all its details. Without carefully and thoroughly treating the fish during all the different stages of its manufacture, no first-class article will ever be produced. Careful treatment is the fundamental principle of every kind of manufacture of all kinds of fish products, no matter what method is employed. We cannot state this with too great emphasis, and we shall refer to it again and again in our articles on the manufacture of various fish products.

Air, water, and heat are the necessary conditions of decay. If one of these is wanting or only exists partially, there will be no decay. Thus, articles of food will not decay in cans from which the air has been removed, or in a certain temperature; and ice and hermetically sealed cans are used for preserving articles of food in good condition for a long time. Dried meat and fish will also keep for years, as long as the quantity of water contained in them is not increased above a very small amount. When salting and drying are employed as means of preserving fish, the principal object is to diminish the quantity of water in the fish. In manufacturing klip-fish this object is reached in three ways, by applying salt, by drying in the air, and by pressing. The object in view could be reached by each one of these ways. If, for instance, fish are salted several times at certain stated periods they will finally become as hard and dry as klip-fish. By drying fish in the air the same end is reached, and even by mere pressing an article will be obtained which, though insipid, will keep well. The salting process, however, has also another effect, as the salt prevents the development of the germs of decay, and by entering all the textures which were formerly filled with moisture, fills all the pores and small apertures, thus preventing the air from entering.

* "*Tilvirkning af klipfisk.*" From *Norsk Fiskeritidende*, Vol. III, Bergen, January and April, 1884. Translated from the Danish by HERMAN JACOBSON and TARLETON H. BEAN.

Codfish contains: Fresh, 81.98 per cent water, 1.44 per cent salts; salted, 49.72 per cent water, 20.53 per cent salts; dried, 16.16 per cent water, 1.56 per cent salts. As has been stated above, three different means are employed in the manufacture of klip-fish to diminish the quantity of water. A well-prepared boneless klip-fish contains 36.82 per cent water, and 15.5 per cent common salt. Some of the water contained in the fresh fish is extracted by means of the salt, which reduces the percentage of water from 81.98 to 49.72, and some is extracted by applying air and by pressing the fish, which also serves to extract some of the salt. A codfish weighing 3 kilograms [6½ pounds] which, when fresh, contains 2.459 kilograms of water, will as klip-fish contain a little less than 0.4 kilogram, more than 2 kilograms having been extracted by the manufacturing process. Its weight will therefore be about 1 kilogram, of which there are—

	Grams.
Mostly nutritive substances	477
Salt	155
Water	368

The three means referred to for extracting water from the fish are employed to a different extent, some people using more salt, others drying the fish more, while others press them more, according to the varying conditions of climate. In Canada, where the air is warm and dry, pressing is little used, and this principally to give the fish a smooth appearance and also to subject it to a sort of fermenting process, while in countries which have a cooler and moister climate pressing forms an essential part of the manufacturing process. If the fish are to lie in salt for a short time only, more and finer* salt is used than if they are to remain in salt for a long time. To what degree the water is to be extracted depends also on the length of time in which it is presumed the fish will be used up. Here, as in all manufacturing processes, it will prove true that the preserving is done at the expense of the flavor and partly of the nutritive value. If fish are brought into the market which are not quite dry, this can only be called a rational manner of carrying on the fish trade, if it is supposed that the fish will be consumed in a short time. This is profitable both for the buyer and for the seller, as the former gets a better article and the latter a better weight and a decrease in expenditure. But how many of our fish are sold as fresh goods? Nearly the entire quantity of manufactured fish which we produce must, on account of the fishing season and climatic conditions, be manufactured in a comparatively short time, and the exports, which remain very nearly the same all the year round, must for a considerable part of the year be made from the stock of fish on hand. We are in this respect not situated so favorably as our competitors who manufacture

*In case they remain in salt only as long as is necessary. If the fish are to be kept for any length of time, more and coarser salt is used.

their fish gradually after the fish have remained in salt the necessary length of time. During the period from 1876 to 1883 we exported on an average from June to December, inclusive, 57 per cent of the entire quantity of fish manufactured during the year, and from January to May, inclusive, 43 per cent. During that period, therefore, almost one-half of the entire quantity of fish had been kept in the warehouse six months and longer. It is therefore a great mistake to carry on the manufacture on a large scale exclusively with the view to sell fresh goods. Furthermore, if we take into consideration the fact that the fish are going to be transported a considerable distance, many of them to warm countries, and in many cases at the warmest season of the year, the principal object should be to manufacture an article which will keep well.

The value of a klip-fish depends on its looks and whether it will keep. These two conditions, however, need not always be found together. A fish which does not look well may keep well, while a fine appearance is not always an indication that a fish will keep well. In manufacturing fish for the world's market, both these objects should be kept in view. The possible advantages which, owing to a fortunate combination of circumstances, may be obtained by paying less attention to the production of an article which will keep well are very small if compared with the loss occasioned by the spoiling of the goods while kept in the warehouse. Taking the raw material, the salt, and the expense of fitting out the fishing expeditions as the normal value of the fish, the difference in the expense for labor or the difference in weight occasioned by more or less careful drying is small in comparison with the risk.* In giving, in the following, the leading principles in the manufacture of klip-fish we would state that these principles have reference both to the production of a fine-looking article and of one which will keep well, and that we shall treat them without regard to the time when, the place where, and the manner in which the producer disposes of his goods.

THE RAW MATERIAL.—Difference of size and fleshiness have a considerable influence on the value of the fish, but as this is principally owing to the sorting we shall not dwell on it here. The first condition for obtaining a first-class article is, therefore, that the raw material should be fresh. The circumstances under which our fisheries take place, namely, the winter season, and the use of more nets than in other countries, make it necessary that also old fish should be used for klip-fish. Klip-fish manufactured from old fish are of much lighter weight, and have a darker color than those made of fresh fish; the flesh becomes broken and loose, especially near the backbone, the skin becomes loose in some places, the bones turn red, the abdomen also turns red and becomes thin, and gets dark stripes, occasioned by the oil which is soon secreted from the liver. The longer the fish has been allowed to lie,

*This risk is with us generally run by the exporters; and it therefore seems all the more strange that they do not make a greater difference in price.

the more noticeable will these defects become. As regards line fisheries it is not of so much consequence whether the fish are allowed to lie for awhile, as in the net fisheries.

If complaints have been made abroad as regards the Norwegian fish, the cause must be sought principally in the condition of the raw material; for our cod fisheries are principally carried on during the severest season of the year, and to a great extent in waters which are without any shelter. Moreover we use nets to a great extent, while this apparatus is comparatively unknown in the cod fisheries of other nations. Even lines are but little used outside of Scotland and the French fisheries on the Newfoundland Banks; and consequently there will always be found more old fish among the Norwegian codfish than among those of other nations. If the complaints have become more numerous during the last few years, this is owing to the greater development of this industry, as a larger quantity of the fish caught are made into klip-fish than was the case in former years. The following were the exports of klip-fish during the periods named:

Table of exports.

Periods.	Klip-fish.	Klip-fish, dried fish, &c.†	Percentage of klip-fish.
	*Kilograms.**	*Kilograms.*	
1830–1835	6,700,000	23,000,000	29
1851–1855	14,100,000	30,500,000	46
1871–1875	30,200,000	48,600,000	62
1882	40,100,000	55,300,000	73

* 1 kilogram = about 2¼ pounds. † Including all cured fish.

More old fish, therefore, are salted now than in former times, when they were hung to dry whenever there was a chance. But as long as old fish find a sale, and can be manufactured into klip-fish without incurring loss, there is no reason why these fish should not be used for klip-fish. The price, however, will of course depend on the quality, and regard should be had to this circumstance when the fish are bought. Line fish, and to some extent also net fish which are two days old, will still make a first-class article; but the difference is already noticeable enough, especially in the net fish, to cause a difference in price. If the fish are still older, the price will be still lower, for they will only make a second class article. Fresh fish, or fish which are supposed to make a first-class article, should be salted by themselves.

