X.—ON THE HERRING, AND ITS PREPARATION AS AN ARTICLE OF TRADE.*

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CONTENTS.

Introduction.

I. Preparation of common Baltic herring for consumption in Sweden and in the German ports on the Baltic.

II. Preparation of extra-fine herring for home consumption.

III. Preparation of spiced herring, ("Kryddsill.")

In the sea which surrounds the Scandinavian peninsula, several kinds of herring are found differing in size and fatness. These are caught on certain parts of the coast, and afterward brought into the market under different names and prepared in various ways. Throughout the whole of Sweden, there are found in the market Norwegian herring, Graben berring, Ludd berring, fat herring, Goteborg or Bohuslän berring, Kulla herring, anchovies, small-herring, spiced herring, &c. All these articles of trade are prepared from two kinds of fish, viz, the herring properly so-called, (Clupca harengus, L.,) which in the Baltic is named "strömming," and the sprat or small-herring, (Clupea sprattus, L.) The former, both in its natural state and as an article of trade, is found in much larger quantities than the latter, which is caught only in comparatively small quantities, and prepared mostly as anchovies. As the strömming is nothing but a variety of the common herring, as will be shown in the course of this article, the term "herring," or "common herring," is used both for the herring of the Western Sea, (Atlantic and Kattegat,) and the herring of the Baltic, i. e., the strömming. The sprat is at first sight distinguished from the herring by having a smaller head and the lower fins placed more toward the front of the body. Its belly is, moreover, sharper and furnished with serrated scales, which are not found in the common herring.

The common herring, which on certain parts of the coast is eaten so extensively, has its proper home in the North Sea and the Atlantic, but is also found in the seas connected with them—the Kattegat and the Like other animals and fish, the common herring has undergone, in course of time, in the different parts of the sea and bays where it lives, various changes as to size, fatness, &c., and which are

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chiefly to be accounted for by the difference of food in the Atlantic, the Kattegat, and the Baltic, differing even in different parts of the Atlantic and the Baltic. We find, therefore, that every part of the sea, and even different bays, have, so to speak, their own peculiar kind of herring, which certainly do not belong to a different family, but which, nevertheless, can easily be distinguished as belonging to a different kind, by certain peculiarities due to the locality. Thus, there is found, e.g., at certain seasons of the year, in some bays of the Baltic, a larger kind of herring, which can easily be distinguished from that which lives and spawns on the outer portion of the coast; and the herring found on the coast of Bohuslan, (the west coast of Sweden,) and in the bay of Christiania, differ greatly in size from those of the west coast of Nor-While this circumstance has, to a certain extent, given way, &c., &c. rise to the different ways of preparing and naming the herring as an article of trade, it affords the means of forming conclusions as to the herring's manner of living, and also as to the improvement of the herring fisheries in the future. Many a fisherman, even in our days, believes what formerly, before science shed light upon the subject, was a common opinion, that the herring only accidentally came from remote portions of the sea to the coast where it is found, and therefore thinks he acts wisely in making use of this accident for catching as many as possible; or, in other words, to fish with implements however destructive to the fish. Since experience, however, has shown that one can never catch Norwegian herring on the Bohuslän coast, Kulla or malmö herring on the Bleking coast, (the south coast of Sweden,) and Gottlam herring near Ostgöta, &c., &c.; and since the discovery has been made of the time and place where the herring spawns, and the mode and place of living of the tender young, it will become evident that the herring, like the salmon and other kinds of fish and animals, has certain distinct limits to its migrations and certain definite places which it frequents in larger numbers, for the purpose of spawning. In order to perpetuate good herring fisheries on the coasts with some reasonable hope of suc cess, fishing must be conducted in such a manner that only a portion of the tribe which has its spawning-place in a certain bay be eaught, and that the young deposited on the coast or at the bottom of the sea be spared.

