

VI.—REPORT ON THE AMERICAN FISHERIES*.

BY FREDRIK M. WALLEM

NOTE BY TRANSLATOR.—*The prices of fish given in section VI are in large part incorrect.*

INTRODUCTORY REMARKS.

In the United States of North America the traffic in fresh fish is of the greatest importance, whereas in salted and dried fish it is of comparatively secondary importance; and the development in all fish-traffic in the Union augurs that this condition will strengthen and advance till fresh fish to a greater extent than now will become the chief product of the fisheries and will employ the greatest capital. The American fish-dealers enlarge their field of operations with remarkable energy and ability. They extend their fishing-grounds along the east coast both south and north, so that in a twinkling they pass from the Gulf of Mexico to a considerable distance up on the Greenland coast, traversing a coast-stretch of 600 to 700 geographical miles. At the same time they extend their field eastward by going farther to sea and employing steamers for fishing-vessels; while the catch inland in the great lakes and streams takes a decided advance, which result is based upon systematic protection and artificial propagation. Halibut, for instance, they fish for off the Greenland coast (since the year 1870), and sell in the fresh state some hundreds of miles inland after having been sent in ice by rail from the landing-place; nay more, the American fishermen have attempted to bring halibut from the Iceland coast.† It will soon be attempted to send salmon caught in California to markets in Europe in a fresh state, just as American oysters in the shell have been, for some time already, to a few in England. The Americans will soon catch fish a thousand miles from home, if they continue to be eaten fresh as latterly; they will buy fish on one side of the globe and sell them on the

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†The first attempt at halibut-fishing off Iceland was made in 1873, but failed, it is said, on the ground of a bad choice of season; it was the experimenter's purpose to repeat the attempt.

other after skillfully cooling and preserving them with ice. The art of preserving fish fresh for a long time and transporting them over great distances is an object of much study, and has called forth many experiments, while salting is little heeded.* And so this national pursuit may advance to this result, that the traffic in fresh fish will become more and more important. The numerous fishery-inspectors in the United States have, besides other duties, to give the coast-extent, lakes and other waters, detailed and continuous advice about food-fishes, to protect them and promote their increase where they already are found, and at the same time to provide barren or depleted waters with a new stock of the kinds of fish which are best adapted to furnish suitable and healthy food for the people. To assist the fishermen and promote extension, the natural as well as the artificial, has become a business which employs many scientifically-cultivated men and many industrious and skillful publicfunctionaries besides. And the fruit of this whole united effort is available with that practical and quick grasp which is peculiar to the people. With regard to good implements, boats and ships, the American fishermen appear to be equally apt to profit by what they have and to invent improvements and new things to the utmost limit. The fishermen consist as a rule of clever people, of whom not a few are from nations of Europe most actively engaged in fishing, so that it is probable that the most of the improvements from Europe are known to them.

The fisheries take a place nearest in the class with the Norwegian so-called "great fisheries"—cod and herring—which is an acknowledgment of the second rank for the United States. In the cod-fisheries on the banks—George's and Newfoundland—the Americans certainly participate with a great number of vessels, but other nations fish here perhaps with a greater number, and compete with them in the world's market. Herring-fishing about Labrador, New Brunswick, and Newfoundland and thereabouts, is not an important business, though partly a comparatively new industry; some of the American vessels fish for herring when they cannot on account of the season prosecute any other fishing, but some buy fresh or frozen herring from the shore fishermen, either to use them, or to sell them fresh in the large coast towns. Of the good (fat) herring the major part are consumed in the United States themselves; the inferior, thin ones they export, in the latter part of the year, to Europe. The oyster and lobster fisheries on the United States coast are, compared with the European, of great importance, and supply not only suitable and very agreeable food for all classes in the Union, but also a tolerably important article of export for the world's market, especially canned.

With this short survey finished, I shall now give an account of the results of my journey.

*In the years 1861-73 were issued twenty-five patents for preparing and preserving fish and bait; only one for salted fish.

I.

THE FRESH-FISH TRADE.

The exhibits of the different countries represented had greater or smaller divisions for their fishery-industry. In the matter of implements there was something, but in the line of products there was much to see. The American division was richest in the first-named respect, while their products were not present in great variety in the exhibition itself, but in the fish-markets. As the products in many respects give the American fisheries a peculiar character and well merit the serious attention of other nations, I set myself as a special task to examine this matter. I adopt therefore as a suitable introduction for my report the fresh-fish traffic.

By the distinguished favor of the Norwegian juror, Consul Joakim Anderssen, I was introduced to some of the more prominent business men in this branch, and in company with him I went through Fulton Market, New York, where an important trade in fresh fish is carried on, and in whose market-building they have their local association, assembly-room, library, &c. Later we continued our examination in Gloucester and Boston until the consul's return home in August, after which I alone went to sea in a fishing-vessel and followed mackerel-catching for two weeks, to become acquainted with its practical working.

I shall not now undertake to mention the fish-merchants' association, its organization, with prices-current, &c., but immediately proceed to the business itself in Fulton Market, in New York City.

Fresh fish are sold here from stands, not boats or ships, and are said to be used at all seasons of the year with ice, to keep them fresh as long as possible. I visited the place the first time in August, in very warm weather; the last time I was there was in February. Then the streets were covered with some feet of snow and ice. Both times the fish were partly hard frozen, partly packed in ice. No fish were sold living; the only approach to living "fish" were the large turtles, which are brought in by steamers from the West Indian and Florida coasts. The retailers were not "fish-wives," but young men, merchants' clerks.

The number of kinds of fish offered for sale was great, and the prices at different times of the year varied greatly, without, however, fluctuating much from one day to another.

Here merchants of moderately large capital carry on the traffic, part of whom have their own fishing-vessels, giving the business a character something like the Norwegian trade in salted and dried fish and herring; I mean that it is free from the mean and dirty market traffic which one as a rule associates with the sale of fresh fish. The retailers in Fulton Market have, in part, marble counters, neatly-arranged stands, a private office where the owner of the stand may note his sales. The large merchants exercise supervision, and the young attendants, dressed in long

aprons, handle the fish and deliver them at fixed prices. The fish-merchant to whom we were introduced, Mr. Eugene G. Blackford, was not only a capable business man but also a highly accomplished gentleman. He was able to give us not only information on all things concerning the fish-traffic, but also scientifically-founded communications on the natural history of fishes. As president of that great society, the American Fish Culturists' Association, he was identified with all the prominent scientific men in that branch, and with the large staff of fishery commissioners in all parts of the United States. We could not have been introduced to any one who was better fitted to be our cicerone and our living lexicon. A great portion of the information which I acquired on the fresh-fish trade I owe to his favor and intelligence.

II.

KINDS AND PRICES* OF FISH.

As I remarked before, the kinds of fishes in the market are numerous, and the prices, naturally, different in different seasons. I shall name such fishes as are generally used for domestic purposes, and the prices of some.

Haddock (similar to our hyse) is one of the commonest and best fish. It is taken on the coast as well as on the Great Banks. They are sold fresh in small quantities from 6 to 8 öre* per pound; they are employed also as stock-fish.

Pogies or menhaden (*Alosa menhaden* of the herring family) are likewise a good small fish; they are taken in great masses with steamers and purse-seines along the coast and some distance out to sea. A great portion is made into oil and guano, the manufacturing of which is done in large factories on the coast. By the barrel, which average 300 to 500 each, they are sold from 44 cents to 88 cents. In the fish-market they are sold fresh, and retail for 6 to 8 and 10 öre per pound.

Thin herring are found in the fish-markets, especially in winter, and then frozen and fresh. These come from the Newfoundland and New Brunswick coasts, where they are either caught or purchased for \$1.09 per barrel. They sell them fresh at retail for 6 to 8 and 10 öre per pound. They are also salted, and then principally whole. Another fat kind of herring, most like the Norwegian great herring, which is found in the fall on the coasts named, and off Labrador, they generally work up into a very choice salted article for the West; lastly they salt the thin herrings for export to Europe.

Some more esteemed and higher-priced kinds of fish are: butterfish (*Poronotus triacanthus*), catfish (species of *Amiurus*), flounders, sheeps-head (*Archosargus probatocephalus*, a sea-carp), sturgeon, swordfish, rock-fish (*Roccus lineatus*, a sort of sea-perch). Cod I did not see; they are

* FOOT-NOTE.—The öre equals $\frac{2}{100}$ or about $\frac{1}{50}$ of a cent.—TRANSLATOR.

found now and then at fair prices. The common mackerel are sold in season for 40 to 50 öre apiece. Here mackerel is the object of an important fishery which lasts from spring till fall on the coast and at sea, the prices varying greatly. A large portion are salted and sold in barrels at prices from \$4.91 to \$15.29, or even \$20.47, for the largest and finest.

Halibut vary greatly in price according to the scarcity or abundance of fish; they send them also by rail many hundred miles inland, whole, partly filled and partly surrounded with ice, in boxes of from 350 to 400 pounds. The prices in the fish-markets fluctuate greatly according to the magnitude of the catch, and when they prosecute the fishery far out at sea on the banks and even along the coast of Greenland no one can constantly have a correct opinion as to where the fishing will be the August, 1876, in New York was 40 öre per pound wholesale, 60 to 75 öre per pound retail, and were noted later in a fishing-port near Boston 50 per cent. cheaper; moreover, the price may vary from 9 öre to 60 öre per pound in large lots.

Halibut are to some extent salted (especially the heads); some parts also are smoked (especially the backs and the bellies). The cheeks are considered a delicacy. From the heads, also, oil is expressed. Salted halibut heads are sold for \$4.91 to \$6.28 per barrel. With regard to the assorting of halibut I shall only remark, that white-naped halibut bring as high as 100 per cent. more than the black-naped.

Salmon fluctuate also greatly in the city markets—from 45 öre to 50 öre—but decline in the height of the season to 23 öre per pound—in July for instance; they may as early as August advance to 90 öre, and in November, in the hard-frozen state, they may bring 33 cents per pound. Speculation in frozen salmon is considerable, for the accumulation in the winter months is often great, and as a consequence of over-speculation the holders may be obliged in January and February to sell their stock at a rather low price, to prepare for the arrival of the fresh fish in the market. Smoked salmon is not uncommon; the price varies from 50 to 90 öre per pound.

The dearest and most esteemed fish are a fresh-water species and the pompano (*Trachynotus carolinus*, a member of the mackerel-family); this delicacy is taken in the South, the champion of the sub-tropical waters, and commands as high as \$1 per pound. Another much hunted fish is the Spanish mackerel (*Cybium maculatum*); we tested it in a restaurant in Fulton Market and found it fat, delicate, and savory.

The commonest fish in general use is the shad (*Alosa sapidissima*, of the herring-family), which often tastes a little mawkish, but in other respects is a fine, though bony fish. Whether the Americans, among other things, have a decided taste for fish will be seen from what follows.

III.

A CULINARY FISH-DINNER WITH INTERNATIONAL DISHES.

Some time after the jury of the exhibition had given its award upon the fish-products from every quarter of the globe, the well-known society, the American Fish Culturists' Association, gave a fish-dinner, at which the choicest international delicacies and rarities of fish-preparations were served at a meeting of connoisseurs. This was in reality a higher jury, which was here to pronounce judgment upon the fish-food of all nations. The whole selection was made by the associations' most capable fish-experts, and as special caterer was engaged "that culinary artist," Mr. M. Sudreau, which was the highest official guarantee upon the bill of fare.

