

half was planted near the falls of the Qualba, a very suitable locality, owing to the sandy bottom and the nearness of a rich aquatic vegetation. All the eggs planted in the two locations referred to were exceptionally fine and healthy. Quite a number of young fish have been observed here, which goes to show, first, that the eggs from the Torbole establishment had been hatched, although some people maintained that this would not be the case, as they had not been fecundated according to the Russian system; and in the second place, that large fish had not come near the shores and devoured them.

Another 100,000 embryonated trout eggs, received from Torbole in an excellent state of preservation, and destined for the Venetian waters, were sent to Count Ninni, who selected the locations where they were to be planted, namely, one-half in Lake Lapisino and the other half in the waters near Trevigiano. These were planted on January 6 and 8 at different spots, where there was a suitable bottom and pure water. Some specimens of the eggs were taken to Venice and there hatched in a small apparatus on January 16, with such success that 130 healthy young fish were placed in open waters, thus proving the excellent quality of the eggs.

Fifty thousand eggs of the *Salmo salvelinus* were received from Freiburg, Germany, and on January 18 were planted in Lake Idro, at a depth of about 10 feet, on a sandy and rocky bottom. Some specimens of these eggs were sent to Pavia, and were very successfully hatched between January 30 and February 1.

Finally, 800,000 young eels, taken near the mouth of the river Arno, were planted in Lake Trasimeno, where they could find ample food in the innumerable *Leuciscus aula*. In former years this lake was very rich in eels, and it is to be hoped that it will regain its ancient fame in this respect, as some of the young eels which were planted have already been caught in an advanced state of development.

PAVIA, ITALY, December 15, 1885.

82.—THE SEA FISHERIES OF NORWAY.*

By Dr. FRIEDRICH HEINCKE.

In no country do the sea fisheries play such an important part in public affairs as in Norway, nowhere is such a general interest taken in them, and in no country are better and more exhaustive fishery statistics taken. For centuries the Government has taken account of the results of the fisheries, and for more than twenty years regular and extensive statistics have been obtained. A uniform plan, however, has been followed only since 1876; and the annual reports published since

*"Die Seefischereien Norwegens." From *Mittheilungen der Section für Küsten- und Hochsee-Fischerei*, Berlin, July and August, 1886. Translated from the German by HERMAN JACOBSON.

that year by the statistical bureau at Christiania give an excellent idea of the condition of the Norwegian sea fisheries.

Norwegian statisticians refer to the extraordinary difficulties in the way of obtaining reliable statistics, and to the consequent necessity of confining them within certain limits. The daily small fisheries, which play an important part in the households of the fishing population, have been entirely left out from the reports, because it was absolutely impossible to obtain any reliable data; the statistics consequently relate only to the fisheries which have been regularly carried on on a large scale. Even in these statistics no account could frequently be taken of the fish which were immediately consumed by the fishermen, so that in many cases the reports covered only the fish which were brought into the market. It will therefore be seen that in most cases the figures given in the statistics are below the actual figures. Least reliable are the statistics relative to the herring fisheries, over which it is exceedingly difficult to exercise any control; while the statistics of the Lofoden cod fisheries and the so-called "lodde" fisheries in Finmark are the most reliable, and in fact often absolutely correct, because these fisheries have for years been under a police supervision organized on a model system.

There are separate statistics for every fishery, covering many different points, especially the number of fishermen, boats, and apparatus; the total yield of the fisheries and the separate yields according to provinces, counties, districts, and sub-districts; the value of the fish; the quantities of fish cured in various ways; the prices of fish; the shares and wages of the fishermen; the quantity of fish exported from Norway, giving the entire quantity and the quantities exported from each port, &c.

According to the census of December 31, 1875, there were engaged in the fisheries 33,255 male persons upwards of fifteen years of age, that is, 6 per cent of the adult male population. To these should be added 23,381 male persons upwards of fifteen years of age who occasionally engaged in fishing; therefore a total of 56,636, or 10 per cent of the adult male population. In no other civilized country is the percentage of fishermen so large as this.

