XXIX.—REPORT ON THE PROPAGATION OF SCHOODIC SALMON IN 1879-'80.

By Charles G. Atkins

1.—Preparations.

The experience of the preceding season had demonstrated the usefulness of a developing-house by the side of the stream, and the experimental structure of that year was this year replaced by a permanent house of small size, measuring on the ground 18 by 22 feet. Were it necessary to use this house for the hatching of fish, it would be too small to be very effective; but as it is only used to bring a portion of the eggs through the earlier stages, the cold water retarding their development till, by shipment of earlier lots, room is made for them in the other house, a comparatively large capacity is secured by making the troughs very deep. The principal ones are 17 inches deep inside, accommodating our deepest frames, with 20 trays of eggs in each, and having a capacity of about 35,000 eggs to each foot in length of trough. There will be room for at least eight troughs, with an aggregate capacity of 2,560,000, and it is practicable to increase this 50 per cent. by making deeper troughs, and to even double it by submitting to considerable inconvenience in the routine work. The supply of water is practically unlimited, and its six-inch conduit now delivers from 60 to 100 gallons per minute, according to the head in the stream, which is affected by the rise and fall of a connecting mill-pond used by the tannery. The head of the conduit is in the stream, two rods from the shore, and, it is supposed, far enough out to secure a supply of water always pure, just as it comes from the lake.

Measures were also taken to increase the volume of water at the old hatching-house by laying a log aqueduct to a springy spot 21 rods distant, and 13 or 14 feet above the floor of the troughs; an opportunity is thus afforded for æration, which goes far to make up for the meager volume secured (only a gallon and a half per minute), and makes this an important addition to our supply.

The experience of the previous season had also suggested a removal of our fixtures for capturing and manipulating the fish to some point above the dam. A very convenient site was found on the west side of the stream opposite the head of the approach to the tannery canal, 230 feet above the dam. Here is near a quarter of an acre of shallow water,

where we can locate all the inclosures needed for the management of a far greater supply of salmon than we have ever had. By stopping their descent at this point we shut them out from all spawning ground except a few square rods immediately above the nets. This insures us hereafter (accidents aside) practically the entire stock of breeding salmon belonging to this stream. An unpretentious shed was erected to shelter working parties, and the inclosures arranged about it with reference to convenient access.

2.—Fishing and spawning.

The season was ushered in by a heavy rainfall, August 17 and 18, which raised all the lakes and streams in this region. Grand Lake stood, August 20, at 3 feet 3 inches on our gauge, being 15 or 18 inches above its ordinary level at that season. It was doubtless in consequence of the increased volume of water that the unusual phenomenon of an August run of salmon down the stream occurred, and this run, or the presence of considerable numbers of salmon in the stream, continued until the spawning season. September 14, the last day of the open season, one man, fishing with a single baited hook, took 17 fish, and found them biting as freely as any day in June. The water afterwards fell to 2 feet 3 inches, at which point it held until the close of the spawning season.

Our first nets were put into the water three or four days prior to September 15, putting a stop to the descent of fish either in the canal or main stream. The canal net had to be lowered often for the passage of boats, and on these occasions a few salmon stole into the canal, but with these exceptions no fish are believed to have passed us after September 12. They were often to be seen leaping from the water above the barriers, and it was the opinion of some of the old residents that an unusually large run of fish was impending.

Nothing noteworthy occurred until the last of October, the time being occupied by the force at work in laying the aqueducts and building the new house. October 30 the inclosures at the spawning place were put in order for the capture of fish, which had been purposely avoided up to this date to save the injury from chafing, to which they are always more or less liable when in confinement. But the salmon having commenced the work of nest-digging in some spots on the 27th of October, it was deemed that the time had now come for their capture.

The early runs of fish were very satisfactory, 153 coming in the first night, 164 the second, and 119 the third. There was then a falling off until the night of November 5 and 6, when but 60 fish came in. All this time the males greatly exceeded the females, not only in the totals, but each night by itself. It was not until November 7–8 that the females presented themselves in equal numbers with the males. That night there were 41 of each sex taken, and the total up to that date was 563 males, 322 females. For the rest of the season the catch of females

far exceeded that of males. The total for the season hardly bore out the great anticipations which some had formed in September, but was nevertheless quite respectable—938 males, 1,084 females, total 2,022. For the sake of comparison the numbers taken in other years may be given, as follows: 2,628 in 1875, 1,021 in 1876, 4,151 in 1877, 2,908 in 1878.

The most of the fish were measured, and the average length of the females was found to be 17.2 inches, and of the males 18.9 inches. The length of the females was the same as in 1878, but exceeded the average for 1875, 1876, and 1877 by 1, 1.5, 1.3 inches, respectively. The length of the males exceeded the average for 1875, 1876, 1877, and 1878 by about 2.1, 3.2, 2.1, .7 inches, respectively. The longest male was 24 inches, the shortest 15 inches; the longest female 22 inches, the shortest 13 inches.

The taking of spawn, which began November 7, proceeded without noteworthy incident until November 22, when the last fish were manipulated. In all, 978 females were deprived of their spawn, and yielded a total of 1,113,456 eggs, an average of 1,136 eggs each. According to our estimates the average yield for the first week was 1,205 eggs apiece. These are considerably higher averages than any other season. The average for 1877 was 1,066 eggs per female.

The ratio of impregnation, deduced by careful calculation later in the season, from the number of unimpregnated eggs found after the others were well developed, averaged 93.3 per cent. The best result (96.5 per cent.) was obtained November 19, in a lot counting 82,000 eggs; the poorest (75.6 per cent.) November 7, in a lot numbering 8,500. No novelties were introduced in the methods of manipulation; experience had convinced me that the methods generally followed here were the best for this species of fish. Many experiments were tried in 1877 and 1878 with a hope of discovering some mode of avoiding the serious loss by reason of non-impregnation, which has always troubled us at this establishment, but the results had not indicated any change in the essential features of our former practice. The prolongation of contact between the eggs and milt was found to effect no improvement in the desired direction, but to become, when excessive, a source of positive injury. One single experiment tried this year illustrates this fact. November 21 a batch of eggs numbering 27,156 was divided, the greater part being treated in the usual way, and the smaller part, numbering 5,156, were subjected to contact with the milt for 4 hours and 40 minutes. Of the former, 91.9 per cent. were found to be impregnated, and they turned out as good as average; the latter died, to the last egg, before development was completed, being one by one picked out and thrown away. Whether any improvement can be effected on the rate of impregnation attained this year I am in doubt. The prevalence of ovarian disease among the Schoodic salmon is, so far as can be seen, an irremediable difficulty, which will probably always result in quite a percentage of eggs incapa-

ble of impregnation and of others which, though they may be impregnated and develop through the earlier stages, are yet destined to perish in the egg or alevin stage.

3.—DEVELOPMENT AND SHIPMENT OF THE EGGS.

The eggs were divided between the old and new houses, 655,000 being placed in the former and 458,000 in the latter. Only the ordinary losses were sustained, and as large a percentage—perhaps a little larger than usual—were brought up to the shipping stage. The unimpregnated eggs were removed from the most forward lots early in January, and from the later lots in March. Without dwelling on the details, the sum of eggs rejected was 74,614 unimpregnated and 46,842 that died from other causes, making a total of 121,456 by actual count, or 11.3 per cent. This loss left 992,000. The 25 per cent. reserve for the lake and stream amounted to 248,000, and the remainder, 744,000, were divided among the subscribers to the fund. The following statement shows the basis of the division, and the numbers of eggs falling to each party:

Party.	Contribution.	Ratio.	Quota of eggs.
United States	$1,400	14/25	434,000
Massachusetts	500	5/25	155,000
Connecticut	300	3/25	93,000
New Hampshire	200	2/25	62,000

The first shipments were made January 6, and others followed during the month, to the number of 570,000, which exhausted the supply in the old hatching-house. The remainder, being in the cold water of the new house, did not reach the proper stage for packing until March, and indeed would not have reached it until April had they not been removed to the old house in January, as soon as the early shipments made room for them.

The packing for transportation was performed after our usual manner, the only change made being the abandonment of sawdust as a packing material, and a slight reduction in the size of the outside cases. The employment of dry moss and leaves as an enveloping material enables us without risk to reduce the thickness of the envelope, with a resultant advantage in lessening the weight and cost of carriage. Speaking in the absence of any comparative test, I think that in dry sphagnous moss we have the most effective material that comes within a proper limit as to cost. It is exceedingly light, and an exceedingly poor conductor of heat. We find it on numerous peat bogs in the vicinity. When wet it is very soft, and the best material in which to imbed the eggs. To dry it we pull it in August or September and spread it thinly on some dry open ground, and wind and sun soon take away its moisture. Leaves are gathered in the neighboring forest, and are mostly beech and maple. It is a good deal of trouble to gather them, and should much wet weather

prevail after their fall it may easily happen that in the hurry of fish-catching and spawning the few opportunities to gather them dry are neglected, and the first fall of snow lays them so flat to the ground that they never dry after it. So far as protecting the eggs against frost is concerned, I doubt whether dryness adds to the efficiency of either of these materials, but as deducting from their weight it is important.

The route by which the packages were formerly shipped was through Calais, from which point they were expressed by rail through Bangor to their various destinations. This route had the advantage of only twelve miles sledding to Princeton, from which place they went by rail to Calais, but the arrangement of winter trains was such that eggs had to lie over nearly a whole day in Calais as well as a night in Princeton, so that they were fifty-two hours on the route from Grand Lake Stream to Bangor. To save twenty-four hours of this time, I this year sent the cases from Princeton by stage to Forest Station, on the European and North American Railway. This subjected them to a five or six hours' ride in the open air, in the coldest part of the day, but my confidence in our mode of packing was justified by the event, for none were frozen.

The packages all went safely to their destinations, except one to France, which was a total loss. Of the twenty-seven sent to various points in this country, sixteen were reported as arriving in "good" condition; one, "O. K."; two, "excellent"; three, "very good"; one, "first-class"; one, "best ever received." None whatever opened in bad condition. The aggregate deaths of eggs in transit to all points in America were 6,621, being a little less than 1 per cent.

The success of those who managed the hatching was very uneven. In most cases the loss incurred was quite small, but in a few it was very large. As in the preceding season, the losses were generally greatest in those lots that were transported farthest. Those sent to Minnesota, however, sustained but a very small loss. The losses reported both before and after hatching amount to 101,910; the young fish sent out from the hatching-houses to 840,871; and those actually planted to 832,131. According to this statement there was a shrinkage of 159,869 between the shipment of the eggs and the final planting of the fish, and the small allowance to be made for the unreported lots hatched in New York and Wisconsin will not affect the result materially. To go still farther back, we find that of 1,113,456 eggs taken, 93.3 per cent. were impregnated, 89 per cent. brought to the shipping stage, and 75 per cent. brought to the feeding stage and turned free.

Appended will be found, 1st, a diary covering the time of the most important operations of the year; 2d, a record of fishing operations; 3d, a record of spawning operations; 4th, the result of the measurement of the fish; 5th, meteorological observations; 6th, a statement of the results of the development of the eggs at Grand Lake Stream; 7th, a record of the shipment of the spawn; 8th, a statement of the hatching of the eggs; 9th, a statement of the planting of the young fish.

4.—EXTRACTS FROM DIARY AT GRAND LAKE STREAM, 1879-'80.

Grand Lake Stream, September 2, 1879.—Munson says that he came up on the 20th of August, and that day noted the water to be 3 feet 3 inches on our mark above the dam, there being at the time a strong north wind. To-day, with a calm, I find it to be 2 feet 8½ inches. (But a small part of this difference is probably owing to the wind.) Mr. Munson had also observed a fall. The rain of August 17 and 18 undoubtedly caused a temporary rise.

Fish are now running on the stream. Haycock and Emerson fishing to-day and yesterday, took 7—all of them on the stream; tried the lake in vain.

Temperature of water in old hatching-house (in the woods near the "Milford Turnpike," an unfinished road) is 48° at 11 a. m; of Low's spring, just afterwards, 49°; but the sun was shining into the latter a little.

Munson has just finished getting in moss. Got 187 bushels dry and 100 bushels wet—all from a bog near the Princeton road, about two miles distant. (The moss was all *Sphagnum.* Drying was effected by spreading it on dry ground, exposed to sun and wind.)

Munson says that the past spring and summer the fishing was not quite so good as usual. The weather was cold, backward, and stormy until the season was well advanced. He thinks a good many have run through into the stream lately.