In several places on the Baltic and the Atlantic, people have suffered severely for their recklessness in conducting the herring-fishery, and especially with regard to the preservation of the young. Thus, observations made during several years have shown that the dying out of the fish has in no small degree contributed to the almost total decline of the great herring fisheries in Bohuslän, which, I am sorry to say, have not yet been revived, chiefly because, as soon as some younger herring appear, they are caught with narrow-meshed nets. For many years the herring were accustomed to approach Bredsund, in Norway, but ceased to appear as soon as people began to use nets. To take a nearer exam-

ble: not long ago the herring went into Braviken (a bay on the eastern coast of Sweden) as far as the mouth of the Motala River, and nets were placed near Lössingsskär and Botilshäst, where considerable quantities of fish were often caught. The fishermen in the village of Quillinge then used the same large nets which are still employed by the inhabitants of Quarse, (both villages on the east coast of Sweden.) But by a reckless use of the net during spawning-time, the whole tribe of herring has been caught; the herring has ceased to appear there, and the fishermen draw but empty nets. In many other inlets on the Baltic the herring has entirely disappeared since excessive net-fishing has been introduced.

With this trustworthy experience as a guide, it will be evident to every one how important it is, if the very existence of the fisheries is not to be destroyed, to follow certain rules based on the nature and habits of the fish.

To enable the fisherman himself to decide, in cases of necessity, what ought to be done for the improvement of the herring-fisheries, (beside those regulations which possibly may be fixed by law,) some further information must be given regarding the herring's nature and mode of living.

The herring is a gregarious fish, mostly found in large schools, especially at the time when he approaches the coast, which he does regularly at certain seasons of the year, partly for the purpose of spawning and partly to seek food, or to "bathe" in calmer waters before and after spawning.

During winter the herring is found in the deep sea outside the coast, where he has spawning places; but even during this period he visits the deeper gulfs, and thus keeps moving as during summer. This is proved by the fact that it can be caught in the Baltic during winter with nets laid under the ice at a depth varying between 5 and 24 fathoms, and even with seines laid in the fjords and bays at different depths. During its migrations to and from the coasts, as well as during its stay in the depths of the open sea, the herring keeps alternately near the surface of the water and at the bottom. These changes, it is thought, are occasioned by the temperature of the water, by the different currents, and by other like circumstances. Our experience in this respect is as yet too limited to deduce safe conclusions as to the depth at which the herring may be found at the different seasons of the year. The best plan for the fishermen, therefore, is to ascertain this by experimenting with nets at various depths.

The spawning-time of the herring occurs at different seasons in the sea where this kind of fish is found. Even the different species of herring, living in the same sea, have different spawning-times; and of the same species some spawn earlier and some later in the season; this latter circumstance being probably occasioned by difference of age, by the slower or quicker development of some fish, &c.

In the Baltic, the herring spawns partly in the spring and partly in the summer, and is therefore called spring-herring and summer-herring. In the southern portion of the Baltic, the herring continues to spawn till about the middle of October, while in the northern portion the spawning season closes in August. The spawning occurs partly outside the coast on elevations of from three to fifteen fathoms from the bottom of the sea, and partly in the fjords (gulfs) nearer to the main land, particularly in places where the bottom of the sea is thickly covered with sea-weeds. The spawning process goes on very rapidly, as the school only keeps to gether at the bottom probably from five to six hours. The spawn is dropped on sea-weeds, stones, sand, and similar objects, where it remains. The development of the spawn takes a longer or shorter time, according to the temperature of the water.

In May, when the water is cool, it takes from fourteen to eighteen days for the spawn to develop, while in July and August, when the water in the spawning places usually has a temperature of from 140 to 150, Réaumur, it requires only from six to eight days. The young hering, which is smaller and more transparent than the young of most other fish, (and on this account difficult to distinguish,) is a little more than one-quarter of an inch long, and has, till about eight days after the development, a residue of the yolk remaining obliquely across the belly, which, at first, greatly impedes its movements. Only when the young herring has lost this so-called "belly-bladder," does it begin to swim around, to collect in schools, and seek food. It is difficult to determine the growth and size of the young herring until it reaches a certain age, especially as all the young ones have not the same ability to gather food, on which circumstance the development of course depends.

Attempts have been made to raise young herring by having them inclosed in small basins, but they have never lived longer than about five weeks, at which time their length was about one-half of a decimal inch. During the whole first year of its existence, the young herring is found in its spawning place both outside the coast and inside the fjords. Young herring about one common inch in length may be supposed to be about two months old. At the age of three months, their length is about an inch and a half. All the fins are fully developed, and the whole shape of the body resembles that of the mature herring, so that it can easily be recognized as the young of this fish, which before that time is somewhat difficult. From comparisons made with the young herring found in the spawning-places, it is safe to assume that those of about 3 inches in length found in the spawning places in spring are of the preceding year's spawning, and, therefore, about one year old. Young herring from 5 to 6 inches in length, which are often caught in nets, are probably only two years old. In fish of this size the roe and the milk begin to be tolerably developed, and when the fish has reached the length of 8 inches and the age of about three years, it is capable of spawning.