The manner in which the fish are treated by the fishermen has a great deal to do with their quality. Fish should therefore not be trodden upon, kicked, or pushed, or be exposed to the weather. In Newfoundland poles are therefore used for conveying the fish from the boat to the shore, and in Scotland boxes are carried in the vessels, so as to afford

protection to the fish. Every fishing boat should be well supplied with tarpaulin, which may prove useful in many respects.*

The next thing in order is to kill the fish in such a manner as to allow the blood to run out, which makes it whiter. Although this manner of killing the fish is acknowledged to increase the value of the article, it is by no means as general as it should be. As far as we know, it is in vogue only among the French and Scotch, and among the Icelanders when fishing is carried on from a vessel. Wherever it can be done, this method should be employed. No time is lost thereby, as it can be done while the line is run out. It requires, of course, a little more labor, and fish killed in this way ought therefore to bring a higher price. On board the vessel fish killed in this manner ought to be salted by themselves, as the quantity will never be very large. In this manner a considerable portion of the cod from our large cod fisheries could be prepared, and become fully equal to the Iceland fish. The extra price of 1 ore [about ¼ cent] per fish, which of late years has been paid for fish killed in this manner, gives a little additional money to the fishermen, amounting to about 10 crowns [$2.68] per thousand. This is the average earning per fisherman during the Lofoden fisheries, and an addition of 10 crowns should therefore not be despised.

A principal condition for obtaining a first class article is, that the fish should be washed before it is put in salt. The Norwegians are the only nation who do not wash their fish. All other nations wash their fish with the greatest care, and even use for this purpose special brushes or rags. The washing had best be done after the fish has been split, in tubs filled with sea-water which should frequently be changed. Special care should be taken to clean the neck, the portion under the dorsal fins where much slime is apt to accumulate, and the lower part of the backbone. All blood should be carefully removed, which is best done by a pressure of the thumb. During the washing the black skin is removed. After the fish has been washed, it should be allowed to lie for awhile, so that the water may run off.

In former times washing was common in Norway, as may be seen from a decree of September 12, 1753, where it says that the thin black skin shall be removed from all fish which are to be salted while they are fresh, imposing a fine on every one who should violate this rule. During the last two years attempts have been made to wash the fish during the winter fisheries. If these attempts have not been accompanied by the expected result, the reason must be sought in the circumstance that they were conducted on too small a scale. In manufacturing klip-fish, so many different things have to be taken into account that no conclusions can be drawn from a few experiments. The experiments

*It may be used to protect the crew both in the boat and on shore. With the boat fastened by the painter or by a hauling-line to the yard and sail, in whose sheets suitable weights are placed, depending from it, the crew, when huddled together under a tarpaulin, will be as comfortable as in a little room.

made last year have shown, however, that washing produces an article distinguished by its extraordinary whiteness, which can only be accounted for as a consequence of the washing. Another proof of the advantages of this process is furnished by the frozen fish, which is distinguished from other fish by its whiteness, which is owing simply to the cleaning process which it has undergone in freezing.

It is not probable that washing the fish should have an injurious influence; for, as we stated above, the Norwegians are the only people who do not wash their fish. The older the fish, all the more necessary it is that it should be washed. The washing of fish, which have been allowed to wait very long, should however be done cautiously, as such fish do not stand much handling. Fish which have been washed should, if only a limited number are washed, be salted by themselves. If the Sondmore manufacturers have, as they think, made the discovery that washing decreases the weight of the fish, they certainly cannot furnish any plausible reason for their assertion. We can understand, however, in what way this idea has originated. As far as we know, only those fish are washed which are brought in by vessels having a deck (which therefore go farther out to sea than mere fishing boats), and if klip-fish manufactured from the fish brought by these vessels weighs less, the simple reason is that it is from 2 to 8 days older, and therefore more shrunk. Common sense also tells us that the time when the fish, during the washing process, comes in contact with water, is too short to exercise any influence on the substances which are soluble in cold water, and that any possible influence of the washing is fully counteracted by the appliance of brine. The only loss of weight which can possibly be occasioned by the washing is the loss of the dirt and slime which is thereby removed. We have often seen fishermen, probably acting on this economical principle, drag fish along the fields through which they were passing, so as to increase the weight of the fish by an addition of dirt. But the advantage which is thought to be obtained thereby is purely imaginary, for all this dirt is, as far as the dried fish are concerned, for the greater part removed by the rain, and as far as klip-fish is concerned, by the cleaning; what remains will rather occasion loss, as it is apt to spoil the appearance of the fish.

As regards the extra labor occasioned by the washing, the fishermen who made experiments in this respect in 1882 declared that if the fisheries are not extraordinarily large, washing can be done without engaging an extra force of laborers, and that the most practical apparatus for the purpose consisted simply in a pump fastened to the outside of the vessel, tubs, woolen rags, and perforated benches, to allow the water to run off. When there is frost, the fish should, as soon as washed, be put in the hold of the vessel, and there be laid on benches so the water can run off.

FROZEN FISH.—In cold weather the fish either reach the shore in a frozen condition, or freeze while they are laid aside to be split. If the

fish are split while frozen, they turn dark and furnish an inferior article. One should therefore hang the fish in the water outside the vessel in a net, but not let them stay in the water any longer than is necessary. As a general rule one or two hours will suffice. In a manual for preparing salt-water fish, published in 1839 by the department of finance, commerce, and customs, it is recommended to let the fish freeze in a tub containing brine. If the fish are fresh, such freezing will not hurt them; but if old—even two days only—their flesh becomes loose and breaks, and only an inferior article is obtained. In cold weather fish should not be salted under the open sky; for if they are put in salt when in a frozen condition they will not make a first-class article.

PRICES.—The raw material may be of greatly differing value, and regard should be had to this circumstance in buying and treating fish, by sorting the fish from the very outset as carefully as the given space will allow. The advantage of doing so will appear both in drying and selling the fish. We also deem it our duty to call attention to a mistake very commonly made in fixing the prices; in buying the fish too much regard is paid to temporary circumstances, so that fish are bought at prices which are unreasonable. It should be remembered that all cod fisheries close in October, and that none of them begin before May, with the exception of the Norwegian and Iceland fisheries,* so that the fish which we catch during winter have to compete with those of future fisheries of other nations. It should further be remembered, that of the 100 million kilograms (in round figures) of klip-fish which are annually brought into the European market, not one-half, and of the 200 million kilograms which are brought into the world's market, not one-fourth comes from Norway. And of this comparatively small portion only about one-half comes from the Loffoden fisheries. The only rational basis for fixing the prices must be found in our own fisheries, and in a comparison with the development which the fisheries have reached in other countries. The safest guide in this respect is statistics, even if they should be of somewhat ancient date. The study of the fishery statistics is therefore essential for a rational fish trade. It is quite natural that the exporters in giving orders relative to the buying of fresh fish to their own agents, have regard to possible combinations in the near future, partly because their order will be small compared with the entire quantity of fish in the market and partly because they can get their own fish into the market before new fish from other countries can reach it. They can, therefore, pay higher prices when it is their interest to obtain a certain given portion. But for other buyers there is no reason to "follow the prices," as it is called. The klip-fish prices of the preceding year exercise a considerable influence on the buying of fresh fish, although less than in former times, owing to the introduction

* And also the Faroe fisheries, which, however, are but small. In winters when there is not much ice, there are some fisheries on the south coast of Newfoundland, and also near the Shetland Islands.

of the telegraph. But this is not a sound basis either; for the prices at which fish sell will principally depend on the result of fisheries which do not begin until our fisheries have come to a close, and regarding which the telegraph keeps the dealers posted. The fish trade will always be more or less of an uncertain business, whose results it will be difficult to predict. There is all the more reason, then, why circumstances which are of but little importance, but which may exert a hurtful influence, should not be allowed to enter into the calculation.