September 3.—Water at old hatching-house, at 6 a. m., 47½° F. In the stream at cottage, at 7 a. m., 66½°; at 4 p. m. (day sunny and warm), 69½° F.

I have estimated the volume of water at the old hatching-house, thus: 4 faucets, each fill a two-quart dish in 13 seconds; 2 others in 11 seconds each; 7th faucet and waste in about 40 seconds; this gives a total of 16.116 gallons per minute. From Low's spring I find, by same method, a flow of 2½ gallons per minute.

Low's spring by measurement to-day I find to be 20 feet 6 inches above the bank of Grand Lake Stream, 31 feet above the surface of the stream below the dam, and 28 feet 3 inches above the present level of Grand Lake. Its distance from the bank is about 662 feet, and from the water's edge about 686 feet.

Mr. Ferguson to-day caught 8 Schoodic salmon far down the stream. Six of them weigh as follows, respectively, viz: 2 pounds 9 ounces, 2 pounds 9 ounces, 2 pounds 3 ounces, 1 pound 8 ounces, 1 pound 15 ounces, 2 pounds 12 ounces. They thus average 2 pounds 4 ounces. Mr. Munson thinks the general average during the fishing season was fully equal to this. With the salmon Mr. Ferguson took a chub weighing 1 pound 3 ounces.

September 19.—Returned from Bucksport yesterday. Mr. Munson reports that since my last visit (first week in September) the fish (Schoodic salmon) have continued to run into the stream. Both he and

Ripley are of opinion that more fish have run past us than we shall catch this season. I don't think they are right. On the last day of fishing, September 14, Forbes caught 17, and he says they did not bite better at any time in spring or summer.

The nets were put in two or three days before the 15th instant.

Considerable progress has been made in a ditch which is intended to bring more spring water into the old hatching-house from a pool on the upper side of the turnpike, which appears to be filled by neighboring springs.

This afternoon I set my three men at work on the excavation for a hatching-house by the stream, on the site occupied by a temporary structure last year. We throw a dam of logs and stone across the stream and turn the water against the bank.

October 1, 1879.—Arrived again from Bucksport at 11 a. m., via Princeton and Big Lake. Water high for the season in Big Lake, but has lately fallen some. Has fallen slightly in Grand Lake.

I find the excavation for the new hatching-house by the stream completed or nearly so. The ditch for aqueduct to old hatching-house has progressed some and a very hard piece of ground reached where many rocks will require blasting.

October 9, 1879.—Having all the materials collected, we slack a cask of lime and begin digging a trench to receive a concrete foundation for our new hatching-house by the stream. This afternoon I find the ground in our excavation to be about 22 inches below the level of the mill-pond from which we must take our supply of water and eight inches higher than the stream at the point at which the hatching-house must discharge. The stream has perhaps been raised a little at this point by our *debris* being driven into it just below. The ground here is all clay—no bowlders except on the surface.

Munson and Ripley to-day finished blasting in the aqueduct ditch, which is now very nearly complete. The first water was struck 260 feet from the hatching-house, where a small vein oozed out of the east bank; several veins above that before reaching the pool. Total length 330 feet = 20 rods. At a rough estimate there is five feet fall from bottom of upper end of the ditch to the eaves of the hatching-house, at which height I propose to take the water into the building. Surface of pool is three feet higher still. North of this pool, on a hillside, at a distance of 500 feet and an elevation of nearly 25 feet above this pool, is a large spring, whose waters spread over a good deal of ground and then sink out of sight. I shall make my arrangements to lead this, at some future time, into the aqueduct laid this fall. (This was accomplished the next season.) I shall lay an aqueduct of logs, using 2½-inch bore below the road, and 1¾ above it. The logs are partly bored already. Mr. William Cavanagh, of Saint Stephen, is doing the work. We use green Norway pine sticks, 7 inches at the top for small bore and 9 inches for large, 14 to 16 feet long.

October 9.—In half an hour in a boat above the dam I see four salmon leaps. Everybody says they are plenty up there. I have not had time to hunt them.

October 15.—The foundation of our new hatching-house by the stream completed to-day. Dimensions, 22 by 18 feet; rather too small an affair, it seems, to write much about, but yet with our deep troughs it has a capacity of 2,560,000.

The foundation is 18 inches thick at the bottom, and narrows up some at top. The ground being already excavated to a level about 6 or 8 inches above the surface of the stream alongside, we excavated a trench for the foundations two feet deep on the northeast and southeast sides, 18 inches deep on the west side. This trench was filled by pouring in a mass of concrete upon the bottom, bedding large stones upon it, and filling in with concrete. The stones were settled into place by heavy wooden mauls, and the same and also smaller ones were used in ramming the concrete into place. After we reached the top of the ground we began carefully placing large stone, and thus built up 15 or 16 inches higher, at which level I propose to lay the sills. The high water of spring will therefore wet our walls some distance above the sills, but we can at any time in the future jack up the building and build the walls higher. The concrete used in this work consisted as follows: 1 part dry London Portland cement; 1 part slacked-lime paste (Rockland lime); 5 parts fine sharp sand; about 7 parts stream gravel of mixed sizes. All were measured in a pail, except the gravel, which was estimated in a heap; water not measured. The mortar for laying the first stone above the ground was 1 part London Portland cement, 1 part lime-paste, 6 parts sand. Thence up we used 3 parts Rosendale cement, including a little lime-paste, 3 parts sand.

October 17, 1879.—Conclude with F. Shaw & Bros. lease of fishery rights, &c., for five years, with privilege of renewing for five more.

Measured volume of water flowing into the old hatching-house, and found 8.24 gallons per minute. Our aqueduct was laid yesterday, but water was shut off to fix the inlet, so that above represents the volume of the original spring. I am sure that not one-twentieth of it comes from the brook.

October 18.—Measured (roughly) the volume of water in the spring north of Forbes's house (this was on the site since selected for a third hatching-house), and found it to be between one and two gallons per minute. Low's spring gives to-day .714 gallon per minute.

October 20.—Left Grand Lake Stream for Bucksport.

October 26.—Back again at Grand Lake Stream. This afternoon, being in boat up the lake as far as the Sister Islands (two miles from the dam), measured temperature of water in several places. On sunny southerly side of Sister Island, out of the wind, I found 51° F. On northerly side I find 50°; on surface of lake, in deep water, below Mun-

son's Island, 49°; in stream at our house, just after our return, I find 47°.

On the shore of Sister Islands, in edge of water, I picked up a stone (granite) twice as big as my hand, which, like all the other stones, is covered with an olive-green slime. I brought it down and on putting it into a dish of water find the slime is a forest of growing plants of several kinds; in this is a multitude of living creatures, mostly entomostraca, a good many slender larvæ of insects, several kinds, and half a dozen amphipod crustacea of the common sort, which I take to be *Gammarus fasciatus* Say, as per S. I. Smith, in the United States Fish Commission 2d Report, p. 653. Altogether, judging roughly, I should say that there are probably more than 500 animals large enough to be seen with the naked eye on this stone, say 10 *Gammarus*, 20 gastropod mollusks, 100 insect larvæ, and 400 entomostraca. The entire bottom at this place, being covered by a similar growth of vegetation, I suppose it is equally well populated with animals. Sandy bottom, or gravel fine enough to be disturbed by waves, is, of course, a less favorable place.

October 27.—At the dam to-day I could see no indications of spawning. A net was put in immediately above the dam on 21st. (The main net, crossing the stream and barring access to it from the lake at the point where our pounds are to be located, was put in place prior to September 15. This one near the dam is to act as a safeguard and assist in the capture of some stray fish between the upper net and the dam.) On the gravels below the dam the fish have begun to dig nests as usual.

October 29.—To-day we begin setting stakes for pounds above the dam, at the same place as last year, and substantially on the same plans. Shall add some large pounds and locate our spawning-shed there.

October 30.—Finished nearly all the upper pounds at the spawning place (same referred to on 29th), and put them in shape for catching fish. One male came in during the day. Changed the net opposite the house (in the stream below the dam), putting it up at the head of the run and gravels; have contrived a trap in connection with it, but this is not quite completed.

At the old-hatching house I found the temperature of the water in the spring to be 47° F. In the feed-trough in the house it is 46½° F.

At 11 a. m. to-day the volume of water inside the old hatching-house was 17.22 gallons per minute, the several faucets yielding from 2.14 to 4.28 gallons per minute. The aqueduct water is not yet admitted, and very little brook water is coming in.

October 31.—Finished pounds, all except that intended for twice-spawned fish. Also got the trap below the dam on the gravels in order for service.

November 1.—This p. m. the aqueduct was delivering 3.75 gallons per minute of muddy water of 40° F. temperature. The supply in old hatching-house from other sources amounts to 17.21 gallons per minute

of a temperature of 46°. Low's spring yields 3 gallons per minute, of temperature of 47°.

November 3.—The new hatching-house by the stream is nearly completed. Troughs and conduits still to be arranged. The troughs of the old hatching-house were taken out into a shed in the spring. Of late they have all been cut in two (now 10 and 14 feet long), varnished with two coats of asphaltum, and replaced.

We get no female fish below the dam. Judging from what I can see of the fish in the pool immediately below the dam, I think several hundred are there, but I believe them to be mostly males. One good nest was made on night of 1st just above our net across the west run. Yesterday I looked for other recent works below the dam, but found none. Above the dam no nests started yet. Net still in place about 20 feet above the dam. This afternoon I saw three fish there—one female, two males.

One of our nets, that separating the second and third pound, dips its upper line 2 inches below the surface of the water, but I think no fish have passed over it. This evening, at 9, Munson examined the third pound carefully, and found no fish in it. (I find these fish are much more inclined to force their way under an obstruction than over it. Yet they will sometimes search the nets for holes several inches above the surface of the water, standing bolt upright, with their heads entirely out of water, and working along inch by inch, and occasionally they will leap quite out of the water in attempting to scale the barriers. These phenomena have, however, come under my observation only when large numbers of the fish are crowded together.)

November 4.—This morning I found among the females taken above the dam one that was surely ripe. We have tried none of our captured fish yet.

November 6.—This forenoon early Mr. Munson found a great run of smelts at the spawning shed (above the dam). He said he could have dipped any number if they had not been so shy and quick. As it was he dipped 150 or 200, which I have preserved. They are mature, showing clearly spawn and milt through their transparent bellies. [These smelts are among the most diminutive of their genus, averaging in length but little more than 2 inches. They are found in several if not all of the Schoodic lakes. In one of the tributaries of "Upper Dobsy" Lake (Indian name *Sysladobsis-sis*) they are wont to spawn late in the month of February.]

Meshed in a net we found a Schoodic salmon 9½ inches long, weighing 7 ounces; red spots plainly to be seen, but not very bright; the dark bars on the sides very faint; sex, male, yielding milt.

November 7.—Began taking spawn. There are but few ripe fish. Below the dam fish appear to be numerous, but we have not caught many yet. Our trap does not work first rate. I dipped this evening on a spawning-bed a male Schoodic salmon, 7¾ inches long, weighing 3½

ounces, very ripe with milt, with red spots and bars still very distinct. There are a good many of these here. I have never observed many of them before. Indeed, when the men got me two specimens of that size last season I regarded them as the first I had ever seen. It may be (though not probable) that they have always been present but mistaken by me for chubs or young trout. I think I have always been too much on the alert to be so deceived. By lamp-light their distinctive marks are not visible while the fish are swimming in the water, but by day-light, standing on a pier of the dam, I see one of them in the stream unmistakably marked.

November 9.—Fish have been coming in slowly and a good many of them are spawning outside of our nets, though few of those we have taken have appeared ripe. I should say that half a dozen pretty good nests have been made at the head of the "west run" (a narrow channel between the shore and the gravels below the dam) and as many more commenced there. Below the lower nets three or four nests are completed, or nearly so, and others begun. That is all below the dam. Above the dam, near the approach to the sluice-gate, one nest is in process of making, and I see the pair on it to-day. Just above our "dam-net" are, say, eight or ten pretty complete nests. Between that and our upper nets there are, say, ten or twelve nests partially made, of which three or four are nearly complete, besides a dozen spots where fish seem to have been working a very little. Above our upper nets I see about 8 nests, but none of them complete. On the gravels above our spawning-shed fish are now spawning, and I propose to have them fenced off to-night. Some of the fish in our main pound are beginning to spawn.