It is naturally not my purpose to give anything in reference to the feast; I shall concern myself only with the official portion of the affair—the bill of fare. This gives through its contents a clear statement of what this "higher jury" considered specially worthy to be served. And in this statement lies an award which shows more clearly than the jury itself what belongs to the choicer fish-preparations, as the fish-products of every country securing premiums were brought into a single collection. To the whole was given a humorous coloring, as an example of which, to a portion of the current American fish-preparations was given a special name after this or that scientific man or matador or functionary in fishery branches; not, however, preventing the attentive specialist from studying the serious side of the affair. No Norwegian fish-dealer can read that bill of fare without observing what a part the Norwegian fish-products were assigned at this fish-dinner. And if he intend to speculate in the American market with fine products, the bill of fare will doubtless give him many useful hints. I shall therefore give an epitome of it.

The repast was begun with genuine turtle-soup or green turtle *à la* Blackford. This is not a costly article in America (a plate costs, as a rule, in the restaurants, 80 öre; while in England one must pay 82 cents to \$1.09). After soup, was served lobster salad, "Seth Green's style." Among the extra selected warm entrées were crayfish salad, roast oysters, and roast crawfish (*Cambarus*). After these, in small part savory preliminaries, came the pith of the affair—the international dishes in selection.

Of American fish-products were served: Striped bass (*Roccus lineatus*, a perch); pompano (*Trachynotus carolinus*, belonging to the mackerel-family—a costly delicacy, which brings as high as a dollar a pound in the fish-market); bowls of terrapin (*Malacoclemmys palustris*); deviled crabs (whole small crabs, which are eaten shell and all; in shedding, the fact is that the shell is quite soft); turbot, flet of sole, and frog or toad salad.

Baked American fish-dishes were represented by sheephead (*Archo-*

sargus probatocephalus, belonging to the sea-carps), and bluefish (*Pomatomus saltatrix*). And these were served cold: Eels in jelly, crayfish, salmon, lobster salad, caviar from California, and oolachans from Alaska.

Norway was represented by: Mackerel in oil, halibut, stewed fish, baked mackerel, and preserved mackerel, together with salmon.

Sweden's representation was: Anchovies and mackerel.

From Portugal were served: Sea-eel, sardines in oil, ling in oil, cuttlefish in oil, soles in oil, mackerel in oil, and swordfish.

From Spain: Sea-eel with tomato sauce, *mixillon*, sardines in oil, sardines in vinegar, and baked bass (a perch).

From Italy: Sardines.

From Holland: Salmon.

From France: Sardines, tunny, and anchovies.

From Russia: Caviar and *poisson au blanc*.

From Turkey: Botargo (roe of *Mugil* sp.) in the form of caviar.

From China: Fins of a kind of shark, white-shark fins, dried *Octopus* egg, and dried fish-stomachs.

From Japan: Shark and dried salmon.

From Africa: Crayfish from the Cape of Good Hope.

For dessert were served, among other things, pudding *à la Neptune* and Neapolitan ice-cream. And for "decoration pieces" were given, besides other things, *Bateau de Pêcheur à la Roosevelt*, and *Kan-Ten*, a Japanese seaweed, *à la Sekezawa Akekio*.

There was also a rich selection, especially of mackerel, eels, and sardines, both from different countries and in different modes of preparation. These food-fishes were served fried, in oil or in vinegar. Salmon also was well represented, and, so far as concerned a single dish, certainly in a rather new form, namely, as dry-fish from Japan. Shark-fins and cuttlefish in oil seemed more curiosities than the actual fish-dishes of foreign countries. The edible seaweed from Japan excited much attention on account of its quality as a refreshing food; not the least because it also represented an important industry in Japan—a kind of tillage of the ocean bottom. Of the modes of preparation, that "in oil" was especially conspicuous, and it has thereby gained a special recommendation.

To the Norwegian manufacturers of fish-products it will at once appear strange that in this selection of "the whole world's" fish-products the common wares from the great Norwegian fisheries were not represented, though both Italian preparations of Norwegian dried fish and Spanish preparations of Norwegian split cod appear to have been obliged to pass in among the dishes prepared with oil. The culinary artist, Mr. Sudreau, had the opportunity to offer the guests Norwegian as well as Canadian split cod, Norwegian and American salted herring, &c., but he has probably found that such things are not according to the American taste. The single exception made in the manner was in serving "stewed fish from Norway." This was prepared from chipped dried cod (exhibited by Bordewich & Co., in Lyngvær) together with "Japanese dried fish," com-

posed of dried salmon. Neither dainty herring nor fat herring from Norway were served, nor Norwegian anchovies, although both Swedish and French anchovies were. Perhaps the Norwegian specimens were spoiled in the strong summer heat; of this, however, I have no certain information. If, notwithstanding this, a small market be found in America for the Norwegian fish-products here named, it will happen in this way, that the strongly mixed population, especially in the Western States, contains many families from countries in Europe where the Norwegian fish-wares are current articles. These families become customers for the Norwegian as well as for the corresponding American wares; also as supplies for different European ships' crews small lots of Norwegian fish-products may find some sale. But, taken in the mass, the population of North America will not become customers for Norwegian dried cod, split cod, and pickled herring.

This committee, conversant with the subject of fish-dishes, confirmed me also in another assumption with regard to the Norwegian manufacturing. As before remarked, there were served both large and small fish in oil—not fewer than seven dishes were in oil—among them Norwegian and Portuguese mackerel, sardines (both Spanish and Portuguese), eels, &c. In restaurants in the great cities in North America one will scarcely find highly spiced herring or anchovies in the way that the North-European taste demands them, but almost exclusively oil-prepared articles. This, I assume, is due to a culinary principle, that it is not desirable to serve up strong articles, with which particularly should be classed brandy and beer or ale, in a dry and warm climate. The Americans have, in this point, appropriated the South-European taste for oil-prepared articles without liquors. Naturally, here, also, exceptions are found, as before mentioned, concerning dried cod and split cod, especially in the Western States; in the communities strongly interspersed with German, Scandinavian, and Irish in the West even highly-spiced herring, sausage, and pickled meats are staple articles; they are served up as “free lunch” in eating-houses, because the strong seasoning makes it necessary for the customer to drink beer to quench the burning thirst which these articles produce and gradually augment.

I have tried these things. They are, according to my taste, a very disagreeable food, and the traffic itself with this sort of “free lunch” is ill-esteemed as an ugly, runseller's speculation.

The bill of fare, moreover, regarded from a culinary standpoint, has interest in this, that prepared fish-roe, other than Russian caviar itself, must be able to find a market, forasmuch as it was adopted to be served up with this dinner. It is true, only the Turks and Chinese supplied these delicacies, but for a manufacturer in Norway this might well be almost a matter of indifference and no serious hinderance from imitation. As for the rest, the Norwegian exhibitors, Bordewich & Co. and Störmer (in Svolvær), had caviar, the first of cod-roe. These articles, however, were not served up with the dinner. For Norwegian manufactured fish-

roe to succeed in a European or American market, the manufactured article must still doubtless be given a stronger agreement with the universal taste, just as it manifests itself in the Russian caviar. At the same time it should be admitted that Russian caviar does not suit all tastes and that a change in manufacturing it might insure success. A comparatively new mode of preparing or pickling was sardines in vinegar (from Spain). I am of the opinion that Norwegian herring in vinegar, or pickled like English pickles, or merely in vinegar and onions with seasoning of pepper, just as they often are served latterly in the west-country families (in Norway), might become a salable article. ("Herring in jelly" resembles somewhat an article which was experimentally introduced into the market from Norway.)

Taken as a whole, I think that the Norwegian manufacturers of fish-products, especially of dishes for the table, will be able to extract useful hints from the bill of fare mentioned, which certainly was made up under the direction of persons conversant with the subject, and with every regard to refined culinary skill. Another "complimentary dinner" which was given by the same association on the 14th of February, 1877, in New York, I had the opportunity of studying, but I found nothing which I have not already mentioned above.

IV.

NORTH AMERICA AS A MARKET FOR IMPORTED FISH-PRODUCTS.

(A FEW STATISTICS.)

From the foregoing remarks on the common kinds of fishes in America, the prices and taste, it is evident, so far as I see, that North America cannot become a great market for Norwegian fish-products, and that for many reasons, any one of which is sufficient to decide the matter. That the most important Norwegian fish-products, as a rule, do not suit the taste of Americans, since neither herring nor dried cod nor split cod are used in households or are served up at any meal, is the principal condition which prevents the sale of these products in America, taken as a whole. In the next place, the kinds of fishes which Americans are most fond of are either not found at all on the coasts of Norway, or sparingly, and therefore, as a rule, will be too dear after transportation across the Atlantic, which is one of the main causes which prevent Norway from supplying the articles most common in America. But whether the Norwegian fisheries themselves can procure the proper kinds of fishes for America, or whether the Norwegian fish-products will be manufactured according to American taste, as they now are occasionally, the main condition of the trade will be to furnish fish-products either fresh in ice or fresh hermetically sealed (canned).

I believe that no one in Norway is at present able to fulfill these con-

ditions; and, in the next place, at the same time that one would find himself able to overcome the difficulties which interpose, he would have, in the Canadian fisheries and kinds of fishes, which are closely related to the Norwegian, too powerful competition.

In the mean time one cannot hope at present or even in the near future to find Americans as customers for Norwegian fish-products; so the business is not ended, on the contrary it is scarcely begun, and it is a matter of considerable importance for Norway, because the relation hinges quite naturally on this: cannot the Norwegians compete with the Americans in the American markets as well, perhaps, as the Americans with the Norwegians in the Norwegian markets? They do so already, and will certainly, year by year, become more dangerous in competition. American salted herring has already been introduced into Sweden, Germany, and Russia, Norway's best customers for the articles mentioned. No doubt many believe that the American article is not dangerous to the Norwegian traffic, because it is carelessly prepared and of inferior quality; but the Americans will hardly fail to make themselves familiar with the mode of preparation which the new customers' taste demands, whether it refers to their great herring or their fat herring. They have almost as much material as the Norwegian, they do not lack the occasion, and certainly there is no want either of inclination or ability to enter into competition. Split cod from the American waters compete with the Norwegian both in Europe and South America; why not also herring from the same places?

It seems to me that it would be very appropriate if the consuls concerned had their attention directed to this matter, and should, through their reports, give the mercantile class of Norway the necessary information on the American competition with Norwegian fish-products in the different markets, together with the result from season to season. I have not been able to get any collected official report concerning the fisheries in America or the exports of fish-products. The United States of North America have no fishery statistics, and the data I have obtained and found respecting them are partly the estimate of private individuals conversant with the subject, partly a digest of many different statistical tables which I have been obliged, under various difficulties, to revise. At the same time, I think that our knowledge of the American export and import of fish-products is so small that any contribution thereto will be received with thankfulness, and not the least from those who are as greatly interested therein as the Norwegian fish-merchants. I shall therefore, here communicate an epitome of the results which were obtained in the way indicated above.

If I estimate the yearly profit of the United States fisheries at fully \$27,300,000, I think that would come as near as possible to the truth. This estimate is founded partly on the estimate of private individuals on the consumption of fresh fish of all kinds in the great cities, partly on the official reports from fishery inspectors on the catch in some States,

and partly on the official statistics of commerce and navigation. In the \$27,300,000 is naturally not included what foreign nations capture on the banks in America, nor what the fisheries of Canada yield. If one should take both these factors into the calculation the amount mentioned may perhaps be increased by one-half, because the French fisheries alone on the Newfoundland banks have a yearly profit of \$1,365,000 to \$1,638,000, and the Canadian fisheries yield \$10,920,000 to \$12,285,000 yearly.

