XXIV.—REPORT ON THE PROPAGATION OF SCHOODIC SALMON IN 1881-'82.

By CHARLES G. ATKINS.

1.—PREPARATIONS.

Hatchery No. 3 was the principal scene of activity during August, September, and October, 1881. The location of this hatchery is an exceedingly favorable one, and it is a matter of regret that the facilities existing at this spot were not discovered at the initiation of the establishment. The ground was, in its original condition, heavily strewn with bowlders, large and small, and beneath them were interstices through which the water of the spring stole away in such a manner as to give the impression that the supply was not only small but inconstant. It was only after the tangled maze of shrubs was torn away and part of the surface earth removed that the permanent character of the spring could be observed. Meanwhile three other sites had been occupied, and the main part of the work of developing the spawn and hatching the reserve had been for years carried on at great disadvantage with an inadequate supply of water (spring water at that), no facilities for aeration, and a liability to occasional flooding by rains. I make no doubt that all the serious losses which during the early years occasionally befell the stocks of eggs in development and transportation might have been avoided had we then possessed the facilities of hatchery No. 3. Among the minor disadvantages which we might have escaped may be mentioned the labor and risk of carrying the eggs by hand from the fishing grounds over half a mile of rough road, often by night; the difficulty of guarding well the property so far out of sight and hearing; and the many weary days spent by Mr. Munson in the transfer of the young fish from the house to the stream in the month of June, amid tormenting clouds of mosquitoes and black flies. The new hatchery is at the head of a small cove that indents the west shore of Grand Lake within a few rods of its outlet, and not over 20 feet from the water's edge when the lake is full, as is always the case in June. The fish cans are taken in a boat, and easily rowed to the place of liberation, with great economy of time and effort. The fishing and spawning ground is not over 300 feet distant and almost in sight. Within stone's-throw, an excellent site for the superintendent's house has been secured, and will be occupied another season, so that the premises

will always be under surveillance. The surface of the ground presents a steep incline, of which advantage has been taken to arrange the floors of the hatchery in a descending series, with a total difference in elevation of about 11 feet. The water is introduced upon the highest of the six floors devoted to the development of the embryos, with ample room for aeration and reaeration at each plunge. The latter circumstance atones for the small minimum volume (9 gallons per minute was the lowest observed this season), and in part for the fact that it is wholly spring water. The volume is least from August to early March, after which the spring rains and the melting of the snows produce so great an augmentation that there is a great surplus during all the season of hatching the reserved spawn and growing the alevins. The minimum volume can be augmented by the introduction of water from other, not very distant, springs.

This house was founded in haste, in December, 1880, and was at first only 30 feet long and 20 wide, but this season we have added wings that increase the floor area to about 1,500 square feet. The floors have all been cemented, and the foundation walls, of massive masonry carried up to a height of from 1 to 8 feet above the ground. Cement pipes were laid to introduce the water from the principal spring, and an aqueduct, partly of bored logs and partly of assorted gravel, brings in the water from another spring 600 feet distant. This will henceforth be the headquarters of the establishment. Here the eggs will be packed for shipment, and the reserve hatched. Here will be the storerooms and workshops.

The fixtures for the development of the eggs are similar to those in use at the other houses and also at the Penobscot establishment. Plain wooden troughs are furnished with movable frames in which the egg-trays are arranged in tiers ten deep, with provision for change of water by a horizontal current. A single new feature has been introduced in the method of aeration. Two troughs are placed side by side and the water allowed to pour from one to the other nearly the whole length, exposing a very broad and thin current to the action of the air, and increasing the opportunity of aeration probably twenty-fold over that afforded by a connecting open spout 6 inches wide. In a rough way it may be estimated that by the repeated use of this arrangement in the new house a gallon of water there is fully equal in efficiency to five gallons in hatchery No. 1.

No change has been made in the location of the fishing ground or the fixtures and appliances pertaining to the work of spawning, except trifling alterations in the form and proportions of the inclosures.

2.—Fishing and spawning.