Between our dam-net and upper net (a space measuring about an acre) are a good many fish; I should think 200 or 300. We have tried in vain to drive them up under the lifted nets, and now propose to sweep that pool with a large seine to-morrow. Fish do not run up through the dam from the pool below to any great extent at this time. Since October 21 we have had a net stretched across the stream 20 feet above the dam to intercept them, and in the space left between this net and the dam I have at no time seen more than a dozen fish, and only one nest has been commenced there, though it is an excellent spot for spawning. [In 1878 we used this space as a trap for fish descending, lifting the net by a long line leading ashore, and at set hours during the night letting it suddenly fall and entrapping all the fish that had sought this spawning-bed. We could not then determine whether the fish caught came from above or from below, but our experience this season indicates that they came from above, and that the fish that occupy by day the great pool below the dam seek spawning-beds on the gravels below them, and not above. This is another manifestation of the instinct of the Schoodic salmon to move downward instead of upward to seek spawning-ground.]

Very few fish have got into the canal this season. Less than a dozen have thus far been seen there.

November 10.—We got our seine (264 feet long) into the water at 10½ a. m., and it took till past three to get it hauled in. We took in all 534 fish, 269 males and 265 females. How these fish came there is unknown, but it is possible that the most of them were lying in this pool when the nets were put in place above and below them. This might be made a receptacle for early-caught fish hereafter.

November 12.—To-day we finished the first overhauling of our main pound, containing all the salmon caught prior to November 7. There were found to be 1,298 salmon, of which 639 were males and 659 females, of which latter 231 only were ripe.

We have now had in hand and entered on the record all the fish caught up to this date, and find them to be 807 females and 807 males. Compared with our fishing record this shows a deficit of 262 males and 99 females, and one whose sex was unknown; total, 362. That is to say, our fishing record shows 362 fish taken into our inclosures more than were found therein. Either some have escaped from us, or, as appears more probable, have stolen under the chains that weight down our nets from the main pound to the one from which the fish are dipped, and thus been dipped up and counted a second time. Such deficits occur every year.

The catch in the trap below the dam has come to a close, apparently by the whole of the fish below the dam being caught up. The net above the dam was put in place October 21, since which time no fish have been able to descend the stream past that point. Hence we have the data for a rough estimate of the number of salmon that descended before that time. Of such fish there were captured 287, of which 168 were males and 119 females. These had been congregated in the deep pool below the dam. If we estimate 50 per cent. of this number to have descended the stream still farther, we have a total of 430 salmon that descended into the stream before October 21; allow 100 per cent. and we have a total of 574, which I think is quite up to the possibilities of the case.

November 13.—We have now handled 1,622 salmon, of which 807 were males and 815 were females. Of the females only 282 have been found gravid and ripe, and these have yielded 339,400 eggs, or 1,205 eggs each. This is an uncommonly heavy yield for Schoodic salmon, indicating what our record of measurement shows, that within a few years the fish have increased in size.

November 15.—The fish in our main pound are very restive—that is, a part of them are. A few are evidently spawning. I find ten nests under way in this inclosure, but don't think many eggs have been laid. I therefore decide to begin overhauling the main pound again to-day.

Weather remarkably mild and favorable. Last week the lower lakes were frozen so that the steamer could not come up from Princeton. On

the night of the 5th the temperature of the air fell to 10° F., but since the 7th it has stood constantly above the freezing point.

November 16.—Have put into the old hatching-house 655,100 eggs, all I think prudent to trust there this year, and shall fit up the troughs in the new house for the remainder of the crop.

November 17.—Set the reservoir tank, the head trough, and two deep hatching-troughs in the new house, and at once placed eggs therein.

November 19.—Examined lot 1 to-day, and find that the embryonic disk now covers about one-third of the yelk. Out of 100 only 75 appeared to be developing, indicating a loss of 25 per cent. from non-impregnation. [This is afterwards determined to be very nearly correct, but it was an exceptionally poor lot.]

November 21.—The embryonic disk in lot 1 (14 days from impregnation) now covers half of the yelk. In lot 2 (10 days from impregnation) it is just beginning to expand.

November 22.—To-day we admit to the old hatching-house a new supply of water, derived from the brook that flows past, which up to this date has been shut out the present season, pending the preparation of a pool for it to clarify itself in. This new supply increases the volume in the hatching-house from 10¼ gallons to 14¾ gallons per minute and lowers its temperature from 46½° to 45° F. It will thus nearly double the capacity of the house. The water from the new aqueduct is not yet admitted.

Grand Lake was frozen over last night as far up as Cedar Island (¾ mile above the dam), but a scow was to-day forced through the ice.

To-day we finish taking eggs and carry up 800 of our fish and liberate them in the lake from 1 to 2 miles distant.

November 23.—By filling an empty trough and making a careful allowance for leakage, I compute that each of the three troughs in the new hatching-house is to-day using 17.7 gallons of water per minute, and that three times as much is flowing to waste; that gives 53 gallons in the troughs and 53 gallons waste, a total of 106 gallons per minute. The size of the conduit is six inches square; its fall and length not accurately ascertained, but the grade is near 1 in 1,000. This is while the mills are shut down; with the mills running the head and the volume in the hatching-house would be somewhat less. [Afterwards ascertained to be 30 per cent. less.] The dams that control the water at the lower ends of these troughs are leaky, and in case of a stoppage of water would leak dry in a short time, estimated at from 16 to 26 minutes. On inquiring of Mr. Munson, I learn that he purposely left leaks at the bottom of the dams to create a bottom draft, lest there should be too strong a surface current at the expense of the lower trays of eggs. He and Mr. Buck did that last year, having observed that the sediment settled much more on the lower than the upper trays, indicating that the surface current was the stronger. I approve this, and also approve putting in cross-boards just above the dam, both at surface and bottom, to pre-

vent these two currents being too direct, thus robbing the middle trays of proper circulation. The leaking out of the water when the flow ceases is also of advantage, in that it secures the eggs against danger of stagnant water, which is much more to be feared than exposure to air with accompanying danger of freezing in any except the coldest of hatching-houses.

November 25.—About 17 gallons of water per minute flowing in the old hatching-house. We have laid some gravel drains to lead tributary springs into the pool whence starts our aqueduct.

November 26.—The old hatching-house has to-day a supply of about 14.6 gallons of water per minute; temperature in the troughs, 45° F.; the main spring being 46½° F. At the new hatching-house the volume is 12 gallons per minute for each trough, temperature 35° F.

At Low's spring a volume of 2.15 gallons per minute, and at the spring near the cove about 5 gallons per minute.

Aqueduct at the old house discharging about 1½ gallon per minute.

In lot 1 (19 days from impregnation), the yelk is four-fifths covered by the embryonic disk. In lot 2 (15 days from impregnation), the yelk is one-half covered.

Ice has closed the lake as far as Cedar Island since the 23d. We broke through it this forenoon with the expectation of carrying the rest of our fish up the lake, but the wind was boisterous and the cold closed the new channel so fast that we were compelled to delay still further the liberation of the fish. Commenced taking out the nets.

November 30.—Heavy rain yesterday morning and warm weather took off all the snow and a great part of the frost out of the ground, and so weakened the ice in Grand Lake (which had only been frozen as far as Cedar Island) that a crew of tannery men broke a channel through to open water this forenoon. In the afternoon our men carried up four boat-loads of fish and liberated them; we have very few left on hand.

The rain gave us in our aqueduct a great flood of water, which was, however, very muddy, from our newly filled ditches. To-day the flood has somewhat sudsided, about 15 gallons per minute now discharging, and it is much clearer, but not yet clear enough to use in the hatching-house, to which it has not yet been admitted. The brook rose also and was shut out of the house yesterday morning. For the present the old spring (also much swollen but not muddy) gives us an ample supply of water.

At the new hatching-house the water grew very clayey early in the thaw, and continued so all of yesterday, but to-day is nearly as clear as ever. Mr. Munson says not a great deal of sediment on the eggs, and what there is washes off readily, unlike the sediment that came into this house last year from the brook, which seemed to "stick." This clayey water must get into the conduit through cracks at the joints, and when the filling is well settled it will doubtless cease to flow. This conduit is 153 feet long, and has its head in the stream about 2 rods from the bank,

where I suppose it will receive pretty pure lake water, the brook water following the shore and running *over* the conduit. This brook is the same that runs by the old hatching-house, whose discharge it receives, but in the half mile between the two houses it runs most of the way through peaty bogs and alder swamps and receives the drainage of several potato fields and stable yards, for which reasons we shut it out from the stream house.

December 1.—On November 27 and 30 and to-day I have examined lots 2, 3, 4, 5, 6, and 7 with especial reference to their impregnation, with following results:

Number of lot.	Date of impregnation.	Date of examination.	Number of eggs examined.	Number found unimpregnated.	Impregnated, rate per cent.
2	Nov. 11	Nov. 27 Nov. 30	6,900	630	90.87
3	Nov. 12	Nov. 30	1,350	158	88.75
4	Nov. 13	Nov. 30	1,800	120	93.33
5	Nov. 15	Dec. 1	1,200	86	92.84
6	Nov. 15	Dec. 1	4,600	250	94.44
7	Nov. 15	Dec. 1	1,600	156	90.25

This is strictly correct as far as it goes, each egg having been closely scrutinized, and in the case of the larger lots, as 2 and 6, samples for examination were taken from 14 to 23 different parts of the lot.

December 3.—At 4.30 a. m. leave Grand Lake Stream for Bucksport. W. H. Munson, as usual, is left in charge of the eggs.

January 3, 1880.—Arrived from Bucksport last night about 12 o'clock. I find to-day that everything is in good order.

The eggs in the old hatching-house all show colored eyes, pretty dark in the earliest ones, very light in the others, being just discernible. I measure the volume of water flowing and find it to be 16.8 gallons. About 1½ gallons of this comes from the new aqueduct, the rest from the brook and spring. Mr. Munson says this is the lowest stage of the water at this house since I left, a month ago. For the most part the faucets have been running very full; it has dropped off only within a few days. At time of the heavy rains the aqueduct water was very muddy and had to be turned off; in fact it was not turned into the hatching-troughs at all until after that. The brook was somewhat muddy (not very), and was turned off for a short time. The spring gave a great abundance of clear water through all the rains.

January 6, 1880.—Made first shipment of spawn to-day. The mode of packing has not been essentially changed since this establishment was first opened. We have, however, discontinued the use of sawdust as a material for outside packing. This year we have a supply of dry moss and dry leaves. The cases always leave the hatching-house about half past two in the afternoon, are taken by Princeton, 12 miles,

and there remain over night, under cover, and generally in a warm room. The next morning they are taken by the "stage," a journey of five hours and 28½ miles, to Forest Station, on the European and North American Railway, where they are delivered to the American Express Company about noon. That evening they reach Bangor, and those bound out of the State reach Boston next morning.

January 20.—Transferred to the old hatching-house all the eggs in the new house except about 80,000.

The water running in the old house is now restricted to 3 faucets; has been so for several weeks. The volume to-day is 15.31 gallons per minute. I expect the volume to diminish during the month to come. The aqueduct yields just about 1½ gallon per minute. This is not strictly pure water, but very near it. A pailful has a slightly clayey tinge.

January 22.—We have now sent away 550,000 eggs. This embraces all of the eggs taken up to November 15, inclusive, except 39,000 left in the troughs. These were originally estimated at 605,000. Thus they measure out within 16,000 of original estimate. As many more than that have been picked out, the original estimate must have been too low. (The number given in the tabular statements is a revised estimate based on the measure now made.)

January 26.—Having now sent away all the eggs that are developed enough to go, shipments must be suspended until other lots brought out from the new house can be sufficiently developed. Temperature of the water in the new house is now 34°, and in the old house 40° F.

March 6.—Returned from Bucksport last night. Water has been very abundant. The volume flowing at old hatching-house to-day I estimate at 31.15 gallons per minute, of which 3¾ gallons comes from the aqueduct. The brook water is now shut out. The aqueduct water has been clear except on one occasion in February. All the eggs are now in the old hatching-house. The last were brought out March 2, and are now so well advanced that the eyes show a little color.

The earliest eggs taken, November 7, began to hatch February 17, were half out February 23, and all out March 1. These have been all the time in the old hatching-house in water averaging 46.36° F. in November, 41.30° in December, 40.33° in January, 39.41° in February, a general average of nearly 42°, and an average period of 108 days. Eggs taken November 15 are just beginning to hatch.

5.—TABULAR STATEMENTS.