I shall not undertake to state more definitely how the sum of \$27,300,000 arises, because it would simply be to render one series of estimates and another series of data, which would not help to make the matter clearer. So much of the statistics shall I, however, particularize as to mention two chief divisions, namely, the profit of the salt-water fisheries at about \$20,475,000 and the profit of the fresh-water fisheries at about \$6,825,000.*

With regard to America's exports and imports of fishery-products, that is a matter more easily substantiated. The following summary of the official statistics for 1875 gives an instructive survey:

IMPORTED INTO THE UNITED STATES.

a. Fish-products free of duty:	
All kinds of fresh fish	amounting to.. \$351,889
Salted herring	" " .. 288,590
Salted mackerel	" " .. 584,283
All other kinds of fish-products	" " .. 928,344
	<hr/>
Total duty free	\$2,153,108
b. Fish-products paying duty:	
Pickled herring	amounting to.. 226,494
Pickled mackerel	" " .. 553
Sardines and anchovies in oil and otherwise	" " .. 526,179
Other fish-products	" " .. 102,283
	<hr/>
Total paying duty	855,509
	<hr/>
	3,008,615

The preceding year the importation of the items here named was \$3,208,527; the articles free of duty amounted, however, to only \$1,800,000, but the duty-paying imports were greater, namely, \$1,400,000. The importation of sardines and anchovies especially was of greater importance, amounting to about \$1,000,000.

* For comparison it perhaps may be instructive to state that the Norwegian marine fisheries may be estimated at \$12,285,000 to \$13,650,000 yearly and the French at \$15,015,000 to \$16,380,000.

According to the same official statistics for 1875 the exports of fish-products from the United States of North America were:

Dried and smoked fish.....	\$710, 121	
Fresh fish	69, 448	
Pickled fish.....	359, 669	
Fish otherwise prepared	1, 855, 550	
Whale and fish oil.....	455, 236	
Oysters	170, 277	
		\$3, 620, 301

Besides those used in transit :

Fresh fish	3, 895	
Herring	11, 722	
Mackerel	10, 254	
Sardines and anchovies.....	23, 296	
Oil of all kinds.....	11, 236	
All other fish products.....	157, 053	
		217, 456
		3, 837, 757

While importation in the last year has been diminished, exportation seems to have increased, by which one may well conclude that the fisheries are in constant advancement. The American fish-dealers' exchange with foreign countries amounts also to about \$7,000,000; but an account more in detail as to the countries with which this exchange occurs may perhaps be of great interest to the Norwegian fish-merchants, wherefore I shall compile an abstract of tables relating to the subject.

The fresh fish, amounting to \$352,000, which were imported duty free, were almost exclusively from Canada; the same was the case with the \$584,000 worth of mackerel and about half the quantity of herring, quoted at \$289,000. On the other hand, the importation of the remainder of the herring, \$226,000, together with sardines, anchovies, and all other fish, was from the following countries:

	Valued at—	From—
Pickled herring, 14,243 barrels..	\$154, 302	Holland.
5,675 “ ..	61, 459	Germany.
1,278 “ ..	6, 854	Newfoundland and Labrador.
218 “ ..	2, 897	England.
126 “ ..	480	Quebec and Ontario.
24 “ ..	298	Scotland.

As the prices quoted are invoice-prices, it is seen that the herring sent from Europe were invoiced at over \$10 to \$12 per barrel, while herring from the Canadian coasts were only \$4 to \$5 per barrel. Direct from Norway and Sweden they are imported for \$2; but I am informed that some of the herring imported from Hamburg are Norwegian.

Sardines and anchovies in oil reached a value of \$1,000,000 in 1874, but in 1875 they were imported only to a little over half the amount, or \$526,179, distributed among the following countries:

From France	to the amount of....	\$445, 022
“ England	“ “ “	56, 518
“ Germany	“ “ “	11, 072
“ Holland	“ “ “	8, 028
“ Italy	“ “ “	2, 448
“ Quebec and Ontario	“ “ “	1, 894
“ Spain	“ “ “	789
“ Sweden and Norway	“ “ “	152

In the importation of anchovies it also holds good that some Norwegian (and Swedish) wares go by way of Hamburg to America.

The great item of import—“all other fish-products”—represents over \$1,000,000, and is due mainly to the following countries :

From Canada, &c.	about....	\$900, 000
“ China	“	48, 295
“ Hong-Kong	“	243
“ Germany	“	22, 822
“ France	“	12, 337
“ Holland	“	5, 750
“ Cuba	“	2, 635
“ Sweden and Norway	“	955
“ Mexico	“	806
“ Italy	“	795
“ England	“	518

The cities and ports to which the greatest portion of the importation came are the following:

Boston and Charlestown, Mass., to the value of.....	\$1, 298, 921
New York, “ “ “	754, 884
Portland and Falmouth, Me., “ “ “	369, 816
Passamaquoddy, Me., “ “ “	158, 586
San Francisco, Cal., “ “ “	101, 152
New Orleans, La., “ “ “	94, 104

Next come the cities near the great inland lakes, which are supplied with \$100,000 worth of fresh fish. To New York, New Orleans, and San Francisco are imported the greatest quantity of anchovies and sardines, while Boston imports most of the salted herring and mackerel.

With regard to America's exportation of fish-products, the greatest items in American wares in 1875 were as follows:

DRIED AND SMOKED FISH.

71,489 cwt., valued at..	\$450, 655	to Hayti.
18,005 “ “ ..	64, 514	“ Hollandish West Indies.
12,089 “ “ ..	49, 628	“ French West Indies.
7,565 “ “ ..	38, 133	“ Cuba.
5,546 “ “ ..	20, 075	“ San Domingo.
3,823 “ “ ..	24, 419	“ Brazil.
1,972 “ “ ..	11, 453	“ English West Indies and Honduras.
1,923 “ “ ..	14, 264	“ United States of Colombia.

A smaller portion of items go to China, Japan, France, the Azores, and Madeira, the Spanish colonies in Africa and elsewhere. Nothing is exported to Spain, Portugal, and Italy, where, on the contrary, Newfoundland split cod has so great a market.

Of fresh fish, as above noted, are exported \$69,000 worth, of which about \$68,000 worth are shipped from Key West, Fla., to Cuba.

Pickled herring are exported to about the same markets as the dried and smoked fish, and, besides, to the French colonies, the English colonies of Australia, Liberia, the Sandwich Islands, Porto Rico, and Venezuela.

The \$2,000,000 worth of "all other fish-products" went for the greatest part to England, the English colonies, and Hong-Kong, because the most important items are the following :

	Value.
To England	\$974, 673
" English colonies in Australia	298, 280
" Hong-Kong	216, 522
" Germany.....	74, 998
" Cuba	46, 924
" France and her colonies	37, 733
" United States of Colombia	33, 461
" Hayti.....	30, 032
" Peru.....	28, 183
" Chili.	7, 441
" China and Japan	8, 826

The exportation of oil, as previously stated, amounted to \$455,000; the quantity was 896,000 American gallons, or about 30,000 barrels, which were shipped in the following principal items:

To England 304,605 gallons, valued at.....	\$125, 583
" France 241,161 " "	123, 937
" Scotland 197,891 " "	80, 670
" Canada 119,007 " "	65, 999

The remainder went to the English possessions in Australasia, Cuba, Hong-Kong, Mexico, and elsewhere.

The great exportation of oysters, which is said to be still in its infancy, amounts to \$170,000; the following were the most important markets:

Canada	\$70, 114
England	38, 661
English possessions in Australasia.....	11, 639
Germany	10, 798
Argentine Republic	6, 609
Uruguay	6, 458
Cuba	4, 388

Next come Brazil and Chili, Mexico and the Sandwich Islands, Venezuela and various states in South America, Japan, China, &c.

The ports from which are exported the American fish-products are only partly the same which receive the greatest import of such wares; exportation, for example, goes on especially by way of San Francisco, which exports to the value of \$1,500,000; New York to the amount of about \$1,000,000; Boston about \$700,000, and Key West a little over \$100,000.

It appears from this abstract that Americans get their greatest supply of fish in oil from France and England, pickled herring from Canada, Holland, and Germany, while all other fish-products come mainly from Canada, China, and elsewhere. And exportation occurs chiefly to England, the West Indies, Australasia, Eastern Asia, and South America.

As it is probable that Norway cannot compete with America in these foreign markets—the West Indies and the east coast of South America excepted—so also it is likely that she will not readily be able to satisfy America's demand for fresh fish, fish in oil, and the rest of the chief articles. But it is more nearly certain that America can act in opposition to Norway as well in Europe as in other countries. It is of much interest to know this.

V.

PRESERVING FISH WITH ICE, AND THE SIGNIFICANCE TO NORWAY OF THIS MODE OF TREATMENT.

The fact that the Americans are able to furnish salted fish-products so cheaply that it may become a serious apprehension that they will compete with the Norwegians even in the markets of Europe, arises partly from this, that the American fishermen sell their fresh fish so readily and profitably, partly because the fishermen are better equipped and more skillful in their calling than the Norwegians, taken as a whole, and finally for the reason that the kinds of fishes concerned abound in the American waters, and besides they are comparatively little in demand for the consumption of the country's own population. I shall next treat of the factors here indicated.

The first—the traffic in fresh fish—I have previously treated in its own chapter, in which I remarked that the preserving of fish with the help of ice and frost plays a principal part in the business. But I shall now enter more fully into this matter, because I will communicate all the information in regard to preserving fish with the aid of ice which I believe at present may have practical interest.

I have read with much attention the articles which have been published on this subject in the Norwegian newspapers, and I have specially noted the interesting information which the consul-general, Mr. W. Christophersen collected. I hardly mistake when I think that the *summa summarum* of the public discussion of the subject has been this, that for the present it is neither practical nor advisable to encourage Norwegian fish-dealers to attempt the exportation of fresh fish in ice from our great fisheries.

Against this result I shall venture to make some objections, because I will point out the weakness of the conclusions which have been advanced.

They have, in the first place, so far as I can judge, confined themselves to *England* as a market and to *cod* as an article of export. Just as I, on the one hand, regard this limitation of the matter as inadequate, so, on the other hand, I consider the views which have put themselves forward in this region; and I may say, further, that the question being limited thus, the answer must be what it is, namely, that for the present the attempt to send *cod in ice to England* should be discouraged. That this should be the answer arises simply from the fact that the English importers of fish desire *living cod*. With it the affair is decided. Closer investigation as to what kinds of cod are most esteemed in the English market might, therefore, at present seem superfluous. And to institute calculations as to how great expenses will attend the carrying of fresh dead cod in ice from Lofoten or Kristianssund to Hull or London may be unnecessary. However, the subject may acquire interest later on, and therefore I shall not retain certain information communicated to me on the prices of cod in England:

Living North Sea and Iceland cod are sold for	\$19.11 to	\$27.30 per score.
Ekerö cod, wet-salted,	“ “ “ .98 “	1.17 “ “
Lofoten cod, “ “	“ “ “ .79 “	.98 “ “

The Norway-coast cod, as well as the Lofoten, are thus seen to rate at very low prices; yes, lower than one as a rule can secure in the fishing-places in Norway itself. Cod in ice command only one-fourth to one-sixth as much as cod in the living state, and are said, under the present management, to have great difficulties to overcome. These difficulties consist chiefly in this, that the wholesale fish-dealers in England (the whole of England's and Scotland's trade in fresh fish is in the hands of ten to twelve wholesale dealers) antagonize the importation of all other fresh fish than those which they themselves get. They have their own vessels with wells for keeping living fish, and every attempt to compete with them in this or in the traffic generally they contend against so recklessly that a fresh attempt hardly occurs.* One may even in Norway have a little experience of this. But should the opposition from the wholesale dealers themselves be relinquished, yet will the fact that the cod is a kind of fish which easily loses its fresh taste in freezing, always render competition with the Englishmen's own living cod the more difficult. After all, one will naturally prefer the living cod.