The spring fishing of 1881 was much better than usual, both as regards the numbers and size of the fish taken. Through the summer there was more rain than usual, and in August and September the lake and

the stream were higher than any year since 1875. A sudden rise of water, owing to copious rains in August, 1880, had been followed by an abundance of fish in the stream early in September. The high water of 1881 did not have the same effect on the fish, scarcely any salmon entering the stream till after the middle of September. The inference naturally suggested is that the condition of the stream favorable to a late summer or early fall run of salmon is not so much a high stage of water as a sudden rise; but the phenomena observed are hardly sufficient for confident generalization. Moreover, during ten days in August the gates at the dam were closed for certain repairs on a dam at Calais, and meanwhile the flow of water was confined to that entering the canal. From August 3 to September 10 there was a fall of 5½ inches, and from September 10 to October 29 a further fall of 15½ inches; November 5, a rise of 2 inches, owing to rains on the two preceding days; and after that date there was neither rise nor fall until December.

The usual nets were placed across the stream and canal about the middle of September, but no preparations for the capture of the salmon were made until October 29, when it was observed that the most forward of them had begun to form their ridds above our nets. On the night of October 31 the capture of fish began. The manipulation was delayed until November 8, when some hundreds of salmon had been collected, and a part of them exhibited great uneasiness, a few actually beginning to spawn in the inclosures. The work proceeded as usual until November 19, when all the salmon taken had been deprived of their spawn, and the almost entire cessation of the catch told that the season was at a close.

An accident during the work of spawning confused the different lots of fish so that the number taken from day to day cannot be stated with the usual accuracy, but the tally-book shows exactly the number of females that were manipulated, and enables me to make an estimate of the total number of males, which, I am very confident, is within 15 of the true number. According to these estimates there were taken 652 female salmon, 370 males, and one of unknown sex—total, 1,023. There were 621 females that yielded spawn, and the eggs obtained from them are estimated at 947,000, being an average of 1,525 eggs from each female.

3.—SHIPMENT OF SPAWN.

The development of the eggs intended for earliest shipment was carried on in hatchery No. 3, the remainder being kept in the colder water of No. 2. It is from the latter that the reserve is always selected, since the retardation of their development will bring them out in the spring much nearer the natural date than if developed in the warmer water.

The shipment of eggs began January 12 and closed March 1. The losses up to the time of the division of the eggs, when they were either shipped or set aside for the reserve, aggregated 87,091, of which 62,159 are known to have been unimpregnated eggs. From this we may fix

the proportion impregnated at 92.9 per cent. Total losses before division $9\frac{2}{10}$ per cent,—about the ordinary rate.

The eggs were shipped in the customary method—packed in wet moss, inclosed in dry moss—and sent down to Princeton, 12 miles distant, in the afternoon; thence by stage 28½ miles to Forest Station, the next forenoon; this part of the journey occupying about 5½ hours, during which the cases of eggs were exposed, with little or no protection, to the wintry blasts.

Excellent success attended the transportation, with a single exception. A case containing 32,000 eggs, addressed to Mr. Brackett, at Winchester, Mass., packed in an experimental manner, which proved to be less efficient than our ordinary mode, was partly frozen on the way, and 8,000 eggs lost. The temperature of the air at the time this package started on its 28½-mile ride in the open air was 20 degrees below zero. In 22 other packages (including all save three, which were not reported on), the entire number of dead eggs on unpacking was reported at 1,806, being three-tenths of one per cent., or three in one thousand.

An attempt was made to economize in bulk, and thereby in freight charges, by the use of asbestos felt in place of moss, but it was found that bulk for bulk it was in no wise superior, while at the same time it was far heavier and more costly. The experiments tried in this connection gave results indicating that, considering only the question of bulk, the best material to save from freezing was wet moss; but if the weight and consequent freight charges be taken into account then the best material is dry moss, which is exceedingly light and as efficient as an equal thickness of asbestos felt or building-paper.

The division of the spawn available for shipment, pro rata with the contributions made by the several parties, was as follows:

United States received	311,750
Maine received	64,500
Massachusetts received	107,500
Connecticut received	107,500
New Hampshire received	53,750

The distribution of the share of the United States will be seen in detail by referring to the subjoined schedule of shipments of eggs.