TABLE I.—*Record of fishing at Grand Lake Stream, Maine, October and November, 1879.*

Date.	Weather during the night.	Height of Grand Lake, 7 a. m.	Temperature.		Schoodic salmon caught.									Notes.
					Catch in detail.					Daily summary.				
			Air, 7 a. m.	Water, 7 a. m.	Hour.	Males.	Females.	Unknown.	Total.	Males.	Females.	Unknown.	Total.	
1879.		*Ft. In.*												
Oct. 30, 31	Full moon 29th; flying clouds; strong northwest wind all night.	2 4	36	47	9 p. m.	70	23	....	93					1 togue; 1 whitefish; both in upper pounds.
					7 a. m.	47	12	1	60	117	35	1	153	
Oct. 31, Nov. 1	Mostly clear; strong northwest wind all night.	2 4½	36	44	9 p. m.	69	33	....	102					1 togue; 1 whitefish; both in upper pounds.
					7 a. m.	44	18	....	62	113	51	....	164	
Nov. 1, 2	Clear all night; moon rises 6.8 p. m.; wind fresh northwest most of night, dying away toward morning.	.....	20	42	9 p. m.	43	47	....	90					
					7 a. m.	20	9	....	29	63	56	....	119	
Nov. 2, 3	Cloudy	2 3½	23	42½	9 p. m.	21	11	....	32					
					7 a. m.	12	9	....	21	33	20	....	53	
Nov. 3, 4	Cloudy; snow at 11.40 p. m.; wind in evening gentle northeast, changing in morning to north, strong or very strong; moon rises at 7.52 p. m.	.....	25	40½	9 p. m.	50	19	....	69					
					7 a. m.	12	6	....	18	62	25	....	87	
Nov. 4, 5	Evening dark; toward morning clearer; wind ceased at 10 p. m.	.....	22	40	9 p. m.	29	16	....	45					1 whitefish.
					7 a. m.	27	21	....	48	56	37	....	93	
Nov. 5, 6	Clear all night; moon rises at 9.56 p. m.; wind in evening light northwest, dying completely away before midnight.	2 3½	10	38½	9 p. m.	18	13	....	31					1 whitefish; 1 small male Schoodic salmon, 9⅓ inches long, 7 ounces weight, yielding milt.
					7 a. m.	5	4	....	9	23	17	....	40	
Nov. 6, 7	Clear in evening, cloudy after 8 or 9 p. m.; wind none in evening, very little afterward; light snow occasionally after 10 o'clock.	.....	28	40	9 p. m.	38	28	....	66					1 brook trout (*S. fontinalis*) in lower pound.
					7 a. m.	17	12	....	29	55	40	....	95	
Nov. 7, 8		2 3	35	40½	9 p. m.	24	25	....	49					
					7 a. m.	17	16	....	33	41	41	....	82	

TABLE I.—*Record of fishing at Grand Lake Stream, Maine, October and November*, 1879—Continued.

Date.	Weather during the night.	Height of Grand Lake, 7 a. m.	Temperature.		Schoodic salmon caught.									Notes
					Catch in detail.					Daily summary.				
			Air, 7 a. m.	Water, 7 a. m.	Hour.	Males.	Females.	Unknown.	Total.	Males.	Females.	Unknown.	Total.	
1879.		Ft. In.												
Nov. 8, 9	Mostly cloudy; calm, with a slight squall and hail at 2 a. m.		38	41	9 p. m.	13	20	....	33					1 whitefish.
					8 a. m.	10	27	....	37					
										23	47	....	70	
Nov. 9, 10	Evening clear, but very dark; moon rises at 1.20 a. m.; slight snow-squall at 11.30 p. m., followed by rain, which was heavy about 1 a. m., and light afterward; total fall, 0.15 inch.	2 3	54	41	9 p. m.	30	68	....	98					1 whitefish.
					12 midnight	12	17	....	29					
					7 a. m.	14	14	....	28					
										56	99	....	155	
					3 p. m.	269	265	....	534	269	265	....	534	Seined from space between our upper trap and the dam; probably all new fish, but possibly part of them escaped from our main pound.
Nov. 10, 11	Evening clear, but dark, with fresh northwest wind; wind increased after midnight, with flying clouds.		34	41½	7 p. m.	15	13	....	28					Several whitefish.
					9 and 11 p. m.	38	91	....	129					
					7 a. m.	67	46	....	113					
										120	150	0	270	
Nov. 11, 12	Evening dark and calm; snow, with light northerly wind, began at midnight and continued light till morning.		34	42	7 p. m.	4	4	0	8					4 whitefish.
					9 p. m.	2	2	0	4					
					11 p. m.	0	4	0	4					
					12 p. m.	27	6	0	33					
					7 a. m.	5	7	0	12					
										38	23	0	61	
										1,069	906	1	1,976	
										262	99	1	362	Deduct deficiencies found November 12.
										807	807	0	1,614	Remainder.
Nov. 12, 13	Evening clear, with northerly wind, gentle; wind increased to fresh at 10 and so continued all night, with cloudy sky.		36	42½	7 p. m.	1	4	0	5					
					9 p. m.	3	9	0	12					
					11 p. m.	0	5	0	5					
					7 a. m.	8	34	0	42					
										12	52	....	64	

Nov. 13, 14	Calm and cloudy			*42*	*43*	7 p. m.	*20*	*26*	*0*	*46*			
						9 p. m.	0	6	0	6			
						11 p. m.	3	12	0	15			
						7 a. m.	11	17	0	28			
											34	61	0	95
Nov. 14, 15	Dark; light rain all night; wind south, strong in evening; lighter toward morning.	2	2½	53	44	7 p. m.	10	22	0	32			
						9 p. m.	2	7	0	9			
						11 p. m.	5	8	0	13			
						7 a. m.	5	10	0	15			
											22	47	0	69
Nov. 15, 16	Wind light west, shifting to fresh northwest early in evening.			34	43	7 and 10 p. m.	13	47	0	60			
						7 a. m.	10	20	0	30			
											23	67	0	90
Nov. 16, 17	Calm; clear at first, clouded toward morning.	2	2½	34	43	7 p. m.	5	15	0	20			
						9 p. m.	3	8	0	11			
						11 p. m.	1	3	0	4			
						7 a. m.	2	4	0	6			
											11	30	0	41
Nov. 17, 18	Wind easterly; cloudy			28	41½	10 p. m. and 7 a. m.	6	9	0	15				
											6	9	0	15
Nov. 18, 19	Wind northeast, changing about midnight to north, light to fresh; snow till 1; after clearing.			24	39	10 p. m. and 7 a. m.	7	5	0	12				
											7	5	0	12
Nov. 19, 20	Cloudy, with wind very light northeasterly			28	40	7, 9, and 11 p. m.	6	4	0	10				
											6	4	0	10
Nov. 20, 21	Snow in evening; clear after 11 p. m			15	37									
											10	2	0	12
	Total										938	1,084	0	2,022

TABLE II.—*Record of spawning operations, Grand Lake Stream, 1879.*

Date.	Remarks.	Fish at first handling.						Females spawned.	Females respawned.	Eggs.			Remarks.
		Total.	Males.	Females.						Number.	Lot.	Impregnation, per cent.	
				Unripe.	Ripe.	Spent.	Total.						
1870.													
Nov. 7	All taken below dam up to this date	103	71	23	9	0	32	9	.....	8,500	1	75.6	
11	Respawning same	.....	.....	.....	.....	.....	.....	.....	9	261,500	2	91.0	
11	At upper trap last night at 10 and 11	108	30	64	14	0	78	239					
11	At upper trap this morning	113	67	26	20	0	46						
11	Main pound	1,136	561	356	205	14	575						
12	..... do	162	78	54	26	4	84	26	.....	31,000	3	88.0	
13	Respawning fish of 11th and 12th	.....	.....	.....	.....	.....	.....	8	265	38,900	4	92.8	
	Summary to date	1,622	807	523	274	18	815	282	274	339,900	.....	.....	282 females yield 339,900 eggs=1,205 eggs each.
15	Fish of last night	69	22	18	26	3	47	26	.....	33,700	5	93.7	
15	Part of main pound	.....	.....	.....	.....	.....	.....	248	.....	249,000	6	93.6	
15	Fish of this evening	63	13	5	41	4	50	41	.....	33,000	7	88.5	
17	Respawning	.....	.....	.....	.....	.....	.....	.....	315	45,000	8	81.7	New hatching-house.
18	From main pound	.....	.....	.....	.....	.....	.....	116					
18	Fish taken this evening	6	3	0	2	1	3	122	.....	260,000	9	96.2	
18	From part of fish taken since Saturday	74	26	4	32	12	48	2					
19	This morning's catch	7	5	2	.....	.....	2	32					
19	Remainder taken since Saturday	8	4	.....	4	.....	4	2					
19	Remainder of main pound	.....	.....	.....	.....	.....	.....	4	.....	82,000	10	96.5	
19	Rehandling of fish found unripe on 15th	.....	.....	.....	.....	.....	.....	1					
20	Respawning	.....	.....	.....	.....	.....	.....	81	299	42,000	11	95.7	
21	.....do	.....	.....	.....	.....	.....	.....	.....	61	22,000	12	91.9	Usual way.
21	Fish taken last night and others handled before, mixed.	.....	.....	.....	.....	.....	.....	21	.....	5,156	13	.....	Kept in milt 4 hours and 40 minutes. Afterward all died.
22	Final spawning	.....	.....	.....	.....	.....	.....	.....	24	1,700	14	81.4	
	Total	1,849	880	552	379	38	969	978	970	1,113,456	14	93.3	978 females yield 1,113,456 eggs=1,136 eggs each.

TABLE III.—*Measurement of Schoodic salmon, Grand Lake Stream, Maine, 1879.*

Date.	Males.				Females.			
	Number measured.	Length.			Number measured.	Length.		
		Average.	Longest.	Shortest.		Average.	Longest.	Shortest.
1879.		*Inches.*	*Inches.*	*Inches.*		*Inches.*	*Inches.*	*Inches.*
Nov. 7	70	18.8	24	16	32	17.2	20	15
Nov. 15	515	19.0	22½	15	427	16.8	22	14
Nov. 18	245	18.7	23½	15	270	17.6	21½	14½
Nov. 19	37	18.8	22	15	61	17.9	20	13
Sums	866	18.9	24	15	790	17.2	22	13

TABLE IV.—*Observations on temperature and weather at Grand Lake Stream.*

Date.	Temperature.				Height of Grand Lake.	Wind.	Other phenomena.
	Air.	Water.					
		Stream.	Old hatching-house.	New hatching-house.			
	7 a. m.	7 a. m.	a. m.	a. m.			
1879					*Ft. In.*		
Aug. 20	.....	.....	.....	.....	3 3	N., strong	
Sept. 2	.....	.....	48	.....	2 8½	Calm	
3	.....	66½	47½	.....	.....	.....	
19	.....	61½	48½	.....	.....	.....	
20	.....	.....	.....	.....	2 7½	Calm morning	Mostly cl'dy; li't showers.
21	48	61	.....	.....	2 8	Northerly, gentle to fresh	
Oct. 1	.....	.....	48	.....	.....	Light westerly	Mostly clear.
2	55	62	.....	.....	.....	NW., brisk a. m.; calm p. m	Clear.
3	60	61½	48	.....	.....	S. to NW., variable; light to fresh.	Clear to cloudy; variable.
4	51	61	.....	.....	.....	NW., very strong	Clear.
5	49	59	47½	.....	.....	NE., light	Cloudy.
6	38	58	.....	.....	2 7	NW., gentle	Clear.
7	45	58½	.....	.....	.....	Westerly, gentle	Do.
8	60	59½	.....	.....	.....	NW., gentle	Clear at 2 p. m.; air 84°; water of stream 62½°.
9	65	62	.....	.....	2 6½	NE. to SE., variable, gentle	Clear.
10	53	62½	.....	.....	.....	NE., gentle	Cloudy and light rain.
11	40	58½	.....	.....	.....	Easterly, light	Cloudy.
12	45	58	.....	.....	.....	Northerly	Do.
13	48	56½	.....	.....	.....	NW., strong	Clear.
14	45	53	.....	.....	.....	do	Do.
15	45	53	.....	.....	.....	do	Cloudy; light rain morning and evening.
16	52	54	48	.....	.....	do	Clear, after rainy morning.
17	.....	.....	.....	.....	2 4½	SW., light	Clear; warm.
18	51	56	.....	.....	.....	S., light	Cloudy; rain at 10 p. m.
19	56	56	.....	.....	.....	NW., strong	Cloudy, mostly; rain in morning.
20	32	48	.....	.....	.....	do	Clear.
21	33	46	.....	.....	.....	Southerly, light	Do.
22	38	50	.....	.....	.....	S., light	Cloudy.
23	55	52	.....	.....	.....	S	Rain.
24	40	51	.....	.....	.....	NW., strong	Clouds and occasional light snow.
25	26	47	.....	.....	.....	do	Clouds light; a few pellets of snow.
26	24	45	.....	.....	2 3	W., fresh	Clear.
27	24	46	.....	.....	2 2½	S., light	Light clouds.
28	30	46½	.....	.....	.....	SE., light to gentle	Cl'dy; rain p. m. and night.
29	48	46	.....	.....	2 4½	E., changing at noon to N., very strong.	Rain most of day, not heavy.
30	36	46½	46½	.....	2 4	SW., changing about 4 p. m. to NW.	Mostly clear, clouds light.