SPLITTING.—The splitting should be done carefully, so as not to damage the fish. Old fish especially should be treated with the greatest care, and not be thrown about as is so often done. The knives should be sharp and be run close to the backbone, so as not to cut off any of the flesh. Along that part of the backbone which is to remain, the point of the knife should not enter deeper than to run along the upper edge of the vertebræ, as otherwise the fish is split open too much during the pressing. The backbone is cut off at least three links below the sexual aperture in an oblique direction, so as to cut across 2 or 3 links. The cutting of the backbone must be done very carefully, so as not to injure the string which runs along its upper edge, as this is to remain in the fish. The portion of the backbone which is to come off, is torn out.

SALTING.—This may be done either in boxes, the so-called dry-salting, or in tubs, the so-called brine-salting. The latter method was generally employed during the last century, and fish were then often salted in tubs, to be manufactured into klip-fish at some later time. Brine-salting is at the present time used only in Scotland. In Norway it could hardly be used, as it presupposes that the drying process begins as soon as the fish have absorbed enough salt. If this cannot be done, the fish are salted again in boxes. This method has been described in our last volume, to whose pages we refer, and shall here confine ourselves to a brief description of dry-salting. This is done by laying the fish in rows, and making piles of fish one row over the other. When laid on the pile the fish should be well drawn out and smoothed down, for whatever folds it may get in the pile it will retain. Care should also be taken that in placing the fish on the pile the abdomen does not come in contact with the cut portion of the backbone of other fish. The piles should be so arranged as to allow the brine to flow off freely, as otherwise there is danger of its turning sour. The center of the pile should therefore be its highest point. Some people who intend to sell fish in brine, in which case the fish are often sold by weight, pile them up in such a manner that the brine remains standing on the fish, and that consequently the fish become partly brine-salted. The attention of buyers should be directed to this method, as such fish will contain a considerable quantity of water, and are very difficult to dry. The buyer should also examine the brine to see whether it possesses the proper degree of freshness. Even the Scotch, who use brine-salting, do not let

the fish lie in the brine any longer than is absolutely necessary. If the season does not allow the fish to be dried, they are taken out of the brine and are placed in well-covered piles, some salt being sprinkled between each layer of fish. To give the fish a second salting is customary among the Icelanders, although they dry-salt their fish. For the first salting they use 1 ton of Liverpool salt to 160 kilograms of dried fish, which corresponds to 6¼ tons of salt per 1,000 Loffoden fish of the usual size. After the fish have lain in salt two or three days they are subjected to another salting, this time one-eighth ton of salt being used per 160 kilograms of fish; after they have remained in the salt for another two or three days they are considered ready for washing and drying. A second salting (using a less quantity of salt than during the first) is also done by English fishermen when they salt the fish in boxes on board their vessels, as well as by all those nations (the Swedes alone excepted) who salt their fish in kegs. In the United States the fish are also salted a second time when they have been unloaded from the vessels; but this is done only because they are dried as they are needed for the market. A second salting may be recommended, but it hardly pays unless there is danger that the fish will turn sour. In salting fish the salt should be distributed evenly over the whole layer, as otherwise some parts of the fish will be salted too strongly. If salting is done under the open sky, the piles of fish must be well protected both on the top and on the sides. Care should also be taken to avoid an accumulation of water at the bottom of the pile.

KINDS OF SALT.—As regards the kind of salt to be used, it is difficult to lay down a rule which will hold good in all cases. We formerly used the gray French salt, which in 1839 was recommended as the best. At present Cadiz salt is generally used in Norway. The Scotch and Icelanders use Liverpool salt; the Canadians during the cold season and for large fish use coarse Liverpool salt, in the warm season and for small fish, fine Cadiz salt. In the United States Trapani salt is preferred to the Cadiz salt, owing to the red plant which is often found on it. In Newfoundland, Cadiz and Lisbon salt are used; to some extent also Liverpool salt for codfish and Trapani salt for herring. The French near Newfoundland use St. Ives or Cadiz salt, using their own salt only for preserving bait. The kinds of salt in general use are, therefore, Cadiz, Lisbon, Liverpool, St. Ives, and Trapani salt. These salts contain about the same amount of cooking salt, as follows:

	Per cent.*
Liverpool salt	92.7
Lisbon salt	91.2
Trapani salt	90.4
Cadiz salt	87.5
St. Ives salt	84.2

* According to an analysis made by Professor Waage. This percentage, however, varies slightly in the different years. An analysis of Liverpool salt, made by Mr. Jensen, showed a percentage of 94.2 cooking salt.

As regards its weight there will in reality be very little difference between the above-mentioned kinds of salt, and we feel safe in stating that not too much importance should be attached to the kind of salt, at least as regards its place of origin. The essential requisites are that it should be clean and have grains of even size, as unusually large grains will produce spots on the fish and give it too salty a flavor in some parts. For fish which are to remain in salt for any length of time coarse salt which does not melt easily is to be preferred.

QUANTITY OF SALT.—The quantity of salt to be used depends on the kind of salt, or the length of time the fish are to remain in salt, and on the size of the fish. Small and lean fish should have less salt than large and fat fish; a rule which is not always carefully observed. On the Lofoden Islands a larger quantity of coarse and not easily dissolvable salt should be used in the beginning, not only because in the beginning of the fisheries the fish are larger, but also because they have to lie in salt a longer time. In Norway the quantity of salt is determined by the number of fish, while in other countries it is determined by their weight when dry, which is the more sensible plan. As we stated before, the Icelanders use 7 tons of Liverpool salt per 1,000 kilograms of fish, or per 1,000 fish when 18 of them go to the *vog* (a Norwegian weight), and 5½ tons when 23 fish go to the *vog*. This quantity was used in experiment No. 2,* described on page 28 of the report for 1883, and proved too much, which is quite natural, considering that the Iceland fish remain in salt for only one week. The fact to which we desire to call special attention is, that it is impossible to fix a certain quantity of salt for a certain number of fish, for a difference of 5 fish per *vog* of dried fish will, if, for example, Liverpool salt is used, make a difference in the quantity of salt used amounting to 1½ tons per 1,000 fish. The Scotch use still less salt, viz., 4½ to 5 tons per 1,000 kilograms dried fish, owing to the fact that they salt their fish in brine. Per 1,000 kilograms dried fish there are used of Cadiz salt 4.2 tons in Canada, 4.5 in Newfoundland in summer, and 5.8 in Labrador. In all these countries the fish remain in salt only from one week to two weeks at the most. If the fish are to lie dry-salted for some time, the quantity of salt should be somewhat greater. Regarding the relation of the kind of salt to the quantity used we must direct attention to the circumstance that, although most salt has about the same degree of saltness, there is considerable difference in the weight. While 1 ton of fine Liverpool salt, loose measure, weighs 99 kilograms [518 pounds], one ton of coarse-grained Lisbon salt weighs 131 kilograms. Packed more tightly, the weight of the former is 136 and that of the latter 162 kilograms. One ton of loosely packed Lisbon salt, therefore, contains 27.7 kilograms more cooking salt than the same measure of Liverpool salt, and less of the former should therefore be used if a certain measure is to be employed as a unit for the quantity of salt needed.

* 1,000 fish were found to weigh 779 kilograms, or 23 to the *vog*.

The relative quantity of cooking salt in the different kinds of salt has been calculated by Mr. Wallem and published in his report on the Berlin Exposition.

Amount of cooking salt per ton.