The hatching of spawn retained (215,000) was accomplished with the insignificant loss of 212 eggs, and of the young fish but 1,691 died; 213,097 young fish were planted in Grand Lake, scattered along shore as usual.

The hatching of the transported eggs and the planting of the young fish were in most instances accomplished with less than the usual mortality. A schedule is subjoined showing the details of the planting.

4.—Extracts from diary.

Grand Lake Stream, *August* 3, 1881.—The season has been very rainy here. The lake stands at 3 feet 11 inches on our gauge. The

water still covers our spawning-house floor, and in hatchery No. 2 it is still several inches above the tops of the troughs. Five gates are open and a great volume passing off, yet Munson thinks the water has been rising lately. The total volume of water now flowing in hatchery No. 1 is 28.6 gallons per minute. In hatchery No. 3 [only one aqueduct was then in operation] the volume is 9.6 gallons per minute. Temperatures of water observed to-day: At hatchery No. 1, 46½° F.; at hatchery No. 3, 53½° F. [the water here is open to sun outside the building]; at Grand Lake, at surface, near dam, 72½° F.

Munson says that the fish hatched out this year were by far the best he ever hatched, stronger and more active. All visitors admired them. None of the fry were planted this year below the dam. They were scattered along the shores of the lake as far as Munson's Island. A number, estimated to have been about 2,000, were taken in a can with six or eight gallons of water, and in turning them out a canful would stretch along several rods of shore.

Both Forbes and Munson testify to the abundance of the young of Schoodic salmon below the dam this year. They often followed and seized the hook intended for large fish. The fishing at the regular season (May and June) this year was excellent. Munson says they took very fine fish and a good many of them, and the fishermen were well satisfied.

September 10, 1881.—Arrived from Bucksport on 9th via Big Lake. The lakes are high, but I hardly think Grand Lake is any higher than in 1875, when, I remember, we used to run canoes down through the sluice-gate of the dam without touching. It stands now on our gauge at 3 feet 5½ inches, with a very light northerly wind. This, it appears, is 5½ inches lower than on August 3. It is now 1 inch below our spawning-house floor. It is 1 foot 7¼ inches higher than November 7, 1880. For about ten days in August the gates were all closed on account of the bursting of the Union dam in Calais. The rest of the time there have been five gates open. The water is believed to be now falling rapidly. In Big Lake the water is very high, there being but two gates open at Princeton.

None of our nets have been put into the water yet, it appearing to Mr. Munson to be unnecessary, because the fish have not come until within a few days. None were caught until Mr. Ferguson's arrival, on the 9th, when he took one. Crossing the bridge on the 9th I saw five of the salmon under the bark-mill. Mr. Ferguson also took two to-day, one just below the dam and one at Big Falls. I have seen several leap above the dam.

October 6.—Third visit to Grand Lake Stream. The nets to intercept the fish in their descent have been in place since the middle of September. Work on the extension and the foundation of hatchery No. 3 is going rapidly forward.

October 26.—Arrived from Bucksport about 11 a. m. The addition to

hatchery No. 3 is nearly finished; cement floors all hard. The stream house (hatchery No. 2) has been put in order for eggs.

October 29.—We put in some of the pound nets to-day. Fish are beginning to spawn above our nets.

October 31.—To-day we put in the second pound, and are now prepared to capture fish.

November 1.—A good many fish ran into pound 2, and were driven through into the large pound. Munson estimates them at 175 at 9 p. m.—say 30 more in the morning. About 40 fish driven in this evening. Very few salmon have got past our nets into either canal or stream.

November 2.—A pretty good run of fish this morning. Munson found in the pound what he called a female sea salmon of 12 pounds weight (afterwards found to be 36 inches long, and probably heavier than this estimate). At 10 a. m. I saw a male sea salmon also within our inclosures.