The food of the young, as well as the grown herring, consists chiefly

of small crustaceous animals, invisible to the naked eye, which are found in enormous quantities in the sea, both in shallow and deep waters. In passing sea-water through a straining-cloth, great numbers of these small animals will be found. Their quantity, however, varies at different seasons, during a change of temperature, and at different depths. This might possibly explain, to some extent, the appearance of herring at different depths. In summer these crustaceous animals are found nearer the surface of the water, and at this season the herring is also found to swim comparatively higher. Like other fish, the herring abstains from food some time before and after spawning, and its stomach is therefore generally found to be empty at this time. But after spawning it begins to eat again, and gradually regains the strength and fatness which it seems to lose during that process. This explains the fact that at some seasons of the year the herring is leaner than at others.

About two months before spawning, the herring may generally be considered the fattest and best. This fatness continues until spawning is over, when the fish becomes lean and thin, and not fit to be caught. The herring, after spawning, usually migrates to the deep sea to seek food, and does not return till it has again gained in flesh and strength. That the herring, like other kinds of fish, as soon as the spawning-time approaches, again seeks the spot where it was born, is proved by the circumstance, mentioned above, that certain easily recognizable tribes or kinds of herring spawn every year at a certain time and at the same That during one year it appears in larger numbers in one place than during another, has doubtless its cause in the change of temperature, currents of the sea, and similar influences, which may even occasion the entire absence of the herring from certain bays in some years. Cold and inclement weather, during spawning-time, often destroys almost the whole breed of one year, so that, naturally, for some years to come, the kind of herring, in places where this has happened, will be very Poor. These, and other causes on which the development of herring is dependent, are, however, as yet so little understood that nothing definite can be said about them. But, on the other hand, it is well known that man himself can destroy the herring in a bay of the sea by catching the whole tribe, both old and young, in large nets, thereby also destroying the spawning places.

It has already been stated that certain kinds of herring, particularly the larger ones, spawn nearer the land, on a bottom overgrown with sea-weeds. If this bottom is made unfit for spawning, by taking up or destroying the sea-weeds, either by nets or in any other way, the herring is, of course, obliged to seek other and more suitable places, and, consequently, deserts those inlets where formerly it came regularly.

By experience gained in Bohuslän and other places it is proved that the herring is extremely sensitive in this respect, and deserts old spawning places entirely if their character is changed.

Every one, therefore, who desires to keep his herring-fishery in good

condition, ought to be very careful not to change the nature of the spawning-places by disturbing the vegetation, or by-casting refuse and other matter into the water.

From what has been said concerning the herring's nature and mode of living, it will be evident that, in order not to risk its annihilation, destroy the young, and disturb the spawning places, it is best not to catch the fish with nets during the spawning season, but to use the net only during those portions of antumn and winter when the herring seeks the deep water in the inlets; while one can catch herring in seines without danger at every season of the year. This mode of fishing is, in the long run, the most advantageous in every respect.

If the herring fishery, however, is really to become remunerative, it is necessary not only to find a good market for the fish, but also to prepare the fish in the proper manner.

As it is frequently impossible for fishermen to sell the fish immediately on being caught, it is of the utmost importance for him to have a knowledge of the best method of preparing it for the trade, particularly in our time, when the vast improvements in the means of communication permit the acquisition of the necessaries of life from the most remote localities, so that every one is obliged to strive, by a constantly improved preparation of his products, to procure and maintain an advantageous market for them.

In consequence of more rapid communication, the herring of the Baltic can be sold with profit not only at home, but also in those distant regions to which, in former times, exportation was impossible. The preparation of the herring must, of course, vary according to the place where it finds its market, as there is a demand for different kinds of herring in different localities. The various methods in which the herring is prepared, so as to secure the best market, are at present the following:

- 1. The common salt Baltic herring, to supply the demand at home, and in the German ports on the Baltic.
- 2. The so-called "delikatess" or extra-fine herring prepared in the Norwegian and Dutch manner for home consumption.
 - 3. The so-called spiced herring, for home and foreign consumption.

