

XIII.—ACCOUNT OF TRIP TO EUROPE WITH EGGS OF THE QUINNAT SALMON.

By FRED MATHER.

Prof. S. F. BAIRD,

United States Commissioner Fish and Fisheries :

On the receipt of your request to accompany a large lot of salmon eggs to Germany and other parts of Europe, I considered it necessary to devise some means for repacking them in New York after their long journey from California. I decided as the best method a box with trays so arranged as to allow frequent inspection, and containing an ice-chamber above them whereby the temperature could be regulated and moisture supplied by the constant dripping from the ice. As there were to be 200,000 eggs for England, France, and Germany, with a possible addition of 100,000 more for the Netherlands, which were to come in packages of 25,000, I had eight of the boxes made. Each of these contained at its top an ice-chamber one foot high with a perforated bottom, and beneath this ten frames fourteen inches square, with bottoms of Canton flannel.

It had not been decided whether the shipment for the Netherlands would accompany the others or be sent by steamer direct to Rotterdam; therefore no provision was made for them, as there would be time enough to provide the boxes after their arrival.

From experience in unpacking eggs from California, I deemed it absolutely necessary to have them repacked, for, though the moss-packing is as good as any for the time required to reach the Eastern States from California if immediately unpacked, my experience indicated that it would not be likely to answer for a much longer time, as the following instances will show.

In the fall of 1875 I was in the employ of the Virginia Fish Commission, who were then building two hatching-houses, one at Blacksburg and the other at Lexington, neither of which were finished on the arrival of the eggs. Both lots of eggs were kept in cool places with ice plentifully supplied; those at Lexington were opened and put in the troughs five days after arrival and were in very good order. All the dead eggs had started a fungoid growth, and in a few cases had attached others to them, but there were not many that were apparently injured by the fungus. All fish culturists are aware that some eggs will die out of the very best lot, whether packed and transported by rail or placed in a trough under the most favorable circumstances, and these dead eggs will grow fungus in a long or short time, depending upon the temperature. Persons who obtain a number of eggs and claim to have hatched an equal number of fish from them, unless the embryo is advanced within a few days of hatching, state what those familiar with

the subject know to be highly improbable, and it is no reflection on any mode of packing to find, after a journey of ten or twelve days, that 4 or 5 per cent. are dead. The fact that they are surrounded by 95 per cent. of good eggs is sufficient to show that the fault is in the egg, as far beyond the power of man to help as the cause is beyond his knowledge.

The eggs at Blacksburg were kept eleven days after arrival, and when opened each dead egg had, by its fungoid connection, become the nucleus of a ring of eggs killed by it, each of which in turn was throwing out the deadly filaments on all sides. One egg can thus be surrounded by six. Outside this ring the eggs were in a good state, but the original egg had decayed, and was so firmly attached to the netting above and below it that in opening it was torn in two parts. The lower layer in each crate was the worst, and in one box this was almost entirely spoiled and *warm*, thus showing that the heat from below was not so well absorbed by the ice on account of the intervening packing.

My next experience was in New York City, in 1876, where it was nearly the same. Twenty thousand eggs arrived six days before the carpenters had completed their work, and were iced in the cellar; on opening them, October 11, 12 per cent. were dead, with the ring and decayed nucleus, as before; the remainder, however, were good, and I find by my notes that the first fish hatched October 16, and all were out on the 26th, or fifteen days after placing them in the troughs. Another lot of 40,000 arriving on the 18th, and opened immediately, had a trifle less than 4 per cent. dead, and not a trace of fungus, the dead ones looking as clean as possible. This I call excellent condition. Having these things in mind, and knowing that the ship would leave New York on October 13, and was due at Bremen on the 26th, the date on which a former lot were all hatched, I saw the necessity also of keeping the temperature down to prevent hatching on the passage, as well as to see that no fungus was allowed to germinate.

On the 7th of October, 1877, the refrigerator car from California arrived at Chicago loaded with salmon eggs, and was received by Prof. James W. Milner, deputy commissioner on fish and fisheries, who delivered to me the following lots of eggs: Two crates, 50,000 eggs, for England, care of F. Buckland, London; two crates, 50,000 eggs, for France, care of Societie d'Acclimatation, Paris; two crates, 50,000 eggs, for Germany, care of Herr von Béhr, Deutsche Fischerei Verein; two crates, 50,000 eggs, for Germany, care of M. Friedenthal, minister of agriculture, Prussia; four crates, 100,000 eggs, for Holland, care of C. B. Bottemanne, royal zoological garden, Amsterdam. As they would arrive in New York on the morning of the 9th, and the ship did not sail until the afternoon of the 13th, it was thought advisable to take them to my own house in Newark, N. J., ten miles from New York, where there was a very cool cellar, and no danger of interference by curious people, nor expense of storage.