	Kilograms.
Liverpool salt contains	91.8
St. Ives salt	108.6
Trapani salt	113.0
Cadiz salt	113.0
Lisbon salt	119.5

According to this calculation one ton of Liverpool salt, of 100 kilograms, would be equal to 0.85 ton St. Ives salt, 0.81 ton Cadiz or Trapani salt, and 0.77 ton Lisbon salt.

To return to the experiments made in 1882, we find that in experiment No. 3, 3.09 tons Cadiz salt were used per 774 kilograms dried fish, and that this was too little. In a former experiment we found that 5.53 tons Liverpool salt for 779 kilograms of fish was too much. According to this proportion 5.53 tons of Liverpool salt should be equal to 4.48 tons of Cadiz salt, which therefore would also be too much. 3.09 tons of Cadiz salt was therefore too little and 4.5 tons too much for 775 kilograms of fish. The suitable quantity of salt would therefore be somewhere between these two figures. According to the above calculations 6½ tons Liverpool salt or 5.3 (more exactly 5.265) tons of Cadiz salt would be sufficient for 1,000 kilograms dried fish, or if weight is used, 650 and 663 kilograms salt respectively. The Cadiz salt has less saltness than the Liverpool salt, and therefore more in weight should be used, although the difference is only 13 kilograms per 650, but as it is heavier, less by measure should be used, the difference here being very considerable, viz., 1.2 tons per 6.5.

To use a certain measure of salt as a unit for the quantity of salt to be employed is less reasonable than to take a certain number of fish as the unit for determining the quantity of salt, as both will vary. The best way will be to use a certain weight of salt for a certain weight of dried fish, for the difference in saltness between the various kinds of salt is comparatively speaking so small, that the same weight may for all practical purposes be considered to contain the same quantity of cooking salt,* and, with regard to the weight of the fish when dried, a skilled eye will soon be able to determine this with a tolerable degree of accuracy. It appears from the above that 650 kilograms of salt, no matter what kind is used, will be sufficient for 1,000 kilograms dried fish. No absolutely binding rule can be laid down before some more experiments have been made, and it is to be hoped that the Society for the Promotion of the Norwegian Fisheries will soon be enabled to make these experiments.

*Of the other principal ingredients of salt, sulphate of lime (gypsum), sulphate of magnesium, and chlorate of magnesium, possess strongly hygroscopic properties.

Fish which have been salted too much become stiff in the salt; when the fish are cured, however, they become soft again.* Excessive salting may be corrected during the washing and pressing, but, if possible, it should be avoided. In regard to this matter we repeat the following quotation from the Report of the Board of Fisheries (given on p. 185 of the last volume): "Excessive salting is used by some persons to increase the weight of the fish, but no greater mistake could be made, for not only is the juice extracted from the fish, thus making it lighter, but as the drying process progresses, a crust of salt forms on the fish, and its value is diminished."

RULES.—We would, in accordance with all that has been said above, lay down the following rules:

1. All fish should be treated with great care both by the fishermen and the manufacturers.

2. The curing should be done as soon as the fish reach the shore.

3. Fish caught with the day line and the deep-water line should be killed as soon as they reach the boat.

4. All fish should be washed, and a few hours should be allowed for the water to flow off.

5. Frozen fish should not be salted before lying in water for some time to let the ice become loose.

6. In splitting the fish, the backbone should be cut obliquely three links below the vent, so that the string running along the backbone remains in the fish. The bone is torn out.

7. Each day the fish are allowed to lie before being cured makes a difference in the price, which will fall rapidly the longer the fish are allowed to lie. Fish which have been killed so as to let all the blood run out bring a higher price.

8. All fish which have been treated with particular care, or which are supposed will make a first-class article, are salted separately.

9. The salt should have grains of even size.

10. For fish which are to lie in salt a considerable length of time coarser and less dissolvable kinds of salt are used.

11. The quantity of salt is calculated on the basis of a certain weight of salt to a certain weight of dried fish.

12. When heaped up in piles the fish should be well stretched and smoothed down, and the salt be distributed evenly. The brine should be allowed to flow off freely.

13. If the salting is done under the open sky, the piles of fish should be kept well covered and have a firm foundation, so that no water can gather at the bottom.

To these we add, conditionally,—

14. For 1,000 kilograms dried fish use 650 kilograms salt. Our own idea is that somewhat less might be used; for the turning sour of the fish, which is sometimes caused by a long period of bad weather while

* The Labrador fish are therefore never stiff.

the fish are being dried, can be prevented by frequently changing the fish in the piles.

THE PROPORTIONS OF SALT.—If one wishes to use the quantity and number of fish as a unit he must simply weigh his salt and divide the weight by 650. With regard to the conversion of fish in weight to fish in individuals, the difference of one fish in a *vog* [36 Danish pounds] makes a difference of 55 and 56 hundredths fish in 100 kilograms. Hence, if we assume the salted fish to weigh 130 kilograms per barrel, we should, according to the rule here mentioned, use, upon the basis of 18 fish to the *vog*, 5 barrels of salt to 1,000 fish; 19 fish to the *vog*, 5 barrels to 1,056 fish; 20 fish to the *vog*, 5 barrels to 1,111 fish; 21 fish to the *vog*, 5 barrels to 1,167 fish; 22 fish to the *vog*, 5 barrels to 1,222 fish; 23 fish to the *vog*, 5 barrels to 1,278 fish.

Or if we take a thousand fish as the standard, when there are 18 fish to the *vog*, 5 barrels of salt; 19 fish to the *vog*, 4.735 barrels; 20 fish to the *vog*, 4.5 barrels; 21 fish to the *vog*, 4.285 barrels; 22 fish to the *vog*, 4.092 barrels; 23 fish to the *vog*, 3.912 barrels.

A difference in weight of two fish per *vog* [18 kilograms] in the dried state therefore causes, if the salting is uniformly done and salt whose weight is 130 kilograms per barrel is employed (the average weight for the kinds of sea salt here mentioned), a difference of a few barrels in the quantity of salt. A difference of five fish per *vog* requires a difference of $1\frac{1}{10}$ barrels in the amount of salt.

The washing out should take place on the shore whereupon the fish are to be dried, and it should be done in clean, fresh sea-water, and not in river water. By washing them in the latter they lose their fresh, bluish color, become dark gray, and acquire an unpleasant smell. The fish are thrown out in the water one by one as they are needed, so that the washing out may take place without interruption, but never more at one time than the workmen can clean up immediately, or, at all events, in the course of a short time. In throwing out the fish it is necessary to observe whether the water is rising or falling, and also its depth, so that the washers may always be able to reach the fish thrown out. A washer of average ability should be able to wash fifty or sixty fish in an hour. The fish are to be thoroughly cleansed, all the blood and slime should be carefully removed, and the black membrane (*peritoneum*) is to be taken off if this was not done before.

Special attention must be given to the *rygfolden* ("blood bone") if this is not cut off as it should have been; also to the ear bones. In the cleansing process woolen mittens are required.* When the fish have been washed they are laid down in slanting piles in five to six layers† with the bellies downwards, so that the water may run off. The lowest layer is placed with the skin side down, the remainder with the skin side up. The substratum must be bare ground, free from irregu-

*If the fish have been washed before pickling, the washing out will be much easier.
†If in many layers, the lowest fish become too dry.

larities, and with suitable inclination, or *kuppelsten*. The last is preferable, especially if the ground slopes somewhat. If boards are at hand they should be used both for the floor and the covering. The fish should remain in these heaps at least twenty-four hours, or as nearly so as the state of the weather will permit.

When there is considerable difference in the size of the fish, they should be assorted before pressing, in order that the larger and the smaller fish may be treated separately. If the cargo is not sufficiently large to warrant the assorting of the fish, the larger and thicker fish must be placed undermost in the press-layers, and the smallest, on the other hand, should be uppermost. Old fish must be treated with greater caution than those which are salted fresh. If the fish is too salt it should be allowed to lie in the water from one hour to several hours longer. The workman himself must decide how long. Should it become necessary afterwards to remove the superfluous salt by pressing, the manufacture will occupy a longer time.

