XXXVII.—REPORT ON THE COLLECTION AND DISTRIBUTION OF SCHOODIC SALMON EGGS IN 1878-'79.

By Charles G. Atkins.

1.—Preparations.

The preparations for the capture of the breeding fish this year were almost identical with those of the year before, and the work proceeded on the old basis until late in the season, when we were compelled to resort to new expedients, which will be detailed below.

For the incubation of the eggs more extensive preparations were made. The ill-success of many of the lots of eggs sent out the previous season warned me not to depend on the old hatching-house, which evidently did not command water enough in a dry winter to forward two millions of eggs and nourish them properly. It was not easy to find a satisfactory remedy. The water of the old hatching-house was spring water. There were numerous other small springs in the neighborhood, but none of those yet discovered could be led into the old hatching-house, and no one of them afforded alone water enough to supply a half million of eggs. Grand Lake Stream affords water of the very best quality, but unfortunately the facilities for using it are very poor. At the dam which commands the outlet of Grand Lake there is, in the spring of the year, a head of perhaps 6 feet, but in the fall, sometimes less than 2 feet, and any hatching-house located low enough to take this water in without artificial raising, at a low stage of the stream, would infallibly be flooded at time of freshet. Nearly equal and generally similar disadvantages attached to every site along the stream. It was, however, finally decided to put in a temporary hatching-house on the west bank of the stream at the first fall below the dam. Even here we had a fall of but little more than 10 feet, and liability to flooding by spring freshets, but the facilities for taking our supply of water from the stream were better than at the dam; and it was hoped that every year we should have the distribution of the eggs completed and the old hatching-house free for the reception of the 25 per cent., reserved for the stream, before the spring freshets should come.

The new hatching-house was a very humble structure, only 20 feet by 10; but there were placed in it three troughs, each 17 inches deep, which had an aggregate capacity of nearly a million of eggs. Wire

trays were employed about 12 inches square, nested in frames carrying 20 trays per frame—the identical apparatus used at this establishment in 1875 and yearly since. The water was taken from the open stream through a covered plank conduit, with the expectation that very pure water would thus be secured. It was afterwards found that the little brook that flows from the old hatching-house through a swampy piece of land discharged its waters into the stream above the new house in such a way that, instead of mingling at once with the water from the lake, they crept down along the shore almost by themselves, as far as the hatching-house. It thus came about that whenever the brook was in flood its turbid waters crowded the pure water of the lake away from the conduit, and took entire possession of the hatching-troughs, making a very dirty piece of work of it. It is not known that any harm resulted beyond the extra work involved in cleaning up and the unpleasant appearance of the fixtures. But steps have been taken to avoid such an occurrence in future by continuing the conduit out under the water of the stream far enough from shore to avoid receiving any part of the brook water. It will be seen that this new hatching-house, though of the greatest service as supplementary to the old one, could not wholly take the place of the latter, which alone afforded facilities for hatching out the reserve for the stream. I therefore turned my attention to the improvement of the old house. In the first place, it appeared advisable to secure, if possible, better aeration of the water; for this end the situation was a very unfavorable one. The spring issued from a gravelly bank, at an elevation scarcely above the level of a large swamp, through which the overflow oozed away. We had the year before cut a wide and deep ditch, nearly half a mile long, for the outflow, so that there was no longer danger of the house being flooded by freshets, but this did not enable us to lower the troughs from their original elevation. We could not curb the spring and thus raise a head, because of the danger that the water would then find a new outlet through the loose gravel and be lost to us altogether. The available head was thus scarcely a foot. The best that could be done was to construct above the hatching-house a narrow, circuitous drain or canal, about 10 feet wide and nearly 70 feet long, through which the water should flow with a surface air-exposure of about 140 square feet, before entering the hatching-house; to have all the overflows and passages, from canal to feeder and from feeder to hatching-trough, at the surface rather than submerged; and to introduce in all the troughs occasional dams which should bring all the water repeatedly to the surface and expose it to the air in wide and shallow currents.

Careful search also revealed a very considerable leak around one end of the hatching-house dam. This was finally, though not without some difficulty, completely stopped. No other change of importance was made in the general hatching arrangements.

The summer, and more especially the early autumn, were rather dry

seasons, and both the lake and the springs were at a low stage. A careful measurement of the amount flowing through the troughs at the old hatching-house indicated but a trifle over four gallons per minute on the 23d of August, 4.164 gallons per minute on the 28th of September; on the 9th of November, after the leaks were stopped, this had risen to 8.4-7 gallons per minute; on the 16th of November, to 12.86 gallons per minute.

2.—FISHING AND SPAWNING.

The progress of the season's work is sufficiently portrayed by the following extracts from my note book, and interpolations.

August 23, 1878.—All reports agree in representing the fishing last spring and early summer to have been uncommonly fine. Fish were plenty, and of unwonted size and fatness. At the dam all the gates are now open, and a lot of logs fill the large pools below our works and partially obstructs its outlet. Consequently the water at our catching and spawning ground is unwontedly high (not high in lake, however). At the dam, in the upper end of the sluice-gate-way, that is, on the upper edge of the rollway, the water is 10 inches deep. At our gauge, on the pier above the dam, the water stands at 2 feet 2 inches exactly, with calm air and still water.

September 28.—Arrived yesterday from Bucksport (second visit). The nets were put across the stream and the head of the tannery canal about the middle of this month.

September 29.—The water being very clear and air still, I looked carefully all along the lower side of the dam, but not a single Schoodic salmon was in sight. I went up to the pier where the water gauge is, but saw nothing there. I think that evidently the fish are coming in slower than last year. On October 6, 1877, I found them very plenty below the dam, but then several hundred had been put in from the canal by Mr. Munson. The water is some lower than last year (nearly 3 inches lower than October 8, 1877), and only one gate is now open instead of three at that time. Water has fallen nearly 5 inches since August 23.

Verified the elevation of the water gauge on the pier above the dam, and found it to agree exactly with the position laid down in Mr. Buck's notes last fall; that is, the 4-feet mark is on a level with the lower side of a drill hole on the south face of a large bowlder, lying in the water near the east shore, "about 225 feet above the dam."

October 1.—Again carefully looked about the dam, but saw no Schoodic salmon. Have not seen one since I came here.

October 31.—Fish have begun to descend below the dam, and nightly come down to our net. Munson thinks them very plenty in lake, from what he has seen above the dam and been told by boatmen. He saw some work in the gravel by fish at the head of our ma'n lead on the 28th, but not much done yet.

November 1.—I see three nests begun at head of our main lead, but

none elsewhere. Got all ready for the capture of fish. Shall not begin sweeping yet. Fish captured every night after this date. See appended "Statement of Fishing."

November 4.—Don't see any new nests above the dam yet; but the old ones, three, are enlarged every night. No new work of consequence in the main lead. I saw yesterday four or five nests in three feet of water, along the west side of the pool below the dam, in precisely the position where I saw them last year.

November 6.—At 8 p. m. I explored the main lead and two first pounds, and found not a single salmon; never knew such a thing before; yet quite a number are just above the gate. Varnum counted 10 there. I think they are mostly males.

November 7.—Scarcely any more spawning operations in our main lead. Two partially-made nests in pound C, our principal inclosure. Above the dam I can count, close together, 13 nests, most of them pretty complete; these are in the swift water above the sluice-gate.

Began taking spawn this afternoon, and find very few ripe females, only 8 out of 54. Total catch of fish to this date, 246, of which 54 are females.

We found among the salmon one gravid female togue—the first time such an event has occurred at this establishment. Her spawn was milted with salmon milt, but all afterwards perished without giving any certain indication as to the cause.

To prevent the fish stealing their nests in the swift water above the gate, I propose to surround this spot on the upper side by a drop-net, and put in some small pounds to entrap any fish that may venture upon the forbidden grounds. This was put in operation the next day, and from November 10 to 17 over 500 salmon were captured on this spot and placed below the dam. Though sharply followed up, the fish succeeded in doing a great deal of nest-digging there. The first nests dug were completely obscured by new ones. Further, quite a number of fish are spawning above all our nets, especially at a gravelly shallow on the site of an old coffer-dam, about 300 feet above the main dam. In former years there has always been some spawning above the dam, but never to an extent approaching their present operations. I attribute their behavior this year to the low stage of the water, which has never been equalled at this date in any year within my experience. To get below the dam, the fish must pass through the sluice-gate, adown an inclined "rollway" about 40 feet long. At the head of this rollway the water is about 10 inches deep, but it flattens out to less than 3 inches at the lower end, so that a fish of ordinary size cannot go down without rubbing upon the plank flooring of the rollway and being pushed partly out of water, to which they appear to be much averse.

