

XXI.—HATCHING AND DISTRIBUTION OF CALIFORNIA SALMON.

A—REPORT ON CALIFORNIA SALMON SPAWN HATCHED AND DISTRIBUTED.

By J. H. SLACK, M. D.

SIR: The first consignment of spawn from California arrived on the evening of September 30, 1873. The weather for the previous few days had been warm, the thermometer ranging from 70° to 75° at noon. The spawn was contained in two packing-boxes inclosed in an open crate, the spaces between the boxes and crate being filled with hay. This hay was rotten, and the boxes exhaled a peculiar and, alas, too well-known odor, showing that a portion at least of the spawn was not only dead, but decomposed. The boxes were at once removed to the hatching-house and opened. Temperature of the air, 62°; interior of upper box, 74°; lower box, 84°. The temperature of the water being 50°, it was feared that if at once unpacked, the sudden change would be fatal. Water was therefore warmed to 70° and allowed slowly to percolate through the boxes, the temperature being gently lowered. About twelve hours elapsed before the temperature of 50° was obtained. The work of unpacking then commenced. Many of the spawn were completely rotten; others had burst, and long vermiform masses of albumen had been ejected; these, I afterward ascertained, were regarded by some as maggots. From the entire mass of spawn, said to number 150,000, only about 25,000 were saved, and about three days labor of two persons was required for the unpacking. The living spawn were all taken from the upper layers of the upper box; the entire contents of the lower box appeared putrid. However, they were emptied into a pond, and from careful examination of the water a few weeks subsequently, a number of living fishes were found. The good eggs were placed upon grilles, and in less than a week all were hatched. The mortality among the young was very slight.

The second lot of spawn arrived October 15, at 8 p. m., accompanied by Mr. Myron Green. On inspection, they appeared much shrunken, but otherwise in good order. Temperature of interior of boxes, 54°, 56°; air, 52°. A gentle current of water at 50° was allowed to pass through the boxes for fourteen hours; at the end of which period the eggs were found to be plump and the embryos lively. Two days were employed in unpacking them, and for a few days all seemed well, the

percentage of loss being very small. But, to my surprise, on entering the hatching-house on the morning of October 21, an immense number were found to be dead. Every precaution had been taken, the water-supply was perfect, and the troughs had been carefully and tightly covered, yet for some days the loss was immense. However, in a few days the mortality ceased, and but little trouble was afterward experienced. This lot of eggs was said to number 175,000, of which it is estimated 130,000 were hatched.

The last lot, said to number 250,000, arrived October 23. These were treated similarly to the previous invoice, with the exception that, fearing they might have suffered from rough handling at the hands of my assistants, every egg was unpacked by my own hands. The result was very satisfactory, about 200,000 spawn being safely hatched. It was noticed that though the lots No. 1 and No. 2 were all hatched within a few days after their arrival, lot No. 3 did not commence to hatch until about two weeks after their arrival.

The after-treatment of the young fishes presented no peculiar points of interest. The loss of young was very small, and confined almost exclusively to the crooked fishes. A full set of specimens illustrative of the growth of these fishes will accompany this report.

The method of packing the spawn was probably the best that could have been devised under the circumstances. I would, however, propose that in the next shipment the eggs be laid between folds of mosquito-netting. This would greatly facilitate the operation of unpacking, which with the simple moss is very tedious and severe.

The following table will show at a glance the details of reception and number of fishes hatched :

Date.	No. spawn sent.	No. fishes hatched.	Percentage saved.	Temperature on arrival.
September 30	150,000	25,000	16.6	74° @ 82°
October 15	175,000	130,000	74.2	54° @ 56°
October 23	250,000	200,000	80.0	52° @ 54°
Total	575,000	355,000	61.7

By January 1, 1874, it was found that the number far exceeded the estimate which I had previously made, and that though ample accommodations for the hatching of fishes had been prepared, that the nursery-troughs were entirely too small for the proper rearing of them. An addition of 20 feet was therefore made to my hatching-house, at a cost of about \$100. As this was done exclusively for the accommodation of the California salmon, it is hoped that the Government will be willing to defray at least a portion of this expense.

The following table will show, at a glance, the number of fishes distributed, and the streams in which they were placed :

Date.	Number placed.	Stream.	Main river.	State.	Placed by—
1873.					
Dec. 2	10,000	Yellow Breeches..	Susquehanna	Pennsylvania	Pennsylvania commissioners.
8	10,000	Conceogogue.....	Potomac.....	do.....	Self, per Downs.
23	10,000	Makontongo.....	Susquehanna	do.....	Pennsylvania commissioners.
1874.					
Jan. 1	10,000	Musconetkong....	Delaware.....	New Jersey...	Self.
3	12,000	Pattenburg Creek.	Raritan.....	do.....	Do.
10	10,000	Pohatkong.....	Delaware.....	do.....	Do.
14	13,000	Musconetkong....	do.....	do.....	Do.
16	30,000	Cedar Creek.....	Potomac.....	Virginia.....	Self, per Downs.
23	30,000	South Side Club.	do.....	New York.....	Self.
26	25,000	Musconetkong....	Delaware.....	New Jersey...	Do.
27	20,000	Bald Eagle.....	Susquehanna	Pennsylvania	Pennsylvania commissioners.
30	10,000	do.....	do.....	do.....	Do.
Feb. 6	30,000	Musconetkong....	Delaware.....	New Jersey...	Self.
7	35,000	Pattenburg Creek	do.....	do.....	Do.
14	50,000	Musconetkong....	Delaware.....	do.....	Do.
16	50,000	Pond.....	do.....	do.....	On hand.
	355,000				

Recapitulation.