THE DRYING PLACE.—In the United States, as well as in Canada, Newfoundland, and Labrador, most of the fish are dried on scaffoldings or "flakes." These consist of a kind of grating laid on a trestle. Sometimes the grating is made to turn so that it may have a greater or smaller inclination to the horizon, according as one wishes to expose the fish to the influence of the sun or protect them from it. In some places there is used for the same purpose a frame-work over the grating, supplied with curtains, which can be put on and removed at pleasure. The grating consists either of laths or of spruce and pine strips (*furruk-viste*), which are cut the year before, so that they may be thoroughly dry. If the last is used the floor of the scaffolding is made in the following manner: Over the lengthwise strips, which rest on the trestle, are laid cross-bars at a distance from each other of from 4 to 6 inches, and across these are placed twigs which are fastened with laths at each fifth or sixth foot of their length. When the bottom is made of twigs, drying is accomplished more slowly than when it is made of laths, as the circulation of air is less free. Where one has both kinds, he should use the first during the closing portion of the drying process. The height and breadth of the scaffoldings vary. In Canada those which are used for the drying of the smaller fish have a height of 4 feet and an equal breadth,* whereas those which are used for the drying of the larger fish are 12 to 14 feet in height and as much as 100 feet broad. For the convenience of the men there is constructed on this a board walk, so that they may readily handle the fish.

In Scotland, also, scaffoldings are used to some extent. The advantage of the scaffoldings is that the fish get a circulation of air both above and below, whereby the evaporation of the water takes place more rapidly, while at the same time they are not exposed to the danger of becoming sunburned. Furthermore, on these the fish are not exposed

* See *Norsk Fiskeritidende*, 1883, p. 12.

to surface-water, or so much affected by dust and other filth as when they are dried on the beach or on a hillside. Finally, the fish become heavier, as they retain more salt than when the drying takes place mainly with the aid of pressure.

The use of the scaffolding in the countries here named is due partly to a want of natural drying places, but chiefly to the fact that the manufacture occurs mostly in summer. Canada and Newfoundland lie between about 43° and 50° of north latitude, or in the same latitude as France, and their southern situation, with the climatic conditions consequent thereupon, has made the use of scaffolding a necessity. This must, therefore, not be considered as a special method, but as a mode of drying called forth chiefly by necessity.

The scaffolding is expensive, wherefore cheaper methods of drying are also employed in places where the conditions allow it, or where there is difficulty in obtaining the necessary wood-work. Thus there are constructed besides the scaffolding some artificial drying places of stone cairns or gravel heaps with shingles. In Newfoundland the latter have an underlayer of bark upon which is placed a layer, 4 or 5 inches thick, of shingles. The stone heaps are used chiefly in Iceland and in Scotland; the gravel heaps, on the other hand, mostly in British North America. In many places stone fences also are used. The artificial drying places of stone here mentioned, have the advantage previously referred to in speaking of the scaffolding (though in a less degree), of a circulation of air on both sides, while the surface water has free drainage.

In Firtiaarene,* in Norway, an experiment was made with scaffoldings; but they were found too expensive in proportion to their advantages. There can be no doubt that these as well as the artificial stone heaps are preferable to a hillside, but when they are not used it is because there is a sufficient number of natural drying places, and because the climatic conditions among us make these more available than among most of our competitors. These make it necessary for us to employ to a greater extent the pressing process in order to remove the moisture from the fish, since there is not sufficient heat to accomplish this by evaporation.

As we also know the advantages from the use of scaffoldings and stone structures, &c., their use demanding less pressing and consequently giving a greater weight, we dispense in drying with the hillside. That these also can produce first-class products the Norwegian klip-fish has given and still gives the best evidence. But it causes more labor and produces less weight.

If a hillside is used the drying place should slope from the sun, and especially towards one of the points between north and east, so that it will be open to the winds from these quarters, and protected from the westerly and southerly winds. It ought to be sloping and level so that

*At the present time small lots are dried on laths on the wharves at Bergen.

the rays of the sun may not by reflection be concentrated on any single point. The fish which are dried in such a place will readily become sunburned. Rough ground or ground with ridges is advantageous, since there is some circulation of air under the fish, and the drainage of water is free. Before the drying begins the place must be freed from grass, moss, &c., and must be swept clean. To remove the turf immediately before the beginning of the drying in order to secure more room is injurious. This work should be performed beforehand, for one should avoid as far as possible everything that may cause dust, because if this gets on the fish in the beginning it can never be removed.

DRYING.—This is performed somewhat variously in different countries according to the climatic conditions. In one respect, however, there exists a complete agreement; it is in the universal dependence upon the conditions of the weather and the uniform results everywhere following upon these conditions. Softening (*sleiphed*), sunburning, salt-burning, and flies are drawbacks which operate against one in America as well as in Europe, and the problem for the manufacturer is to counteract them as well as he can. The remedies are the same on both sides of the Atlantic, whether one uses sheds, scaffoldings, stone heaps, or slopes. They can be included into one word, which we never weary of repeating—carefulness. A great many "disasters," as they are called, may be prevented, but very few can be repaired. We shall treat of drying in its details under Norway, and thereupon give a short synopsis of the conditions which exist in other countries, as far as these are not touched upon in previous pages.

NORWAY.—When the water is run off after washing, for which at least twenty-four hours should be allowed, drying begins as soon as the weather is favorable, by carrying the fish to the drying place, for which purpose hand-barrows are employed, and laying them out with the flesh side up. If the weather is dry and good, the fish may remain out over the first night, but the skin side must be turned up towards evening. On the forenoon of the next day the flesh side is again turned up, and in the afternoon the fish are collected into layers containing thirty to fifty each. When they have been laid out two to three times they must be well stretched, especially in the belly. As this work is of great importance to the appearance of the fish it must be carefully performed. It requires much time, and one should rather sacrifice a day to it than undertake it in a hurry during the collecting of the fish before night. When the fish have been out three or four times,* or when they have become so dry as to admit of being put in press, which is indicated by the breaking of the belly upon bending it, they are placed in the first press layer. In this they remain five to eight days, according to their dryness at the time of putting them in, whereupon they are relaid in another press layer so that the uppermost are underneath, and in this they remain for an equal length of time. Thereupon they are again

* Before each time of taking in the fish they are laid more and more in piles.

laid out, if the weather permits, but only every other day, and before which time they are put in piles, which are again formed during the days when the fish are not out. If they have been laid out four or five days the drying will usually be finished. The fish is not sufficiently dry as long as it continues moist under the dorsal fins, or is not sufficiently hard to withstand the pressure of the thumb without retaining the impression. Under ordinary conditions the drying will occupy about six weeks.

These are the principal features of the Norwegian method of drying. We cannot go further into details, because one frequently has a whole day for drying, while at other times, again, only a few hours. Frequently a week or more may pass by during which one may be unable to get the pickled fish out, while at other times it may be necessary to allow a day of good weather to pass unused in order to allow the fish to remain in piles. If there is good drying weather in the beginning, the fish should not be laid out every day, but should remain in small piles one or two days in order that they may not dry too rapidly, as thereby they become brittle and do not look so well. The power of deciding when they should be laid out and the size of the piles in which they may be placed, if they are oversalted, demands practical skill, which must be obtained through long experience. We can, however, give a few directions showing how one must proceed in certain individual cases:

If adverse weather occurs during the drying, the fish should be heaped up every day or every other day as soon as the opportunity offers, and the piles should be made smaller in order to give freer circulation of air. To spare labor in these respects is bad economy. By repiling, the fish become whiter and they are not so readily exposed to become *sleip*. A little rain in the beginning need cause no anxiety. Towards the close of the drying process, however, it should be avoided, as it makes the fish yellow. If, notwithstanding your efforts, they become *sleip*, this can be remedied by dipping or washing them with brine or by strewing a little salt between the layers.