November 16.—So many fish are beginning to spawn above the dam, that to-day we put in a set of pounds at the old coffer-dam, entirely closing the stream at that point. This evening fish are entering our new pounds in great numbers.

The fish are remarkably backward in development. Of 385 females examined up to this date, only 139 (36 per cent.) have yielded spawn. To-day we found among the fish caught last night at our lower works 7 ripe females and 50 unripe.

November 17.—Very good success with our new trap at the coffer-dam. We find in it this morning 113 female fish and 36 males. Ninety-seven females and 54 males were also taken last night at the lower pounds, making a total of 300 fish last night—all Schoodic salmon. The weather was clear and calm.

I think, however, that the new trap is somewhat defective in form, especially at the entrance, and that many fish, after once entering the first pound, find their way out again. Some also broke through the net last night, and so escaped. All the fish captured here this morning taken in a salmon-car to the lower pounds, by dragging the car through the sluice at the dam.

At one o'clock to-day, the sun shining, I saw two female fish in the act of spawning close above the dam, turning on their sides and flapping after their usual manner, with no male in sight. Two hours later I find the same two and one other female spawning near, and still no males near. I made these observations very carefully, and have no doubt of their entire accuracy. There is no sort of difficulty in distinguishing the sexes. I have often watched them on the same spot.

November 18.—Another clear and calm night has given us 246 fish, of which 187 were taken in the new trap. The majority of the females handled to-day are pronounced unripe. All the eggs taken previous to this date have been placed in the old hatching-house, and 155,000 eggs are now there. To-day we place 67,000 in the new house.

November 19.—Last night was stormy, with sleet and snow, and much westerly and northerly wind, which continued all night. Total catch of Schoodic salmon, 201; three-quarters females.

November 20.—Last night the wind was very light, and varied from northeast to northwest; cloudy and clear by turns through the night; 288 fish caught, of which 271 came from the upper trap.

November 21.—A rainy evening and fresh northerly wind, clearing at midnight, brought us in last night 187 fish.

November 22, *a. m.*—Clear and calm last night, and we took 306 fish; the best catch of the season.

In the appended tabular record of fishing will be found notes on the weather of each night during the fishing season. So far as the indications go, they seem to be in favor of the conclusion that stormy weather deters the fish from running.

Among the fish handled to-day was one small one, 12 inches long and weighing 11 ounces. This is an unusual size, of which a few are taken each year. Only two of them have been seen this fall. One of the largest of the females handled to-day, a full and ripe fish, measured 22 inches in length, weighed before spawning 4 pounds 1 ounce, and yielded

15 ounces spawn. I think this a small yield of spawn for so large a fish. Another female to-day, 19 inches long, weighing 2 pounds 1 ounce after spawning, gave 14 ounces spawn, which counted out 2,068 eggs. The average yield is much less than this. Up to this date we have taken 450,000 eggs from 386 female fish, an average of 1,166 per fish. This is a much higher average than any preceding year, the fish averaging larger than usual. There is always a slight uncertainty in the estimates of the number of eggs, but the error from this source is probably not over 5 per cent.

The backwardness of the fish this season is more evident now than ever. Less than half of our female fish have yielded their eggs, and the number of eggs taken is less than ever before at this date. We have, however, over 500 gravid fish on hand, besides the catch of the last two nights.

November 22, *p. m.*—On examining the fish taken during the last two nights, we find 241 ripe out of 406 females. They add 243,000 to our stock of eggs, and will add 25,000 more on second handling.

November 25.—The catch of fish has fallen off rapidly since the 22d. Only 38 taken last night. Evidently the season is drawing to a close.

To-day's work adds 445,000 to our stock of eggs, and brings the total thus far up to 1,170,000, with some hundreds of females yet on hand; 948,000 are now deposited in the new hatching-house, and the remainder will be placed in the old house.

To-day we have taken 445,000 eggs. This unusual feat was accomplished by six men working all day, without weighing or measuring any of the fish handled. That gives an average of 74,000 as a day's work for a man, or, say, 7,400 per hour. This would be accounted very slow progress with sea-going salmon, either of the Atlantic or Pacific. But the Schoodic salmon are among the least prolific of fishes, and to get the eggs taken to-day we had to handle over a thousand salmon. The work of putting the eggs in the trays took over four hours in addition. I find that the best working party at the spawning-shed consists of five or six persons—one to dip the fish and pass them to the spawn-takers, one to keep the tally, three to take spawn, and, perhaps, one more to wash and care for the eggs. In addition to these, it will require one man to carry the eggs to the hatching-house, and another to place them in the troughs, and, if the fish are weighed and measured, another man will be required for this. The weighing and measuring have been done this year, as usual, every day except when the work pressed too much. The general results are tabulated below.

December 3.—This afternoon we began sending off the parent fish. Up to this date all caught have been kept in our inclosures. All unripe, and all awaiting manipulation, were kept in the inclosure below the spawning-shed. After the final manipulation they were placed in a roomy inclosure above the spawning-shed. Having now, as is supposed, taken all the fish possible for this season, there is no objection to setting the

old fish free in the lake. With the purpose of securing them as far as possible from destruction, and affording the best facilities for feeding and recovering their condition, we take them in salmon-cars from a mile and a half to two miles up the lake and there set them free. The cars used are fishing "dories" sunk in the water, with grated apertures at either end, the same used on the Penobscot. From one to two hundred of these Schoodic salmon can be transported in one of them at each trip. The weather, fortunately, has been mild for several weeks; otherwise we might be unable to force our way far up the lake by reason of ice.

December 4.—To-day we finished taking spawn by giving the final manipulation to the last fish. We have taken in all 1,723,000 eggs.

December 6.—All the nets and chains were taken out of the water to-day, except a net to guard the passage of the dam by any returning fish.

Grand Lake is not yet frozen over. Big Lake and the other lower lakes are also open, and the steamer continues to run between this stream and Princeton. Ordinarily the lower lakes close about the 18th of November; and this year there have been two interruptions to navigation. On the night of November 15 those lakes froze over and so remained for a week, and once since then they have been frozen over for a single day.

December 9.—Last night the thermometer dropped to 12° F., and ice formed on Grand Lake as far as we can see from the outlet. Within six days the temperature of the water in the new hatching-house has fallen from 40° to 32° F., and we do not expect to see it often above 34° until spring opens.

A good many of the fish that we carried up the lake have come back and got into the canal, and others are hanging about near the dam, just above the net set to intercept their descent. I think they are nearly all males; I looked carefully at about 50 of them and do not see one that I think is a female.

December 11.—A warm rain, with a southeast wind, breaks up the ice in Grand Lake and carries off the snow. There is quite a flood in the brook at the old hatching-house and the water rises to within 3 inches of the tops of the hatching-troughs. A good deal of sediment is deposited in the troughs and on the eggs in both houses, but they can be easily cleansed by the careful hands of Mr. Munson. Grand Lake has risen to 3 feet 6½ inches on our gauge; it has been steadily rising since November 16, when it stood at 1 foot 9 inches.

December 13.—The last of our nets removed from the water to-day. No fish to be seen about the dam, and I think most of them have returned to the lake.

December 14.—The wind blew strongly from the northeast throughout last night, and the lake being open, and the temperature low (15° F.), the rapidly-forming ice-crystals were driven down to the dam, where they were piled up in a mass that clogged the gates and came near being the cause of a serious calamity. At 6.30 a. m. it was discovered

that the water in the stream was very low; that it had actually ceased to flow into the hatching-house, and that from the hatching-troughs themselves it had leaked away, till they were only half full and half the eggs were in the air. The air of the hatching-house was far below the freezing point. Ice coated the frames, and the upper layers of eggs in several of the frames appeared to be frozen. The situation was alarming. The greatest exertions were made to free the gates of the dam from the ice blockade, and in half an hour we had the satisfaction of seeing the water flowing through the hatching-troughs as usual. An examination into the condition of the eggs a few hours later dispelled our fears. Not more than a hundred were killed. I suppose that those which appeared to be frozen on the first examination were merely encased in ice, or possibly the outer shell was frozen, the interior of the egg remaining untouched. At any rate, they all thawed out without loss, except the few mentioned. These losses were confined to the outer edges of the upper and more exposed trays. It would probably have taken some hours longer for the freezing temperature to have penetrated to the interior of the frames of eggs (each frame held 20 shallow trays piled one above another). Had the stoppage of water continued for six or eight hours, I question whether the loss from freezing would have been much more serious than the injury that would have resulted from confining the eggs for the same length of time in a trough filled with stagnant water. It is therefore doubtful whether, even in this cold house, there would be any advantage in a tight trough. In a house kept always above 32° F. in temperature, I think a leaky trough would, without doubt, be the safest, and I would advise that pains be taken to provide some small leak, so that in case of stoppage of the water the troughs may be drained and the eggs left exposed to the air. In a covered trough drying would proceed very slowly, and the eggs would be in no way harmed by contact with air, so long as they neither froze nor died. Such an occurrence as the clogging of the gates of the dam by ice can only occur when the lake is open, and at the same time a very strong wind accompanies extreme cold, a conjunction of circumstances not likely to come about very often.