November 5.—There were good runs of fish on nights of November 2 and 3. Last night about 15 salmon came in before 9 o'clock, and during the remainder of the night a very large school. Yesterday and the day before were rainy, and it cleared at 7 last evening.

November 7.—A good run of fish every night; last two nights less than a hundred each, we judge.

November 8.—To-day we begin the taking of spawn. All the fish captured prior to this date are gathered in a single large inclosure. From this stock we to-day manipulated 591 Schoodic salmon, 210 being males, 192 unripe females, 166 ripe females, and 13 spent females. The predominance of females at so early a date indicates that the majority of the salmon we shall catch have already entered our inclosures. It is usual to take a larger number of males until the season is well advanced, the later catches being mostly of females. The large number of unripe females taken indicates that the delay in beginning manipulation was judicious. Thirty of the females spawned (= 18 per cent) yielded some defective eggs, commonly but very few each. This includes only such eggs as bore some visual sign of imperfection. In most cases they were chalky-white in color; in some there were only small white spots. In others there was the color and transparency of good eggs, but the yelks were collapsed and rolled together. This phenomenon has always been present with the Schoodic salmon, but no exact record made of the matter before. Besides the Schoodic salmon we handled to-day 2 sea salmon and 11 small togue (*Salmo* (*Cristivomer*) *namaycush*). The sea salmon were 1 female 36 inches long, gravid, and 1 male 31½ inches long. The togue ranged in length from 17 to 21 inches, being, apparently, all spent fish. The eggs taken to-day (235,000) are placed in hatchery No. 1.

November 11.—Spawning proceeds daily. There are more togue than usual, among the salmon; 22 of them were found to-day, all small. One salmon found to-day whose sex could not be distinguished. It measured 16 inches in length.

November 13.—First snow of the season last night—a mere trace. The temperature of the lake has fallen since November 4 from 49 to 41. Spawning still continues. No large runs of salmon; on night of 11th and 12th only 25 in all. Yesterday we began to put eggs into the stream house, hatchery No. 2.

November 14.—Two nights have brought in but 50 salmon. It appears that the season is drawing to a close.

November 19.—The last day of spawning. We had but 27 gravid females on hand this morning. Twenty of them yielded spawn, and they, with the 7 remaining unripe, were placed in the final inclosure, whence they are to be taken up the lake and liberated. The work of transportation begins to-day.

November 21.—The transportation of fish concluded to-day, and part of the inclosures taken from the water. The main nets are left in place for some days, to prevent the fish that have been turned loose descending the canal and stream, which many of them (perhaps 20 per cent.) attempt to do immediately after they are set free, notwithstanding they are freed one or two miles up the lake. Two inches of snow on the night of 19th. All the eggs deposited in hatchery No. 1 are transferred to No. 3, the latter, with No. 2, having ample accommodations for them.

November 22.—Returned to Bucksport, leaving everything in charge of Mr. Munson.

January 11, 1882.—Arrived from Bucksport at 8.20 p. m.

January 12.—To-day I find at hatchery No. 3 that the west aqueduct is delivering 20 gallons of water per minute, and the south aqueduct 10 gallons. Munson says the volume has been about the same all the winter, except immediately after heavy rains, when it was greater. We have now 485,000 eggs in the new hatchery, and 200,000 additional will be immediately brought up from the river house to hasten their development, so that they may be ready for shipment before March. Munson thinks the rate of impregnation is better than usual this year. We took a tray of lot 1 (earliest eggs), picked out 110 contiguous eggs, and found only 5 of them unimpregnated.

January 13.—Transferred 200,000 eggs from No. 2 to No. 3. These have been in very cold water, averaging a little less than 34° since they were put in the troughs in November, and their eyes are not yet formed.

January 17.—This p. m. Munson picked the unfertilized from six stacks of eggs (120,000 nearly) in two hours forty-seven minutes. He took out 6,700 white eggs, being at the rate of 40⅛ eggs per minute, no allowance being made for moving stacks back and forth, shifting trays, &c. Such speedy work can only be accomplished by a practiced hand. The unfertilized have been induced to turn white by previous agitation. To attempt to remove them while retaining their natural color would be tedious and uncertain.

