

## XXVI.—CALIFORNIA SALMON IN THE NETHERLANDS.

BY C. J. BOTTEMANNE.\*

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Mr. C. J. Bottemanne, of Bergen op Zoom, chief superintendent of the fisheries of the Scheldt and other rivers in the south of Holland, who has been commissioned by the government to superintend the experiments in stocking some of the Dutch rivers with California salmon, has made the following report on the results of his experiments during the period 1878-1880:

During the investigations relative to the different kinds of salmon inhabiting our rivers, and the condition of the fisheries, which our government had made during the years 1869 and 1873, my attention was directed to the circumstance that so little is heard nowadays of salmon being caught which had been marked before they were set out, and that it is very difficult to mark any considerable number of young salmon, which, nevertheless, is necessary for furnishing the only possible proof of the beneficial influence of pisciculture upon the fisheries. I consequently arrived at the conviction that other steps must be taken to convince not merely the general public, but especially the fishermen, that pisciculture was no chimera, but a science, and a considerable industry whose benefits *they* were principally destined to reap, and towards the furtherance of which they must extend a helping hand. After mature deliberation I found that the best way to reach this object would be to put salmon of a kind not known in our country in some of our rivers which contain few or no salmon. Such a river was soon found. The Limberg Meuse is well known as containing but few salmon, for although formerly these fish were frequent in that river, hardly any are caught there now. Another great difficulty was the question as to what kind of salmon should be selected. It must be a fish which, when caught, would not leave a doubt in the mind of the fisherman who had caught it that it was a salmon, and still it must differ from the common Rhine salmon. The fisherman, in fact, must be able to see at once that he has caught

\* *Californische zalm in Nederland.* Translated by HERMAN JACOBSON.

a strange salmon. In addition to all this the salmon must, of course, be of a good quality.

Various circumstances favored me. During my stay in America, in the autumn of 1874 I saw in Mr. Seth Green's piscicultural establishment, in the State of New York, some young California salmon which had been brought from California when still contained in the egg. Even when quite small they could at once be distinguished from the Rhine salmon, and a drawing of an older salmon of the same kind convinced me that I had found what I was looking for. As it was for the time being impossible to obtain eggs of the California salmon, I made an attempt to take trout-eggs back with me to the Netherlands, and, considering the difficulties attendant upon this attempt, it must be said that it proved reasonably successful.

In 1876 I at last found a live specimen of about the size of a St. Jacob's salmon in the New York aquarium, which, as far as its external appearance was concerned, fulfilled all the conditions required of it.

I had no opportunity to judge of the flavor of fresh salmon, but I tasted some that had been canned, and found it very good. If I therefore succeeded in obtaining eggs of this California salmon (*Salmo quinnat*), in transporting them safely to the Netherlands, and hatching them there, no one who caught such a fish would fail to see its difference from the Rhine salmon (*Salmo salar*), and the fact could not be kept a secret, as, in my opinion, is generally done when a marked Rhine salmon is caught.

When, therefore, late in the autumn of 1876, the minister of finance asked me to take the place of superintendent of the Scheldt fisheries, I immediately accepted the offer, and in February, 1877, talked over the matter with Prof. Spencer F. Baird, the American Commissioner of Fisheries, whom I had learned to know during my visits to the United States. Before I left America, he promised to send me in the autumn a considerable quantity of California salmon. Late in the summer of the same year (1877), Professor Baird sent me 100,000 salmon-eggs, which were accompanied by his assistant, Mr. Fred. Mather, as far as Bremerhaven, where, owing to the impossibility of my receiving them, they were received by the assistant director of the Royal Zoological Society, "Natura Artis Magistra," of Amsterdam, in whose gardens these eggs were to be hatched. Through the kindness of the director, Dr. G. F. Westerman, the society undertook the hatching of these eggs free of expense. To my great sorrow nearly all these eggs perished, owing to their not having been properly packed.

Some fish were successfully hatched; but with the exception of three, they all died very soon. These three, however, developed so well, that I had no doubt that if other eggs were sent and were more carefully packed the attempt would prove successful. As soon as Professor Baird was informed of the failure, he at once offered to send other eggs, which arrived during the year 1878. These eggs, which, at my suggestion, had been packed in a different way, arrived in good condition at

Amsterdam via Bremen. This time the minister, at my suggestion, offered to bear all the expenses, to be paid from the treasury of his department, leaving the whole matter entirely in my hands.

When, on the 26th of October, the eggs were placed in the gardens of the Zoological Society, where they were to be hatched, 82,600 out of the 85,000 which had been received were found to be in good condition. Of these 19,497, or 24 per cent., perished during the incubation. This was probably caused by the high temperature of the water during the hatching process; it is also possible that in unpacking the eggs I did not change the temperature gradually enough. Raising the temperature too quickly and letting it remain high is very apt to prove injurious to the eggs. When hatched, many of the little fish did not seem to possess the necessary strength to get free of the egg-shell when it burst, and in their attempts to do so some of them were choked.

Through the good care which was taken of the young fish in the gardens of the Zoological Society, about 61,000 young salmon were successfully hatched, whose umbilical bag had almost entirely disappeared. Although there was no precedent that salmons younger than one year had been set out in rivers, 50,000 of these fish had, nevertheless, to be set out in the river Meuse, near Venlo, in January, 1879, as the Zoological Society needed all the space at their command for the hatching of Rhine salmon.