3.—THE DEVELOPMENT OF THE EGGS.

As soon as the lots of eggs successively reached a stage of development, suitable for the determination between impregnated and non-impregnated, they were subjected to a close scrutiny to determine their condition in this respect. In working upon smaller lots, a sample, numbering 20, taken at random from the eggs as they lay upon the trays, was placed in a shallow testing-box, perforated with 20 holes. Holding this up so that a strong light shone up through the bottom, we could see the condition of the eggs with great distinctness. Several trials were made with each lot, not less than 100 eggs being examined in any lot, except in case of some experiments embracing less than 100 eggs in

all. In the larger lots, however, this was found to be too tedious a process, and resort was had to another. A whole tray of eggs was held up to a window so as to throw a strong light upon the under side, and all the eggs were so lighted up as to make their condition plainly discernible. A whole row, or two or three whole rows, next to the frame, were critically examined and the unimpregnated counted. Each row being known to contain on an average 40 eggs, the ratio of impregnation was speedily arrived at. In this way, in the largest lots, 2,000 and more were examined, and it is believed that the result obtained must be very nearly correct. The result of the examination was fairly satisfactory, but did not indicate so good a ratio of impregnation as I had hoped. Exclusive of the experimental lots, it ranged from 74 to 93 per cent., and averaged, by careful computation, 90.1 per cent. At Bucksport, in former seasons, with sea-going salmon, an average of 96 to 98 per cent. was attained. The reason for the inferior result at Grand Lake Stream is not apparent, but is most likely connected with these too-well attested phenomena: first, that the Schoodic salmon, far more than the Penobscot salmon, are subject to diseases which affect the eggs before they are laid, so that often a large percentage, and sometimes the entire litter, is damaged past all remedy when laid; second, that unlike the Penobscot salmon, the Schoodic fish often came into our hands while yet unripe, and therefore liable to be prematurely pressed.

The percentage of non-impregnation would account for a loss of 172,300 eggs. The shrinkage up to the time of dividing and shipping the eggs was 253,000, as deduced from the number shipped and turned out to hatch. Probably the actual deaths were not far from the latter number. Aside from the ordinary pickings of white eggs, there were some entire lots which perished. These were all experimental lots except in one instance. A lot taken on the 28th of November, numbering 103,000, was a total loss. There was nothing unusual in the appearance of these eggs until December 14, when it was observed that there were small circular white spots in a great many of the eggs; these were near the embryonic disk in all cases, and in most cases directly over it, moving about with the disk as if attached to the yolk. At this date, the eggs of the embryonic disk were just beginning to expand. In a few days it was observed that the lines showing the progress of the growth of the embryo were less regular in this than in other lots. If allowed to remain in the water, the white spots enlarged and the eggs soon decayed. They were, therefore, picked out as fast as they appeared, the examinations being made every three days. From 1,000 to 8,000 were taken out at a picking, and on one day the number rose to 15,000. By the 9th day of February 80,000 had been taken out, one by one. They were then removed to the new hatching-house, when, in the month of March, about 5,000 of them hatched into weak fish. Unfortunately, the record does not throw any light upon the causes that led to this failure, but I have a suspicion that the eggs were kept too long in contact with

the milt, which I have found is sometimes fatal. The eggs and milt were this season kept in contact much longer than I have ever practiced before, with the hope that a more complete impregnation would thereby be secured. The latter object was not attained, and I now believe that a minute is as good as an hour of contact. With the above-named exceptions the eggs were to all appearance a healthy lot, and the shipments were made in a very hopeful spirit.

The water in the new hatching-house fell, during the month of November, from 48° F. to 38°. December 14 it stood at 32°, and thenceforward through the winter between 32° and 33°. The development of the eggs placed therein was, therefore, very slow. The water of the old hatching-house, however, was about as warm as usual, ranging from 44° to 38° in December, from 41° to 39° in January, 39° to 37° in February, 39° to 38° in March, 38° to 34° in April. The eggs placed in this house early in the spawning season came forward rapidly, and were ready for shipment early in February. It was decided to take the 25 per cent. reserve out of these, and, therefore, but 150,000 of them were shipped. These were sent to Connecticut, Massachusetts, and New Hampshire, February 10 and 11. The remainder of the shipments were made from the eggs that passed the winter in the cold water of the new hatching-house, and so much colder was the water and so much more backward the development of these eggs than I had anticipated, that not until April did they reach the state at which I thought it safe to pack them up.

4.—Division and shipment.

There were left at time of shipment, as nearly as could be estimated, 1,470,000 eggs; 370,000 of these were retained for hatching, and the balance, 1,100,000 were sent away—616,000 on account of the United States Fish Commission, and 484,000 on account of the States of Massachusetts, Connecticut, and New Hampshire. The distribution is given more in detail in Table IV.

It has been the practice, rarely omitted at this establishment, to remove the unfertilized eggs from each lot before packing it up. At the stage suitable for packing, the unfertilized eggs are very tender, and a moderate agitation suffices to turn most of them white, when they can be easily removed. This was generally done at the time of packing, but in some cases a few days before. The packing-boxes used this year were from 1¾ to 3½ inches deep. The eggs were, as usual, enveloped in mosquito-netting, between layers of wet sphagnous moss. Between the packing-boxes and the outer cases was a space of about 3 inches, filled with chaff, dry moss, or sawdust. The cases generally left Grand Lake Stream in the afternoon, and were carried on sleds to Princeton, where they passed the first night. The second day they went to Calais, and there passed another night. The third day (two days from starting) they took the railroad train at St. Stephen, N. B., and from this point the journey was generally uninterrupted.

The eggs endured the journey in most excellent condition, and very encouraging reports were received from most of the consignees. Out of thirty lots shipped, sixteen were reported as arriving in "good" condition; three, "very good"; one, "splendid"; one, "excellent, and very superior"; only four were reported in inferior condition. The promise of an unusually successful issue was very flattering, but it was only partially fulfilled.

5.—HATCHING AND PLANTING.

The eggs that were reserved at Grand Lake Stream suffered least loss in hatching. Out of 370,000 but 22,000 were lost, and had the unfertilized been all removed, as in the case of those shipped, the loss would have been much less. The young fish were apparently healthy and vigorous. They were, as usual, set free the last of April and early in May, in the shallow waters around the shores of Grand Lake, and a few in Grand Lake Stream.

Next best were the eggs that were hatched at other points in New England. The poorest results were obtained from the eggs that were shipped to the farthest points. The total number of fish planted is reported at 1,145,665; this indicates a total loss of 324,335 after shipment, which, considering the careful removal of the unimpregnated eggs, is not quite satisfactory. I am disposed to locate in the Grand Lake establishment the causes which led to the greater part of this loss. Though unable to point them out with certainty, I think I am on their track and shall be able to ferret them out. The details of the distribution of the young fish are given in Table V. In the other tables, not yet referred to, will be found records of temperature, of fishing, of spawning operations, and of measurement of the parent fish.