TABLE IV.—*Observations on temperature and weather at Grand Lake Stream*—Continued.

Date.	Temperature. Air.	Water. Stream.	Old hatching-house.	New hatching-house.	Height of Grand Lake.	Wind.	Other phenomena.
	7 a. m.	7 a. m.	a. m.	a. m.			
1879.					Ft. In.		
Oct. 31	36	47	.....	.....	2 4½	Westerly, very strong	*Mostly* cloudy.
Nov. 1	26	44	46	.....	.....	NW., strong	Clear.
2	20	42	.....	.....	2 3¾	*NW. & W., fresh to gentle.*	Clear; cloudy evening.
3	23	42½	.....	.....	.....	E.; NE., p. m	Clear a. m.; cloudy p. m.; snow at 11.40 p. m.
4	25	40½	.....	.....	.....	N. to NW., strong	Snow in morning, slight am't; cl'dy most of day.
5	22	40	48	.....	2 3½	NW., fresh	Clear most a. m.; cloudy most p. m.
6	10	38½	.....	.....	.....	Variable, very *light*	Clear.
7	28	40	47	.....	2 3	NE. to SE., very light	Cloudy; trifle of snow last night and to-day.
8	35	40½	.....	.....	.....	Southerly, light	Cloudy.
9	38	41	.....	.....	2 3	.....do	Clear, mostly.
10	54	42½	.....	.....	.....	NW., strong	Clear.
11	34	41½	48	.....	.....	NW., light, mostly; var...	Do.
12	34	42	.....	.....	.....	Easterly, chang'g to northerly; light.	Snow in early morn'g, then very light rain.
13	36	42½	.....	.....	.....	Northerly, *fresh*, dying to calm at night.	Cloudy; occasional slight snow.
14	42	43	.....	.....	2 2½	*Southerly* and SW., gentle increasing to fresh.	Cloudy; some sprinkling.
15	53	44	.....	.....	.....	Southerly, light	Cloudy; slight rain.
16	34	43	47½	.....	2 2¾	NW. to N., gentle	Clear.
17	34	43	.....	.....	.....	NW., fresh	Do.
18	28	41½	47	.....	.....	NE., light to gentle	Cloudy; snow commenced at 4 p. m.
19	24	39	46½	.....	.....	*Northerly, gentle*	Clear, mostly.
20	28	40	.....	.....	.....	NE., gentle to fresh	Began to snow at 9 a. m. ceased at 10 p. m.
21	15	37	46½	.....	.....	NW., strong	Clear; drifting snow.
22	2	34	45	.....	.....	W., fresh to gentle	Clear.
23	31	36	.....	.....	.....	E	Rain and sleet all day.
24	21	36½	.....	.....	.....	NW	Clear
25	5	35	.....	.....	.....	S	Cloudy a. m.; began to snow at 12 m.; turned to rain; cleared at 7 p. m.
26	25	35	46	.....	2 3	NW., strong	Clear.
27	15	34	.....	.....	.....	Variable, light	Cloudy, mostly.
28	30	35	.....	.....	.....	Southerly	Clear, mostly.
29	51	37	.....	.....	.....	S., chang'g to NW. at night	Rained nearly all day; flurry of snow in eve'ng.
30	15	34½	43½	.....	.....	NW., strong	Clear; ice has moved down to near the dam.
Dec. 1	9	34½	43½	.....	.....	NW., light; changing to *southerly*.	Clear morning; cloudy p. m.
2	31	33½	.....	.....	.....	.....	
3	30	34	42½	34	.....	NE	Cl'dy, with snow and rain.
4	32	34	42	34	.....	SW	Cloudy and raining.
5	19	32½	41	32½	.....	W	Clear at times.
6	20	33	41½	33½	.....	S	*Cloudy* morn'g; clear p. m.
7	38½	35½	42½	35½	2 7½	SE	Heavy rain; clearing away at noon.
8	30	34	40½	34	.....	S., changing to W	Cloudy morning; clear rest of the day.
9	17	32½	40	32½	.....	NW., light	Clear and very bright.
10	20	33	39½	33	.....	NE	Cloudy day.
11	47½	34½	41	34½	.....	S	Cloudy, with a little rain.
12	32	34½	40½	34½	.....	NE	Cloudy morn'g; at 12 commenced a snow squall.
13	10	32½	40	32½	.....	W., light	Clear.
14	8	32½	40½	32½	2 0¾	*NE*	Cloudy day.
15	23	33	42	33	.....	NE	Snow, 7 inches.
16	20	33	42	33	.....	W	Clear day.
17	14	33	42	33½	.....	NE	Snow, 1¼ inch.
18	—7	32	42	33	.....	NW	Clear.

TABLE IV.—*Observations on temperature and weather at Grand Lake Stream*—Continued.

Date.	Temperature.				Height of Grand Lake.	Wind.	Other phenomena.
	Air.	Water.					
		Stream.	Old hatching-house.	New hatching-house.			
	7 a. m.	7 a. m.	a. m.	a. m.			
1879.					*Ft. In.*		
Dec. 19	6	32	42	33	.....	N	Clear.
20	2	32	42	33	.....	E., changing to W	4 in. snow; clear at 10 a. m.
21	—14	32	41	32½	.....	NW	Clear.
22	—19	32	41	32½	.....	NE	Cloudy; 3 inches snow.
23	2	32½	41	33	.....	SW	Clear.
24	7	33½	41	33½	.....	NE	Snow, 4½ inches.
25	22	33½	41½	34	.....	N	Cloudy.
26	—16	32½	41	33	.....	N	Clear.
27	—24	32	40	32	.....	NE	Clear morn'g; cloudy p. m.
28	8	33½	41½	33½	.....	NE	1 inch snow in morning; clear p. m.
29	23	34	42	34	.....	S	Cloudy; thick fog.
30	30	34	42	34	.....	E., changing to W	1½ inches snow in morning; clear p. m.
31	—19	32	40	32½	.....	N., changing to E	Clear morn'g; cloudy p. m.
1880.							
Jan. 1	2	32	40	33	.....	NW	Clear; 5½ inches snow last night.
2	29	34	41½	34	.....	SW	Partly cloudy.
3	9	33½	41	33½	.....	N	Clear.
4	12	33½	41	34	.....	S	Cloudy; rain and hail; 2 inches snow.
5	27	34	41	34	.....	NW	Clear.
6	—10	33	40	33½	.....	S	Cloudy morn'g; snow p. m.
7	28	33½	41½	34	.....	N	Clear.
8	4	33	41	34	.....	NW	Do.
9	12	32	40½	33	.....	W	Do.
10	28	34	41½	34½	.....	SE	Cloudy.
11	2	33½	40½	34	.....	N	Clear.
12	28	34	41	34½	.....	SE	Cloudy.
13	18	33½	41	33½	.....	NE	Cloudy; 2 inches snow.
14	—6	32	40	32½	.....	N	Clear.
15	—7	33	40	33	.....	SW	Cloudy.
16	0	33	41	33	.....	NE., to S., light	Cloudy all day.
17	22	34	41	34½	.....	Southerly, very light	Cloudy and foggy all day.
18	34½	34	41	34½	.....	S	Cloudy and rainy.
19	30	34	41	34½	.....	N., light	Clondy nearly all day.
20	14	33½	40½	34	.....	W	Clear morn'g; then cloudy; 5 inches snow.
21	10	32	40	32½	.....	NE	Cloudy and blustering snow-storm.
22	2	32	40½	32	.....	W., light	Clear.
23	16	33½	41	33½	.....	E	Cloudy, rainy, and foggy.
24	26	34	39½	34	.....	NW	Clear morn'g; cloudy p. m.
25	12	33½	40	34	.....	SW	Clear.
26	11	33½	40	34	.....	SW	Do.
27	23	34	40½	34	.....	S	Clear a. m.; cloudy p. m.
28	34	34	41	34½	.....	SW	Cloudy morning; partly clear.
29	12	33	38½	33½	.....	N	Cloudy half the day.
30	—7	32	39½	32	.....	W	Clear morn'g; cloudy p. m.
31	42	35	40	35	.....	SW	Cloudy, foggy, and sunshine.
Feb. 1	28	34	39½	34½	.....	SE	Cloudy all day.
2	—15	33½	39	34	.....	N	Clear.
3	— 6	32	39½	32	.....	NE	Cloudy; 7 inches snow.
4	8	33	39½	33½	.....	W., light	Cloudy morning; clear p.m.
5	4	32½	39	33	.....	W., very light	Clear.
6	8	33½	39½	33½	.....	Southerly, light	Cloudy morn'g, then clear.
7	—10	32	39	32½	.....	SW	Clear.
8	2	32½	39	32½	.....	W., light	Clear morn'g; then clouds.
9	18	33	40	33½	.....	SW	Clear nearly all day.
10	—16	32	39	32	.....	W., light	Clear all day.
11	— 6	32½	39½	33	.....	Northerly	Clear; 1½ in. snow last night.
12	20	33	40	33½	.....	SE	Cloudy; 1 in. snow & rain.
13	31	33½	40	34½	.....	S	Cloudy.

TABLE IV.—*Observations on temperature and weather at Grand Lake Stream*—Continued.

Date.	Temperature. Air. 7 a. m.	Water. Stream. 7 a. m.	Old hatching-house. a. m.	New hatching-house. a. m.	Height of Grand Lake.	Wind.	Other phenomena.
1880.					*Ft. In.*		
Feb. 14	25	33½	40	34	.....	E	1½ inches snow.
15	6	32½	40	33	.....	NE	Cloudy.
16	20	33	40	33½	.....	NE	Do.
17	0	32	40	32	.....	W., light	Clear morn'g; then clouds.
18	34	34	40	34½	.....	S	Cloudy morn'g; then clear.
19	30	34	39	34½	.....	W	Clear most of the day.
20	5	32½	38	32½	.....	NW	Clear.
21	6	33	39	33	.....	SE	2 inches of snow after 12 m.
22	18	33½	40	34	.....	SW	Clear.
23	14	33½	39½	34	.....	E	Cloudy morn'g; 7½ in. snow
24	10	33½	40	33½	.....	W	Clear.
25	6	32	39½	32½	.....	W	Do.
26	32	34	40	34½	.....	SE	Showers.
27	31	34	38	34½	.....	W., light	Clear.
28	30	34½	38	34½	.....	NE	Cloudy morn'g; then clear.
29	38	34½	39½	35	.....	S	Rain.
Mar. 1	23	34	39½	34	.....	NE	Cloudy morn'g; then clear.
2	11	33½	39½	34	.....	NW	Clear.
3	15	.....	39	.....	.....	SW	Cloudy nearly all day.
4	33	.....	39½	.....	.....	SW	Cloudy morn'g; then clear.
5	31	.....	39½	.....	.....	NE	Cloudy; 2 inches snow.
6	14	.....	40	.....	.....	N	Clear morn'g; then cloudy.
7	12	.....	40	.....	.....	NW	Do.
8	31	.....	40	.....	.....	SE	2 in. snow; afterwards cl'r.
9	— 9	.....	39½	.....	.....	N., light	Clear.
10	12	34	40	34½	.....	SE	2 in. snow; clear at noon.
11	— 1	.....	40	.....	.....	N	Clear.
12	0	.....	39½	.....	.....	NE	Cloudy nearly all day.
13	—10	.....	39½	.....	.....	W., light	Clear.
14	10	.....	39½	.....	.....	Easterly	1 inch snow.
15	6	.....	39	.....	.....	NE	Clear.
16	18	.....	40	.....	.....	E	Cloudy, and 2 inches snow.
17	21	34	40	34	.....	W	Cloudy nearly all day.
18	20	.....	40	.....	.....	NW	Clear.
19	23	.....	40	.....	.....	SW	Clear most of the day.
20	24	.....	40	.....	.....	W	Clear.
21	28	34½	40	35	.....	Southerly	Cloudy, partly.
22	16	.....	40	.....	.....	W	Clear part of the day.
23	28	.....	40	.....	.....	NW	Cloudy; then clear.
24	27	.....	40	.....	.....	NE	Cloudy morn'g; then snow
25	20	.....	39	.....	.....	NE., strong	Cloudy; 14 inches snow.
26	10	.....	39	.....	.....	W	Clear.
27	2	32½	38½	33	.....	N	Do.
28	22	.....	39½	.....	.....	NE	Clear part of the day.
29	24	.....	40	.....	.....	E	Cloudy nearly all day.
30	21	.....	40	.....	.....	N	Partly cloudy.
31	27	34½	40	.....	.....	NE	Cloudy.
Apr. 1	28	.....	41	.....	.....	N	Cloudy morn'g; then clear.
2	17	.....	40	.....	.....	W	Clear.
3	26	.....	39½	.....	.....	S	Foggy and rainy.
4	44	35½	39	.....	.....	S	Showers.
5	42	.....	38	.....	.....	SW	Cloudy morn'g; clear p. m.
6	34	.....	38½	.....	.....	NW	Clear.
7	28	.....	39	.....	.....	N	Cloudy nearly all day.
8	20	.....	39	.....	.....	N	Clear part of the day.
9	19	.....	39	.....	.....	W	Clear morn'g; then cloudy.
10	32	35	39½	.....	.....	SE	Do.
11	41	.....	39½	.....	.....	S	Cloudy, with a shower.
12	14	.....	40	.....	.....	N	Clear.
13	26	.....	40½	.....	.....	S	Cloudy.
14	30	.....	41	.....	.....	NW	Clear.
15	32	.....	41	.....	.....	NE	Clear, then cloudy.
16	30	36½	41½	.....	.....	NW	Clear.
17	21	.....	41½	.....	.....	E	Snow and rain.
18	28	.....	41	.....	.....	NE	Cloudy morn'g; then clear.
19	28	.....	40½	.....	.....	W	Clear.