Of halibut, salmon, and mackerel—three kinds of fishes which are well adapted for sending in the frozen or iced condition—there have gone, on the contrary, for many years, a not inconsiderable quantity from Norway

* When the Americans began to export to England fresh meat in ice the English butchers raised a strong opposition, and only after sundry conflicts, which cost much money, the Americans, with the aid of the press and the people, won admission. However, a time was selected when a single English butcher, in order to spite the Americans and their meat, called all his worst meat "American," and sold it cheap.

to England, which demonstrates practically, indeed, that the fish business treated of can be prosecuted with England and certainly succeed besides, because it is carried on by nearly the same Norwegian firms summer after summer, year after year.

But the chief question was, not whether fish from the so-called great fisheries—herring fishery and cod—could be exported in ice instead of in pickle, or salted and dried. In England, the main question was, "Will I buy dead cod instead of the living?" And the answer was "No!" But in South and East Europe the inquiry was different, namely, "Will I buy fresh fish instead of salted and dried?" And it is this question which I believe cannot be regarded as capable of being answered in the negative in reference to the investigation of the English business-relations. My personal opinion of the matter is this, that herring as well as cod can be transported without too great expense to Norway's present great customers in East and South Europe. The difficulty consists not in this but in the fact that one of those markets must be prepared to preserve these frozen or iced wares in this condition, even in the manner of loading. But this difficulty itself can gradually be overcome, provided the traffic only can endure the expenses attendant upon it, which I can have no opinion of, since I do not know the proportions of the ice business in the countries concerned. That the whole may be amended without exorbitant expenses, so that fresh cod and herring may be delivered in South and East Europe, I am confident, from the fact that similar kinds of fishes are delivered in America to markets as far distant from the fisheries. At the same time it is indeed clear that all depends upon whether those customers really desire *fresh* fish from Norway. If they do not, then the matter is thereby decided. But until one has experience of this by some experiments, the question cannot be regarded as satisfactorily answered, and it was only this I wished to take exception to in the results which the public discussion appears to have desired to establish, and that immediately.

For a clearer understanding of the matter, I had some time before examined the relations of this business in America, the fish concerned as well as other articles of food, and I shall now communicate what I learned.

With regard to the treatment of fishes with ice, a distinction must be made between merely *packing* fish in ice and *freezing* them for storing. The first—packing in ice—is employed in ordinary transportation, as from the sea or fishing-banks to ports, and from the ports (generally after replenishing with fresh ice) to the selling-places or markets in cities. The other ice-treatment, by which the fish are frozen, is employed mainly in storing fish, as, for example, to enable the fish-dealer in question to preserve fish from summer until winter or from one season to the next.

Preserving in ice appears to require no skill, yet it demands some judgment to answer the purpose entirely, as to the quantity of ice in proportion to the quantity of fish; the convenient size of the pieces of

ice, the material and shape of the box—all are things of importance, and not the least elements of a practical economy.

Greater judgment, however, is demanded in freezing for a subsequent storing of wares. This is truly a new art, on which a patent was taken ten or twelve years since in America, and it will become very important. I shall, therefore, venture to describe a so-called freezing-apparatus or frost-vault.

VI.

THE AMERICAN REFRIGERATOR.

A refrigerator must not only keep the article cold, but it must keep its temperature near zero or below the freezing-point; and to do this is required not only a constant supply of ice, but also such an effect of ice as will produce and maintain intense cold.

Most persons have seen a common ice-chest for household use; its purpose is only to keep articles of food cool or cold. But no matter how much or how often one may fill it with ice, the provisions will not generally freeze; partly because the ice-compartment is too small, partly because the mass of ice cannot of itself send out sufficient cold over the provisions to freeze them hard; besides the distance from the ice is so great that the intervening air makes freezing (in mild weather) nearly impossible.

The largest and best furnished freezing-vault which I saw was one belonging to the above-named Mr. Eugene G. Blackford. It was, practically speaking, a cellerage 80 feet long, 11 feet wide, and 10 feet deep, fitted up as a small store-room. The outer frame of the vault was much like a ship's deck, tight, and composed of planks. A trap-door led down to a room where it was dark and the temperature some degrees below the freezing-point; on the day on which I inspected it there was a strong summer heat of 35° C. (= 95 Fahr.). The ceiling itself was double, and the lining was partly sawdust (to prevent the influence of warm air), partly ice mixed with a certain proportion of salt (to send the cold in the ice out over the room, "liberate" it, as it is called in physics). Along the sides and at the ends and across the vault itself were constructed large conduits or rather long reservoirs for ice mixed with salt, to act on the air in all parts. The situation and shape of this reservoir form a very important part of the apparatus. The art is to get the cold in the ice, which is "liberated" with salt, to operate so that it will be of the greatest benefit and also most valuable with least expense. As cold or cold air "falls," these ice-reservoirs are placed highest up in the top; the cold air must also fall right through the whole vault and cool the entire room in its wandering. Were they, on the contrary, placed on the sides or bottom, the cold liberated from the ice would simply fall along or down the reservoir itself. Side-reservoirs would also merely form a cold wall or ice-belt around the vault. Such a cold wall they have also, but the ice of the reservoir is best utilized, as indicated, by allow-

ing the cold to fall out in the room; therefore the wall-reservoirs, which appear as closed conduits, are given an oblique position, so that the cold from the uppermost ice may fall out freely and operate as a corresponding ice-blast from the ceiling. The floor is least liable to an invasion of warmth; the ice-receiver here is, therefore, most poorly supplied with ice.

To protect the provisions against ice-water drip from the ice-box, there are placed conduits and conductors. As for the rest the oblique position of the reservoir will contribute toward carrying the ice-water away without dripping. When once the warm air is expelled and the ice has supremacy, it requires less to maintain freezing for a year or as long as one wishes.

This vault of 10 by 80 by 11 feet, or 8,800 cubic feet, could easily hold 100,000 pounds of fish. It was divided by walls and ice-pipes into four parts, each part furnished with an endless number of shelves of moulding. To keep the temperature in the whole apparatus some degrees below the freezing-point, 1,400 pounds of ice is required daily in the heat of summer. The price of the ice was about \$4 per ton of 2,000 pounds. The expenses in this respect were therefore only about \$2.80 per day in the heat of summer and proportionally less during the remainder of the year. In winter are required for the apparatus only about 1,000 pounds of ice per week, about 29 cents per day. In the cooler country of Norway an apparatus of this size would require a smaller quantity of ice, and the ice would be had at a much cheaper rate, in Bergen City for instance, for \$1.64 to \$2.18 per ton, which would amount to only 82 cents to \$1.09 per week to preserve 100,000 pounds of fresh fish in winter; truly, a cheap preserving! Even a smaller quantity of fish could profitably be stored here when the prices in midsummer are very low, and it could be calculated upon with safety that they would advance later in the autumn, as happens with the price of salmon, which rises from 10 and 12 cents to 25 and 30 cents; yes, as high as 50 cents a pound toward Christmas. But it will readily be perceived that a quantity of fish, say only 1,000 pounds, would not support the increased expenses of an apparatus so large for a longer time.

Not every kind of fish can endure such cold, but like many kinds of provisions some lose much in flavor. And even the articles of food which endure it must be treated in a peculiar manner. Among other things it must be observed carefully that fish intended for storing in cold must be frozen stiff immediately, or as fresh as possible. Delaying the stiff-freezing some time, or, under certain circumstances, any time, is a source of great loss. Also, in thawing, measures must be taken that nothing shall be spoiled. Thawing must, by preference, take place in cold air so as to "repel (*skyde*) the ice," as it is called in the Norwegian household language, before further dressing or cooking can occur.

The kinds of fishes which best endure storing in cold are salmon and halibut; next very fat herring and mackerel; but cod and flounders and other common fishes will lose their flavor; also oysters. The fatter fish

are, the less will their agreeable taste suffer; the poorer, the greater such danger.

Experiments have been made with all kinds of provisions, drinks, and fruit. The result so far reached is this, that every kind endures a certain low temperature, below which one cannot venture without injuring the flavor. Especially fruit and most kinds of flowers are very sensitive in this respect. To treat them directly with ice-cold air will, I think, not succeed; but perhaps the indirect method, or the now common cold-air method for cooling off the preserving-room will do better. Pork is also somewhat difficult to handle, but for a different reason: it requires such intense cold to be entirely protected. Again, it has been found that the more uniform the cold is kept the better.

My informant states that the use of ice as a means of preserving these articles dates back only twelve years. A patent for freezing salmon had yielded the patentee \$30,000 to \$40,000; but while the patent was respected concerning salmon, competitors soon learned that the patent-right was not infringed upon by employing freezing for other provisions, and after a lawsuit respecting it the patentee lost, as the tribunal declared that freezing other articles of food than salmon was free or not patented. At the same time the use of ice is considered yet to be in its infancy, or taken as a whole only to have acquired importance in the treatment of salmon and some other fish-wares, together with fresh meat. With regard to fruit no one has gone beyond experiment; but as soon as the proper ice treatment is discovered one must admit that America will export to Europe large quantities of fresh fruit,* just as is already the case with fresh meat, and experimentally with fresh salmon.

VII.

TWO KINDS OF REFRIGERATORS ON BOARD PACKET-STEAMERS FOR CARRYING FRESH MEAT.

As the transportation of fresh meat from America to Europe in steamers has attracted marked attention, and as a similar transfer of fresh fish will perhaps in time become an example for the Norwegian fish and game dealers, I undertook a journey across in a steamer which was furnished with cooling-off apparatus (refrigerators), and then remained many days in Liverpool to investigate the condition of the meat after the voyage, and to make myself better acquainted with all the details of the arrangement.

So far as my experience goes, the method employed in the transportation of fresh meats across the Atlantic is copied from a rather common method of refrigeration used by the pork-butchers in the West. This last-

* Fruit-growing is a great industry in the United States. Much is exported in the form of conserved and preserved fruit. Of all kinds of apples alone were exported in 1875, as officially advised, more than \$1,000,000 worth.

named method I shall, therefore, treat of first, also for the reason that it may possibly be interesting to the public.

The great pork-slaughtering houses operate chiefly in winter; the summer killing is regarded as of an inferior quality (judging from the recommendatory advertisement, "winter-cured" American pork). The reason is, that heat will prevent, in a greater or less degree, the successful salting of pork; in the cold of winter one may be more certain that the pork will be put in salt sufficiently early, or that the air will not influence the flesh before the salt has begun to operate. During a visit which I paid to a pork-butcher I convinced myself of the significance of refrigeration for the trade. The body of the hog, as soon as the animal is killed, is thrown into a large scalding-trough filled with hot water, where it remains some minutes, to be scalded, or sufficiently long for the whole carcass to become so thoroughly hot that it takes a long time before it is cold enough for salting and packing. It is important, now, to shorten this interval, and also to prevent any hurtful influence from the action of the air. In winter this is not so dangerous. In summer or in warm weather it is hurtful. A sudden cooling-off by putting the pork in ice, it is thought, will injure its flavor; and even a natural cooling-off in wintry air is not to be recommended. It is important, therefore, to devise a method by which refrigeration could proceed to a proper length of time and uniformly, independent of the weather, and in such a way that the right point of time for salting could be determined with safety. They have here, among other things, constructed for a refrigerator a large box with a blowing contrivance or pump. Inside of this box, large enough to hold a small drove of hogs, the carcass is hung up; thereupon the air-pump is set in motion, first to pump out the warm air given off by the carcass, and then to blow more and more cool air in until the air corresponds with cold water, and cold air from an ice-chamber follows. The current of air travels constantly the same way, flowing along the ceiling or the upper side of the box towards one end, from which it goes backward along the bottom to the other end, when it carries the heat from the carcass up and out. When the cooling is somewhat advanced, they do not allow the current of air to escape into the outside air, but into an ice-chamber, and thereby it becomes colder and colder until it is everywhere uniform and the cooling of the carcass is finished. To give the current of air greater cold, ice is mixed in the ice-room with salt in such proportion as will give out the degree of cold desired.