TABLE I.—*Record of fishing at Grand Lake Stream, Maine, November, 1878, and October and November, 1879.*

Date.	Weather.	Height of Grand Lake.	Temperature.		Schoodic salmon caught.									Notes.
			Air.	Water.	Nightly catch.					Nightly summary.				
		7 a. m.	7 a. m.	7 a. m.	Hour.	Males.	Females.	Unknown.	Total.	Males.	Females.	Unknown.	Total.	
1878.		Ft. In.	°	°										
Nov. 1-2	Calm, clear	1 9¼	36	48½	7 a. m	65	5	0	70	65	5	0	70	1 small togue.
2-3	Mostly cloudy; shower in night	1 8¾	34	48	7 a. m	40	11	0	51	40	11	0	51	
3-4	Clear; some wind from N	1 9¼	39	48	7 a. m	38	12	0	50	38	12	0	50	
4-5	Evening clear, moonlight; in morning cloudy, beginning to snow.	1 8¾	21	45	7 a. m	31	13	0	44	31	13	0	44	
5-6	Evening clear; morning clear, still	1 8¾	18	42½	7 a. m	14	11	0	25	14	11	0	25	
6-7	Perfectly calm and clear; moon nearly full	1 9	20	41	7 a. m	5	1	0	6	5	1	0	6	
7-8	Cloudy all night; nearly calm	1 8¾	14	40	7 a. m	7	3	0	10	7	3	0	10	
8-9	Cloudy, with N. wind fresh all night	1 8¾	28	40½	7 a. m	25	25	0	50	25	25	0	50	
9-10	Cloudy and light snow all night; full moon 9th; wind NW.		28	43½	7 a. m	24	12	0	36	24	12	0	36	
10-11	Wind slightly strong at nightfall; dying away entirely by midnight; perfectly clear.		27	39	7 a. m	11	6	0	17	11	6	0	17	
11-12	Rain	1 9¼	28	38	7, 9, 12, 3, 6	48	17	0	65	48	17	0	65	
12-13	Calm and clear	1 8¾	40	40	7, 9, 12, 3, 6	69	31	0	100	69	31	0	100	
13-14	Rain, snow, and wind until 12.30; after that clear and calm.	1 9¼	24	40		118	102	0	220	118	102	0	220	
14-15	Clear all night and calm		27	39		121	89	0	210	121	89	0	210	
15-16	Calm and mostly clear	1 9¼	23	38	7, 9, 12 p. m.; 3, 6, 7 a. m.	49	54	0	103	49	54	0	103	
16-17	Clear and calm	1 9	20	37½	7, 9, 12 p. m.; 3, 6 a. m.	90	210	0	300	90	210	0	300	
17-18	do		30	38½	7, 9, 12, 3, 6	69	177	0	246	69	177	0	246	
18-19	Stormy; sleet and snow, with much westerly or northerly wind all night.	1 9¼	25	38	7 p. m.; 12, 3	48	153	0	201	48	153	0	201	2 whitefish in upper trap.
19-20	Wind very light; variable NE. to NW.; starlight beginning of evening; mostly cloudy till 12; cloudy and half cloudy by turns rest of night.		31	37		38	250	0	288	38	250	0	288	
20-21	Wind fresh northerly, falling to light NW.; rain in evening; clear at 12.		34	37½		35	152	0	187	35	152	0	187	1 togue in upper trap 26¾ inches long, 6¾ pounds; 3 whitefish.
21-22	Clear and calm, or with very little westerly wind till 4 a. m., when clouded up; calm, foggy morning.		33	38	2 p. m.; 1, 5¾, 7 a. m.	51	254	1	306	51	254	1	306	
22-23	Rained hard all night, with NE. wind	1 11	30	38½	7 a. m	21	63	0	84	21	63	0	84	

22-24		1 11½	47	38½	7 a. m.	14	46	0	60	14	46	0	60	
24-25		2 0½	37	40	7 a. m.	10	28	0	38	10	28	0	38	
25-26	Snow light nearly all night		30	39		17	12	0	29	17	12	0	29	
26-27	Clear and calm		32	39	7 a. m.	12	17	0	29	12	17	0	29	
27-28	Clear evening; rain all night after 10.30	2 1½	21	37	7 a. m.	9	5	0	14	9	5	0	14	
28-29	Clear and calm		31	39½	7 a. m.	12	13	0	25	12	13	0	25	
29-30	do		30	38	7 a. m.	17	8	0	25	17	8	0	25	
Nov. 30 / Dec. 1	Clear and some NW. wind		30	38½		5	1	0	6	5	1	0	6	
1-2			16	35		9	4	0	13	9	4	0	13	
1879. Oct. 29	Full moon													1 togue; 1 whitefish; 47 suckers.
30-31	Flying clouds; strong NW. wind all night	2 4	36	46½		117	35	1	153	117	35	1	153	All in upper pounds.
Oct. 31 / Nov. 1	Strong NW. wind all night; mostly clear	2 4½	36	47		113	51	0	164	113	51	0	164	1 togue; 1 whitefish; about 40 or 50 suckers; all in upper pounds.
1-2	Clear all night; moon rose at 6.8 p. m.; wind fresh NW. most of night, dying away toward morning.		26	44		63	56	0	119	63	56	....	119	2 or 3 suckers.
2-3	Cloudy	2 3½	20	42		33	20	0	53	33	20	0	53	Suckers.
3-4	Cloudy; snow at 11.40 p. m.; wind NE.; gentle in evening, changing to N.; strong or very strong in early morning; moon rose at 7.52 (Boston).		23	42½		62	25	0	87	62	25	0	87	Do.
4-5	Wind ceased at 10 p. m.; dark evening; clearer toward morning.		25	40½		56	47	0	103	56	47	0	103	1 whitefish; suckers.
5-6	Wind light NW., calming completely away before midnight; clear all night; moon rose at 9.56.	2 3½	22	40		23	17	0	40	23	17	0	40	1 whitefish; 1 small male Schoodic salmon, 9¼ inches, 7 oz., mature.
6-7	Wind calm in evening, and nearly so all night; clear in early evening, but cloudy from 8 or 9 till morning; snow very light, by spells from 10 till morning.		10	38½		55	40	0	95	55	40	0	95	
7-8		2 3	28	40		41	41	0	82	41	41	0	82	
8-9	Mostly overcast; calm, with a slight squall of hail at 2 a. m.		35	40½		23	47	0	70	23	47	0	70	1 whitefish.
9-10	Evening clear, but very dark; slight snow-squall at 11.30 and rain afterwards; heavy about 1 o'clock; light after; total fall 0.15 inch; moon rose at 1.20 a. m., 10th.	2 3	38	41		56	99	0	155	56	99	0	155	Do.
10-11	Evening clear but dark, with fresh NW. wind; wind increased after midnight, with flying clouds.		54	42½		120	150	0	270	120	150	0	270	Several whitefish.
11-12	Evening dark and calm; snow with light northerly wind began at midnight, and continued light till morning.		34	41½		38	23	0	61	38	23	0	61	4 whitefish.
12-13	Evening cloudy, with northerly wind gentle; wind increased to fresh at 10, and so continued all night, with cloudy sky.		34	42		12	52	0	64	12	52	0	64	
										1,934	2,488	2	4,424	

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TABLE II.—*Record of spawning operations at Grand Lake Stream, 1878.*

Date.	Remarks.	Fish at first handling.							Females.				Eggs.				Remarks.
		Total.	Males.	Females.				Barren.	Spawned.		Total spawned.	Respawned.	Weight.	Number.	Lots.	Impregnation.	
				Unripe.	Ripe.	Spent.	Total.		First handling.	Afterwards.							
1878.													Lbs. oz.			Pr. ct.	
Nov. 7	Pound C, comprising all the females and part of the males in it; rest of males put right back, not wanted.	68	14	46	8	0	54	0	8	....	5	.....	2 2	4,000	1	87	Two fish called ripe were only partially so.
	Female togue	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	31	82	
12	Respawning	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	7	1 1	2,000	2	93	8 females yield —.
	Respawning togue	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	32	87	
	Part of last night's catch	55	46	2	7	0	9	0	8	....	8	.....	3 2	5,500	3	88	
14	Respawning	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	8	0 11	1,500	4	94	8 females yield —; 16 yield —.
	Last night's catch	217	118	69	29	1	99	0	29	....	29	.....	14 13	30,000	5	90	
	Pound C (main stock entire)	398	331	50	27	0	77	0	27	26	53	.....	26 15	57,000	6, 28, 29, 37	.....	
	Summary to date	738	499	167	71	1	239	0	72	26	98	15	50 12	100,000	.....	.....	
15	Respawning of yesterday's catch	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	82	5 9	10,000	7	82	98 females, 110,000; 82 females, 97,000.
	Last night's catch	210	121	55	34	0	89	0	34	0	34	.....	16 14	33,000	8 & expr.	93½	132 females yield —; 34 females yield —.
16	Respawning, yesterday's catch	.....	.....	.....	.....	.....	.....	.....	.....	.....	7	34	2 5	4,000	9	86	Lot 9 washed as usual.
	Last night's fish	112	55	50	7	0	57	0	7	.....	.....	.....	4 6	8,000	10 & expr.	74	
18	Respawning (from 16th)	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	7	0 13	.....	.....	.....	Placed in new hatching-house.
	Fish caught last two nights in lower pounds.	233	76	107	49	1	157	0	49	....	49	.....	27 0	} 67,000	11 & 12	90 & 91	
	One draught of seine in pound C: 174 males, 15 ripe 76 unripe females.	.....	.....	.....	.....	.....	.....	.....	.....	15	15	.....	7 1				
20	Respawning fish of 18th	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	64	4 12	9,000	14	90	New hatching-house; 203 females yield 231,000; 64 females, 76,000.
	Fish of last two nights	473	98	184	183	8	375	....	183	....	183	.....	91 9	198,000	13, 15, 16, 26	.....	New hatching-house.
22	Respawning 183 females	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	183	15 3	21,000	17	91	Do.
	Summary to date	1,766	849	563	344	10	917	0	345	41	386	385	226 4	450,000	.....	.....	
	Fish of last two nights	489	92	160	241	5	406	1	241	....	241	.....	116 8	243,000	18	88	Do.
23	Respawning 241 females	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	241	16 2	25,000	19	.....	Do.
	Last night's fish	76	20	46	10	.....	56	....	10	....	10	.....	4 5	7,000	20 & 33	.....	Do.
25	Respawning same	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	10	0 10	.....	.....	.....	