TABLE IV.—*Observations on temperature and weather at Grand Lake Stream*—Continued.

Date.	Temperature.				Height of Grand Lake.	Wind.	Other phenomena.
	Air.	Water.					
		Stream.	Old hatching-house.	New hatching-house.			
	7 a. m.	7 a. m.	a. m.	a. m.			
1880.					*Ft. In.*		
Apr. 20	35	38½	40	.....	.....	S	Cloudy, and showers.
21	38	.....	40	.....	.....	NW	Clear.
22	36	.....	40	.....	.....	SW	Do.
23	34	.....	40	.....	.....	N	Do.
24	30	40	39½	.....	.....	N	Do.
25	26	.....	39	.....	.....	N	Do.
26	34	.....	40	.....	.....	E	Cloudy, with a little rain.
27	40	40	41½	.....	.....	SE	Cloudy and foggy.
28	30	.....	40	.....	.....	N	Clear.
29	38	.....	40	.....	.....	N	Clear half of the day.
30	46	39½	41	.....	.....	SE., strong	Rain.
May 1	32	.....	41	.....	.....	NW	Squally nearly all day.
2	38	40	41	.....	.....	NE	Cloudy morn'g; then clear.
3	36	.....	41½	.....	.....	SE	Foggy morn'g; then clear.
4	42	.....	42	.....	.....	NW	Clear.
5	40	.....	42½	.....	.....	W	Do.
6	52	.....	42½	.....	.....	E	Cloudy; showers.
7	37	.....	42½	.....	.....	N.	Clear.
8	38	.....	42½	.....	.....	N	Do.
9	52	.....	42½	.....	.....	.....	
10	54	.....	42½	.....	.....	.....	
11	53	.....	42	.....	.....	Southerly	Showery morn'g; then cl'r.
12	52	.....	42	.....	.....	W	Clear.
13	44	.....	42	.....	.....	NE	Showers.
14	39	.....	41½	.....	.....	N	Cloudy.
15	.....	.....	41½	.....	.....	N. by E., strong	Clear.
16	50	.....	42½	.....	.....	N. W., strong	Do.
17	54	.....	42½	.....	.....	Variable	Cloudy.
18	52	.....	42	.....	.....	Calm	Clear.
19	46	.....	42½	.....	.....	Southerly, strong	Cloudy.
20	56	.....	43	.....	.....	.....	
21	56	.....	44	.....	.....	SW	Showery morn'g; then cl'r.
22	53	.....	43½	.....	.....	E	Cloudy.
23	.....	.....	44	.....	.....	S	Showery part of the day.
24	54	.....	44	.....	.....	SE	Foggy morning.
25	57	.....	44½	.....	.....	NW	Clear.
26	55	.....	44	.....	.....	S	Foggy morning.
27	64	.....	45½	.....	.....	SW	Clear.
28	74	.....	45½	.....	.....	NW	Clear morn'g; then clouds.
29	50	.....	44	.....	.....	W	Clear.
30	55	.....	45	.....	.....	NW	Clear morn'g; then cloudy.
31	52	.....	44½	.....	.....	SE	Rainy.
June 1	57	.....	44½	.....	.....	.....	
2	61	.....	45½	.....	.....	.....	
3	59	.....	45	.....	.....	.....	Heavy frost.
4	37	.....	44½	.....	.....	.....	
5	50	.....	44½	.....	.....	.....	
6	.....	.....	45	.....	.....	.....	
7	.....	.....	44	.....	.....	.....	
8	52	.....	44	.....	.....	.....	

TABLE V.—*General summary of observations on temperature at Grand Lake Stream, Maine, from September 2, 1879, to June 8, 1880, inclusive.*

Date.	Air at 7 a. m.						Water in stream at 7 a. m.					
	Number of observations.	Average degrees.	Max.		Min.		Number of observations.	Average degrees.	Max.		Min.	
			Date.	Degrees.	Date.	Degrees.			Date.	Degrees.	Date.	Degrees.
1879.												
September	1	48.00	21	48	21	48	3	63.00	3	68½	21	61
October	29	44.34	9	65	26	24	29	53.93	10	62½	26	45
November	30	28.23	10	54	22	2	30	39.50	1	44	27	34
December	31	12.97	11	47½	27	—24	31	33.13	7	35½	31	32
1880.												
January	31	15.05	31	42	6	—10	31	33.34	31	35	1	32
February	29	13.10	29	38	10	—16	29	33.14	29	34½	3	32
March	31	16.42	4	33	13	—10	7	33.86	31	34½	27	32½
April	30	31.10	30	40	12	14	1	35.50	4	35½	4	35½
May	29	49.55	28	74	1	32	....	.....	....	....	....	....
June	6	52.67	2	61	4	37	....	.....	....	....	....	....

Date.	Water in old hatching-house, a. m.						Water in new hatching-house, a. m.					
	Number of observations.	Average degrees.	Max.		Min.		Number of observations.	Average degrees.	Max.		Min.	
			Date.	Degrees.	Date.	Degrees.			Date.	Degrees.	Date.	Degrees.
1879.												
September	3	48.00	19	48½	3	47½	....	.....	....	....	....	....
October	5	47.60	1	48	30	46½	....	.....	....	....	....	....
November	11	46.36	5	48	30	43½	....	.....	....	....	....	....
December	30	41.30	1	43½	10	39½	29	33.31	7	35½	27	32
1880.												
January	31	40.53	10	41½	29	38½	31	33.69	31	35	30	32
February	29	39.41	26	40	20	38	29	33.50	29	35	3	32
March	31	39.64	31	40	27	38½	6	34.08	21	35	27	33
April	30	40.00	27	41½	5	38	....	.....	....	....	....	....
May	31	42.92	28	45½	1	41	....	.....	....	....	....	....
June	8	44.62	2	45½	7	44	....	.....	....	....	....	....

TABLE VI.—*Results of development and hatching of eggs at Grand Lake Stream, 1879-'80.*

Lot numbered.	Development of the general stock.								Hatching of those retained.						General averages before and after division.						
				Picked out before division.					Picked out dead after division.						White eggs picked out.			Impregnation computed.‡			
	Date.	Original number of eggs.	When divided.	Unimpregnated.*	Miscellaneous, unimpregnated and others.†	Total.	Number divided.	Number shipped.	Number retained.	Unimpregnated.*	Miscellaneous, unimpregnated and others.†	Total.	Number hatched.	Died after hatching.	Net result in fish to be planted.	Known to be unimpregnated.*	Miscellaneous.†	Total.	Unimpregnated.		Impregnated.
	1879.																				
1	Nov. 7	8,500	Jan. 18	1,641	1,444	3,085	5,415	2,500	2,915	.....	96	96	2,819	38	2,781	19.3	18.1	37.4	2,074	24.4	75.6
2	Nov. 11	261,500	Jan. 12	20,237	11,463	31,700	229,800	229,800	.....	.....	.....	.....	.....	.....	.....	7.7	4.4	12.1	23,676	9.0	91.0
3	Nov. 12	31,000	Jan. 13	3,046	2,254	5,300	25,700	25,700	.....	.....	.....	.....	.....	.....	.....	9.8	7.3	17.1	3,722	12.0	88.0
4	Nov. 13	38,900	Jan. 13	2,117	2,283	4,400	34,500	34,500	.....	.....	.....	.....	.....	.....	.....	5.5	5.9	11.4	2,802	7.2	92.8
5	Nov. 15	33,700	Jan. 14	1,438	2,262	3,700	30,000	30,000	.....	.....	.....	.....	.....	.....	.....	4.3	6.7	11.0	2,117	6.3	93.7
6	Nov. 15	249,000	Jan. 18	13,042	9,803	22,845	226,155	223,800	2,355	.....	106	106	2,249	54	2,195	5.2	4.0	9.2	15,983	6.4	93.6
7	Nov. 15	33,000	Jan. 18	2,700	3,624	6,324	26,676	23,700	2,976	.....	209	209	2,767	36	2,731	8.2	11.5	19.7	3,787	11.5	88.5
8	Nov. 17	45,000	Mar. 2	2,763	3,237	6,000	39,000	39,000	.....	.....	.....	.....	.....	.....	.....	6.1	7.2	13.3	3,734	8.3	91.7
9	Nov. 18	260,000	Mar. 16	3,816	16,184	20,000	240,000	86,000	154,000	1,300	228	1,528	152,472	664	151,808	2.0	6.3	8.3	9,971	3.8	96.7
10	Nov. 19	82,000	Mar. 16	1,200	5,511	6,711	75,289	24,000	51,289	.....	42	42	51,247	150	51,097	1.5	6.8	8.3	2,853	3.5	94.5
11	Nov. 20	42,000	Mar. 16	.....	3,315	3,315	38,685	.....	38,685	800	106	906	37,779	88	37,691	1.9	8.1	10.0	1,794	4.3	95.7
12	Nov. 21	22,000	Mar. 16	.....	2,284	2,284	19,716	.....	19,716	1,100	101	1,201	18,515	28	18,487	5.0	10.8	15.8	1,785	8.1	91.9
13	Nov. 21	5,156	Mar. 19	.....	5,156	5,156	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	100.0	100.0	.....	.....	.....
14	Nov. 22	1,700	Mar. 16	.....	636	636	1,064	.....	1,064	125	56	181	883	2	881	7.3	40.7	48.0	316	18.6	81.4
	Total.	1,113,456	.....	52,000	69,456	121,456	992,000	719,000	273,000	3,325	944	4,269	268,731	1,060	267,671	5.0	6.3	11.3	74,614	6.7	93.3

*The eggs entered in columns thus marked are those that were separated from the others by concussion, to which they were subjected on purpose to kill the unimpregnated.

†These eggs were taken out from day to day through the season, and are supposed to have consisted of about 20 per cent. unimpregnated, 80 per cent. impregnated that died from other causes.

‡Computed by adding 20 per cent. of the "miscellaneous" white eggs to those "known" to have been unimpregnated.