This last part of the refrigeration forms the basis of the method of treating fresh meat in its transportation over the Atlantic in steamers. The meat is brought on board soon after killing, and is quickly cooled off and sewed in muslin; thereupon it is hung up in the inclosure arranged in the room for transportation. It is important now to maintain a low temperature until the vessel reaches the European port. How this is accomplished I shall seek to explain as I describe the refrigerators which I saw in the American steamer which carried me across.

The steamer had three rooms furnished with cooling-apparatus (refrigerators); of these, two were on the second deck, a little forward of midships; the third was astern in the peak, and extended from the keelson up through the two decks. The first were kept cold by water, the last by air. Each of the rooms was 9 to 10 feet high, 12 to 14 feet wide, and 40 to 45 feet long. They were perfectly empty inclosures. The cold-water rooms, which I shall mention first, were provided with doors for loading and unloading the meat. The doors opened out into a stairway by which one reaches the deck. Immediately outside the door was the steam-engine which forced the cold water; close by was the ice-box, through which the water is led; also, finally, two separate zinc-covered and well-lined ice-storerooms—one for each room—5 to 6 feet wide, 10 to 12 feet long, and 9 to 10 feet high. A sufficient quantity of ice was kept for the voyage. The inside of the refrigerating-rooms was provided with close series of hooks, on which the carcasses were hung, sewed in muslin. They must, as far as possible, hang clear of one another, partly to prevent chafing during the rolling of the ship, partly to give the cold air free access to all parts of each carcass. When the rooms are filled there is not room for a boy, hardly enough for a cat, to creep along the floor. The fuller they are the easier it is to maintain the cold. All sides of the rooms were encircled by lead pipes $2\frac{1}{2}$ inches in diameter, 16 coils on each side. The pipes were fastened directly to the wall. This was the furnishing of the room.

The work of refrigeration I shall next briefly mention. The problem is to keep the temperature uniform and low—usually 37° Fahr., or, more accurately, never above 40° Fahr., nor below 35° Fahr. To this end the rooms were first completely inclosed, made tight, then hermetically sealed. In the pipes, which with an aggregate length of 1,700 to 1,800 feet encircled all the walls, was pumped cold fresh water by a little steam-engine, which worked a pump for each room. The water circulates through the whole length of the pipes in a room, returns to the starting-point, holds, then, a temperature near 29.3° F., is conducted over ice and salt, forced again into the pipes, and produces and maintains a temperature of about 35.6° to 37.4° F. This current of water is continuous, since the circulation is uninterrupted; the quantity of water is increased by the melting of the ice; the surplus finds an outlet. Fresh ice is supplied constantly in the ice-boxes, and each ton of ice is mixed with nearly a quarter as much salt. The temperature of the room is controlled through a very small window, inside of which a thermometer is hung, and by that the temperature of the body of water is regulated. To protect the meat, the pumping is continued until the last carcass is unloaded.

The work or oversight of the work of the pumps is taken in charge by two men who watch alternately. This superintendence, as well as the engines, pumps, pipes, &c., is at the expense of the shipper of the meat; the steam, on the contrary, is furnished free by the ship. The

freight amounts to so much per ton of the whole room occupied; this trip, about 30s. per ton. The apparatus employed returns free in the steamer, and the vacant room is used by the vessel for other freights.

The third refrigerating-room had cold air instead of cold water, wooden air-tubes 14 to 15 inches wide instead of the leaden water-pipes of $2\frac{1}{2}$ inches diameter. The current of air which is to cool off the room and keep the temperature low is set in motion by a blowing-arrangement which is driven by a little steam-engine of $\frac{1}{2}$ horse-power. The blower which stands upon the first deck makes 180 to 210 strokes per minute. This drives the air through a box of ice and salt down into the room, which is everywhere penetrated by it; it is led back in a similar way through a box filled with ice and salt, and comes from this up again under the fan, which forces it downwards in an endless round as long as there is meat to be preserved in the room. The temperature, which is here controlled within the blower, is in the room about as in the cold-water rooms, but often 3° Fahr. lower. The principle is the same, and no one is able to point out any difference of advantage of one over the other system. Both are considered excellent. This cold-air room was 30 feet long, two decks high, and for the rest extended alongside over the whole peak. This accommodated 250 whole beef carcasses, which hung in two layers, one for each deck's height. The box in which the fan worked was only 5 feet high, $2\frac{1}{4}$ feet long (alongships), and $1\frac{1}{4}$ feet broad (athwartship). The expenses were met as in the other room, and the freight was paid, as there, only for the room occupied.

This, then, was the information I had to convey, and which I believed would be a matter of interest. One may see herein why the ice treatment of provisions is employed in America in the different industries and for different purposes. That something similar might be practiced in Norway appears to be a conclusion not without foundation; it is important only to overcome the difficulties and regulate the mode of treatment which the Norwegian traffic must involve. But to point out more in detail the practical mode of laying hold of the matter may be found to lie somewhat outside of my present task; it will be enough to indicate incidentally that the wealth of our country in game, fish, and other provisions which are mainly used fresh, might be made serviceable to a great extent if the tradesmen interested should follow the example of the Americans. The many fast steamers along the whole coast and going to foreign countries appear to me, for instance, well enough fitted as a field of experiment for such a refrigerating-room; yes, merely having ice-boxes on board a large steamer for chartering for the use in question might perhaps be found both a good speculation for the owners and a convenient and noteworthy arrangement for the consignors and consignees in our large cities and in foreign countries.

It remains to prove by an adequate trial of such enterprise what I, for my part, consider for the present as certain, namely, that the using of ice is a practical method of preserving and transporting provisions

in the fresh state for a long time; also, for ourselves, I think it will not require a long time before great advantage will be found in using ice for our great fisheries, even to a greater degree than is now common in America. I think, also, that our fat-herring fisheries will find a valuable adjunct in ice-using, when, for instance, the fishing occurs far from a salting-station, and it is important to preserve herring in summer until salt, barrels, and sufficient help can be secured. In America they freeze whole cargoes of herring. Bait, too, for the cod and coal-fish fishery might be preserved by the proper amount of ice where now it is wasted or cannot be had.

The matter is first brought into practical operation for the salt-water fisheries, so we should next investigate how far our numerous rivers, lakes, and fiords, well adapted for fishing, ought to derive advantage from the use of ice, and be made to furnish a great quantity of goods for sending abroad. As matters now stand, our inland and fresh-water fisheries rank rather low, and the yield can scarcely be conveyed to market, except in a half-spoiled condition, in summer. The experiments, the experience in the practical business itself, which one acquires with reference to this fishery in America, have brought me to believe that much might be accomplished by us.

The fresh-water fisheries of the Americans, inland and on the great lakes, are prosecuted so largely by using ice and storing frozen fish, that the traffic in these fish-products is a comparatively great business. On this I shall venture to communicate more detailed information.

VIII.

FRESH-WATER FISHERIES IN AMERICA.

That the fresh-water fisheries have an entirely different signification for America from that in other countries was shown in the Exhibition in many ways. While the fishery-division of most countries consisted mainly of fishery-products from the sea-fishery, and only occasionally had some fine implements for lake-fishery, or a portion of the products of the fresh-water fishery, the main strength of the American division lay in this direction. One noticed instantly that this branch was the object of special partiality on the part of the American functionaries concerned.

In Agricultural Hall there was a series of aquaria in which various fishes disported themselves, surrounded by all the comforts which belong to a happy domestic life in fresh-water depths; the handsome, sprightly aquarium-tenants were not only well fed, but were also shown all other attentions which fish delight in; their home was furnished with beautiful sea-weeds, shells, corals, and muscles; in shady grottoes of curious stones reposed friendly-disposed sea-creatures and crabs of exquisite beauty; fresh water bubbled forth continuously and diffused an agreeable coolness which the outside spectators certainly envied them in the

oppressive summer heat; and, finally, they were constantly surrounded by a dense circle of spectators, especially children and ladies, who felt themselves very fortunate to see them, admired them, and in their delight gave them rare dainties. Nearly as much attention was bestowed on the fishes cast in plaster and painted with great skill. This collection (the cost of which is stated to be \$27,300), was larger than that, and had a place in the Government Building, where also a collection of photographs (with the scale of measurement attached) and color sketches of all sorts of fishes were exhibited. Here was found a great variety of implements, hatching-apparatus, and the requisites for the transportation and planting of young fishes.

The products of the fresh-water fisheries were also exhibited in great abundance, chiefly all forms of preserved salmon. In a couple of refrigerators were shown fresh fish, which, in spite of the oppressive heat, kept their fresh, delicate appearance many months. This was both an exhibition of fish and of a mode of preservation, and the two parts combined were an illustration of the advanced development of the fish-traffic. Beside California salmon lay pompano from the Gulf of Mexico, always equally fresh and sweet. The great prominence which they had thus given the fresh-water fisheries must naturally excite one's interest in them; but since, as before remarked, no detailed statistics of the fisheries are to be found, one is cut off from access to an easy mode of furnishing himself clearer information on their extent and importance as a public industry. At the same time there are found so many local statements respecting them, and also copious individual estimates concerning this and the proportions of the fisheries in other directions, that one with their help can form a tolerably good conception of the part they play.

In a more detailed account of the relations of the great lakes it is seen that the whole fishery-traffic here is entirely similar to the great coast and sea fisheries. The author, one of the esteemed functionaries of the Government of the United States, had visited most of the great lakes and procured statements regarding the scientific as well as the practical interest in this connection. The annual supply of fresh-water fishes which fifteen cities alone take near the borders of the lakes, is found to amount to not less than 32,250,000 pounds, of an aggregate value of \$2,184,000, the local expenses not included. Nearly two-thirds were furnished in the fresh state, and consisted of 14,000,000 pounds of salmon, trout, pike, whitefish, and fresh-water catfish; over 4,000,000 pounds (or 20,000 to 25,000 barrels) of fresh-water herring were supplied, but of these 10,000,000 pounds more were delivered salted.

The prices were not stated for the individual kinds, but the total of \$2,184,000 for 32,250,000 pounds gives an average price of 27 cents per English pound, or about \$2.73 for 36 Danish pounds, and this must be called a good price. But if one take properly into consideration that here are mentioned fish so fine and well flavored as salmon and trout

it must be granted that the prices were very low. And without low prices on these inland fish-products it would not be practicable for the Americans to furnish so considerable a quantity for export to Europe and to almost the whole world. In reality the state of things is this, that Americans furnish, in the European markets, fresh salmon, for example, cheaper than many countries in Europe themselves can get them from their own fishermen, and that, notwithstanding the fact that the Americans have considerable expenses on their goods besides a long transportation.