After getting all ready and opening and repacking one of the boxes for Germany, the contents of which were in splendid condition, I received a

telegram from you that Mr. Stone protested against their being opened, giving as a reason that it would hasten their hatching, and stating that they would go much better without repacking. This was so directly contrary to all my experience that my first impulse was not to go with them; but, on more mature thought, it appeared that by this order the responsibility of their journey was, without option on my part, shifted from myself to Mr. Stone. The best of care was given all of them, and I profited by my experience with those unopened, while also seeing how my own box worked, and having the advantage of not having all the eggs in one basket.

The ship was the "Mosel," of the North German Lloyd, Captain Neinaber, with whom I sailed three years before on the shad expedition in the "Donau," and to whom I am indebted for many favors. Two tons of ice were bought and placed in the ice-room of the ship situated in the lower hold in the extreme forward end, where the "provision steward" keeps his supplies of meats, ice, &c. The crates were placed in the forward hatchway on the main (not upper) deck, in exactly the same place in the same ship as were the shad eggs of Messrs. Welscher and Green in the summer of 1875. The crates were merely an outside frame to hold the fern leaves that enclosed the box of eggs within; they were wedged fast by the ship's carpenter to prevent shifting in a heavy sea, and were kept covered with a large piece of ice all the time, renewed night and morning. The small pieces were removed to the top of my refrigerator box.

Professor Milner had suggested packing the entire lot in ice, surrounded by a load of straw, of which I thought most favorably, but found that, though fish culturists might propose, owners and insurance men would have the final disposition of combustibles, and so that project was dropped, as the officers of the ship objected to it.

The following is a record of temperature within the box of trays in which I had repacked 25,000 eggs. On opening the crate 206 eggs were dead of the 25,000, and after packing I found the temperature next day to be 46° in the top tray and 56° in the bottom, while the air in the cellar was 62°. Ship sailed at 2 p. m. 13th; no record of temperature.

Date.	Air in hatchway.	Top of box.	Near bottom of box.	Remarks.
Oct. 14	56	41	48	No eggs on top tray; poured a gallon of ice-water on it.
15	54	42	50	Puzzled about the difference at top and bottom; shifted the trays.
16	54	43	50	Think frames too snug; cut grooves to let heat go up.
17	54	42	52	Put small piece of ice in corner of each tray.
18	70	43	60	Heavy sea; hatchway closed all night; put small ice in ferns of crates.
19	74	48	60	Hatch still closed; cut notches on top of frames to equalize temperature.
20	70	44	60	Raised the screens and put ice below; good result.
21	72	42	48	Hatch closed yet; temperature in box more even.
22	68	42	46	Hatch open; one fish hatched; getting scared.
23	65	42	46	Hatch open.
24	65	43	46	Hatch open; delivered two crates for France at Southampton to Lloyd's agent.
25	70	40	44	Hatch closed; rainy.
26	72	40	43	Hatch closed; rainy; arrived at Bremerhaven.

All consignees were telegraphed from New York of the date of the expected arrival of the ship, and the instructions were not to deliver unless called for. Through some mistake, as I have since learned, Mr. Buckland's agent arrived an hour after the ship had left, consequently the quota for England was taken to Germany and added to the lot for Herr Von Béhr as per previous orders.

At Bremerhaven the eggs were met by Dr. O. Finsch, curator of the Bremen Museum, on behalf of the Deutsche Fischerei Verein; Director Haack of the Imperial Fischerei at Hünningen, Mr. Heck of the Amsterdam Zoological Gardens, and Mr. Schreiber of Hameln on the Weser, who took charge of their respective packages. By request I went with Director Haack to Hünningen, whither my own box was destined.

At Bremerhaven, when the crates were inverted, some decayed matter was seen on one of them, which created an alarm, and several boxes were opened. Of the lot for Amsterdam one box was quite warm, many fish were hatched, but enough appeared good in it to warrant Mr. Heck in taking them home. Mr. Schreiber reported his two boxes better, but I did not see them opened.

Director Haack and self went to Hotel d'Europe with the two English crates, his own, and my box; found the two former entirely spoiled, hot and steaming like a manure heap; thermometer showed 80° in the packing. From his remaining crate we took 8,000 apparently good and put them on a tray in my box.

It is worthy of note that these apparently good ones were in all cases in the corners of the boxes, where the density of the packing kept the heat of the decaying central mass from them. The following shows the mortality in my box:

Oct. 16.....	60 dead five days after repacking.
19.....	42 dead eight days after repacking.
22.....	37 dead eleven days after repacking.
26.....	11 dead fifteen days after repacking.
29.....	40 dead when put in troughs at Hünningen.