January 18.—To-day we began shipment of spawn, sending 60,000 to E. A. Brackett, Winchester, Mass., and 50,000 to H. J. Fenton, Windsor,

Conn. The outer packing of both cases was dry moss. While packing I observed that not all of the unimpregnated eggs had been removed, and there were some impregnated that were not healthy, small embryos and irregular development. I saw three or four bursted eggs. Now I cannot think that these defects are owing to any fault in our management. The inside moss in part of our boxes was rather drier than ordinary, and I think that all or most of these went to Fenton. (Both packages arrived at their destinations in good order. Mr. Brackett reported condition "excellent." Mr. Fenton said, "good, except some indented." Dead on unpacking in latter lot, 47; subsequent losses, light.)

January 23.—Shipped another lot of eggs (32,000) to Mr. Brackett. I had a case made on purpose for it, intending to have a space of 2 inches all around for outside packing, but by mistake it was made so shoal as to leave but 1¼ inch above and below. I lined it with two thicknesses of asbestos roofing felt on all sides and packed the remaining space with the ordinary dry moss. The case is of half inch pine. The felt used was about 3½ pounds. (Without laps there would have been needed only 2½ pounds.) It costs in Boston 20 cents per pound—here, about 22 cents. It weighs about 1 pound per square yard, and its cost can be put at 2½ cents per square foot. The package weighed, in detail, as follows:

	Lbs.	Oz.	Lbs.	Oz.
3 boxes eggs packed in wet moss	40	9		
Cover, side cleats, and nails	1	7		
Total of inner package			42	0
Moss	6	9		
Asbestos felt	3	8		
Case	20	4		
Total of envelope			30	5
Total of entire package			72	5

A package with a protecting envelope of dry moss one inch thicker than the above on all sides would weigh about 3 pounds 14 ounces more. Supposing the two modes equally efficient in protecting against cold, we save near 4 pounds weight, and corresponding amount on freight by an outlay of 77 cents for asbestos and the trouble of lining the cases with it. I believe this will hardly pay. [Subsequent experiments showed that not even the above economy of space would be effected by the use of asbestos felt, its resistance to the escape of heat being not much, if any, greater than that of an equal thickness of moss alone.] Temperature of air at 7 a. m., 0° F. It has been below zero on six mornings this month previous to this date, and once in December.

January 25.—Cold weather has shrunk the volume of water at the hatchery from 30 to 20 gallons within two weeks.

January 27.—This morning we had a smart rain for several hours; yesterday a thaw. No material change in the volume of water in the hatching-house. Grand Lake is rising; the water is just beginning to flow on our spawning-house floor.

January 28.—Mr. Brackett writes that the case of eggs sent him on 23d arrived at Winchester, Mass., on evening of 25th, and on unpacking next morning were found to be "frozen through and through, with the possible exception of a small space in the center." [But this proved to be an exaggerated statement, the actual loss being 8,000 eggs out of 32,000.] These eggs went down to Princeton on stage on 23d. Next morning, with the temperature of the air at 20° F. below zero, and a high wind, they went to Forest on the stage, a drive of five and one-half hours, thence to Boston by rail in a car warmed by a stove. Doubtless the freezing was accomplished before the package reached the railroad. This was the first instance of the kind that has occurred since this establishment was organized. Probably the protecting power of asbestos felt is less than I supposed.

February 2, 1882.—*Experiment with packing materials.*—Last night I took a box made out of an old packing-tray, 12 inches long, 9 wide, and 3¼ deep; ends one-half inch thick; top and bottom about one-fourth of an inch; all pine, joints open, construction loose. On the bottom I put 4 thicknesses of asbestos felt, then a board one-fourth of an inch thick; then I filled it with wet moss, just such as we use in packing eggs, and pressed it in hard with my hands; then put on another quarter-inch board, and finally the cover. This was put together in our shop, temperature 50° or 60° F. The moss was from the moss storeroom, the temperature of which is from 35° to 40° F. About 9 p. m. this box was put out of doors on our shop platform, stood on end, and there allowed to remain till 7 a. m. I then took it in and opened it. The out-door temperature at 6 p. m. was +8° F; at 7 a. m. it was +18° F. On opening the box I found the moss frozen nine thirty-seconds of an inch on the bottom (the felted side). On the top (the board side) twelve thirty-seconds of an inch, on the side without either board or felt, three-fourths of an inch. Reckoning from the inside of the cover, the penetration of the frost was, through felt and board and moss, about twenty-five thirty-seconds of an inch; through board and moss, twenty thirty-seconds of an inch; through moss alone, on narrow side, twenty-four thirty-seconds of an inch; in the latter case had the side been broader I think the frost would not have penetrated so far.