The total value of the Norwegian fisheries (exclusive of oysters) was, for the period from 1866 to 1874, on an average per annum 22,470,000 crowns* [\$6,021,960], the minimum (1869) was 18,644,000 crowns [\$4,996,592], and the maximum (1877) 29,434,000 crowns [\$7,888,312]. These calculations, like all the following, have been made on the basis of the average prices paid at the fishing stations; they cannot, therefore, lay claim to absolute correctness, but give a fair approximation of the actual value.

As regards the different kinds of fisheries carried on in Norway, this country shows a remarkable difference from all other nations inhabit-

* The reductions are made on the basis of one crown equaling 26 $\frac{2}{3}$ cents.

ing the shores of the North Sea and carrying on sea fisheries. This difference is caused by the nature of the bottom of the sea off the coast of Norway. From the Skager Rack to the Polar Sea the bottom in immediate proximity to the coast sinks to a considerable depth, only a few of the numerous fiords having a depth of less than 100 fathoms. The North Sea proper, on the other hand, and the sea surrounding the British Isles, has a depth of more than 100 fathoms in only a few places, but is full of flat banks, approaching the surface of the sea within 10 fathoms or less. This explains the wealth of the North Sea in flat-fish and the great importance of the English trawl-net fisheries in the North Sea. The case is very different in Norway. Here the deep bottom of the sea has very few flat-fish, or at least trawl-nets cannot be employed on account of the great depth. Plaice, halibut, and even haddock are therefore not caught very frequently, and their place is taken by the fish inhabiting the open ocean, such as the cod, herring, and mackerel, which approach the coasts at certain seasons of the year for the purpose of spawning.

The main places of sojourn of all these fish are far out in the open sea, or farther north in the Polar Sea, that is, in regions which so far have been almost entirely inaccessible. Thus the enormous shoals of fish which at regular seasons approach the coasts of Norway appear to the Norwegians more than to other nations as the gift of providence, which man may accept, but which he can in no wise either increase or decrease. In fact, the history of the Norwegian fisheries and the statistics of the last twenty years show that the fluctuations in the yield have nothing whatever to do with excessive fishing or other hurtful measures taken by the fishermen, as is to some extent the case on the British coasts, but that they must be explained from entirely different (and so far unknown) causes, to be found in the nature of these northern seas.

As regards the kinds and yields of the sea fisheries, the entire coast of Norway may be divided into four districts: The first is the coast of the Skager Rack from the boundary of Sweden to Cape Lindesnaes. It produces about 3½ per cent of the entire yield of the fisheries. The second district is that of the North Sea from Cape Lindesnaes to Cape Stat, yielding about 9 per cent. The most important fisheries of this district are the spring-herring, lobster, and salmon fisheries. The third district is the Norwegian North Sea coast from Cape Stat as far as the island of Sorøe, in Finmark. Here the most productive of all the Norwegian fisheries are carried on (about 71 per cent). This is the region of the fat-herring, great-herring, and cod fisheries. The fourth district embraces the coast of the Polar Sea, from the island of Sorøe, yielding about 17 per cent. The principal fish caught in this district is the spring cod. The above will show that it is not the North Sea proper, but the open ocean, which is the main source of the Norwegian wealth of fish.

The most important of all the Norwegian fisheries are the cod fisheries, their production being about 60 per cent of the entire yield. These fisheries are carried on within a distance of 10 miles* from the coast, almost exclusively with open boats, which carry nets, long-lines, and hand-lines. Every boat with nets has a crew of three or four men; every boat with long-lines, generally three; and every boat with hand-lines, four. The net fisheries are the most expensive, but also the most productive, while the hand-line fisheries are the cheapest, but the least productive. Prior to 1881 nets were mostly used, but of late years the line fisheries have become more important, the hand-line fisheries yielding on an average 8 to 10 per cent of the entire production.

During the period from 1879 to 1884 there were on an average engaged in the cod fisheries 77,289 fishermen, with 18,135 boats, the average annual yield being 53,516,000 codfish, valued at 12,544,000 crowns [\$3,361,792]. In 1880 the number of cod caught was 68,000,000; in 1883, only 33,000,000; and in 1884, 50,000,000. It will thus be seen that there are great and sudden fluctuations in the yield, but as far as our statistics go they have quickly reached the usual average, while the causes of these fluctuations are entirely unknown.