	Two night's fish	96	23	32	24	7	73	....	34	....	34	.....	15	3	.....	.....	.....
	Pound C	.....	.....	.....	.....	.....	.....	.....	.....	431	431	.....	233	13	.....	.....	.....
	Summary to date	2,427	974	801	639	92	1,452	1	630	472	1,102	636	612	13	1,170,000	.....	.....
27	Respawning 431 females	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	431	24	5	40,000	23	93
	Fish of last two nights	57	26	5	16	10	31	0	16	....	16	.....	5	5	211,000	24	93
	Part of pound C	.....	.....	.....	.....	.....	.....	.....	.....	211	211	.....	113	10			
28	Rest of pound C	.....	.....	.....	.....	.....	.....	.....	.....	111	111	.....	60	1	163,000	25	89
	Fish of last night	14	10	0	4	0	4	0	4	....	4	.....	1	1			
29	Respawning	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	342	25	10	40,000	30	89
	Fish of last night	25	12	0	3	10	13	0	3	....	3	.....	2	2			
30	Fish of last night	25	17	0	2	6	8	0	2	....	2	.....	0	14	106,000	34	91
	Pound C entire	.....	.....	.....	.....	.....	.....	.....	.....	145	145	.....	69	7	20,000	34 expr.	.....
Dec. 2	Remaining on hand	.....	.....	.....	.....	.....	.....	.....	.....	23	23	.....	11	12	31,000	35	81
	Respawning of 152 females	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	152	8	6			
4	Respawning of 23 fish	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	2,000	36	91
	Summary to date	2,548	1,039	806	654	48	1,508	1	655	962	1,617	1,561	935	6	1,723,000	.....	.....

TABLE III.—*Measurement of Schoodic salmon at Grand Lake Stream, Maine*, 1878.

Date.	Males.							Females gravid before spawning.							Females spawned.						
	Number weighed and measured.	Weight.			Length.			Number weighed and measured.	Weight.			Length.			Number weighed and measured.	Weight after spawning.			Length.		
		Average.	Heaviest.	Lightest.	Average.	Longest.	Shortest.		Average.	Heaviest.	Lightest.	Average.	Longest.	Shortest.		Average.	Heaviest.	Lightest.	Average.	Longest.	Shortest.
		Lbs.	*Lbs. oz.*	*Lbs. oz.*	*In.*	*In.*	*In.*		*Lbs.*	*Lbs. oz.*	*Lbs. oz.*	*In.*	*In.*	*In.*		*Lbs.*	*Lbs. oz.*	*Lbs. oz.*	*In.*	*In.*	*In.*
November 7, 1878	14	2 2	2 12	1 8	18.6	20	16	46	2 2	3 0	1 7	17.8	20½	16½	8	2 0	3 4	1 7	17.7	20½	16½
12, 1878	46	2 4	4 4	1 5	18.3	21	15½	2	1 0	2 1	1 12	17 2	17½	17	7	1 8	2 9	1 4	16 8	19	13½
14, 1878	122	2 3	3 4	1 6	18 4	21	15	68	2 3	3 12	1 8	17 2	20	16	30	1 8	2 14	1 3	16 9	19½	15
15, 1878	121	2 4	3 8	1 4	17 6	21½	15	55	2 3	3 0	1 9	17 5	20	15½	33	2 1	3 3	1 1	16 6	21	15
16, 1878	35	2 2	3 5	0 14	18 0	22	13	50	2 2	4 3	1 6	17 3	21½	16	7	2 0	2 13	1 2	17 0	19	15
22, 1878	33	2 4	3 8	1 6	18 5	22	16	30	2 3	4 1	1 6	17 6	20	16	82	1 7	3 2	1 2	17 3	21	15
Sums	391	2 3	4 4	0 14	15.5	23	13	280	2 2	4 3	1 6	17 5	21½	15½	177	1 8	3 4	1 1	17 2	21	13½

TABLE IV.—*Record of shipment of salmon-spawn from Grand Lake Stream, February and April, 1879.*

Date.	Consignee.	Address.	On whose account.	Number of cases.	For what State.	Number of eggs.		Total.
						Belonging to State.	Donated by United States.	
1879.								
Feb. 10	George Jelliffe	Westport, Conn	Fish Commission	1	Connecticut	50,000		50,000
11	E. A. Brackett	Winchester, Mass	do	1	Massachusetts	50,000		50,000
	A. H. Powers	Plymouth, N. H	do	1	New Hampshire	50,000		50,000
Apr. 7	F. N. Clark	Northville, Mich		2	Wisconsin, Iowa, and Minnesota.		60,000	60,000
	T. B. Ferguson	Baltimore, Md	T. B. Ferguson	1	Maryland		50,000	50,000
	Prof. M. McDonald	Lexington, Va	Prof. M. McDonald	1	Virginia		30,000	30,000
	George Jelliffe	Westport, Conn	Fishery Commission	1	Connecticut	70,000		70,000
	C. S. White	Romney, W. Va	do	1	West Virginia		30,000	30,000
8	Dr. R. O. Sweeny	Saint Paul, Minn	do	1	Minnesota		45,000	45,000
	B. F. Shaw	Anamosa, Iowa	do	1	Iowa		35,000	35,000
	William Welch	Madison, Wis	do	1	Wisconsin		20,000	20,000
	D. B. Long	Ellsworth, Kans	do	1	Kansas		10,000	10,000
	E. A. Brackett	Winchester, Mass	do	2	Massachusetts	140,000		140,000
9	G. H. Jerome	Niles, Mich	do	1	Michigan		40,000	40,000
	F. N. Clark	Northville, Mich		1	do		20,000	20,000
	State Hatching-House	Caledonia, N. Y	Fish Commission	1	New York		25,000	25,000
	L. C. Starkel	Belleville, Ill	Belleville Fishing Club	1	Illinois		10,000	10,000
	E. A. Brackett	Winchester, Mass	Fish Commission	1	Massachusetts	30,000	10,000	40,000
10	Alfred Swazey	Bucksport, Me	do	1	Maine		50,000	50,000
14	Mrs. J. H. Slack	Bloomsbury, N. J	do / Hon. A. B. Hewett	1	New Jersey		35,000	35,000
	P. H. Christie	Clove, Dutchess County, N. Y	P. H. Christie and others	1	New York		20,000	20,000
	James Duffy	Marietta, Pa	Fish Commission	1	Pennsylvania		25,000	25,000
	Seth Weeks	Corry, Pa	do	1	do		12,500	12,500
	E. D. Potter	Toledo, Ohio	do	1	Ohio		10,000	10,000
	A. H. Powers	Plymouth, N. H	do	1	New Hampshire	38,000	30,000	68,000
15	E. A. Brackett	Winchester, Mass	do	1	Massachusetts		10,000	10,000
	Alfred Swazey	Bucksport, Me	do	1	Maine		9,000	9,000
	George Jelliffe	Westport, Conn	do	1		56,000	19,000	75,000
	A. E. Neill	Grand Lake Stream			Maine		10,500	10,500
	Total			30		484,000	616,000	1,100,000
	Retained at Grand Lake Stream, 25 per cent. reserve							370,000
	Total divided							1,470,000