[Other experiments with packing materials were tried February 4, and the results may be stated with tolerable accuracy, thus: Asbestos felt and common building paper vary very little in conducting power, frost penetrating through five-eighths of an inch of either material, and further into wet moss, .25 to .35 inch in case of the asbestos envelope,

and .31 to .37 inch in case of the paper envelope. Dry moss is about the same as asbestos and paper, the frost penetrating through the asbestos 1.60 inch, and through dry moss, under the same circumstances, 1.62 inch. Through wet moss the frost penetrated only from .7 to .9 inch under same circumstances, showing that the latter material is more effective, bulk for bulk, than either dry moss, dry paper, or dry asbestos felt. This agrees with the results of other experiments I have tried with wet moss, yet I think the weight of the latter will forbid its employment in ordinary cases. The paper and asbestos are excluded by their cost and also by their weight. The relative weights of the several substances are about as follows: Asbestos felt, 82; paper, 50; wet moss, 20; dry moss, 3. The comparative weights of the asbestos and paper are given exactly. Those of wet and dry moss are correct relatively to each other, but possibly a little too low relatively to the other substances. But evidently none of the other substances can rival dry moss for our purpose, when efficiency and economy are both considered.]

February 13.—The shipment of eggs, suspended since January 24, is resumed to-day.

February 22.—As in former years we measure our eggs for shipment in old corn cans, each one holding about 2,500. On 13th instant Mr. Munson found that, filled as usual, a measure counted out 2, 720 eggs; twice since then he has counted a measure full and found in one case 2,710, and in another 2,725. The record of shipments before 13th is corrected accordingly, and since that date the measures have been filled not quite so full, with intention to have 2,500 in each as near as possible.

February 23.—To-day I examined the most forward eggs in the river house (No. 2): The eyes have not yet begun to color. To try their hardiness for packing, I took a tray of them and rapped it smartly six or eight times on the table, making the eggs rebound into the air.

February 25.—There were picked from the above tray 94 white eggs and all were unimpregnated. So I should dare to pack these eggs now.

March 1.—Shipment of eggs concluded to-day; 645,000 have been sent away, and 215,000 remain to be hatched and planted in Grand Lake.

March 3.—I return to Bucksport, leaving Mr. Munson in charge.

5.—NOTES FROM MR. MUNSON'S RECORD BOOK.

February 28.—The earliest eggs received from the Penobscot station commence to hatch to-day. [Two hundred and sixty-seven thousand eggs of Penobscot salmon were hatched here at the charge of Mr. Frank Todd, of Milltown, N. B., the same being furnished free by the State of Maine, to be planted in the Saint Croix, the boundary river between Maine and New Brunswick. For the hatching and expenses Mr. Todd paid the establishment $91.26. The eggs were received in three lots, January 30, February 12, and March 11.—C. G. A.]

March 14.—First lot of Schoodic eggs begin to hatch [taken Nov. 8th, and kept meanwhile in hatcheries Nos. 1 and 3, water ranging from 48° to 34½° F. and averaging 39°.1 F. The time occupied has been 126 days to the commencement of hatching.]

March 16.—Lot 1 all hatched.

March 21.—Lot 4 [taken November 11] begins to hatch.

March 23.—Lot 4 all hatched.

March 25.—Moved all eggs from hatchery No. 2 to No. 3.

March 28.—Penobscot eggs received February 12, begin to hatch.