The entire cod fisheries may be subdivided into the winter cod fisheries and the spring cod ("lodde") fisheries. In the winter cod fisheries fish are caught which, when approaching the coast, contain a great deal of roe and milt. These fisheries last from January till April, when the fish, having spawned, again leave the coast. The main winter cod fisheries are carried on near the Lofoden Islands. The spring cod make their appearance on the coasts of the Polar Sea from February till May, and are not mature fish (not ready to spawn). They only come near the coast in pursuit of the "lodde," a kind of smelt, which at this season frequents the bays of the Polar Sea in enormous quantities, and is caught for the purpose of serving as bait. Consequently but few nets are employed in the cod fisheries, but principally long-lines and hand-lines.

The winter cod fisheries near the Lofoden Islands and Vesteraalen, carried on principally on the side of these islands towards the mainland, have from time immemorial been the most important fisheries of Norway, and are unique. From January innumerable fishing boats come to these islands from all parts of Norway, accompanied by trading vessels, which carry the necessary supply of salt for salting the fish, which buy a great many fish, and supply many of the wants of the fishermen. The entire fisheries, from January 16 till April 14, are under the careful and strict supervision of a naval officer, and they are thoroughly regulated by numerous laws and regulations. The supervising officer is also commissioned to take the statistics of these fisheries. These statistics are exceedingly comprehensive and exact. During the last ten years there were engaged on an average, per annum in this district, about 25,000 fishermen, with about 6,000 boats, and the annual aver-

* This is probably the Norwegian mile, which equals about 4.7 English miles.

age yield was 24,000,000 codfish, each weighing on an average 4 kilograms [8.8 pounds]. The number of trading vessels was on an average from 500 to 600, of which more than 100 were exclusively engaged in supplying the fishermen with articles of food, clothing, and other necessities of life. Liquor can be sold to the fishermen only by specially licensed persons, one to every 400 or 500 fishermen. Owing to the weather, fishing cannot be carried on every day, but generally on from three to five days a week. The temperature of the atmosphere is, of course, low; during the years 1879 to 1884 it varied during the season only from -2.2° to $+2.4^{\circ}$ C. [about 28° to $36\frac{1}{2}^{\circ}$ Fahr.]. There are on the coast regularly about 100 persons engaged in serving and amusing the fishermen, such as photographers, restaurant keepers, musicians, and owners of panoramas and other shows. The majority of the fish caught near the Lofoden Islands (about two-thirds to three-fourths) is worked into "klip-fish," that is, the head is cut off, the backbone and entrails are taken out, and the fish are then salted and dried. The remaining portion of the fish are dried without being salted, and are called "stock-fish." Of these latter there are three kinds, namely, the common "stock-fish," called "round-fish," of which only the head and the entrails have been removed; when the fish has been split lengthwise along the back, the backbone has been taken out, and the two halves have been pressed asunder, it is called "rotscher" or "flack-fish;" and the third and least valuable kind is the "sei" or dried *Gadus carbonarius*. "Klip-fish," of course, fetches a higher price than "stock-fish."

Next to the fish the most important product of the Lofoden fisheries is cod-liver oil. During the years 1875 to 1884 there were, on an average, produced per annum 26,500 barrels of common cod-liver oil and 2,440 barrels of fine (so-called medicinal) cod-liver oil. The roe of the cod is salted and sold as bait to the French sardine fishers. Formerly the heads were generally thrown into the sea or dried and used for feeding the cattle. Of late years, however, buyers regularly visit the fishing stations and buy the heads for guano factories. As early as 1878, 53 per cent of all the heads were used in guano factories. According to a calculation for the period 1876 to 1878, the total value of the Norwegian cod fisheries was distributed as follows: The fish themselves, 73.3 per cent; liver and cod-liver oil, 18.3 per cent; roe, 7.7 per cent; and heads, 0.7 per cent.

The total annual value of the Lofoden fisheries from 1876 to 1884 has averaged 6,200,000 crowns [\$1,661,600].