TABLE V.—*Statement of the distribution of young Schoodic salmon, 1879.*

State.	Place of hatching.	In charge of hatching.	Number of fish sent out.	Waters stocked.	Tributary to what other water.	Locality.	Number of fish set free.
Maine	Bucksport	Alfred Swazey	55,000	Moosehead Lake	Kennebec River	Moosehead	20,000
				Pond		Damariscotta	5,000
				....do		Unity	5,000
				....do		Auburn	5,000
				....do		Dexter	5,000
				Pushaw Pond		Glenburn	10,000
				Cobosseecontee Lake		Manchester	5,000
	Grand Lake Stream	Wm. H. Munson	348,000	Grand Lake	Saint Croix River	Hinkley	348,000
			10,500	Nash's Lake	....do	Calais	10,500
New Hampshire	Plymouth	A. H. Powers	104,500	Jones Pond		Raymond	5,000
				Merry Meeting Pond		New Durham	5,000
				East Pond		Wakefield	5,000
				Ossipee Lake		Ossipee	5,000
				Massabesic Lake		Manchester	5,000
				Tarlton Pond		Piermont	5,000
				Sunapee Lake		Newbury	10,000
				Star Pond		Springfield	1,500
				Echo Lake		Franconia	2,500
				Newfound Lake		Bridgewater	5,000
				Squam Lake		Holderness	10,000
				Mascoma Lake		Enfield	5,000
				Connecticut Lake		Pittsburg	5,332
				Winnipiseogee Lake		Centre Harbor	5,000
				Pond (no name)		Sandwich	5,000
				Nutt's Pond		Manchester	5,000
				Bradford's Pond		Bradford	5,000
				Chestnut Pond		Northfield	2,000
				Sundry Ponds		Cheshire County	5,000
				....do		Antrim	5,000
Massachusetts	Winchester	E. A. Brackett	221,000	Pond		Harvard	6,000
				....do		East Brookfield	10,000
				....do		Winchendon	4,000
				....do		Natick	3,000
				....do		Milton	6,000
				....do		Wenham	10,000
				....do		Framingham	8,000
				....do		Lynnfield	8,000
				....do		Ashburnham	20,000
				....do		Hubbardston	10,000
				....do		East Brookfield	8,000

TABLE V.—*Statement of the distribution of young Schoodic salmon, 1879—Continued.*

State.	Place of hatching.	In charge of hatching.	Number of fish sent out.	Waters stocked.	Tributary to what other water.	Locality.	Number of fish set free.
				Pond		Acton	9,000
				do		Wakefield	3,000
				do		Middleborough	20,000
				do		Great Barrington	6,000
				do		Stockbridge	20,000
				do		Mendon	3,000
				do		West Scituate	3,000
				do		Paxton	6,000
				do		Westfield	20,000
				do		Rochester	4,000
				do		Westborough	4,000
				do		Essex	10,000
				do		Holyoke	6,000
				do		Milford	3,000
				do		Falmouth	3,000
				do		Marshall	6,000
				do		Waltham	2,000
Connecticut	Westport	George Jelliffe	178,715	Round Pond	Housatonic	Ridgefield	10,000
				Lake Kenosha	do	Danbury	10,000
				Twin Lakes	do	Chapinsville	5,000
				Green Pond	do	Sherman	5,000
				Wamonscoponous Lake	do	Lakeville	5,000
				L. S. Reservoir	Thames	Stafford Springs	10,000
				Long Lake	Naugatuck	West Winsted	10,000
				Saltonstall Lake		East Haven	10,000
				Hog Lake	Connecticut River	Lyme	10,000
				Gardiner's Lake	Thames	Salem	10,000
				Tributary	Housatonic	Newtown	10,000
				Wan-am-aug Lake	do	New Preston	10,000
				Bantam Lake	do	Litchfield	10,000
				Lake Pocatapang	Connecticut River	East Hampton	10,000
				Tributaries	Thames	Willimantic	10,000
				Wangambong Lake	do	South Coventry	10,000
				Reservoir	Connecticut River	West Hartford	3,715
				Melrose Pond	do	Melrose	10,000
				Snipsic Lake	do	Rockville	10,000
				Southport Pond	Mill River	Southport	10,000
New York	Caledonia	Seth Green	15,000	Woodhull Lake		Herkimer County	5,000
				Allen Creek	Lake Ontario	Monroe County	10,000
	Clove, Dutchess Co	P. H. Christie	24,000	Silvan Lake		Dutchess County	3,000

				Upton's Pond		do	3,000
				Long Pond		do	3,000
				Furnace Pond		do	10,000
				Little Whale Pond		do	5,000
New Jersey	Bloomsbury	A. A. Anderson	38,400	Drake's Pond	Paulinskill River	Sussex County	1,000
					Passaic River	Passaic County	2,000
				Shepherd's Lake	do	Ringwood, N. J.	9,400
				Green's Pond	Pequest River	Oxford, Warren County	4,000
				Lake Hopatkong	South branch Raritan	Drakesville, Morris County	16,994
Pennsylvania	Marietta	J. P. Creveling	23,500	Harvies Lake	Susquehanna River	Wilkesborre	6,000
				Tobyhanna	Lehigh River	Scranton	3,000
				Paupock Lake	do	do	11,500
				Big Pond	do	White Haven	1,500
				Moses Wood Pond	do	do	1,500
	Corry	Seth Weeks	12,000	Bay	Lake Erie	Erie	10,000
						Potter County, Pennsylvania	2,000
Virginia	Lexington	H. W. Williamson	27,350	Appomattox River	James River	Farmville	6,000
				South River	do	Lexington	2,500
				Middle River	Shenandoah River	Staunton	6,500
				Buffalo Creek	James River	Lexington	250
				McKee's Spring	do	do	300
				Jackson River	do	Covington	6,500
				Craig's Creek	do	Fincastle	2,800
				New River	do		2,500
Maryland	Baltimore	Frank Bebler	26,500	Stream	Bearerdam Creek	Baltimore	750
				do	Susquehanna River		1,000
				Pond	Charles River	Baltimore	500
				Lake		Druid Hill	8,000
				do		do	2,000
				do		do	2,000
				Pond	Little Pipe Creek	Westminster	1,000
				Cobb's Branch	do	do	2,000
				Pond	Gunpowder River	Hampton	1,000
				Lake S	Stony Run	Charles street avenue	500
				Pond	Big Pipe Creek	Union Bridge	500
				do	do	do	1,000
				Lake	Patapsco Falls	Reisterstown	500
				do		Druid Hill	1,000
				Green Spring Run	Jones Falls	Burnsides	1,500
				Lake	do	Baltimore	1,000
				Pond	Miles Creek	Easton	250
				do		do	250
				do	Miles Creek	do	500
				do	do	do	250
						Druid Hill	500
						do	500
West Virginia	Romney	Z. J. Graham	27,200	Pond at Institution for Deaf, &c.	Potomac River	Romney	400
				Dillon's Run	do	Hampshire County	600
				Fountain at Institution for Deaf, &c.	do	Romney	50

TABLE V.—*Statement of the distribution of young Schoodic salmon, 1879—Concluded.*

State.	Place of hatching.	In charge of hatching.	Number of fish sent out.	Waters stocked.	Tributary to what other water.	Locality.	Number of fish set free.
West Virginia	Romney	Z. J. Graham	27,200	West Fork	Monongahela	Clarksburg	2,000
				do	do	Weston	1,500
				Wheeling Creek	Ohio River	Cold Spring	5,000
				Fish Creek	do	Littleton	5,000
				Dry Fork	Greenbrier River	White Sulphur Springs	3,000
				Williams Spring	Patterson's Creek	Williamsport	1,000
				Mill Creek	Potomac River	Hamot's Mill	500
				do	do	do	1,500
				South branch of Potomac River	do		650
				Greenbrier River	New River	Hinton	5,689
Ohio	Toledo	E. D. Potter	1,000	Maumee River	Lake Erie		1,000
Kansas	Ellsworth	D. B. Long	5,000	Smoky Hill River	Kansas River	Ellsworth County	3,000
				Inman Lake		McPherson County	2,000
Minnesota	Willowbrook and Red Wing.	R. O. Sweeny	48,500	Sandy Lake		Cass County	5,000
				Spring Lake		Dakota County	5,000
				Lake Como		Houston County	3,000
				Barnum		do	500
				Canosia Lake		Duluth County	5,000
				Roberts Lake		Rice County	4,000
				Cedar Lake		do	4,000
				Long Lake		Watonwan County	3,000
				Cedar Lake		Martin County	3,000
				Lake Alley		Renville County	5,000
				Lake Preston		do	5,000
				Skellman's Pond		Wabasha County	5,000
				Cannon River	Cannon Falls		1,000

TABLE VI.—*Observations on temperature and weather at Grand Lake Stream, 1878 and 1879.*