The explanation of this peculiar circumstance must be exclusively sought neither in the abuse or overdoing by the countries concerned of the fisheries in their waters by which the abundance of the fishes diminished and the prices enormously advanced, nor should the explanation be sought in the natural wealth of fishes in American rivers. None of these explanations will strike the right point in the matter. The only satisfactory reason, in my opinion, is this: the Americans latterly prosecute their inland fisheries with a deliberation on the basis of practical scientific measures, which in the course of time must bring and already has brought it to pass, that these fisheries will increase and year by year make their competition with all other countries quite overpowering. Americans can overdo the fishing in a water-course just as well as others, and in reality the complaints about such abuse are not few. But at the same time that they seek to prevent this abuse they do not restrict themselves to protective laws and prohibitory enactments against fishing at certain times or with certain destructive implements. They do not confine themselves to passive measures; they do not depend exclusively on nature's own assistance to counterbalance the fishermen's want of judgment and selfish efforts. The American fishery commissioners have a hold on much more effective measures, active measures: they transfer young fishes to the best water-courses; they see that the barren rivers and waters again get a supply of edible fishes; they erect great hatcheries for the "cultivation" of new material for the fisheries, hatching out both the fish themselves and the subordinate fish on which they feed. And all these active endeavors take place on a grand scale and with a generosity on the part of the people, which at first thought might seem exaggerated, but which upon closer consideration will be found to contain a wise economy combined with practical truth and correct apprehension of what is for the best. As I next have to treat of the fishery itself I shall defer until the next chapter mentioning the hatching operations and give here only some few presumably very instructive particulars on the "cultivation of fish-material" for the fisheries.

In the year 1872 the United States Congress voted \$15,000 to defray the expenses of transporting shad (*stamsild*) to the Pacific States and the States bordering on the Gulf of Mexico and the Mississippi River, and to transport salmon, whitefish, and other edible fish to the waters in the Union which were best adapted for them. The same year was

voted anew \$10,000, and the next year \$17,500. But this was not the beginning of these operations, nor was it a solitary series of concessions; but it was, so is it stated in the reports, the natural outgrowth of what so many individual States already had voted, and so many private individuals had already performed. From another statement it is learned that in thirteen States was voted on an average \$2,730 yearly for many years for the development of the inland fisheries, and individual States had in the last eight or ten years also applied \$27,300 to \$40,950 for restocking their water-courses with fish. On the Pacific coast there is a river, the Columbia River in Oregon, in which nearly 7,000,000 salmon-fry were let loose, to make the fishery flourish. In the same river they are also caught quite extensively; because one has estimated that of the catch there in the last year will be produced \$3,013,000 to \$3,276,000 worth of canned salmon in tin-boxes to export to the States and England. Salmon of the year are planted as well as the fry. They spare no pains to aid the producing-power of nature itself; the stream, productive and rich in fishes, is by combined scientific and technical aid made still richer, still more productive. They will take care that the great fishery shall become still greater, and under no circumstances less. As there are naturally many fish here, it must be a suitable place for them; so they plant millions of fish because there is plenty of room.

The inland fishery is carried on with no small employment of capital in implements, boats, ice-houses, steamers, &c. Large stationary nets and traps are used, which have an average value of \$546 to \$819. Of boats valued at \$546 there are hundreds on the great lakes, but \$109 is a common value. A peculiar kind of boat called "Norwegian," and so described that I must believe it to be related to the "*listerbaaden*," is, however, considered clumsy for rowing by Americans, wherefore only fishermen from Norway, Sweden, and Denmark use this form. On Lake Michigan the fishery is prosecuted also with small steamers; they cost, as a rule, \$1,092. Not fewer than 100 ice-houses for keeping fish fresh are found throughout the extent of the lakes named. In several places a considerable quantity of salmon and trout are stored until a later time, when the fishing is ended, and they sell at a higher price. Also in the fishing-vessels themselves they have apparatus for hard-freezing fish, and they sail from one lake to another with a cargo frozen in this manner; on board the vessels in Lake Superior alone are frozen 270,000 pounds. The greatest inland market for the fishery-products of the great lakes is Chicago, to which city, in 1872, were conveyed about 4½ million pounds of salmon, trout, pike, &c., and a total of 7½ millions of fresh-water fish, at a value of \$4,641,000.

It will be a long time before the fishery of any Norwegian water-course will reach results which can in any manner stand by the side of those here mentioned. But there is certainly no insurmountable obstacle in the way of increasing the profits of all the inland fisheries of Norway

to such considerable amounts as will endure the comparison. Norway has so many famous fish-streams and rivers, that one should have in them an invitation to the attempt, especially since one has so practical and satisfactory an example to follow as the Americans present. But as matters now are the good waters yield only indifferently well to a rational fishery; one sees the profits diminish and the cost of carrying on an antiquated fishery increase, the less the occasion for old methods becomes.

IX.

HATCHING YOUNG FISHES FOR THE SAKE OF THE FISHERIES.

As in most other countries where the fishery is a greater industry, some persons also in the United States have sometimes complained that the fishing is falling off; and as elsewhere so here one has for some time heard complaints of uncertainty as to where the cause was to be sought for. Some were of the opinion that it was over-fishing or with too many implements; others were just as sure that the destructive quality of certain appliances was the cause. That the fish were scared away by the noise of steamers, cannonading, or by the bad smell of decayed offal from manufactories, I have, however, not seen advanced.

The question of the decrease of the number of fishes on the coast arising in earnest in the years 1860 to 1870, was, in the spring of 1871, intrusted to Prof. Spencer F. Baird to investigate the matter. He received a commission to learn how far the fishing on the coast, as well as in the fresh waters, was diminished; what cause had occasioned the decrease, and what expedients in the form of law and otherwise ought to be employed to furnish the fishing-grounds with a new supply of fish, and in other ways make fish diet *cheaper for the people*. The professor immediately set his hand to the work. With the assistance of a number of practical men and men of scientific acquirements he begun investigations of the temperature of the water at different depths, its varying transparency, its chemical composition, the influence of currents in the depths and at the surface, food-supply for the edible fishes—in short, examinations of everything on which the success of the fisheries must depend. This was the first year; the next year saw a rapid advance, and Professor Baird associated then with himself a corps of thirty-seven specialists, more than half of whom were professors, teachers, and students in zoölogy and natural history, the rest being fishery inspectors and similar functionaries from eight different States and from British America; so great was the interest with which they participated in the investigations. A fund was established for the propagation of one or another special kind of fish, as, for example, the salmon from the Atlantic coast; and for the people at large, who ought to become interested in the mysteries

of development, a large aquarium,* the importance of which for scientific study was especially set forth. It was not long before they found out what should especially be done; they resolved to devote great energy to the propagation of young fishes, or, to speak perhaps more correctly, to the protection of young fishes. Instead of leaving the young to their own fate, they secure the spawn and the milt in time, allow the whole process of development to proceed in the publicly established apparatus, to set free therefrom the young as soon as they can take care of themselves. For many years have a portion of the fishermen followed the business of hatching spawn, raising the young in order to sell the grown fish later; and so skillful had individuals become in this achievement that the scientific men learned from them and took some of them into the service of the state as superintendents of the hatching operations throughout the Union. This thing, that individuals had acquired a considerable fortune by hatching and rearing fish, contributed naturally towards giving the whole matter the powerful impulse in a purely practical direction, which it gained very early.

In a book on trout-culture, written by a practical breeder, it is said, quite significantly for the stand-point which has already been reached, that it "pays better to rear trout than hogs"; and every one knows what the pork business is for America. All that I have learned indicates that this assertion has gained general acceptance both among the common people and the learned; and it is said to be assured that in the art of rearing fish the Americans surpass all others.

Partly to control the fisheries themselves, and partly in great measure to carry on the hatching operations, there were by degrees appointed in eighteen different States, taken together, fifty-two commissioners or fishery inspectors, besides a regular staff of subordinate officials. There was established by the United States Government, besides, a fish commission, whose chief is the well-known Prof. Spencer F. Baird. With this complement of special practical cultivated officials and talented scientific men the effort was untiring to produce and distribute young fishes from the mountain to the sea in small rivers and lakes, in the great streams, and in the great bays, both of fresh-water and salt-water fish.

Of large hatching-establishments there are many, public as well as private. A more detailed description of them would certainly be interesting, but without illustrative drawings such a thing would be hard to understand. Besides, the public is much too little informed about the matter to regard anything other than the practical results as particularly interesting. I shall, therefore, here devote my attention to throwing light upon what I will call the great enterprise of the hatching operations in America.

* This aquarium was set up after the example of the previously named society, the "American Fish Culturists' Association." It was established in New York on a rather large scale, and had at one time even a living whale to exhibit, which, however, unfortunately died, after the expiration of some time, from consumption, according to the statement of the doctors.

One of the most popular kinds of fishes in America is the shad, or "*stamsild*," which forty or fifty years ago was caught by the million in many bays and mouths of rivers. As soon as there was talk of restoring the depleted fisheries to their former magnitude, it was resolved, among other things, that they should also try the shad, both because it is a favorite article and because it multiplies rapidly. An experienced culturist, Mr. Seth Green, was taken into the service of the government and began the experiments. At the first hatching the eggs yielded only 2 per cent. of young; later it advanced to 70 per cent., and increased to 99. This was regarded as a triumph, because this high percentage of young hatched out was greater than ever was seen or hoped for, and it was also among the first great attempts with the herring kind. During a period of twenty days 40,000,000 of young shad were liberated at the mouth of the Connecticut River. No one knows in what time this fry will become mature or return to its nursery. Some think it will be about five years; others, a much shorter time. The next summer they began to hatch a new brood, and after an attempt of twenty days the summer heat became too strong for the eggs (they had already gained experience as to what temperature the young should have), and they concluded their work after having liberated 60,000,000 of living shad-fry. The following year they wished to await the result of the 100,000,000 before intrusting much money to the sea. The fourth year the people were highly surprised. It was three years since the first young shad were set free, and as early as the close of May it was reported that for twenty years such shoals of shad had not been seen approaching the land, and vessels which had come through the neighboring sound reported also great schools which stood towards the mouth of the river. The next day there was reported from five different fishing-places an unusually large catch of shad and from the rest that the fishing was remarkable. It continued to be great the whole fishing-season through, and the fish were large and good. By a comparison of this year's catch with that of previous years, it is found that this year's greatest haul yielded about 60 per cent. larger profits than ever before reported. The State's (Connecticut's) fish commissioner did not stop with this; the result had indeed been good, and they continued to set free the young and then capture the adult. In the two following years 156,000,000 eggs were taken and impregnated. Many States followed the example, and there will be planted yearly millions of shad-fry, carefully hatched, for the enriching of the fishery of the coast and in the rivers.

An interesting experiment was undertaken with shad in 1871. This fish was never seen in California or on the Pacific coast. In the year mentioned upward of 20,000 young shad were sent there and set free at Sacramento. They wished to introduce shad into a sea entirely new to them, and submit them to the experiment as to whether they would live there, and whether they would return to the place where they were liberated. The 20,000 shad disappeared in the deep in 1871; two years

later a few shad were seen here and there in the neighborhood, and in 1874 a number were caught. They had reached a good size, weighing as high as $3\frac{1}{2}$ pounds. This with many other experiments testified that shad require three years to become adults, that the shad will return to its feeding-place or where it was set free, and that the shad can thrive in entirely different seas from that in which it is thought to be a native.*

With a similar herring-species, the alewife, many experiments have been made also, which have testified how easy the alewife is to hatch out, how quickly it grows to an edible size (three years), and how rapidly it multiplies. It is estimated that every shad with spawn has 50,000 to 80,000 eggs, and that the "fresh-water herring" or alewife has, in proportion to its size, four times as many eggs. This naturally great capacity for reproducing itself is what one takes advantage of when one attempts with hatching-apparatus to protect the young from falling a prey to its natural enemies. Even a small number of herring will, provided their reproduction is protected, be able to increase to a great shoal in the space of a few years, and with this consideration in view it becomes an entirely practical economy to liberate millions of young every year and allow the fishermen to catch the adults for the fish-market. From one fishing-place it is stated that they yearly set free 4,000,000 to 5,000,000 young shad, and that the fishing steadily improves, so that now they catch between 300,000 and 400,000 pounds of mature shad.