In spite of the very unfavorable weather, as there was a hard frost, we succeeded in preventing the freezing of the water in the cans in which the fish were transported, principally through the very valuable aid extended by the superintendents of the railroad stations at Amsterdam, Utrecht, Boxtel, and Vinlo. Although the journey—and, therefore, the stay of fish in the cans—lasted about eight hours, the loss was trifling. With the same success 5,000 young salmon were set out in the Zwaansprong, near Apeldoorn, and about the same number in the small streams which feed the Molecate ponds near Hattem, to which the owner, Baron van Heeckeren van Molecate, kindly gave his consent. The object was to have an opportunity of observing the development of the young fish when in a free condition. In spite of all precautions it seems that the young fish escaped from Molecate; and although every effort was made to track them, they could not be found.

In the Zwaansprong we were more successful. It is true that their number decreased through cannibalism; but this is a common occurrence with fish of prey when—as in this case purposely—they are not fed. A considerable number, however, were lost by the breaking of a dike, the fish escaping through the opening into the Diereusche Canal. As the break in the dike was fortunately soon discovered, about 1,400 of the deserters were caught and placed in one of the ponds of the neighboring establishment of Mr. Nordhock Hegt. As early as October, 1879, I found young salmon measuring  $13\frac{1}{2}$  centimeters. Of those which had been set out in the Meuse many were observed during the first few days

after their liberation; but after that nothing more was seen of them till the spring of 1880, when some of them were again seen. Finally Mr. Rijke succeeded in May, 1880, in catching several of these salmon near Fegelen. One of these fish put up in spirits of wine was sent me by Mr. Rijke, and found to measure 14 centimeters.

In 1879 the Dutch Government asked the American Government to make another attempt to send salmon-eggs. The request was granted, and the eggs, which had been carefully looked after during the voyage, arrived at Rotterdam in excellent condition. The vessel which brought them was the steamer "Schiedam," Captain Chevalier, of the Netherland-American Steamship Company. This company brought these eggs to Europe free of expense, as the German Lloyd had done on former occasions. The number of eggs was somewhat less than the year before, viz, about 60,000 (59,300). Of these 10,146 perished during the hatching process—counting in, however, 1,200 which were already spoiled when they arrived; the loss during this attempt was therefore only 15 per cent. During the umbilical period 2,154 more were lost (counting in 345 that were deformed). The total number of fish which were successfully hatched was, therefore, 46,000.

As it seemed too great a risk to set out these young salmon in open rivers, and as I knew of no small stream which fulfilled all the conditions for their successful raising, I proposed to his excellency the minister this time to put all the young fish in the piscicultural establishment of Mr. Nordhock Hegt, on the Zwaansprong, and to keep them there till the spring of 1880. I made this proposition, because up to that time I had not heard anything about any of the young salmon having been caught which the year before had been set out near Blerik. As his excellency granted my request, 45,500 young salmon were successfully transported to the Zwaansprong, where they grew rapidly. According to their size they are distributed through several ponds. The mortality was very small, and it is probable that during the coming spring a large number of young salmon can be set out in the Meuse.

In the basins of the zoological garden at Amsterdam, I retained 500 of these fish. Some of these fish, which from the Zwaansprong were taken to the piscicultural establishment at Velp, I saw last summer and found them in excellent condition. The size of these young fish seems to keep step with their voracity, which is truly astonishing, and which, in spite of the ample and good food thrown to them, proved a considerable source of danger to their weaker brethren.

The young fish from the hatching period, 1878-'79—several hundred in number—which are still in the Zwaansprong, measure at the present time 22-23 centimeters, whilst young fry taken there in March, 1880, measure 6-7 centimeters.

It is a great satisfaction to me that Professor Baird has expressed his willingness this year also to send some salmon-eggs to the Netherlands.

The result of all our experiments so far may be summed up as fol-

lows: After counting out those eggs which on their arrival in the Netherlands were found to be in bad condition, the loss—including the deformed fish—during the hatching and umbilical periods was 26 per cent. in 1878, and not quite 21 per cent. in 1879.

If in pisciculture one has 74–79 per cent. sound young fish at the end of the umbilical period, the result must be called very satisfactory. I think that this result is in the highest degree satisfactory if we take into consideration the many stages of the long journey which the eggs had to perform before they reached their final destination. First, they were gathered in the wilderness of California, the gatherers being protected by the bayonets of soldiers; then they had to travel quite a number of miles over a rough road in jolting wagons before they reached the railroad. Thereupon they had to be in the cars for a whole week—often in a tropical heat—traveling from California to New York; in that city there would generally be some delay until they could be placed on board the steamer; this would be followed by a voyage of very nearly two weeks, their whole trip concluding with a railroad journey from Rotterdam to Amsterdam.

If after young salmon have been set out in the Meuse in January, 1879, the percentage of successfully hatched fish is more favorable than I had expected, and if, as now seems likely, more than 80 per cent. of the young fish taken to the Zwaansprong continue to live, salmon of this kind will certainly be caught in our rivers in a few years.

Hardinveld and Gorinchem will probably be the first places where such salmon will be caught, as the young salmon, when going towards the sea (if not all, at any rate by far the greater number), will go by way of the Nieuwe Merve de to the Holland Deep and will return the same way.

If our experiments are again successful this year, a considerable increase of the Meuse salmon fisheries will be noticed in a few years.

C. J. BOTTEMANNE.