The choice of any one of these three methods is determined partly by the fatness and condition of the fish, partly by the ease or difficulty with which buyers are found for one or the other kind, and partly by other considerations. The fat herring, which is sometimes eaught in summer or autumn on certain coasts, is, of course, best suited for the finer kinds of trade herring, i. e., the extra fine herring or the spiced herring, while the common herring is best suited for the common salt herring, observing, however, in its preparation those rules which are indispensable for obtaining a good article.

In the preparation of every kind of fish, the most important rule to be observed is, to bring the fish, as soon as possible after eaught, in contact with the salt; and special care must be taken that the fish, be-

fore it is salted, is not too much exposed to the heat of the sun, for this spoils it. In summer, therefore, every boat ought to be furnished with sufficient tarpaulin to cover the fish while returning home. also very useful to have in the boat a large tub or vessel with crushed ice, in which the fish should be placed immediately after it is eaught, as this keeps it quite fresh until salt can be applied. Those fish which have been brought to market fresh, and exposed for some time to the sun, cannot be used for salt fish, since, as a general rule, the fish are more or less injured while being transported to the market. Another important rule in preparing any kind of fish is to preserve the greatest possible cleanliness. Care should be taken not to let fish-refuse or other objectionable matter lie around in the salting houses, or in the tubs or ressels used for salting. Old brine, which is full of slime, blood, or other little particles, must never be used for salting, as a foul, disagreeable taste is apt to be thus imparted to the fish. Another very important consideration in the preparation of fish is the quality of the salt used, for it is not only necessary to have a loose, strong, and hard salt, which is best suited for preserving different kinds of herring, but a prime article must be used. Salt that has suffered from sea-water, or that contains impurities, ought never to be used.

I.—PREPARATION OF COMMON BALTIC HERRING FOR CONSUMPTION IN SWEDEN AND IN THE GERMAN PORTS ON THE BALTIC.

In the salting of herring, as at present carried on by the fishermen on most parts of the coast, two mistakes are frequently made: first, salting the fish too much; and secondly, pressing it too hard. It is very important to prepare the fish in such a manner as to keep for a long time without spoiling. It is likewise important for the merchants to secure well-packed barrels. But both these advantages may be gained without producing a fish entirely saturated with strong salt, or made thin by pressing as to lose all its natural fat and only taste of salt. In many places the fish are pressed so hard into the barrels that they form a thick mass, from which the brine soon flows off, leaving the fish dry and rancid, and by no means pleasant to the taste. Even if the fish are to be sold in one place, a precisely similar mode of preparing them is by no means to be recommended. And although no one can prescribe rules for preparing fish or producing an article which will satisfy many different tastes, especially as one buyer cares little for the flavor or fatness of the herring, but only for its weight, while with another the case is just the reverse, most buyers nowadays endeavor to Secure a well-flavored article, which is also carefully packed. The mode of preparation given below has been tried for a number of years in the best salting establishments in Gottland and on the southern coast of Sweden, and fish preserved in this manner will never fail to find a ready market.

In the preparation of the common herring, St. Yves, (Setubal,) Lis-

bon, and other strong kinds of salt ought to be used, but Cagliari salt, and other looser kinds of English and French salts may also be employed, especially if the fish is intended for immediate consumption. The salt must be somewhat crushed so that the larger crystals may melt in the brine, and the salt thus come into contact with the meat of the fish as much as possible.