Given to Pennsylvania commissioners.....	50,000
Placed in tributaries of Potomac.....	40,000
Placed in Long Island streams.....	30,000
Placed in tributaries of Raritan.....	47,000
Placed in tributaries of Delaware.....	138,000
Still on hand in ponds.....	50,000
	355,000

In choosing locations for planting fishes the greatest care was exercised. Streams were selected as near as possible the spring-heads, and containing no other fishes. Most of these small streams having no names, the name of the nearest named stream is given in the table. The small streams selected were admirably suited for the purpose, the temperature ranging from 48° to 52°, and every stone and particle of aquatic plants being covered with minute insects or crustaceans, the latter, of which I send specimens, (*Gammarus?*), being very abundant.

On February 21 a careful examination was made of the Musconetkong. I found large numbers of salmon beneath projecting roots and rocks, especially at the points where small streams empty into the creek. The salmon were of comparatively enormous size, and might be readily divided, from their size, into three classes; the largest fish taken being over 2½ inches in length. It is very probable that these largest fishes are from spawn thrown out from the first invoice, as mentioned.

The rapid growth of these fishes is a strong argument in favor of turning them loose in the streams which they are destined to inhabit at an early age, in fact as soon as the yolk-sac is absorbed.

In conclusion, I would state that I consider this attempt at transporting the spawn and planting the young of the *Salmo quinnat* in our eastern waters a perfect success. With the exception of lot No. 1, which were literally cooked by the high temperature to which they were exposed, fully 75 per cent. were hatched and reared, a proportion rarely exceeded, if the truth be told, by our most successful fish-culturists, with spawn of their own impregnation. From experiments with various kinds of fishes, I would place their relative vitality as follows:

- 1st. *Salmo quinnat*.
- 2d. *Salmo corfinis*.
- 3d. *Salmo salar*.
- 4th. *Salmo fontinalis*.

I might state that the number of fishes on hand was at first very much underestimated. As an example: one trough, containing 24 square feet of surface, was supposed to contain about 20,000 fishes. When placed in cans for transportation, the number was found to be more than double the estimate.

The method of counting was as follows: Fifty fishes were repeatedly counted and placed in a very small gauze net until the eye was familiar with their aggregate bulk; netfuls were then taken and counted; this was repeated until the number taken could be accurately estimated; in fact, it is believed that the total is rather below than above the true number.

All of which is respectfully submitted.

Prof. S. F. BAIRD,

United States Commissioner of Fish and Fisheries.

B—HATCHING AND DISTRIBUTION OF CALIFORNIA SALMON IN TRIBUTARIES OF GREAT SALT LAKE.

By A. P. ROCKWOOD, *Superintendent of Fisheries in Utah Territory.*

SIR: I have this day received communication from Mr. Webber, superintendent of your fish-ponds in Charlestown, N. H., dated November 19, 1873. He purports to write at the request of Professor Baird, asking statistics in regard to salmon-eggs forwarded me from California. I received them at the junction of the Utah Central and Central Pacific Railways, on the 12th of October; placed them in my hatching-troughs the same evening; they were, generally, in good order. I found about twelve hundred bad eggs out of the forty thousand. Each day, for three weeks, the eggs were examined, and the bad ones thrown out, which amounted to about seventy-five per day on an average; on the third day I found two dead and the first fish hatched; on the seventh day several more were hatched; at the expiration of twenty days most of the hatching was through with. My hatching-troughs were only calculated for 30,000; the putting-in of 40,000 covered the nests so thick that the bottom could not be seen.

The umbilical sac was absorbed in from twenty to thirty days after hatching. The hatching-troughs and nursery-boxes were so crowded that I tried the experiment of removing some of them to the nursery-ponds before the umbilical sac was absorbed. My nursery-ponds are from 10 to 15 feet square, with an average depth of 12 inches of water, each fed by a spring at the head of respective ponds; the flow of water in each is from 25 to 30 gallons per minute, and about 3° colder than the water from which I removed them; for this, or for some other cause, they all settled to the bottom, and remained in an apparently dormant state for about an hour when they then began to revive, and in less than an hour they were all bright and active. Seeing this result, I immediately placed about four thousand more in the same pond, and about the same number in two more ponds that were in readiness. Very few that have been thus removed have died, whereas those that were left in the hatching-troughs have died in a much greater ratio. A portion of this mortality may be attributed to the fact that the cripples were left in the troughs as they lay near the bottom, and were not taken up in the dip-net used in removing.

I feed them on boiled grated liver. They are thriving well, and are much larger than the medium-sized ones of the same age referred to in "American Fish-Culture."

The young fry are now about thirty days old, and the umbilical sac is nearly all absorbed. The fry are from one to one and one-half inches long, and are not so full and plump as the fish of this age are represented to be in the work just referred to.

The shad-fry which I received from you about the 1st of August were placed in the Jordan River, about fifteen miles from the mouth. This river is the outlet of Mato Lake and empties into Salt Lake. I have not heard of any of them being seen since they were put in. I presume they will be like the "bread cast upon the waters to be gathered after many days."

Any suggestions or recommendations you will please furnish me will be thankfully received.

Please to make me a passing call at your convenience.

My respects to Professor Baird for the interest he has taken in fish-culture in Utah.

Mr. LIVINGSTON STONE,

Charlestown, N. H.

SALT LAKE CITY, UTAH TERRITORY, *December 2, 1873.*