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In original package 206

396 lost in 25,000 from California to Germany.

Half of this lot were sent to the private fishery of Oberburgomeister Carl Schuster, at Freiburg, two hours' ride by rail, where I saw them a week afterward in most beautiful condition, just beginning to hatch.

It is evident that the mode of packing in moss so tightly, while excellent to keep out external heat, is equally effectual in keeping in that which is generated internally, or, as is commonly said, in excluding the cold; and the decaying eggs caused the thermometer to record 80°, while the air outside was not above 50°. Again, the record above shows that of ten frames lying close upon each other, while the top one was 42° those near the bottom were 4 to 6 degrees warmer. This confirms the

result of some experiments made formerly, that a *living fish-egg evolves heat* as a fish does; whether by the friction of circulation, consumption of oxygen, or otherwise, is not to the point here, but from the experiments referred to, and the fact that after getting the eggs in the center of the box as cold as those next the ice, and though completely surrounded by others equally cold they would not remain so, it does appear that such is the case.

Had it been possible to have divested the boxes of the outside ferns and crate, and then packed the boxes in the ice-room, there is no doubt but what the decay of the dead eggs might have been retarded some, and so have preserved the others from the heat; but the ice-room is used for meat, fish, and vegetables, and unless the boxes were at the bottom they might be damaged by overhauling, and should I have to do it all over would use such a box as the one described with a slight modification.

In Germany the question was frequently asked, "When you felt sure that you were right, why didn't you violate orders and repack them all?" to which I could only reply by saying that I did not *know* that the box would be successful; it only *appeared* to be the best, and if a man violates his orders and is victorious he is forgiven, but if he fails he is branded as a self-willed, obstinate fellow.

Returning by way of Berlin, through the kindness of Herr von Béhr Schmoldow, I met the Fischerei Verein, several members of which are in the German Parliament; in fact, most public men in that country take an interest in fish culture, and that it is in high favor may be known by one of the titles of the Crown Prince, which is "Protector of Fisheries."

This lot of eggs was shipped from Sacramento October 2, and some were opened on the 26th; how long they had been packed before delivery to the express company I do not know.

I am aware that in a previous year a successful shipment had somehow been made to New Zealand, and now while writing this I have received a letter stating that a shipment made this season to that country arrived in good order after an ocean voyage of eight weeks; but it does not state how carried, nor at what temperature. My own experience leads me to believe that a crate of eggs packed in California will not keep in good state two weeks after arriving at New York, even in a cool cellar with plenty of ice on top of the crate, and certainly not in a hatchway where, after passing the Banks of Newfoundland, the air ranged from 65° to 74°, as shown in the record above.

As previously stated, one-half of the eggs taken to Hünigen were sent to the Freiburg Society for Fish Culture on the 29th, and after remaining four days at the fishery and seeing the first spawn of the season taken from the trout (*Salmo fario*) by the director, I went to inspect the old salmon fishery belonging to Mr. Glazer, of Basil, situated ten miles up the Rhine at the village of Rhinefelden, where an immense

weight suddenly elevates the net when sprung by the person watching, who holds a cord with twenty branches reaching to as many parts of the net, by which he feels a fish strike against any portion of it.

By request of Herr von Béhr, I then went to Freiburg to await the arrival of the Crown Prince at Wiesbaden, to whom I had letters, and who, as I was informed, was desirous of hearing of the progress of fish culture in America, a subject in which he takes great interest; but, on account of some change in his plans, I received a telegram that he would not reach Wiesbaden during my stay there. I had the pleasure of meeting the president of the Fischerei-Verein, Herr von Béhr, on November 5, at Berlin, and on the evening of the 8th met the society, whose members consist of the leading scientists and statesmen of Germany.

After the transaction of their usual course of business I was called upon for an explanation of the methods in use in America for taking spawn, packing and transporting it, the number of eggs obtained in a season from our different fishes, &c., when, after stating all of importance that came to mind and answering a few questions, we adjourned to a dinner composed of the favorite fishes of Germany.

The fish culturists of that country are keenly alive to the progress of the art wherever practiced; and especially to American improvements, of which there are so many, do they look to see what may be of real value.

For the *Coregoni* they have many of the Holton boxes, which are to be tried upon a large scale this season for the first time for stocking Lake Constance and other waters, while for the *Salmonidæ*, exclusive of the genus above named, they use our unpatented trough with wire or glass trays, and Williamson's trough for the greater part of the work, employing the Coste tray only to a very limited extent.

I left Bremen on the 10th of November for England, where my efforts to collect and transport turbot and sole to our waters met with only a partial success. I will leave the remainder of the trip for a special report concerning those fishes.