Date.	Temperature.					Wind.	Other phenomena.
	Air.		Stream at dam.		Old hatching-house water.		
	7 a. m.	1 p. m.	7 a. m.	1 p. m.			
1878.							
Oct. 1	39	70	59½	61½	47	Southerly; light in morning, gentle through day.	Foggy till 9 a. m.; some thin clouds, but sun four-fifths of time.
2	54	71	60	62½	48	A. M., light NW.; p. m., light S. by E.; E. in evening.	Clear all day; cloudy evening.
3	55	70	61	63½	48½	Light N. by W., dying away at night.	Foggy till 8½ a. m.; clear rest of day.
4	51	67	61½	63½	48½	Fresh N. by W. or NW.; light morning, and calm evening.	Clear all day.
5	48	61	61	62	48½	NW.; fresh in morning, strong through day.	Do.
6	45	57	60	60½	48½	A. M., very light NE.; in p. m. hauled to light N. and W., dying entirely away at night.	Cloudy till middle of p. m.; perfectly clear rest of day.
7	44	59	58	60	48	West	Clear.
8	42	56	58	59	48	South	Cloudy.
9	47	58	58	59	48	...do	Do.
10	48	52	57	58	48	West	Do.
11	40	53	54	56	48	North	Clear.
12	38	52	54	56	48	East	Cloudy.
13	40	50	54	54	48	North	Do.
14	41	60	51	54	48	West	Clear.
15	38	68	53	56	48	.....do	Do.
16	52	67	54	55	48	.....do	Cloudy.
17	50	54	55	55	48	Southwest	Clear.
18	55	60	55	57	48	South	Do.
19	60	55	57	57	48	..... do	Rainy.
20	44	46	55	55	48	West	Cloudy.
21	42	56	53	54	48	. do	Clear.
22	40	59	53	54	48	.....do	Do.
23	37	46	53	53	47	East	Cloudy.
24	49	50	52	53	47	.....do	Rainy.
25	49	52	52	53	48	West	Cloudy.
26	46	55	52	52	47	North	Do.
27	45	50	52	52	47	South	Do.
28	46	46	52	52	47	North	Do.
29	28	36	47	49	47	.....do	Clear.
30	22	37	46	47	46	.....do	Cloudy.
31	46	48	49	50	47	West	Do.
Nov. 1	38	44	48½	49	....	NW., fresh	Half cloudy.
2	34	53	48	49	46½	South, very light	Do.
3	30	42	48	49	46½	Northwest	Clear mostly.
4	21	39	45	46½	46	SE., light till 3 p. m.; then NW., fresh.	Clear a. m., cloudy p. m.; snow began at 3 p. m., cleared at 5½; 3 inches.
5	18	29	42½	42½	....	NW., strong all day	A little snow in a. m., cloudy rest of day.
6	20	35	41	42	....	NW., strong, dying away at night	Clear all day.
7	14	38	40	41½	....	Southerly, gentle	Clear a. m., cloudy p. m.
8	28	30	40½	39½	46	NW., fresh in a. m., strong in p. m.	Snow began to fall at 8 a. m.; continued all day; 5 or 6 inches.
9	28	31	43½	43½	45½	NW, fresh or gentle	Snowing very lightly all day.
10	27	33	39	39	...	NE. to NW., strong	Partly clear, partly cloudy; fully clear at sunset and after.
11	28	38	38	39½	....	Northerly in a. m; calm in p. m	Clear a. m., cloudy p. m.
12	40	46	40	41	....	S. E., gentle; late in p. m. changed to SW.	Light rain in a. m., cloudy in p. m.; cleared in evening.
13	24	42	40	41	....	Southerly, light	Light rain from 10 a. m. to 5 p. m.; clear morning and evening.
14	27	35	39	40	....	NW., fresh	Mostly clear.
15	23	33	38	39	....	NW., light, calm at evening	Clear.
16	20	37	37½	39	....	S., light all day	Cloudy mostly.
17	30	41	38½	39½	....	Variable; westerly, easterly, very light.	Clear.
18	25	34	38	39	....	Southeast, gentle	Cloudy, snow and sleet in evening and all night.
19	31	35	37	37½	....	N. to NE., fresh	Light snow and some sleet all day.
20	34	38	37½	38	....	N., gentle to light	Cloudy, with very light rain.

TABLE VI.—*Observations on temperature and weather, &c.*—Continued.

Date.	Temperature. Air. 7 a. m.	Air. 1 p. m.	Stream at dam. 7 a. m.	Stream at dam. 1 p. m.	Old hatching-house water.	Wind.	Other phenomena.
1878.							
Nov. 21	33	36	38	39	....	N. to NW., light; dying away in p. m.	Clear in morning, but soon cloudy, and cloudy rest of day till sunset; after that clear.
22	30	35	38½	39½	....	NE., light; increasing at evening.	Cloudy all day; slight rain in evening.
23	47	49	39½	40½	...	Southerly; light to gentle	Cloudy, with occasional light rain.
24	37	41	40	41	....	NW. to W., light	Clear.
25	30	40	39	40	....	Westerly a. m., southerly p. m.	Clear a. m., cloudy p. m.; snow in evening and nearly all night.
26	32	36	39	40	....	NW., fresh	Clear.
27	21	54	37	39	....	Westerly	Do.
28	31	32	39½	40½	....	Southeast and southwest	Rain since 10½ last evening and nearly all to-day.
29	30	08	38	30	....	NW., strong	Clear.
30	30	36	38½	39	....	NW., light a. m., strong p. m	Mostly clear.

Date.	Temperature. Air. 7 a. m.	Water at new hatching-house. 7 a. m.	Water at old hatching-house.	Wind.	Other phenomena.
1878.					
Dec. 1	16	35	44	Westerly	A. m., clear; p. m., cloudy.
2	....	34½	43½	Southerly	Cloudy.
3	....	40	43	Southeasterly	Cloudy, rain; heavy rain last night.
4	....	37	44	Southerly, light	Cloudy; some rain.
5	36	38	44	Northerly, light	Cloudy.
6	25	37	43½	Westerly, gentle	A. m., cloudy; p. m., clear.
7	....	34	42½	Northwest, gentle	
8	18	33	42	Northwest, fresh	
9	12	31½	42	Westerly, light to gentle	Cloudy.
10	23	32½	42	SE. and SW., gentle to strong	A. m., snow.
11	45	36	42	SE. and S., strong	Rained heavily all last night, and moderate rain through day.
12	29	36	43	Northwest, fresh	Cloudy.
13	21	33	43	Northwest, strong	Cloudy, mostly.
14	15	32	42	Strong, NW., through night and a. m.; p. m. changed to easterly.	A. m., clear; p. m., cloudy.
15	27	33	41½	Light, southerly	Cloudy; snow early a. m.
16	28	33	41½	Strong, northerly	Cloudy till evening.
17	13	33	38	Gentle, westerly	Clear.
18	10	32	38		
19	17	32	38½	Northerly	Clear.
20	10	32	39	Westerly	Do.
21	2	32	40	Snow, calm a. m.	Mostly cloudy; gale in night.
22	38	33	40½	Southeasterly	Mostly cloudy.
23	16	32½	38½	Westerly	Clear.
24	9	32½	39		Do.
25	....	32	40	Southwesterly	Do.
26	....	31½	41	.....do	Do.
27	3	32½	40½		Do.
28	13	32	41	Northerly	Do.
29	5	32	41		Do.
30	....	32	41		Cloudy; snow in evening
31	5	32	40½		Clear.

TABLE VI.—*Observations on temperature and weather, &c.*—Continued.