If the fish become *sleiped* in the store, a result of bad drying, wipe the moisture off, and afterwards give them one or two days of drying.

If the weather has been warm during the day, the fish when they are collected before night must not be pressed in piles until they are cooled off, as otherwise they will readily become salt-burned. If one is obliged on account of squally weather or for some other reason to take in the fish while they are warm, and the next day is unfavorable for laying them out, they must then be piled up again.

In warm and still weather one must be careful also in laying out the fish for drying that they do not become sunburned, especially if the sun has had time to heat the ground. In Canada, during intense sunshine, they cover the fish with spruce boughs or canvas. If these are not at hand, the fish on the warmest side during still and intense sunshine

must be thrown in heaps of ten or twelve in such a manner as to present as little surface to the sun as possible. When the fish, after having remained in press, have become sufficiently stiff to admit of being "raftered" (laid on edge), one must observe, during the conditions of weather just named, that they are not turned broadside to the sun; but the *spærrerne* must be turned according to this.

The fish must not be too dry before they are placed in the first press layer, else they will with difficulty "repel salt."* At first the brine is turbid and has a bitter saline taste; later it becomes clear as water and acquires a milder taste. If the brine becomes turbid afresh, the fish must be placed in smaller piles so that they will not be pressed any more.

When the fish are laid in piles, the best way to place them is just as herring are crowded in a barrel. It is necessary to observe precisely that the belly of one fish is placed in the middle of the back of another. When the *floen* is filled on one side, the beginning must be made on the opposite side, provided only one person is engaged in the work. The layers are heaped vertically and perfectly straight from the bottom to the top.†

In relaying the press layers it must be observed that the napes, which at the first pressing were turned outwards, should be laid inwards. If the fish in repiling appear to be too dry this can be remedied by sprinkling them with fresh water.

The piles must always be well protected from rain and sun. They ought properly to be placed on some elevation and in such a manner that the surface water cannot reach them. A foundation of pebbles is the best. In the absence of these wood is used. The undermost layer is placed with the skin side down, the remainder with the skin up.

The heaps from the beginning of the drying ought to be covered with stone, and the weight of the stone should increase progressively as the drying advances. Weight must be divided uniformly over the cover.

The dried fish are removed after they are finished, and are brought either on shipboard or placed in well-covered heaps.

Some manufacturers recommend laying the fish in the sun with the skin side up, if it has been over-salted or if it is salt-burned, as the salt is thereby drawn from the flesh side. Turning occurs more frequently the further the drying process advances. The fish should never be stowed away when they are warm.

In damp weather the fish in the warehouse should be well covered, but in dry weather, on the contrary, air them by opening the windows and doors. It is likewise desirable to repile them every second or third month, partly to air them and partly examine them, so that the

*See "Rules for the guidance of the fishing population on the manufacture and treatment of klip-fish." Aalesund, 1880.

†Rules for the guidance of the fishing population on the manufacture and treatment of klip-fish. Aalesund, 1880.

damaged ones may be taken out and improved. Oat straw, between the layers is said to absorb the superfluous salt, giving the fish a good color and preventing it from becoming slimy or *middet.*

UNITED STATES.—After the fish have been taken out of the vessel* they are washed, and are then placed in piles with a little salt between each layer (kench cured), or they are laid in strong pickle in the vat, which holds about 400 kilograms. They are afterwards dried according as they are wanted for the market. The dry-salted appear to be the best and receive from one to several weeks drying, according to the market, while the brine-salted, being mostly used inland, are dried only one to three days. Pressing is never employed.

CANADA.—On the first day after washing the fish they are placed with the skin side up, towards evening they are turned and are left lying out during the first night, if the weather is suitable. Later they are collected before night and are laid the first time two and two together. According as the drying advances they are placed at night, or in unfavorable weather, in larger and larger heaps, the number in which, however, never exceeds 50 fish. When they are nearly dry they are placed in round heaps containing as much as 5,000 kilograms, which are covered well and loaded with stones. In the heaps they remain at least five to six days, after which they are dried on shingles for one day in front of the store-house. When the fish are in heaps for pressing they frequently remain in that condition for a long time, even until they must be shipped, when they receive "the last sun."

NEWFOUNDLAND.—Here the fish are not placed in the press heaps† until they are nearly dry, when they are kept in them fourteen days, after which they receive four to five days' drying inside of the store-houses. Every evening they are placed under the store-houses in large piles. They are considered sufficiently pressed when the dust salt begins to appear on the outside.

LABRADOR.—When the fish are three-fourths dry, which occupies four to five days of drying, they are placed for ten days in press layers in order to "work," after which they are considered to be finished.

FRANCE.‡—After the fish have been taken out of the vessel they are

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*Those who fish on George's Bank, to which the voyage occupies three weeks, use one bushel [30.28 liters] or 28 kilograms of salt to 150 kilograms of split fish, which corresponds with 560 kilograms of salt to 3,000 kilograms of raw fish, while in our country we recommend 650 kilograms to 1,000 kilograms of dried or 3,000 kilograms of green fish. Those who fish on the Grand Banks of Newfoundland, and are absent from two to three months, use twice as much salt.

†It may be superfluous to remark that by "press heaps" we mean the piles in which the fish (*principmassigt*) remain untouched for a certain time.

‡See Candidate Wallem's report on the Berlin Exhibition, 1880, page 219. The method here mentioned is employed, moreover, unchanged, which is especially remarkable since the author assumes that possibly some improvement has taken place. The French fish manufactured in Newfoundland are exported directly without going over to France.

washed in fresh water, which possibly has given rise to the name *lavè*, by which they are known in Italy, and then they are suspended from cords in covered dry sheds, where they receive from three to six days of drying, according to the market. They are not pressed. Since, on account of the proximity of the markets, they can be shipped by rail or steamer, according to necessity, it is not necessary to lay much stress upon their durability.

SCOTLAND.*—After fourteen days' drying the fish are placed in press heaps for ten days, after that dried for one week, placed again to "sweat" four to six days, whereupon, after two to three days' drying, they are finished.

ICELAND.†—The drying process here is about the same as among us, except that the fish are placed in the press somewhat later.

Thus in the countries in which klip-fish is manufactured the drying is done on similar principles. The chief difference exists in the extent of the pressing and in the time before placing the fish in the press. Where the temperature or the condition of the drying places allows the diminution of the moisture of the fish to take place by evaporation, whether this is produced by heat or circulation of air, pressing is less needful in proportion to the extent of the operations than when the water must be removed by mechanical means (pressing). Where the drying takes place chiefly by evaporation, the object of the press heaps is principally to allow the fish to undergo a kind of fermentation. Where the drying, on the contrary, occurs chiefly or in part by pressing, the fish must be placed earlier in the press heap before the outside crust becomes so hard as to prevent the penetration of the pickle. If the fish of our competitors appears to be more salted than ours, it is not because they use more salt,‡ but because the salt which the fish have absorbed either becomes crystallized in them or dissolved, while a portion of the salt dissolved in the water escapes when this is removed by pressing. When certain manufacturers in your country use little pressing in order to increase the weight, which is done at the expense of the preservation, they must be discouraged. In this method, it is true, the fish retain a little more salt, but at the same time, also, a corresponding quantity of water which diminishes the durability of the fish; for, as we have seen, moisture is one of the elements which promote decay. The greater the amount of this in proportion to the weight of the fish the more rapidly softening takes place. The water must therefore be removed by evaporation, a thing, however, which can be accomplished in a protracted drying season under favorable conditions for drying. Therefore, if one wishes to employ less pressing he must use more drying,

* See *Norsk Fiskeritidende*, 1883, pp. 185, 186.