As salt herring are mostly exported to distant places, and during their transportation in ships are exposed to injury from contact with heavy freight piled upon them; and as, even on railroads and wagons, they run the risk of being somewhat roughly handled, they ought to be transported only in tight and strong barrels, firmly hooped, so that there may be no danger of the brine escaping. It may be well to mention here, that a leaky barrel of herring is not worth one-fourth the price of a sound barrel. As soon as the herring are taken from the net, they ought to be thrown into vessels filled with pure and clear brine. In no case ought so many herring to be put into a vessel as to cause the upper layers to press too heavily on the lower ones. If the number of fish caught is very great, a larger number of vessels ought rather to be employed After the herring has thus been brought into immediate contact with the salt, it is, after a while, taken out to be cleaned, in which process care must be taken to remove the eutrails and gills, but not the roe and Every fisherman knows how to do this. After the herring has been cleaned, it is again placed in another vessel filled with pure brine. When all the fish have been cleaned, or while the process is going out the cleaned herring are taken out of the brine and washed in fresh and pure sea-water, and then placed in small baskets with wood-shavings at the bottom, so that the water may drain off. The fish are then sprinkled with salt in the following manner: They are placed loose in a barrel, together with crushed salt, the proportion being 3 gallons (kappa) per barrel, (tunna,) of about 4 bushels. In every layer the fish and the salt are stirred so as to mix properly. After twenty-four hours, the fish are again taken out of the salt and placed in baskets, so that the brine may run off. This process is finished in about an hour, and the fish are then properly packed and salted in other barrels, arranged in layers, with the back downward, and crushed salt placed between every layer, reck oning about 5 gallons to every tunna, (see above.) When the barrel is full it is exposed to a slight pressure, so slight that the fish is kept under the brine, but not so heavy as to cause the fat and juice to exude from the fish into the brine, since this would injure their flavor-

The barrels are left standing open in this state for some time, (about two or three days,) and as the mass of the fish sinks down, new layers are placed on the top. When, after some days, the sinking of the fish may be considered finished, the barrels are filled up and closed. Every fourteenth day, at least, these barrels ought to be gently rolled about and turned up and down, so that the brine may penetrate the whole

mass. Before the fish are to be shipped, the barrels must be examined again, and if any further sinking is noticed, the barrels are filled up with fish for the last time.

The brine, which during the filling of the barrels, flows over, as well as that which is obtained during every salting, may be put into those vessels in which the fish are placed immediately after being caught, and where they are kept during the cleaning process. It is, however, important that such old brine be exchanged for new after it has been once used and has become filled with impurities.

To salt fish, as is done in the province of Ostergötland, with 9 gallons of salt per tunna, is not advisable, because then the fish is pressed too bard and salted too thoroughly. After it has been sprinkled with salt all that is required is 25 gallons per tunna, and for this purpose the fish ought to be placed immediately in the barrels and not be pressed more than is absolutely necessary for the proper filling of them. In the province of Norrland it is customary to let the herring lie uncleaned in the brine for twenty-four hours; and, moreover, to use brine which has been often used for the same purpose. That this mode is objectionable, and that the herring ought to be cleaned as soon as possible, will be evident from what has been said above.

In Carlskrona, south coast of Sweden, it is customary to use only 1 gallon of salt per tunna for sprinkling the fish, and then to salt them with 7 gallons per tunna. This method cannot be recommended, as the fresh fish, if they have absorbed enough of the brine, do not require as large a quantity of salt as 7 gallons per tunna.

The Baltic herring, prepared in the manner explained above, find a ready market, not only at home, but also in foreign ports on the Baltic. The Price paid for herring differs of course in different years, being partly regulated by the quality of the fish and partly by the price of Norwegian and other foreign herring. In some years, when the herringfishery both in Norway and Sweden has been good, the fishermen can scarcely dispose of their fish at home at such a price as to fully remunerate them. It is, therefore, advantageous to seek a foreign market, and prepare the fish accordingly. German ports on the Baltic, especially Stettin, Stralsund, and some others, afford, at certain seasons, a very good market for the common salted herring. The most profitable season for selling herring in these places is from midsummer to the beginning of September. The fish intended for exportation to Germany are pre pared in the above-mentioned manner, but ought to be very carefully Dacked in good sound barrels, not in barrels ("tunna") of the same size as in Sweden, but somewhat smaller, such as are used in Bornholm and on the German coast. In Stettin, such barrels, if the fish are sound and well packed, bring from 13 to 21 riksdalers, (1 riksdaler, silver= about \$1 currency,) which is a very good price, considering the fact that these barrels are much smaller than the Swedish ones.

II.—PREPARATION OF EXTRA-FINE HERRING FOR HOME CONSUMPTION.

It is well-known that Sweden annually imports a considerable quantity of Dutch and Norwegian herring, which are partly sold in barrels, ("tunna,") but mostly in smaller vessels ("fjerdingar,"*) for household use among the better classes. Experiments have proved that the large and fat Baltic herring, which are caught in several places on the Swedish coast, can very easily be prepared in the same manner as in Holland and Norway. In this way an article is produced which, although perhaps not in every respect equal to the foreign herring, nevertheless resembles it very closely, and therefore finds a ready market at a profitable price at home, and this all the more since the Swedish extra-fine herring can be furnished at much less expense than the foreign.