Date.	Temperature. Air. 7 a. m.	Water at new hatching-house. 7 a. m.	Water at old hatching-house.	Wind.	Other phenomena.
1879.					
Jan. 1	6		41	Northerly, light	Clear.
2	0		40	Southeasterly, light	Cloudy to snow.
3	8		41	Northeast, fresh	Snow.
4	12		41	Northerly, light	Clear.
5	18		40½	Northerly, squalls	Do.
6	12		41		
7			41		
8	12		40	Southerly	Cloudy and snow.
9	16		41		
10	12		40	Northerly	Clear.
11	— 4		40	do	Do.
12	— 7		40		Do.
13	8		40½		Cloudy.
14	18		40	Northwest	Clear.
15	—10		39	do	Do.
16	—10		39	Northeast	Cloudy.
17	—16		39	Northerly	Clear.
18	20		40	Southerly	Snowy to clear.
19	— 1		39		Clear.
20	2		39	Easterly	Snow last night; clear.
21	—20		39	Easterly and northerly	Clear.
22	9		39	Northerly and westerly	Do.
23	11		39	Northeast	Snow; clear.
24	6		39	Northerly to southerly	Clear.
25	26		39½		Snow.
26	— 7		39	Strong northerly	Clear.
27	— 6		39		Cloudy and little snow.
28	15		39		Do.
29	23		39	Northwest, fresh	Cloudy to clear.
30	5		39	do	Clear.
31	6		39	do	Do.
Feb. 1	8		39	Northerly	Clear to snow.
2	20		39	do	Snow to clear.
3	28		39	do	Mostly cloudy; clear evening.
4	20		39		Clear.
5	10		39		Do.
6	18		39		Do.
7	10		39	Northerly or northwest	Do.
8	2		39	do	Do.
9	— 7		38	Southerly and southeasterly	Snow.
10	10		38	Northerly and northwest	Clear.
11	9		38½	Southerly and easterly	Clear to cloudy.
12	40		37	Southerly and southeasterly	Rain.
13	8		37	Northerly	Clear.
14	— 2		37	Northwest	Do.
15	— 8		37	do	Do.
16	2		39	Northerly and westerly	Do.
17	8		38½	Variable	Mostly clear.
18	12		38½	Northeast	Snow storm.
19	4		39½	Northerly	Clear.
20	4		38½	Easterly	With snow.
21	7		38	Northerly, gale	Cloudy and snow.
22	3		38½	Northerly, fresh	Clear.
23			38½	Southwesterly and southerly	Clear to cloudy.
24	17		39	Variable, snow squalls	Partially clear.
25	— 5		39	Northerly	Clear.
26	19		39	Easterly to southeast	Cloudy to hail, to rain, snow last night.
27	29		39	Northeasterly	Snow to clear weather.
28	— 4		38	Northerly	Clear weather.
Mar. 1	0		38	Variable, and very light	Cloudy.
2	19		38½	Northerly, light	Clear; a little snow last night.
3	7		38½	do	Clear.
4	27		38½	Southerly	Clear to cloudy.
5	29		38½	Northerly	Clear.

TABLE VI.—*Observations on temperature and weather, &c.*—Continued.

Date.	Temperature. Air. 7 a. m.	Water at new hatching-house. 7 a. m.	Water at old hatching-house.	Wind.	Other phenomena.
1879.					
Mar. 6	— 2	....	38	Northerly to southeast	Clear, followed by snow.
7	17	....	38½	Northeast	Four or five inches light snow; clear evening.
8	8	....	38	Easterly	Clear.
9	....	....	39	.....do	Clear morning; hail and rain at night.
10	27	....	39		Rain.
11	30	....	38	Easterly	Do.
12	22	....	38	Northerly	Clear.
13	21	....	38½	.....do	Do.
14	....	....	39	Northerly and westerly, light	Clear; a very little snow last night.
15	36	....	39	Northerly	Clear.
16	15	....	38	North and northwesterly	Do.
17	16	....	38	Northeast	Snow storm, six inches at 6 p. m.
18	22	....	38	Light, northerly and westerly	Clear.
19	— 4	....	38		Clear weather.
20	14	....	38	Westerly	Clear.
21	2	....	38½	Southerly and easterly	Clear to snow.
22	16	....	38½	Southerly, a. m.; northerly, p. m.	Clear to cloudy.
23	22	....	39	Easterly	Snow storm, nine inches,
24	15	....	38		Clear, a. m.; cloudy, p. m.
25	33	....	39		Cloudy, a. m.; clear, p. m.
26	30	....	39		Light snow, a. m.; clear, p. m.
27	27	....	38½	Easterly	Cloudy.
28	28	....	38½	Westerly	Clear.
29	27	....	39	Easterly	Cloudy.
30	37	....	39	.....do	Foggy and wet.
31	37	....	39	Northeast	Cloudy to rain, with thunder and lightning.
Apr. 1	36	....	34	Northeast to northwest	Rain to snow; cleared off in evening.
2	22	....	36	North and west	Clear.
3	20	....	37	Northerly	Snow, a. m.; clear, p. m.
4	14	....	37	Northeast	Snow storm, five inches.
5	24	....	38		Cloudy; snow, p. m.
6	26	....	38	Northerly	Mostly cloudy.
7	28	....	38	Variable	Cloudy to clear; snow squalls.
8	33	....	38½	Northerly	Clear weather.
9	34	....	38	Strong, northerly	Clear.
10	25	....	38		Clear weather.
11	28	....	37½	Northeast	Snow storm.
12	28	....	38	Northerly, with snow squalls	
13	....	....	38	Southwest or westerly	Clear.
14	....	....	38		Fair weather.
15	26	....	38	Northerly	Clear.
16	30	....	38½	Northerly, gentle	Do.
17	38	....	38½	do	Do.
18	....	....	38	Northerly to northeast	Clear to snow.
19	29	....	37	Northeast	Cloudy; cleared off at night.
20	28	....	36½	Gentle, northerly	Clear.
21	35	....	37	.....do	Do.
22	36	....	37½	.....do	Do.
23	40	....	37	Northeast to heavy north	
24	34	....	37	Strong, northerly	Clear.
25	34	....	37	Light, southerly	Do.
26	38	....	37½	.....do	Do.
27	40	....	38	Light, southwest	Do.
28	42	....	38	Light, southeast	Cloudy.
29	46	....	38	Easterly air; no wind	Do.
30	47	....	38	Southeast	Rain all day.
May 1	46	....	38½	No wind	Clear, a. m.; thunder shower, p. m.
2	41	....	38½	Northerly	Clear.
3	....	....	39		

TABLE VI.—*Observations on temperature and weather, &c.*—Concluded.

Date.	Temperature.			Wind.	Other phenomena.
	Air.	Water at new hatching-house.	Water at old hatching-house.		
	7 a. m.	7 a. m.			
1879.					
May 4	.....	.....	39	.....	
5	.....	.....	39½	.....	
6	.....	.....	39½	.....	
7	44	.....	39½	.....	
8	.....	.....	39	.....	
9	.....	.....	39	.....	
10	.....	.....	38½	.....	
11	.....	.....	39½	.....	
12	.....	.....	39½	.....	
13	.....	.....	39½	.....	
14	.....	.....	40	.....	
15	.....	.....	40	.....	
16	.....	.....	40	.....	
17	.....	.....	40	.....	
18	.....	.....	40	.....	
19	.....	.....	41	.....	
20	.....	.....	41½	.....	

TABLE VII.—*General summary of observations on temperatures at Grand Lake Stream, from October, 1878, to May, 1879, inclusive.*

Date.	Air.								Water of stream.								Water at old hatching-house.						Water at new hatching-house.					
	7 a. m.		1 p. m.		Max.		Min.		7 a. m.		1 p. m.		Max.		Min.		7 a. m.		Max.		Min.		7 a. m.		Max.		Min.	
	No. of observations.	Degrees.	No. of observations.	Degrees.	Date.	Degrees.	Date.	Degrees.	No. of observations.	Degrees.	No. of observations.	Degrees.	Date.	Degrees.	Date.	Degrees.	No. of observations.	Degrees.	Date.	Degrees.	Date.	Degrees.	No. of observations.	Degrees.	Date.	Degrees.	Date.	Degrees.
1878.																												
October	31	44.6	31	55.8	2	71	30	22	31	54.7	31	55.9	3	63½	30	46	31	47.7	5	48½	30	46						
November	30	29	30	38.3	27	54	7	14	30	40.2	30	41.1	1	49	19	37	5	46.1	3	46½	9	45½						
December	31	18.2	.....	.....	11	45	21	2	.....	.....	.....	.....	.....	.....	.....	.....	31	41.3	1	44	17	38	31	33.5	3	40	9	31½
1879.																												
January	30	5.5	.....	.....	25	26	21	—20	.....	.....	.....	.....	.....	.....	.....	.....	31	39.7	1	41	15	39	.....	.....	.....	.....	.....	.....
February	27	9.7	.....	.....	12	40	15	— 8	.....	.....	.....	.....	.....	.....	.....	.....	28	38.5	19	39½	12	37	.....	.....	.....	.....	.....	.....
March	29	19.9	.....	.....	30	37	19	— 4	.....	.....	.....	.....	.....	.....	.....	.....	31	38.5	9	39	1	38	.....	.....	.....	.....	.....	.....
April	27	32.1	.....	.....	30	47	4	14	.....	.....	.....	.....	.....	.....	.....	.....	30	37.5	8	38½	1	34	.....	.....	.....	.....	.....	.....
May	3	43.7	.....	.....	1	46	2	41	.....	.....	.....	.....	.....	.....	.....	.....	20	39.5	20	41½	1	38½	.....	.....	.....	.....	.....	.....