TABLE VII.—*Record of shipment of Schoodic salmon spawn from Grand Lake Stream, Maine, January and March, 1880.*

Date.	Consignee	Address.	Final destination.	For whose use.	Number of eggs.		
					Belonging to State.	Donated by United States.	Total.
1880.							
Jan. 6	H. J. Fenton	Windsor, Conn	Poquonock, Conn	Connecticut Commission	80,000	.....	80,000
7	E. A. Brackett	Winchester, Mass	Winchester, Mass	Massachusetts Commission	60,000	.....	60,000
7	A. H. Powers	Plymouth, N. H	Plymouth, N. H	New Hampshire Commission	50,000	.....	50,000
12	P. H. Christie	Verbank, Dutchess Co., N. Y	Clove, Dutchess Co., N. Y	P. H. Christie	.....	10,000	10,000
12	F. Mather	Newark, N. J	Paris, France	Acclimatization Society	.....	10,000	10,000
12	Mrs. J. H. Slack	Bloomsbury, N. J	Bloomsbury, N. J	New Jersey Commission	.....	20,000	20,000
12	Jas. Duffy	Marietta, Pa	Marietta, Pa	Pennsylvania Commission	.....	12,500	12,500
12	Seth Weeks	Corry, Pa	Corry, Pa	do	.....	12,500	12,000
13	O. A. Dennen	Moosehead Lake, Maine	Moosehead Lake, Maine	Maine Commission	.....	25,000	25,000
13	N. K. Fairbank	Chicago, Ill	Geneva Lake, Wisconsin	N. K. Fairbank	.....	25,000	25,000
13	B. F. Shaw	Anamosa, Iowa	Anamosa, Iowa	Iowa Commission	.....	20,000	20,000
14	R. O. Sweeny	Saint Paul, Minn	Saint Paul, Minn	Minnesota Commission	.....	20.000	20,000
14	D. B. Long	Ellsworth, Kans	Ellsworth, Kans	Kansas Commission	.....	10,000	10,000
14	S. G. Worth	Morganton, N. C	Morganton, N. C	North Carolina and South Carolina Commissions.	.....	40,000	40,000
15	J. G. Portman	Pokagon, Mich	Pokagon, Mich	Michigan Commission	.....	30,000	30,000
15	F. N. Clark	Northville, Mich	Northville, Mich	do	.....	10,000	10,000
15	H. W. Welsher	Madison, Wis	Madison, Wis	Wisconsin Commission	.....	20,000	20,000
19	T. B. Ferguson	Baltimore, Md	Baltimore, Md	Maryland Commission	.....	25.000	25,000
19	M. McDonald	Lexington, Va	Wytheville, Va	Virginia Commission	.....	20,000	20,000
19	C. S. White	Romney, W. Va., via Green Spring Run.	Romney, W. Va	West Virginia Commission	.....	20,000	20,000
19	E. D. Potter	Toledo, Ohio	Toledo, Ohio	Ohio Commission	.....	30,000	30,000
26	E. A. Brackett	Winchester, Mass	Winchester, Mass	Massachusetts Commission	15,000	5,000	20,000
Mar. 2	do	do	do	do	80,000	.....	80,000
8	E. G. Blackford	Fulton Market, New York City	New York City and Caledonia	New York Commission	.....	10,000	10,000
9	H. J. Fenton	Windsor, Conn	Poquonock, Conn	Connecticut Commission	13,000	5,000	18,000
9	A. H. Powers	Plymouth, N. H	Plymouth, N. H	New Hampshire Commission	12,000	5,000	17,000
15	O. A. Dennen	Moosehead Lake, Maine	Moosehead Lake, Maine	Maine Commission	.....	24,000	24,000
	Total				310,000	409,000	*719,000

* In addition to the 719,000 eggs shipped, as per this schedule, there were kept at Grand Lake Stream 273,000 eggs, of which 248,000 represented the 25 per cent. reserve for the lake and stream, and 25,000 were hatched for parties in Calais, to whom they had been donated. These figures give us a total of 992,000 eggs divided, as the net result in eggs of the season's work.

TABLE VII.—*Record of shipment of Schoodic salmon spawn from Grand Lake Stream, Maine, January and March*, 1880—Continued.

Date.	Consignee.	Number of cases.	How packed.*	Time en route.†	Distance.	Arrived at final destination.	When unpacked.	Condition on unpacking.	Number died in transportation.
1880.				*Hours.*	*Miles.*				
Jan. 6	H. J. Fenton	1	Dry moss outside	68	502	10 a. m., January 9	2 p. m., January 9	Good	690
7	E. A. Brackett	1	Dry leaves outside	72	389	January 10			432
7	A. H. Powers	1	do	49	515	3 p. m., January 9	3.15 p. m., January 9	Good	582
12	P. H. Christie	1	Dry moss outside	103	687	9 a. m., January 16	10 a. m., January 16	Very good	100
12	F. Mather	1	Dry moss outside; repacked by Mather in his method.		3,260				10,000
12	Mrs. J. H. Slack	1	Dry moss outside	75	683	5 p. m., January 15	6 p. m., January 15	In very good condition	125
12	Jas. Duffy	1	do	73	723	3 p. m., January 15	5 p. m., January 15	O. K	41
12	Seth Weeks	1	do	96	972	2 p. m., January 16	3 p. m., January 16	Good	158
13	O. A. Dennen	1	do	68	232	11 a. m., January 16	2 p. m., January 16	do	145
13	N. K. Fairbank	1	do	150	1,483	8 p. m., January 19	9 p. m., January 19	do	184
13	B. F. Shaw	1	do	141	1,607	11 a. m., January 19	3 p. m., January 19	do	188
14	R. O. Sweeny	1	do	116	1,789	10 a. m., January 19	10 a. m., January 20	Best ever received	230
14	D. B. Long	1	do	170	2,095	4 p. m., January 21	10 a. m., January 22	Good	200
14	S. G. Worth	1	do	118	1,515	12 m., January 19	3 p. m., January 19	In excellent condition	350
15	J. G. Portman	1	do	100	1,299	6 p. m., January 19	7 p. m., January 19	Good	210
15	F. N. Clark	1	do	120	1,158	January 20	January 20	do	563
15	H. W. Welsher	1	do	121	1,536	3 p. m., January 20	4 p. m., January 20	do	377
19	T. B. Ferguson	1	do	75	805	4.50 p. m., January 22	10.30 a. m., January 23	do	169
19	M. McDonald	1	do	169	1,363	3 p. m., January 26	3 p. m., January 26	First class	263
19	C. S. White	1	do	125	1,005	7 p. m., January 24	10 a. m., January 25	Very good	320
19	E. D. Potter	1	do	92	1,158	10 a. m., January 23	12 m., January 23	Excellent	40
26	E. A. Brackett	1		72	389	January 29			132
Mar. 2	do	2			389			Good	564
8	E. G. Blackford	1	Dry moss outside	‡68	‡617	10 a. m., March 11	12 m., March 11	do	§500
9	H. J. Fenton	1	do	44	502	do	2 p. m., March 11	do	20
9	A. H. Powers	1	do	48	515	2 p. m., March 11	3 p. m., March 11	do	14
15	O. A. Dennen	1	do	99	232	5 p. m., March 19	9 a. m., March 20	do	24
		28							

* The eggs were in all cases first packed in shallow wooden boxes in layers, alternating with wet moss. The outside packing, 2 or 2½ inches thick, was either dry moss or leaves.

† Time here given is the time between leaving Grand Lake Stream and arrival at final destination. In addition to this the eggs were packed up some hours generally before starting, and some time elapsed after arrival at destination before unpacking.

‡ This is only the transportation to New York.

§ All this loss occurred between New York and Caledonia.

TABLE VIII.—*The hatching of Schoodic salmon, season of* 1879–'80.

Place of hatching.	In charge of hatching.	No. of eggs sent to each.	Died in transit.	Died in incubation.			No. hatched.	No. of fish sent out.	No. actually planted.	Remarks.
				Before hatching	After hatching.	Total.				
Connecticut, Poquonock	H. J. Fenton	98,000	710	4,080	1,400	5,480	93,210	91,000	91,000	
Iowa, Anamosa	G. F. Slocum	20,000	188			1,000	†18,812	‡19,000	19,000	
Kansas, Ellsworth	D. B. Long	10,000	200	200	200	400	9,600	9,400	9,400	
Maine, Moosehead Lake	David Brown	49,000	169	1,231	2,000	3,231	47,600	‡47,769	47,769	
Maine, Grand Lake Stream	Wm. H. Munson	273,000	(*)	4,269	1,060	5,329	268,731	267,671	267,671	
Maryland, Baltimore	Frank Behler	25,000	169	2,033	6,098	8,131	22,798	16,700	16,700	
Massachusetts, Winchester	E. A. Brackett	160,000	1,128			†1,270		157,600	§157,600	
Michigan, Pokagon	J. G. Portman	30,000	210	807	26,883	27,890	28,983	2,100	2,100	
Michigan, Northville	F. N. Clark	10,000	563			435	9,002	9,000	9,000	
Minnesota, Saint Paul	S. S. Watkins	20,000	230	277	215	492	19,493	19,278	19,238	
New Hampshire, Plymouth	A. H. Powers	67,000	596	888	463	1,351	65,516	65,000	60,500	
New Jersey, Bloomsbury	A. A. Anderson	20,000	125			557		19,318	19,318	
New York, Caledonia	Martin Fitzgerald	5,000	500	400	600	1,000	4,100	3,500	3,500	
New York, New York and Brooklyn	E. G. Blackford	5,000				100				No further report.
New York, Clove	P. H. Christie	10,000	100	324	326	650	9,576	9,250	9,250	
North Carolina, Morganton	S. G. Worth	40,000	350	6,000	2,500	8,500	33,650	16,825	12,625	
Ohio, Toledo	Flavel Grant	30,000	40			2,000		27,960	27,960	
Pennsylvania, Marietta	J. P. Creveling	12,500	41	267	1,692	1,959	12,192	10,500	10,500	
Pennsylvania, Corry	Seth Weeks	12,500	158	2,126	3,516	5,642	10,216	6,500	6,500	
Virginia, Wytheville	Wm. F. Page	20,000	263	177	1,120	1,297	†19,560	‡23,500	23,500	
West Virginia, Romney	Z. G. Graham	20,000	320	1,000	8,680	9,680	18,680	10,000	10,000	
Wisconsin, Geneva Lake	Frank Welsher	25,000	184	625	15,191	15,816	24,191	9,000	9,000	
Wisconsin, Madison	H. W. Welsher	20,000	377							No record kept.
		982,000	6,621			101,910		840,871	832,131	

*Not transported.

NOTE.—This statement is made up from reports returned by the recipients of the eggs. In nearly all cases all the figures are exactly those returned to us. In some cases, however (marked †), I have inserted figures obtained by computation from the reports received. It will be observed that in three cases (marked ‡) the number of fish reported as planted exceeds those stated to have been hatched. These discrepancies may arise from various causes, the most probable of which is an overestimate of the number of young fish sent out from the hatching-house.

§In the case of Massachusetts the fish were delivered free to applicants, who took them from the hatching-house and made no return as to the occurrence of losses; the number set down as actually planted may therefore be in excess of the true number.

TABLE IX.—*Statement of the planting of young Schoodic salmon in* 1880.