It was after a little practice in the art that they succeeded in hatching out this herring-species, which now appeared so greatly increased. Before they had confined themselves mainly to salmon and trout, whose hatching was an ancient and well-known matter in Europe. And after the successful experiments with the shad itself they did not neglect these species of fish, because salmon and trout are far more valuable articles, and the California salmon especially is celebrated for its agreeable flavor. They applied themselves very diligently to their multiplication and distribution to new waters. For the illustration of this work I shall merely call to mind the operations on the Columbia River, in Oregon, and only add here that in 1875 11,000,000 of salmon-eggs were collected at the establishment of the United States Government, which were sent eastward to the waters of different States; this shipment amounted to not less than 20,000 pounds, including the packing. From another river were sent 5,000,000 eggs, packed in boxes of 50,000 each. On this scale they prosecute the work now with unabated vigor and with the mutual co-operation of the different States.

The economical question will indeed be of great interest for Norway.

* In a report printed in January, 1878, and which I have just received, it is stated that it is considered certain that the "adult shad will return to the place where it was set free when young." And by the fish-commissioner of California it is reported: "Shad were in 1876 and in 1877 right abundant in the Sacramento River." "There can be no doubt that the first shad which were brought from the Hudson River in 1871 have been out in the depths of the sea and have now returned and spawned."

In the numerous reports which I have read I have, however, found very little concerning it, so I cannot state in dollars what it will cost to hatch out some millions of salmon or shad. At the same time I have seen that the gathering of salmon-eggs, according to a statement, is becoming less expensive each year, and that the profit steadily increases. The same was still more the case with the shad, which yields so remarkably many more eggs. In the large establishments it is managed so that they succeed in one of them in hatching out a million shad for \$1.09, including all expenses. This million of shad one cannot naturally keep under his care until they become salable fish. They set free the whole mass, and it disappears in the deep to return in about three years to the shore where it was liberated. It is believed that one-fourth part return from their wandering about in the sea, where they are persecuted by so many fish. But even with so small a portion in safety, it must indeed turn to good account. Because, if one estimate, for instance, that an establishment hatches one billion in three years at \$1.09 per million, then would this outlay of \$1,092 in the space of the next three years yield a shoal of two hundred and fifty million shad. If only 2 per cent. of these are caught, one will then get five million shad, which would amount to from ten million to fifteen million pounds of fish, worth at least 11 cents per pound, which is \$273,000 to \$409,500 gross receipts. This calculation will seem, however, so exaggerated that, perhaps, no one will accept the result. One can, therefore, take off, deduct freely, and reckon on getting merely 10 per cent. profit, and then it reaches \$27,300 to \$40,950 gross profits from the young shad hatched out for \$1,092.

I have been informed that this shad (and the alewife also) might be particularly adapted to our Norwegian fiords. Lately I have come to the belief that an experiment in this direction will be worth the trouble. If one could, along the Norwegian coast, for an outlay of several thousand crowns, cause some shoals of shad to visit the coast annually, there would be a possibility that an attempt would be made with our own herring; perhaps it would multiply just as rapidly. With the American experiments in sight, I cannot, for my part, consider it a bold idea to contemplate the possibility that one, by skillful hatching, might be in condition to make up for the vanished spring-herring. But what will it cost? With the above calculation as a clew, the price would not appear to be great. But the point for the Norwegian herring concerned is this: that no one yet understands hatching it, scarcely how to use an apparatus; yes, indeed, no one knows how long it takes before it will mature or become salable. The prospects so far are indeed uncertain, and it is perhaps far too early to suggest the idea. It is also with a certain risk that I at present entrust it to paper and—publicity. However it is allowed to stand as my calculation.

With regard to the expense of hatching salmon and trout, they have in Europe varied experience in these branches. But the Americans maintain, as previously remarked, that they have carried the business

much farther, and hatched them both more safely and cheaper—uniformly cheaper. It will, therefore, be interesting to see the prices of salmon-eggs. I shall first, however, premise the remark that, according to the statement, salmon of both sexes must be bought from the fishermen and then brought to the establishment to spawn. The expenses of this plan naturally become considerably greater than with the little shad, because salmon ready to spawn are costly. The table refers to an establishment in Penobscot, Me.:

Year.	Number of eggs per fish.	Price per 1,000 eggs.
1871.....	651	\$16 25
1872.....	2,269	4 25
1873.....	3,560	2 73
1874.....	5,151	2 00

In the last-named year 3,039,000 salmon-eggs were gathered, assorted, and packed for the price of \$2 per thousand eggs; the whole operation cost \$6,000. A similar condition obtains with the trout; but, notwithstanding, this is so profitable that this hatching is carried on as an industry by fishermen and countrymen. And so great importance do they attach to the general distribution of salmon and trout in all waters, that the fish-commissioner of the State of New York has decided that the State establishment, which can now produce the young indefinitely, shall deliver to every owner of small streams or lakes as many young as he desires to plant in his waters, whereas hitherto only the great waters were supplied. They desire that the edible fish shall spread to all waters, even to the smallest streams and ponds.

In connection with this benevolence and generosity with which the fishery-inspectors are animated, to oblige all interested, it should be mentioned that they instruct the people in hatching and rearing young fishes. And the work enlarges so as to include more and more kinds of fishes, so as to succeed gradually by study and experiments in learning the peculiarities of the fishes concerned, and what there is to notice with regard to the temperature of the water, the nature of the bottom, articles of food, &c. For this study material is collected from the whole world; even from the interior of China information is seen to be brought on breeding; and it was, therefore, not surprising to see that the Norwegian spring-herring question also, and the dispute between Axel Bœck and Ossian Sars about their new herring-theory has found a place in the official reports. In a fishery-meeting in New York in 1877, to which I was invited, they wished even to have an account of the Norwegian legal provisions for the preserving of fish, on which occasion I, on a special summons from the directors, was obliged to come forward with a discourse. A fishery-inspector from Holland also, who, by chance, was present, was questioned on his country's fishery-relations.

Besides the proper fish hatching and rearing they have also applied

themselves to cultivating and raising oysters, lobsters, frogs, eels, &c. The so-called oyster-culture, with which is next intended systematic preserving and capture, is a great business, without a parallel in any country.*

From what I have here communicated in extracts and brief summaries it will presumably be evident that the American example contains a stirring invitation also to Norway to develop her fresh-water fisheries, which are now greatly neglected.

X.

LIFE ON BOARD A FISHING-SCHOONER AT SEA.—MACKEREL-CATCHING WITH THE PURSE-SEINE.

After having waited some time for an opportunity to go to sea, to witness the business out there, I succeeded in getting a promise of a place on board the schooner William Baker, Captain Pearce. It was an old vessel, but a good sailer, and the captain was recommended to me as an experienced, enlightened, and generous man, who would take much interest in communicating to me all the information he could give. He had carried on the herring-fishing at Labrador, halibut-fishing off the west coast of Greenland, and was now determined to prosecute mackerel-fishing in the sea north of Boston.

Late on a rainy evening I was informed that the vessel was now ready to sail, in Gloucester Harbor, and that I could come on board. Neither the weather nor the vessel particularly invited one out in the dark, foggy night. But after being shown a tolerably good bunk astern, where besides myself four of the crew had quarters, I soon found myself adjusted and anxious to get under sail. Early in the morning we cast loose and the vessel hauled out into the channel. But the wind was still; we could make no headway. While we waited for the wind a portion of the crew passed away the time by taking a bath and swimming out in the deep. Their invitation to me to swim a race with them I was in the notion of accepting, when the signal was given to make sail and get under way. All came on board, took off their swimming-clothes, put on dry clothes, and caught hold at the anchor-breaking and later at the hauling-out so that it was a pleasure to see them. The brutal execution of discipline, so often censured on American merchant-ships, did not exist on board here. The whole crew were native Americans, active and experienced fishermen. They associated with one another with good-will, eating at a table common to us all, and carried on their work with mutual satisfaction. Neither beer nor whisky is found on board; but warm

* In one of the last official reports to the United States Government is found printed a full description of the oyster-industry in the United States. Here, according to the older statements, the whole oyster-trade is estimated to amount to the sale of 4,000,000,000 oysters, worth about \$69,250,000. To this may be added the profit of other shellfisheries, and of the oyster-shell, which is burned into lime.

coffee and tea can be had from five in the morning to six o'clock in the evening. In other respects the victuals were good and nourishing, consisting mostly of beef, pork, all kinds of fresh fish, different kinds of pie and pudding, sometimes vegetables, with eggs occasionally; in short, about as in a frugal municipal family in Norway. The men were not hired, but had half the weight or a half share of the profits, which were calculated after the expenses of salting, packing, barrels, &c., were deducted. The cook, who besides the usual work in catching had to prepare the meals, got besides for his part \$27.30 per month. The trip just ended had been made in three weeks and had yielded a profit of a little over \$81.90 net per man, which is considered a very good trip. The crew in herring-fishing, on the contrary, is generally hired. They ship at \$10.92 to \$13.65 per month for young boys; \$32.76 to \$40.95 for able-bodied fishermen.

After being under sail a couple of days we saw a whole fleet of mackerel-schooners. There were between 80 and 90 sail, some of which had made a light catch. We passed some steamers which carried on menhaden-fishing, and which went into port every evening to unload. These vessels were quite recognizable by this, that they had two men on the lookout in the cross-trees, on the foremast, and the rest in boats prepared for fishing. Among other sail we passed also an old-fashioned French-rigged vessel, which carried on mackerel-fishing with trolling-lines; the vessel was belayed and went before the wind. A crew of ten men stood to leeward, and each man with at least two hand-lines, which he incessantly cast out and hauled in, while two men ground bait (in a hand-mill) and threw out "chum." The catch was poor, and the mode of catching, itself, most fishermen had given up for capture with purse-seines, which have superseded all other implements.

While crossing back and forth we often saw mackerel-schools playing in the water, but they vanished suddenly. The folks told me that one could smell mackerel as well as menhaden when the large schools of fish were in the water. I entertained doubt of the truth of this information, but in the following week I became perfectly convinced of its authenticity. Early one morning one of the crew said that he smelt menhaden, and went immediately aloft on the foremast to discover the school. A half hour later we saw a school playing on the surface of the water; it was large mackerel. In haste everything was made ready; the purse-seine, which lay on the after hatch coiled up in a bundle and wet with brine (to prevent rotting), was quickly flung down in the seine-boat, which was kept constantly in tow; next two small boats set out, so-called "dories", flat-bottomed, light-rowing boats, half "*sjægte*" and half lighter. These are said to be the best fishing-boats known. When all was ready I leaped down into the boat, and away it went. After a half-hour's rowing the seine-boss found that the time had come to row in on a large school, which played quite delightfully. In three minutes the seine, of about 250 fathoms, was rowed out and cast in a circle around the

school. After ten minutes more the seine was pursed, and in it they estimated that they had caught 300 barrels of mackerel. A dory was sent with a message on board the schooner, which was managed by the captain and a small boy; after a little manœuvring the schooner sailed close to the seine, got a portion of the cork-line on board, so that the catch was brought between the vessel's side and the seine-boat. A large dip-net, with tackle and a long handle, was made ready, and in a few minutes the living mackerel were thrown upon the deck by the half-barrel. The captured fish in the seine became, in the mean time, very uneasy, and rushed from one side of the seine to the other; suddenly the seine burst in many places; they sought to haul in the seine, both in the boats and on board, and after much trouble they succeeded in retaining and heaving on board a total of about 50 barrels. The rest of the mackerel escaped through the large holes in the seine.