The spring cod fisheries (the "lodde" fisheries) in the Polar Sea are likewise very important. From 1869 to 1884 there were on an average engaged per annum 3,714 boats with 12,825 fishermen. Many of these come there after the Lofoden fisheries have come to end. During the last six years the average annual yield was 13,000,000, valued at about 2,500,000 crowns [\$670,000]. Of late years the yield has fluctuated

very much, as in 1880 it was upwards of 23,000,000 fish, while in 1883 it was only 3,500,000 (the smallest yield during the last 25 years); in 1884, however, it had again reached 16,000,000. The fish were in equal parts worked into "klip-fish" and "stock-fish," the latter being almost exclusively "round-fish."

Besides these cod fisheries within the 10-mile limit, cod fisheries are also carried on farther out, off the coast of Romsdal, in covered boats. Swedes, occasionally Frenchmen, and fishermen from the Färöe Islands also engage in these fisheries. On an average 100 boats are every year engaged in these fisheries, and the yield has averaged 1,000,000 fish. Cod fisheries are also carried on during the summer near Spitzbergen by boats from Transöe and Finmark. The yield varies very much, averaging from 250,000 to 500,000 per year.

The Norwegian herring fisheries, comprising about 25 per cent of the total annual yield of the fisheries, and during the period from 1866 to 1884 yielding annually fish to the average value of 6,400,000 crowns [\$1,715,200], are of four kinds, namely, the spring-herring fisheries, the fat or summer herring fisheries, the great or north herring fisheries, and the small herring or sprat fisheries. These fisheries are carried on with open boats, partly with floating nets and partly with stationary nets. The boats with floating nets are generally about 30 feet long and 10 feet broad, and have as a rule gaffs, jibs, and foresails, a crew of 4 or 5 men, and from 20 to 60 nets, each 10 to 15 fathoms long and 100 to 120 meshes deep, with cork or glass floats at the top and with stone weights at the bottom. According to the depth at which the shoals of herring are found, the nets can be set nearer to or farther from the surface. The fisheries with stationary nets are carried on by associations, each consisting of 13 or 14 men, and owning several boats and nets. When the herring which have entered a fiord want to get out again, the entrance of the fiord is closed with one or several large stationary nets, and the fish are then caught with seines. It has happened that in small fiords which had been closed in this manner, such enormous masses of herring had been shut up that they could be dipped out with pails or caught with the hand.

The spring herring is a large full herring which comes from the North Sea in January and February for the purpose of spawning, and in dense shoals, the approach of which may be recognized by a peculiar movement of the surface, and by the whales following in their wake and the sea-gulls hovering over them. These herring enter the fiords, especially north and south of Stavanger. In former years this fish formed the principal object of the Norwegian herring fisheries. But from 1786 till 1807 they failed to approach the coasts of Norway in any considerable quantity; from 1807 on, however, these fisheries again became productive. During the last twenty years the largest quantity (947,000 hectoliters *=2,680,010 bushels) was caught in 1869; from that year on

* The hectoliter equals about 2.83 United States bushels.

the yield very rapidly decreased to 1,200 hectoliters [3,396 bushels] in 1874, kept on fluctuating, with a slight tendency toward an increase, and finally rose from 32,000 hectoliters [90,560 bushels] in 1883 to 261,000 hectoliters [738,630 bushels], valued at 1,500,000 crowns [\$402,000], in 1884.

At present the fat or summer herring fisheries are much more important than the spring-herring fisheries. The summer herring fisheries furnish 20 per cent of the yield of the entire Norwegian fisheries. The summer herring is not a spawning fish, but probably a herring which has fattened again after spawning. It appears in the sea from Cape Stat to the island of Sorøe, principally in the district of Northland, south of the Lofodens, and near these islands. In this region it fills the fiords and bays during the summer and autumn months. By far the greater portion are caught in stationary nets. From 1879 to 1884 there were annually engaged in these fisheries an average of 29,187 fishermen, with 5,377 drift-net boats, and 1,077 stationary net associations. The annual average yield was 568,000 hectoliters [1,607,440 bushels], valued at 4,233,000 crowns [\$1,134,444]. The fluctuations of the yields are not near so great as in the spring herring fisheries.

Still more mysterious than the spring herring is the so-called great or north herring. Prior to 1863 it was entirely unknown; but in that year it appeared, a very large mature herring, in considerable numbers on the coasts of Northland and South Finmark, from November till the beginning of January, and disappeared in 1874 without leaving a trace. These fisheries were mostly carried on with stationary nets, and their annual yield from 1863 to 1874 varied between 69,000 and 1,056,000 hectoliters [195,270 to 2,988,480 bushels].