State.	Eggs finally hatched at—	Waters in which the fry were placed.	Tributary to what other water.	Locality of deposit.	Date of transfer.	No. of fish.
Maine	Mount Kineo, Moosehead Lake.	Masterman Brook	Moosehead Lake	Tomhegan Township, Somerset County	June 25, 1880	9,554
		Shaw Brooks	do	Day's Academy, Grant, Piscataquis County	do	9,554
		Hatchery Brook	do	do	do	9,554
		Mansell Brook	do	Somerset County	do	9,554
		West Outlet	Kennebec River	do	do	9,553
	Grand Lake Stream	Grand Lake	Saint Croix River	Hinkley Township, Washington County	do	243,671
New Hampshire	Plymouth	Tolman Pond	Merrimack River	Nelson, Cheshire County	May 4, 1880	3,000
		Adams Pond	do	Sandwich, Carroll County	May 13, 1880	1,500
		Winniequam Lake	do	Laconia, Belknap County	May 18, 1880	5,000
		North Pond	Connecticut River	Stark, Coos County	May 19, 1880	4,000
		Berry Pond	Merrimack River	Pittsfield, Merrimack County	May 20, 1880	2,500
		Spofford Lake	Connecticut River	Chesterfield, Cheshire County	May 20, 1880	3,000
		Diamond Pond	do	Stewartstown, Coos County	May 25, 1880	2,500
		Cunningham Pond	Merrimack River	Peterborough, Cheshire County	May 26, 1880	2,500
		Emerson Pond	do	Rindge, Cheshire County	May 26, 1880	2,500
		Gilmore Pond	do	Jaffrey, Cheshire County	May 26, 1880	2,500
		Walker's Pond	Saco River	Conway, Carroll County	May 28, 1880	6,000
		Newfound Lake	Merrimack River	Hebron, Grafton County	June 2, 1880	3,000
		Heart Pond	do	Canaan, Grafton County	June 2, 1880	2,500
		Walker's Pond	do	Boscawen, Merrimack County	June 8, 1880	2,000
		Long Pond	Connecticut River	Benton, Grafton County	June 9, 1880	3,000
		Sunapee Lake	do	Newbury, Merrimack County	June 10, 1880	4,000
		Cold Pond	do	Acworth, Sullivan County	June 10, 1880	3,000
		Bean Pond	Merrimack River	Warner, Merrimack County	June 10, 1880	3,000
		Echo Lake	Connecticut River	Franconia, Grafton County	June 14, 1880	3,000
		North Pond	Merrimack River	Sandwich, Carroll County	June 17, 1880	2,000
Massachusetts	Winchester	Mendon Pond		Mendon, Worcester County	May or June, 1880.	1,500
		Onota Lake	Housatonic River	Pittsfield, Berkshire County	do	18,000
				Holliston, Middlesex County	do	5,000
		Naumkeag Lake		Ashburnham, Worcester County	do	10,000
				Sharon, Norfolk County	do	5,000
		Battacook Pond		Groton, Middlesex County	do	4,000
				Brewster, Barnstable County	do	8,000
		Fresh Pond		Falmouth, Barnstable County	do	4,000
		Hardy's Pond	Charles River	Waltham, Middlesex County	do	2,000
				Otis, Berkshire County	do	6,000
		Wenham Pond		Wenham, Essex County	do	8,000
		Dorrity Pond		Millbury, Worcester County	do	4,000
		Little Pond		Braintree, Norfolk County	do	4,000
				Sandwich, Barnstable County	do	2,000
		Long Pond		Rochester, Plymouth County	do	4,000
		Mahkunac and Overic Ponds		Stockbridge, Berkshire County	do	20,000

TABLE IX.—*Statement of the planting of young Schoodic salmon in* 1880—Continued.

State.	Eggs finally hatched at—	Waters in which the fry were placed.	Tributary to what other water.	Locality of deposit.	Date of transfer.	No. of fish.
Massachusetts	Winchester	Buell Pond			May or June, 1880.	20,000
		Eel Pond		Melrose, Middlesex County	do	2,000
				Westfield, Hampden County	do	18,000
		Dennis Pond and Bass River		Yarmouth and Dennis	do	8,000
		Mystic Pond		Winchester and Medford	do	4,100
Connecticut	Poquonock, Hartford County.	Pitsquag Pond	Connecticut River	Durham, Middlesex County	Apr. & May, 1880.	5,000
		Higganum Reservoir	do	Higganum, Middlesex County	do	5,000
		Rogers Lake	Long Island Sound	Lyme, New London County	do	5,000
		Quinnebang Lake	do	New Haven County	do	5,000
		Halfway River	Housatonic River	Fairfield County	do	5,000
		Canaan Mountain Pond	do	Litchfield County	do	5,000
		Kanosiac Pond	do	Fairfield County	do	5,000
		Still River	do	do	do	5,000
		Quosepaug Lake	Naugatuck River	Litchfield County	do	5,000
		Plainville Reservoir	Farmington River	Hartford County	do	5,000
		Pemparaug River	Naugatuck River	Waterbury, New Haven County	do	5,000
		Parry's Pond	Long Island Sound	Fairfield County	do	5,000
		Mianus River	do	do	do	5,000
		Black Pond	Quinipiac River	Meriden, Hartford County	do	5,000
		Bolton Reservoir	Hockanum River	Bolton, Tolland County	do	5,000
		Scontic River	Connecticut River	Enfield, Hartford County	do	5,000
		Broad Brook	do	Hartford County	do	5,000
		Salmon Brook	Farmington River	do	do	5,000
		Colt's Reservoir		do	do	1,000
New York	Spring Side, Clove, Dutchess County.	Upton Pond	Wappenger's Creek and Hudson River.	Clinton, Dutchess County	Apr. —, 1880	4,000
		Bullis Pond	Fishkill Creek and Hudson River.	Washington, Dutchess County	do	1,650
		Little Whala or Crystal Lake	do	Pawling, Dutchess County	do	2,000
		Furnace Pond	do	Beekman, Dutchess County	do	1,600
	Caledonia	Blue Pond Inlets		Monroe County		3,500
New Jersey	Bloomsbury	Outlet of Stagg Pond	Pequest and Delaware Rivers.	Sussex County	Apr. 6, 1880	19,318
Pennsylvania	Marietta	Bear Lake	Susquehanna River	Wilkesbarre, Luzerne County	Apr. 8, 1880	5,000
		Heart Lake	do	Montrose, Susquehanna County	do	4,000
		Tigley Lake	do	Susquehanna County	do	1,000
		Donegal Spring	do	Lancaster County	do	500
	Corry	Sugar Lake	Allegheny River	Venango County	May 10, 1880	3,000
		Lake Pleasant	French Creek	Erie County	Sept. 6, 1880	3,500
Maryland	Baltimore	Pond	Monocacy River	Buckeystown, Frederick County	Mar. 22, 1880	200
		Little York	Ohio River	Oakland	Apr. 5, 1880	3,000
		Pond	Monocacy River	Buckeystown	Apr. 15, 1880	500
		do	Gwynn's Falls	Pikesville	Apr. 18, 1880	500
		do	Lake Roland	Green Spring Valley	Apr. 19, 1880	500

		....do	Patapsco Falls	Carrollton	....do	500
		....do	Patuxent River	Oakland	Apr. 20, 1880	500
		....do	....do	Baltimore	....do	500
		....do	Gwynn's Falls	Airey Hill	....do	500
		Trout Branch	Patuxent River	Baltimore	....do	500
		Pond	Linganore Creek	Unionville	Apr. 21, 1880	500
		Winter's Run	Bush River	Wilna	Apr. 22, 1880	500
		Pond	Gunpowder River	Baltimore	Apr. 24, 1880	500
		....do	Gwynn's Falls	Near Catonsville	Apr. 26, 1880	500
		Mill pond	Potomac River	Clear Spring	Apr. 28, 1880	500
		Pond	Bush River	Belair	....do	500
		....do	Patapsco River	Eden	Apr. 30, 1880	500
		Patuxent River	Chesapeake Bay	Baltimore	May 1, 1880	500
		Dripping Spring	Gunpowder River	....do	May 4, 1880	200
		Pond	Big Gunpowder River	Long Green Valley	May 6, 1880	500
		....do	Deer Creek	Norrisville	May 8, 1880	500
		....do	Potomac River	Frederick County	May 11, 1880	500
		....do	Monocacy River	Mount Pleasant	May 13, 1880	500
		....do	Choptank River	Denton	May 14, 1880	500
		Gunpowder River	Chesapeake Bay	Warren	May 17, 1880	500
		Bush Run	Conococheague Creek	Fairview	May 18, 1880	500
		Pond	Patapsco River	Sulphur Springs	....do	500
		....do	Gunpowder River	York Road	May 24, 1880	500
		....do	Patuxent River	Sandy Spring	May 27, 1880	500
		Pond and stream	Northwest River	Stanmore	....do	500
Virginia	Wytheville	Gibboney's Spring	Reed Creek (New River)	Near Wytheville	Mar. 20, 1880	300
		South Fork Red Creek	New River	Near Hatchery	Mar. 22, 1880	200
		Barret's Pond	Reed Creek	Near Wytheville	Mar. 25, 1880	4,000
		Lake Spring	Roanoke River	Near Salem	Mar. 29, 1880	250
		New River	Kanawha River	Near Wythe Lead Mines	Mar. 31, 1880	8,000
		North Fork Holston River	Tennessee River	Near Saltville	Apr. 1, 1880	7,000
		Streams	New River	Near Newbern, Pulaski County	Apr. 5, 1880	3,750
North Carolina	Morganton	Pond of B. A. Berry	Catawba River	Near Morganton, Burke County	Mar. 10, 1880	200
		Pond of C. A. Shuping	....do	....do	Mar. 12, 1880	100
		Mill Creek	....do	McDowell County	Mar. 15, 1880	2,000
		Curtis Creek	....do	....do	....do	2,700
		Ponds	French Broad River	Near Asheville, Buncombe County	....do	1,000
		Ponds of J. H. Schultz	Dan River	Near Winston, Forsythe County	Mar. 23, 1880	200
		Ponds of Mr. Sellars	Haw River	Guilford County	....do	200
		Ponds of David Anderson	Neuse River	Near Raleigh	....do	200
		Ponds of W. H. Ragan	Deep River	Near High Point, Guilford County	....do	100
		Ponds of Raleigh Fish Culturists' Association.	Neuse River	Near Raleigh	....do	400
		Little Alamance Creek	Haw River	North Carolina R. R. Crossing, Guilford Co.	....do	500
		Ponds of L. W. Estes	New River	Watauga County	....do	1,800
		Upper Creek	Catawba River	Burke County	Mar. 26, 1880	1,000
		John's River	....do	....do	....do	1,000
		Ponds of C. W. Alexander	....do	Near Charlotte, Mecklenburgh County	Mar. 28, 1880	200
		Ponds of J. S. Bryant	Yadkin River	Near Salisbury, Rowan County	... do	200
		Ponds of Hatchery	Catawba River	Burke County		825
West Virginia	Romney	South Branch	Potomac River	Hampshire County	Apr. 20, 1880	10,000

TABLE IX.—*Statement of the planting of young Schoodic salmon in* 1880—Continued.

State.	Eggs finally hatched at—	Waters in which the fry were placed.	Tributary to what other water.	Locality of deposit.	Date of transfer.	No. of fish.
Ohio	Toledo	Sandusky River	Lake Erie	Fremont, Sandusky County		10,000
		Rapids of Maumee River	do			17,960
	Northville, Mich	Sandusky River	do	Fremont, Sandusky County	May 4, 1880	9,000
Michigan and Indiana.	Pokagon, Mich	Higgins Lake	Muskegon River	Roscommon, Roscommon County, Michigan	May 4, 1880	21,000
	Do	Stoney Lake	No outlet	La Porte, La Porte County, Indiana	May 9, 1880	
Wisconsin	Geneva Lake	Geneva Lake	Fox River	Walworth County, Wisconsin	—— —, 1880	9,000
	Madison	Mendota Lake	Rock River	Madison		(?)
Minnesota	Saint Paul	Prior Lake	No outlet	Scott County	Apr. 7, 1880	3,000
		Lake	do	Houston County	Apr. 14, 1880	2,000
		Zumbro River	Mississippi River	Wabasha County	Apr. 28, 1880	3,000
		Lake Alley	No outlet	Renville County	May 4, 1880	3,500
		Big Stone Lake	Minnesota River	Big Stone County	do	4,000
		Detroit Lake	No outlet	Becker County	May 10, 1880	1,000
		Lake	do	do	do	500
Iowa	Anamosa	Okibovi Lake	Little Sioux River	Dickerson County	May 30, 1880	5,000
		Clear Lake	Cedar River	Cerro Gordo County	Apr. 9, 1880	5,000
		Shell Rock Lake	do	Butler County	do	3,000
		Storm Lake	Des Moines River	Buena Vista County	Apr. 14, 1880	3,000
		Twin Lakes	do	Calhoun County	do	3,000
Kansas	Ellsworth	Pond	Smoky Hill River	Fort Harker	—— —, 1880	1,000
		do	do	Wilson	—— —, 1880	500
		Ash Creek	do	Near Ellsworth	—— —, 1880	2,000
		Pond	do	do	—— —, 1880	200
		do	do	Venango	—— —, 1880	500
		Bluff Creek	do	Bluffville	—— —, 1880	500
		Spring Creek	do	Harker	—— —, 1880	3,000
		Bradley Springs	do	Bradley Springs	—— —, 1880	300
		Elm Creek	do	Near Terra Cotta	—— —, 1880	300
		Clear Creek	do	Farisville	—— —, 1880	300
		do	do	do	—— —, 1880	300
		Spring Creek	do	Trivola	—— —, 1880	500
New Brunswick	Grand Lake Stream, Maine.	Nickerson's Lake	Saint John River			10,000
		Loch Lomond	Mispeck Stream	10 miles from Saint John		6,000
		Chamcook Lake	Passamaquoddy Bay	Charlotte County		8,000