The term "extra-fine herring" ("delikatess—sill") implies that it is not an article for every-day use. It ought, therefore, to be put up in smaller kegs than the common herring, such as the "fjerdingar," (see above.) As a matter of course the extra-fine herring must not be salted nearly as much as the common salt-herring, because the fine flavor which ought to distinguish it would thus be lost. As a consequence it cannot be kept as long as the common herring. In preparing the extra-fine herring, looser kinds of salt ought to be used, those that are milder finer, and more easily dissolved, such as Liverpool salt, Lüneburg salt, Cagliari salt, &c.; the best on the whole being Lüneburg salt.

Preparation of extra-fine herring after the Norwegian manner.—The fresh-caught herring are placed, during the cleaning-process, in pure brine. Some, in cleaning the fish, take out only the entrails; but it is, in all cases, best to take out both the entrails and the gills. As soon as they are cleaned they are placed in layers in kegs, the back downward. Between every layer salt is put, reckoning about six gallons to one "tunna;" salt also being placed on the top of the uppermost layer. the layers gradually sink in the keg, others are put in. After about six days, an opening is made with a stick between the mass of herring and the side of the keg, into which salt is poured, and the keg then closed Before shipping them, the kegs are all examined again and filled up, if necessary, in the same manner as mentioned in the preparation of the common salt-herring. If sufficient brine has not formed, a small hole is bored in the side of the keg, pure brine is poured in, and the hole closed. It is well, too, frequently to roll and turn the kegs. Herring prepared in this manner have kept quite good and fresh for six months.

Preparation of the Bultic herring after the Dutch manner.—Fresh and fat Baltic herring are put, immediately on being taken out of the water, into a keg in small quantities, and frequently stirred for at least an hour with fine-crushed Lüneburg salt. Then the fish can be cleaned as described above, or without being cleaned, placed in kegs in layers, with fine-crushed Lüneburg salt between every layer; reckoning about from

1 to 1½ gallons of salt to every "fjerding." When a keg is full it is closed, but also examined and filled up again, as before mentioned. The uncleaned herring, which are called in foreign countries "round-salted herring," do not keep near as long as the cleaned herring; for, of the latter kind, I have seen some prepared at the Herta Salting Establishment, on the island of Gottland, preserved fresh and good for over a year. Baltic herring prepared after the Norwegian or Dutch manner find a very ready and profitable market in Stockholm and other Swedish cities.

III.—PREPARATION OF SPICED HERRING, ("KRYDDSILL").

The so-called spiced herring is an article found here and there in the market, kept like anchovies in small kegs or glass jars. It may be prepared from any kind of herring, and it is much sought after in some places in Sweden, but especially in North Germany. Its preparation, however, cannot, as yet, be said to form any important branch of trade, and must be considered rather as an experiment by housewives for the purpose of introducing a little variety into their meals, especially for the lunch-table. As there seems to be some demand for this article, particularly for the foreign market, the most approved method of preparing it is given below.

The fresh-caught herring are immediately put into vinegar, with one-fourth water, and some salt. After remaining in this mixture for twenty-four hours, the herring are taken out and the vinegar drained off. The fish are then placed in a keg with a mixture of the following spices, reckoning these quantities for every (fourscore) 80 herrings:* I "skål-pund" fine dry salt, "1 skålpund" pulverized sugar, 1 "lod" pepper, 1 "lod" bay-leaves, 1 "lod" saltpeter, ½ "lod" sandal, ½ "lod" ginger, ½ "lod" Spanish hops, ‡ "lod" cloves.

Others use the following mixture: 1 "skälpund" salt, ½ "skälpund" sugar, 2 "lod" pepper, 2 "lod" allspice, 1 "lod" cloves, 1 "lod" Spanish hops,

The herring must be left in this mixture for two months before it is fit for use. Some put the herring immediately into vinegar, without water and salt, from which it is taken, after twelve hours, and treated as above described.

If the spiced herring, after some time, should not have sufficient brine, good brine of Lüneburg salt is poured over it, by means of which it will keep for years.

^{*} Swedish weights mentioned.—1 "skålpund" of 32 "lod," = nearly 1 pound avoirdupois; 1 "lod" of 4 "quintin," = nearly 1 ounce avoirdupois.