The small herring or sprat fisheries furnish the well-known Christiania anchovies and other small herring, and are principally carried on in the North Sea, from Cape Lindesnaes to Cape Stat; they furnished from 1879 to 1884 an annual average of 156,000 hectoliters [441,480 bushels], valued at 338,000 crowns [\$90,584].

The Norwegian mackerel fisheries are confined to the coast from the boundary of Sweden to Cape Stat, therefore to the Skager Rack and the North Sea. Since 1858 fresh mackerel on ice have been exported, especially to England, and since that time these valuable fisheries have increased considerably. The mackerel come to the coast in May and stay till autumn. The fisheries are carried on partly with floating lines, partly with drift-nets and stationary nets, but principally (and increasingly so) with large covered boats and drift-nets. Each net is 20 to 30 fathoms broad and 80 to 120 meshes deep (breadth of meshes from 38 to 40 millimeters [about 1½ inches]), and 40 nets form a set. They are cast in the evening and taken up in the morning. During the period from 1879 to 1884 there were on an average engaged in these fisheries per annum 3,767 fishermen, with 974 boats with drift-nets. The average annual yield was 5,586,000 mackerel, valued at 720,000 crowns [\$192,960].

Where the mackerel fisheries cease, as they do near Cape Stat, other very important fisheries commence in summer and autumn, and extend as far as the Polar Sea, giving the largest yields on the coast of Finmark. These are the so-called summer fisheries for ling (*Lota molva*), *Brosmius brosme*, *Gadus carbonarius*, halibut, flounder, and other deep-water fish, which are carried on partly in open and partly in covered boats with lines and hand-lines, and extend beyond the 10-mile limit. The importance of these fisheries will appear from the fact that their yield comprises about 10 per cent of the entire yield of the Norwegian fisheries, and from 1869 to 1884 was valued at an average annual sum of 2,458,000 crowns [\$658,744]. Of late years these fisheries have increased considerably. The fish are prepared in various ways, salted or dried.

The salmon and salmon-trout fisheries carried on near the coast and at the mouths of rivers have also increased very much since fresh salmon on ice have been exported. Different kinds of apparatus are employed in the fisheries; stationary and drift nets, traps, lines, and fish-hooks or spears. From 1869 to 1884 the average annual yield was 366,000 kilograms* [806,884 pounds], valued at 387,000 crowns [\$103,716]. The more important fishing stations are in the Skager Rack and in the North Sea.

Of special interest are the Norwegian fisheries in the Polar Sea, which, exclusive of the spring cod and ling fisheries described above, are principally carried on beyond the 10-mile limit, by open and covered boats from Transöe, Hammerfest, and Vardöe. The most important fish caught are *Delphinapterus leucas*, *Scymnus borealis*, codfish; beside seals, walruses, and whales. The most important of these fisheries are the whale fisheries, which are principally carried on in the Varanger Fiord with steamers and harpoons fired from guns. After the fat has been removed from the whale the rest of the body is worked into guano. These fisheries have increased considerably during the last few years. In 1878 only 135 whales were caught, valued at 266,000 crowns [\$71,288]; while in 1883, 561 were caught, valued at 1,011,000 crowns [\$270,948]. Walrus fisheries and seal fisheries are during the summer carried on near Spitzbergen, and from 1878 to 1884 yielded, on an average, annually 433 walruses and 8,120 seals, besides whitefish, polar bears, reindeer, and eider-down. The *Scymnus borealis* is caught with harpoons, partly with open boats near the coast, and partly with covered boats far out at sea. Its liver is used for preparing oil. From 1881 to 1884 there were annually engaged in these fisheries 22 open boats, each with 4 men, and 26 covered boats, each with 5 men. These fisheries yielded on an average 4,713 hectoliters† [124,894 gallons] of oil, valued at 94,000 crowns [\$25,192].

OLDENBURG, GERMANY, *June, 1886.*

*A kilogram equals 2.2046 pounds.

†A hectoliter equals about 26½ United States standard or wine gallons.