† See Annual Report for 1883, pp. 3-10 (Appendix 2).

‡ Except in Iceland.

provided the durability is to remain the same. A drying place which allows circulation of air on both sides is essential for this purpose.

Because of the antiseptic qualities of the salt a strongly salted fish is more endurable than one which is less strongly salted. The capacity of the fish to take salt is, however, limited. To dissolve one portion by weight of salt requires 2.85 times the same quantity of water. If we assume that 100 round fish will weigh 3,000 kilograms, about 2,460 kilograms of this weight will be water, whereby 863 kilograms of common salt can be dissolved. Whatever is in excess of this weight will remain undissolved.*

WEIGHT OF THE FISH.—With regard to the proportion between the weight of the fish in the fresh, salted, and dried conditions, which is dependent upon the quantity of water, salt, and nourishment it contains in these different conditions, we have little information based upon accurate observations or chemical analysis.

We have already given an analysis of Norwegian klip-fish, made by Candidate Jensen, one of the teachers in the Technical School of Bergen. An analysis by the same chemist of a well-dried Iceland klip-fish which weighed 1.5 kilograms gave the following result: Water, 42.23 per cent; salt, 19.90 per cent. The proportion between a Norwegian and an Iceland klip-fish of 15.10 kilograms should be: Norwegian klip-fish, 552 grams water, 232 grams salt, and 716 grams mostly nourishment. Iceland klip-fish, 633 grams water, 298 grams salt, and 569 mostly nourishment.

Of the examples examined, which were specially selected materials, the Norwegian fish thus contained 147 grams, or nearly 10 per cent less water and salt than the Iceland, or 10 per cent more nourishment. A chemical analysis of the klip-fish of other countries will certainly likewise show that they contain a varying percentage more of salt, possibly also of water, than the Norwegian. When people, therefore, in these countries get during drying "better weight," this is to be accounted for partly by the fact that the fish in such places contain more of the comparatively worthless materials, water and salt, which the buyers pay for as fish, provided the price per kilogram is the same. Many of our manufacturers oppose this measure, but they forget that in our drying with circulation of air on one side only we get, if that spares the salt, too much water retained in proportion to the salt. An analysis of the Iceland fish shows a surplus of 5.41 per cent of water and 4.41 per cent of salt. If we wish now to retain 4.41 per cent more salt, we must also retain 4.41 times 2.37 per cent of water, which is the proportion between salt and water in a Norwegian klip-fish,† provided we do not use

* With regard to herring the excess of salt over 32 kilograms, or one-quarter of a barrel to a packed barrel of the fish, remains undissolved.

† The proportion between salt and water in an Iceland klip-fish is as 1 to 2.12, thus, comparatively, more salt to the water, wherefore also it is more durable.

more drying for the lightly pressed fish than we use in proportion for the fully pressed fish. The one means of increasing the weight without diminishing the durability is to retain the salt and remove the water; but this can be done only by evaporation, not as is attempted in our country by light pressing and medium drying. These processes, it is true, give increased weight, but durability is sacrificed. By strong salting, on the other hand, we can gain weight, but the fish thereby lose in return nourishment and are exposed to the danger of becoming salt-burned.

The weight of the fish is most closely dependent upon the time during which it has remained in salt, as its elements which are soluble in water are taken up by the pickle. We lack, however, the necessary materials for deciding how much it loses thereby in weight. On the other hand, fish which have remained long in salt yield a better weight of klip-fish, as the salt finds time to penetrate everywhere, and thereby its capacity for salt is increased. Finally, the greater or less plumpness of the raw product certainly has an influence on the weight of the klip-fish.

Concerning the relations between the weight of green and dried fish in different countries we are in possession of fixed data concerning only a few. We append below the result of some experiments instituted in the United States:

Weight.		Loss.		Remarks.
Split.	Dried.	Weight.	Per cent.	
Pounds.	*Pounds.*	*Pounds.*		
18.31	11.94	6.37	34.8	Twenty-two days drying. The ordinary dried fish.
15.12	10.12	5.00	33.1	
10.75	7.50	3.25	30.2	
7.62	4.94	2.68	35.2	
4.44	3.06	1.38	31.1	
23.50	14.62	8.88	37.8	Thirty-seven days drying.
14.88	9.14	5.74	38.6	
7.50	4.38	3.12	41.6	
5.00	3.00	2.00	40.0	
2.25	1.38	0.87	38.7	

According to this table, in one case 100 kilograms of green fish yield 66.8 kilograms of klip-fish, in the other case 61.2 kilograms. In Scotland they calculate that 100 kilograms of raw fish will yield 39.3 kilograms; in Iceland, 50 kilograms;* in Norway, 33.3 kilograms; in Sweden, 40 kilograms (ling); and in Newfoundland, 36.4 kilograms of klip-fish. The difference consists chiefly, it is true, in the saltness.

Concerning the proportion between the weight of salted and dried

* Employing the analysis previously named as a basis of calculation and excluding from the reckoning the loss of materials dissolved, 100 kilograms of fresh Iceland fish should have yielded 47.4 kilograms of klip-fish, and the Norwegian 35.4 kilograms. On this basis the Icelanders should use 1 kilogram of salt to 1.43 kilograms of klip-fish, or every third kilogram of raw fish, while we, in our calculation, estimated on the loss of weight of 66 per cent.

fish there is given below the result of some experiments made in the United States:

Salted in the vessel.	Dried.	Weight.	Per cent of loss.	Remarks.
30.19	25.81	4.38	14.5	Common dried. From St. George's Bank.
21.44	19.31	2.13	9.9	
11.00	9.66	1.31	11.9	
6.06	5.31	0.75	12.4	
5.00	4.69	0.31	6.2	

According to this, 100 kilograms of salted fish yield on the average 88 kilograms of klip-fish. Some experiments made in our country gave the following result: Finmark fish, 100 kilograms salted gave 49 kilograms klip-fish; Loffoden fish, 100 kilograms salted gave 48.5 kilograms klip-fish; domestic fish, 100 kilograms gave 51.7 kilograms salted.

According to statement in the description of the cod fishery at Iceland in 1883 by First lieutenant Trolle, which will be considered in a later number, he obtained from 100 kilograms of salt fish an average of 71.8 kilograms of klip-fish.

Chemistry is becoming more and more employed for the examination of our food stuffs, and perhaps the time is not far distant when it will be of practical importance to the klip-fish trade so that one need not pay for salt and water as fish.

ASSORTING.—On inquiry into the means of promoting a better manufacture, it has always been advanced, and rightfully, that a change cannot be effected until in the purchase from producers a greater difference of price is made between the different qualities; or, in other words, until in the *purchase we discriminate between the various qualities and draw a sharper line between them* than is done at present. Herein the producers as well as the shippers appear to be unanimous.*

If we now find ourselves *in statu quo*, it is principally because of the difficulty in becoming unanimous as to the practical solution of the question whether there is more profit for speculation in an unassorted sale and purchase, which has exercised its influence on both sides and contributed to the lack of attempting any decisive step towards working a reform.

In assorting klip-fish we must separate them according to their qualities. This may be done (1) at the purchase from the manufacturer; (2) upon shipping to and their "reception" in a foreign country; and (3) in selling at retail.

We shall here first give some examples showing how the assorting is done in different countries.

CANADA.—Here they assort fish, first according to size into large, medium, and small;† they are likewise assorted according to quality

* See report of the proceedings in the discussion meeting in Bergen, October 27, 1880, pp. 29–32.

† These are exported in barrels

into merchantable fish (*morue marchande*); second quality (*morue inférieure*); and refuse (*morue refusée*). Among the last are placed all damaged fish (sunburned, salt-burned, injured by rain, &c.).