March 30.—Gates all shut down.

March 31.—Penobscot eggs received February 12, all hatched.

April 18.—Penobscot eggs received March 11, begin to hatch.

April 21.—Same all hatched.

May 7.—Lot 6 of Schoodic eggs begin to hatch. [These were taken November 14, and have been since then until March 25 in the cold water of the stream, averaging 34° F., and from that date to the present in spring and snow water averaging 37° F. The general average of temperature has been 34.7° F., and the total time to the commencement of hatching has been 174 days. One more day, 175 days from the beginning, will be the average time of the hatching of this lot of eggs.]

To-day, May 7. The ice broke up in Big Lake.

May 9.—Eggs taken November 14 are all hatched.

May 10.—Ice broke up in Grand Lake.

May 11.—Lot 7, Schoodic eggs, begin to hatch [taken November 16].

May 14.—Lot 7 all hatched. Lot 8 [taken November 18], begins to hatch.

May 15.—Lot 8 all out; lot 9 [taken November 19] begins to hatch.

May 17.—Lots 9 and 10 all hatched. These are the last eggs.

May 22.—Lots 1 and 4 turned out. Also the earliest of the Penobscot fry.

May 26.—Second lot of Penobscot fish turned out.

May. 30.—The last of the Penobscot fish turned out. [In number, 266,240; there having been a loss of 760.]

June 15.—Three men took 84 Schoodic salmon with fly to-day: wind southwest, strong.

June 26.—The last Schoodic salmon turned out.

June 28.—Closed up.

TABLE I.—*Spawning operations at Grand Lake Stream, Maine, November,* 1881.

Date.	Fish at first handling.*							Females spawned.			Eggs taken.	
	Total.	Males.	Females.				Sex unknown.	First time.	Second time.	Females yielding defective eggs.†	Weight.	Number.‡
			Unripe.	Ripe.	Spent.	Total.						
1881.											*Lbs.* *oz.*	
Nov. 8	609	238	192	166	13	371	.....	166	.....	30	86 15	235,000
9	94	44	21	29	.....	50	.....	29	.....	3	12 11	40,000
10	123	48	28	46	1	75	.....	61	.....	(†)	37 4	110,000
11	109	32	36	40	.....	76	1	51	254	9	47 2	180,000
12	33	12	6	15	.....	21	.....	101	49	10	44 12	116,000
14	50	17	16	15	2	33	.....	105	101	10	59 8	150,000
16	18	2	10	5	1	16	.....	52	105	16	37 13	90,000
18	15	5	2	6	2	10	.....	36	45	11	19 12	47,000
19	.....	.....	.....	.....	.....	.....	.....	20	37	6	11 9	29,000
	1,051	398	311	322	19	652	1	621	001	95	357 6	947,000

*In these columns each fish is recorded when it first comes to hand, and the footings show the total catch.

†In most cases the defective eggs were few in number, sometimes but 1, 2, or 3. Doubtless there were some with defective eggs that the workmen neglected to report, and probably the blank on the 10th is in consequence of some such omission.

‡These figures are obtained by adding the number rejected at the daily pickings to the number measured out at the time of dividing the eggs in winter.

TABLE II.—*Transfer of Schoodic salmon eggs from Grand Lake Stream, Maine, in 1882.*