As soon as the catch was secured on board they took in all sail and began on the preservation of the mackerel. With small dip-nets the fish were thrown in a square trough, and from this, as they were cut and washed, they were assorted according to size. The fish was split or cut in the belly (?) about as cod which are manufactured into split fish. While sprinkling them with salt they give them some slight cuts in the back to make the flesh swell and give the fish a fatter and fuller appearance. This is a trick which both the sellers and buyers understand. Twelve men are engaged at a time with the salting, while the remaining two men examine and repair the seine. In the space of two and a half hours 47 barrels stood ready salted. For every four barrels of fish was required one barrel of Liverpool salt, the packing being done later on shore.

The next morning at 6 o'clock we were again in the boats, made a new cast, but caught nothing. At 8 o'clock we were again out, went half way round with the seine, when the whole school sank to the bottom. We caught nothing. The mackerel were wild and shy, played a little at the surface of the water, but vanished quickly, to emerge again farther away. The mackerel-schools were very large this day; for as far as we could see on all sides they were playing on the surface of the water. We made no catch notwithstanding. The captain's attempt to entice the schools with "chum" also failed. At 11 o'clock we again made a cast, but took only eight mackerel. At 2 o'clock p. m. we made the fourth cast and got a couple of barrels; at 4 o'clock, another cast, and took 10 barrels, but small mackerel; and at 6 o'clock we made another, but got almost nothing save small fish. This was a laborious day; but, notwithstanding, we were the next day, at 5.30 in the morning, again in the boat, made a cast, but instantaneously the school turned around and made their escape. We saw many schools also this day, and at 6.30 we were again on the way after one. This time we were successful. They estimated the catch in the seine at 400 to 500 barrels. They were very large and fat mackerel. After some trouble, the vessel sailed to us, got

a portion of the seine on board, and the taking in the fish was about to begin. But the fish were very uneasy in the seine; sunk to the bottom with such force that the boat was on the point of capsizing, although we placed eight men on the other gunwale to counterbalance the mackerel. At one time all went smoothly enough to haul in on the seine and make the purse smaller and smaller to prevent the frantic rushing of the mackerel. But suddenly they sank again to the bottom, careened the boat over so that we took in a quantity of water. We were scarcely ready to place ourselves on the other gunwale when we felt that the boat suddenly righted itself and lay still. The most knew what had happened; it was that the mackerel succeeded in breaking the old seine. Through a large hole, which became larger and larger, about the whole school escaped; and although we in all haste hauled in on the fragments and tried to form a new purse, we succeeded in saving not more than five in the whole 500 barrels.

At 9.15 we set sail for the nearest port; it was considered useless to attempt to mend the more than half worn-out seine. After a day's quick sailing, we reached Boothbay late in the evening. In the harbor lay a schooner just arrived, which was filled to the rail with fresh-caught mackerel. The crew worked the whole night in preserving them. With resignation our crew saw this work. Had we had a better seine, we would also have had remunerative night-work in salting some hundred barrels of mackerel. The next morning I left the vessel, to return to Gloucester by steamer and railroad.

In this way 600 to 700 schooner-rigged vessels carry on mackerel-catching out in the sea, and almost exclusively with purse-seines. They are of from 120 to 150 tons burden, and 10 to 14 men for crew. I have seen the statement that one, as a rule, can calculate that each schooner during the summer catches 1,000 barrels, at \$10.92, which would give \$6,552,000 or \$7,644,000 as the aggregate profit. The catch, however, is quite variable; some successful vessels have caught many thousand barrels in a season. The fishing begins in April or May, far south on the coast. Then the mackerel are fat. The fishing-fleet follows them northward week after week, and in July or August they have advanced as far north as Nova Scotia. Thereupon they bear southward again. The mackerel have now become very fat and large; the catch is then at its best. In September the schools are in full retreat to the warmer waters again; and in October and November the fishing closes.

Salted mackerel are submitted to public inspection. They are assorted into three numbers, the prices of which in August, 1876, are subjoined here:

Length of fish.	Number per barrel.	Price per barrel.
No. 1, 13 English inches	About 140	\$16 38
No. 2, 11 English inches	About 240	7 64
No. 3, under 11 English inches	About 350 and over	6 00

3

For No. 1's with the heads cut off is obtained \$5.56 more than for common 1's. For packing, barrels, and inspection, is estimated on the average \$1.91 per barrel.

The same schooners which prosecute mackerel-catching go partly also into the herring-fishing; the best fat-herring fishing begins in the middle of August and continues at Newfoundland and Labrador until about mid-winter. In the winter months are caught also large fat herring. Alternating with this fishing the same vessels carry on in part cod-fishing on the Great Banks, and halibut-fishing there and off Greenland. These fisheries I had not the opportunity to make myself more familiar with, as it would have taken a long time to follow the vessels out on the banks and see them. But with regard to the profit in general I can state that it is about as in mackerel-fishing, with the difference, however, that the herring-fishing yields something less than \$5,560 to \$8,190 to a schooner for the season, while bank-fishing for cod and halibut yields something more, namely, as much as \$10,920 to \$13,650. However, the halibut-fishing fluctuates greatly, it is said; since it may sometimes yield a far greater profit, of which one has an illustration in this, that a vessel has brought its owners about \$27,300 profit in a year, and that skippers have earned from \$1,638 to \$5,560 for their share.

A description of the universal implement for the capture of mackerel, menhaden, and herring, namely, the purse-seine, I have already sent to the honorable department in a printed letter. Besides I have treated of the purse-seine in a couple of articles in the "Bergen Post" last summer, in which I gave an account of a trial trip with a Norwegian purse-seine of hemp thread. This trial trip, at which I was present by request, after four days' sojourn at home on my return from Philadelphia, was made from Stavanger and required 14 days' time in the beginning of June. The result arrived at was briefly this, that even a large, heavy purse-seine of hemp thread may at a pinch be used for the capture of herring, but hardly of mackerel. However, we saw only herring, but not a single mackerel, which could hardly be expected either, since the weather was cool and partly stormy near the coast as well as twenty miles out in the North Sea. That a large purse-seine of about 200 fathoms is not suitable arises from this, that it is cumbersome to handle; the thread alone in a hemp seine is about 50 per cent. heavier than in a cotton seine, and the heavier the seine is, the more cork and lead must it have; from this it follows again, that heavier twine must be used; one gets also a far heavier implement, and for its management is required a larger crew, which again involves a larger boat—in short, step by step one departs from the chief qualifications for the purse-seine's cardinal virtue, *facility of management* united with strength, by which its whole cost as well as the expenses of working it are not so inconsiderably greater at the same time that the profit in general must be diminished. The fact that the purse-seine in question later in the summer caught mackerel partly shows that it should not be entirely rejected.

Another Norwegian purse-seine of hemp thread, procured in Bergen, was used north of Doore in the summer-herring fishing; it was, though more nearly perfect, yet larger and more massive; but it caught a few herring. Some errors and inaccuracies I had occasion to point out and partly remedy in both of these. In the southern spring-herring district in the winter a partial attempt was made with more or less unpractical imitations of purse-seines, as the common herring-seines were fastened together; concerning these attempts I think it should be said that they surely injure rather than benefit the matter; because they must as a rule bring disappointments and indirectly weaken the desire to make the attempt with a proper and easily managed implement. In Sweden and Germany also they wish now to experiment with American purse-seines of cotton; thither were sent, after the receipt of orders, many small models with descriptions from Norway.

The purse-seine is, however, fully discussed in Consul Joakim Andersen's interesting communication on his operations as a jurymen at the Exhibition. I shall therefore not occupy myself further with it, but take leave of it by closing with a little note, which has its special interest: The American purse-seine is arranged on exactly the same principle as that which forms the basis of an implement of capture for herring invented by Berent Chr. Vedeler, of Bergen, now deceased, on which he, by a supreme resolution of the 12th of March, 1859, received a patent for five years. A drawing and model of Vedeler's purse-seine are found in the Polytechnic Journal for 1864 (the time registered by engineer N. H. Brun, *m. fl.*), pages 123 and 124. From this it is seen that it differs very slightly from the American; the difference is essentially this, that Vedeler allowed the pursing-rope to run in rings along three sides of the seine, while the Americans more practically let the pursing-rope run only along the bottom line. Moreover Vedeler decided that his seine ought to be only 40 fathoms long and 10 fathoms deep, also only a sixth part of the usual size among the Americans for large seines. Since Vedeler said nothing about the thread, I assume that he has used hemp thread, which, as before mentioned, is not used in America, where cotton thread is considered far more suitable and the only proper thing for purse-seines. It is not so unlikely that Vedeler's patent is the first entirely original invention, and that his invention, like so many remarkable ones, has found its way to America, and there received the merited appreciation and such a practical adaptation that it has become the most important implement for a very considerable business. In any case it seems to me that Mr. Vedeler's invention deserves mention and his talent to be commemorated at this time, since his original idea returns to its native land in improved form now to find in all probability full appreciation.*

* The purse-seine was in use in America in its present form at least as early as 1855.—Translator.

XI.

CONCLUDING REMARKS.

As one will have seen, I have treated only of what is especially peculiar in the American fishery business. I have only occasionally and quite hastily touched upon what there is in common to the Norwegian and American relations. The task which I set myself was to find out in what direction the development of America's fisheries went, as I believed that therein would be found the cause of the growing superiority of the Americans as fishermen and fish-dealers. If I have succeeded in showing this, and that the track in which development proceeds there must lead to great profits above the present average, then I may flatter myself that I have given those most interested in Norway's fisheries some useful hints. That I have not been able to exhaust everything, is evident; I have not dared to extend my treatise over the entire field, but was obliged to confine myself to several points so as to be able to give something collected and complete. Since one for so many years frequently has heard complaints, for instance, about the management of the herring, the herring-barrel's capacity, the handling and drying of split cod, &c., I consider it useless to repeat or support these current complaints in the survey of the state of things in America; besides, there is doubt whether the Norwegians, just in this respect, had so much to learn from the Americans.

What Norway needs first and foremost is an enlarged market for its products. So far as the herring are concerned, this may in part be attained by using better barrels, which will endure longer transportation without allowing the herring to become dry or pickle. Beyond this there is indeed nothing new for the management of herring. But for the fishery-products in general more is required; they must have more varied preparation and not be exclusively salted, pickled, or dried.

These modes of preparation will no doubt be demanded by the most important markets for Norwegian wares; but it is certain that both fresh and oil-prepared articles may also find profitable markets. And indeed the more variety one employs in the treatment of the raw material the less will one be liable to suffer from overfishing and overproduction. When we employ new modes of preservation we will find new markets, and when we secure more markets we will make more profitable sales.

In discussing the American traffic with fresh fish in ice, their storing of fish in a freezing-apparatus, their import and export, preserving articles and treating them with oil, I have sought to point out how the fish-traffic is developing in America, and thereby also indicate in what direction, in my opinion, we also ought to go to work in Norway. In treating of the American hatching-operations and what is therewith associated, I have wished to point out what means they have at hand for

increasing the country's profits from the lesser fisheries, yes, perhaps, partly even for creating new and quite important fisheries. In finally discussing the arrangement and use of the purse-seine, I have sought to direct attention to an implement of capture which we stood greatly in need of, namely, an instrument with which one can fish in the open sea, and among other fishes catch also the herring, which will not resort to the shore. It seems to me that much might be accomplished with all the implements here named. The fisheries in our country, it is true, are associated with so many ancient traditions and continue in many parts in so little developed proportions, that it could not be expected that new ideas should be accepted at once, to say nothing of a complaisant reception; but perhaps on that very account one should labor the more diligently to extend in this field an acquaintance with improvements and new methods of work.