NEWFOUNDLAND.—The fish are assorted here into three kinds: Merchantable, which must measure at least about 22 English inches [56 centimeters] from the nape to the last dorsal vertebra; Madeira; and West Indies. The assorting is done by private sorters at the fixed charge (one penny) per quintal.

ICELAND.—Here the fish are assorted, upon their receipt from the fishermen, into two kinds, according to size, those which are over and those which are under 18 inches; also, according to quality, into first and second. At the exportation to Spain* the authorities appoint two sorters, who see that the fish are good, well dried, and well handled articles of the year's production, free from wet and spoiled fish, and not mixed with haddock, ling, pollock, and small fish. An affidavit to that effect is signed upon the bill of lading, which besides is certified to by the district judge or the town judge. In exporting to England and Denmark there is no assorting by public sorters, but the small fish and the seconds are shipped separately from the remaining fish.

SCOTLAND.—Here klip-fish are treated just like herring by the merchants. In purchasing green fish from the fishermen they distinguish between fish over 14 inches and those under 14. Only perfect fish, and fish over 14 inches, are exported; the remainder go to Ireland or to the inland markets. Fish intended for the colonies are dried more thoroughly than those for other markets.

FRANCE.†—Most of the fish at present shipped from here to Spain are caught south of Iceland. They are assorted for exportation into two kinds according to quality and into two kinds according to size. A fish weighing from 2 to 2½ kilograms is considered large; fish from ½ to 1½ kilograms are medium or small.

BARCELONA.—Here fish are separated, as well upon the receipt from the fishermen as in retailing, into three kinds: first kind, superior *meclado* (superior unassorted); second kind, *buen meclado* (good unassorted); and inferior fish. As inferior fish they classify brownish and somewhat *middet* fish. If it is very *middet* or dark, it is classed as refuse fish.

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*From the north and east coast klip-fish has not hitherto been exported directly to Spain.

†The French sea fishery is aided by the Government with the following premiums: Every registered man, an owner, whose vessel goes to Iceland or to Newfoundland and dries fish there, obtains 50 francs [36 crowns]; if, on the contrary, the fish are dried in France, he obtains 30 francs [21.57 crowns]. Dogger Bank fishermen obtain half as much.

Also, in the exportation of klip-fish, he obtains when exported: To foreign transatlantic countries, 20 francs per metrical quintal [100 kilograms]; to French colonies or European countries, 16 francs; to Algiers and Sardinia, 12 francs; then for every metrical quintal of roe imported, which is the yield of a particular kind of fish, there is obtained 20 francs.

BILBOA.—Here fish are separated for retail into many sorts, which are here arranged with the addition, for the sake of comparison, of the prices according to a price-current received from one of the trading houses there, dated January 4, 1884.

Norwegian cod are divided into: large club fish, *toston*, 224 reals per 50 kilograms;* small club-fish, *toston cito*, 210 reals per 50 kilograms; large fish, *crecido*, 220 reals first kind, 216 reals second kind, 208 reals third kind, (?) reals fourth kind; small fish, 200 reals; ling and cusk are divided into three kinds.

The cod klip-fish from Iceland, Shetland, and the Faroes are divided into:

Iceland: First kind, 202 reals; second kind, 194 reals; third kind, 186 reals; medium, 192 reals; small fish, 186 reals.

Newfoundland fish are divided into: large klip-fish, *truchuelon*, 194 reals; medium, *truchuelon*,* 194 reals.

Labrador, 164 reals.

French fish are divided into:

Iceland, first quality, 180 reals; second quality, 160 reals.

Newfoundland, first quality, 170 reals; second quality, 150 reals.

It will be seen from this price-current that even the fourth quality of Norwegian fish exceed in price the klip-fish from other countries.

ITALY.—Here fish are divided, according to size, into large, medium, and small; according to quality, into first, second, and refuse, following the same rules which are operative in Barcelona.

The assorting is thus based in most places upon both the size and the quality; and as a rule they are separated with regard to both into three kinds: by size, they are separated into large, medium, and small, or large and small; by quality, they are divided into first quality, second quality, and refuse. This assorting also is perfectly rational, and is therefore in our country in part the basis for assorting by the sorters.

Size plays an important rôle in the market, since in some places large fish are preferred, in other smaller fish. The difference in the size of the fish in our waters is, however, at present not so great that we feel in need of making a general sorting with reference to size in purchasing from producers.‡ As the manufacture of the yield of the daily coast fishing into klip-fish becomes more general and the bank fishing expands, the number of small fish will increase; and the time will therefore come when size will be so important a factor that it will have to be taken into consideration in the purchase of fish. For the present, however, as previously remarked, it has little importance; wherefore we omit it here.

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* One real equals 17.5 ore; 200 reals = 35 crowns = $9.38.

† Divided again into two qualities. Under this brand occur also the Norwegian fish. Translated, it means "small dried cod."

‡ The fact that the unusually small fish are rejected we will leave out of the calculation.

As regards quality (under which size and condition of flesh also belongs, strictly speaking, but which we do not consider here), fish are divided among us at the "reception" into only two kinds, unassorted and rejected, while the price in part has a division into three, depending upon whether in the agreement as to price attention is paid to the impression which is made by preliminary examination into the condition of the cargo. In this way the truly good, well-made fish do not get full justice, while less carefully manufactured fish, on the other hand, bring a price which they would not have reached had there been two sorters instead of one—unassorted. The present universal method of sale, therefore, rather encourages the manufacturers to produce a medium article than to attempt to make the most possible out of the raw product. The result of this, besides the direct loss which arises from not making the most out of what we have, will be increasing discredit in the world's markets, which again will cause the Norwegian klip-fish to be sold only when other better wares are not to be had. At present the result is not so evident with klip-fish as with herring; but if the system is continued the Norwegian klip-fish industry and those which are associated with it will in a longer or shorter time meet the same fate as every prodigal, disorderly economy, in which everything "*gaar paa Raus*," an expression which we may be allowed to use, although it is scarcely grammatical. We ask, what encouragement has one to purchase by preference fresh fish, or to pay for their dressing, or to wash them, or to use the means necessary that the drying may be as complete as possible, when no special attention is paid to these different factors, although they contain all the conditions for securing especially desirable products, or when they are not considered in their full bearing, but disappear, so to speak, into "chaos"?

We have in the foregoing shown how certain conditions, under which the greater portion of our fisheries are conducted, make the Norwegian products in many respects faulty and cause them to be surpassed by those of our competitors. But just herein is an invitation to keep pace with them, where the conditions are the same; while the present mode of sorting and of manufacture consequently thereby produces, by a similar principle, the opposite result. It brings the manufacture down instead of improving it. We cannot, therefore, sufficiently emphasize the necessity in the purchase from the producer of resuming the old method of sorting with its three classes: First quality, white, well-dried, perfect fish, and, if size is taken into consideration, large, plump fish; "*blodstuven*" ought to be rejected. Second quality, overworked, salt-burned, indifferently dried, yellow fish. Rejected, lacerated, damp, split, sunburned, dark, sour fish.

In the foregoing remarks we advised the producer to sort his fish at the salting and at the washing out, because we believe that he can thereby contribute to the accomplishment of the proposed reform. If he comes into the market with unassorted fish, he must sell the whole lot to one

purchaser, and he will possibly find it difficult to make him agree to any more stringent assorting than the customary one. If, on the contrary, the fish are assorted beforehand, he will be likely, because of competition, to find different purchasers for each kind of fish, while dried first quality will always command a good price at the close of the season, in which we include the time from December to May.

The question of sorting is, we can readily say, a live issue for the Norwegian klip-fish trade, and is one of great importance in our national economy. It will be a source of gratification to the editor to place the Tidskrift at the disposition of authors for the continuation of this discussion which he has here only begun.