Date.	Consignee.	Address.	Final destination.	No. of cases.	Weight.	Number of eggs.			Miles transported.	Hours en route.	Condition on unpacking.	Dead on unpacking.
						Belonging to States.	Belonging to United States.	Total.				
1882.					*Pounds.*							
Jan. 18	E. A. Brackett	Winchester, Mass.	Winchester, Mass.	1	(†) 150	65,000	.....	.....	389	70	Excellent	*350
18	H. J. Fenton	Windsor, Conn	Poquonock, Conn.	1	(†) 150	53,750	250	54,000	502	73	Good, except some indented.	47
23	E. A. Brackett	Winchester, Mass.	Winchester, Mass.	1	72	32,000	.....	32,000	389	70	Partly frozen	8,000
24	A. H. Powers	Plymouth, N. H.	Plymouth, N. H.	1	120	54,000	.....	54,000	508	70	Good	73
24	H. J. Fenton	Windsor, Conn	Poquonock, Conn.	1	93	43,000	.....	43,000	502	73	Good	11
Feb. 13	Mrs. J. H. Slack	Bloomsbury, N. J.	Bloomsbury, N. J.	1	75	.....	22,000	22,000	683	104	"Good, but much indented; a few hatched, and some bursting sack."	106
13	Seth Green	Mumford, N. Y.	Mumford, N. Y.	1	45	.....	11,000	11,000	840	102	"Splendid"	23
13	T. B. Ferguson	Baltimore, Md	Baltimore, Md	1	50	.....	11,000	11,000	805	120	"Good, but too far advanced."	25
13	Seth Weeks	Corry, Pa	Corry, Pa	1	48	.....	11,000	11,000	972	122	"Good"	85
14	J. M. Haven	Rutland, Vt	Rutland, Vt	1	45	.....	10,000	10,000	525	64	"Good"	3
14	E. G. Blackford	New York	Roslyn, N. Y.	1	45	.....	10,000	10,000	640	.....	Good	.....
14	C. H. Brownell	Saint Joseph, Mo.	Saint Joseph, Mo.	1	85	.....	25,000	25,000	1,847	120	"Very superior"	47
15	B. F. Shaw	Anamosa, Iowa	Anamosa, Iowa	1	81	.....	25,000	25,000	1,607	168	"Good"	147
15	M. T. Bailey	Madison, Wis	Madison, Wis	1	84	.....	25,000	25,000	1,536	120	Good	191
16	R. O. Sweeny	Saint Paul, Minn.	Saint Paul, Minn.	1	81	.....	25,000	25,000	1,789	192	"Good"	167
16	J. G. Portman	Paris, Mich	Paris, Mich	1	81	.....	25,000	25,000	1,431	156	"Good"	304
24	F. Mather	Newark, N. J	Germany	1	63	.....	20,000	20,000	3,840	.....	Good	.....
27	E. A. Brackett	Winchester, Mass.	Winchester, Mass.	1	52	10,500	5,000	15,500	389	72	"Excellent"	10
27	H. J. Fenton	Windsor, Conn	Poquonock, Conn.	1	53	10,500	5,000	15,500	502	74	"Good"	11
27	B. B. Redding	San Francisco, Cal.	San Francisco, Cal.	1	51	.....	10,000	10,000	3,818	270	"Good"	100
27	A. H. Powers	Plymouth, N. H.	Plymouth, N. H.	1	30	.....	4,750	4,750	508	72	"A No. 1"	0
27	E. M. Russell	Paris, Tenn	Paris, Tenn	1	99	.....	5,000	5,000	1,660	144	"Excellent"	20
28	F. N. Clark	Northville, Mich.	Northville, Mich.	1	150	.....	56,750	56,750	1,158	98	"Best lot of salmon eggs I ever received."	44
28	O. A. Dennen	Mount Kineo, Me.	Mount Kineo, Me.	1	(†) 80	23,000	.....	23,000	232	100	"Good"	20
Mar. 1	F. C. Hewey	Rangely, Me	Rangely, Me	1	(†) 80	23,000	.....	23,000	300	72	"Very good"	10
1	A. J. Darling	Enfield, Me	Enfield, Me	1	(†) 80	18,500	5,000	23,500	103	50	"Good"	12
			Total	26	1,973	333,250	311,750	645,000				9,806

*Including those that died for several days after unpacking.

TABLE III.—*Planting of Schoodic salmon reared from eggs gathered in 1881.*

State.	Where hatched.	Waters in which the fry were placed.	Tributary to what other water.	Locality of deposit.	Date of transfer.	No. of fish.
					1882.	
California	San Leandro	Prosser Creek	Truckee River	Near Boca, Nevada County	Apr. 7	1,986
		Blue Lakes		Lake County	Apr. 13	2,447
		Lake Honda		San Francisco County	Apr. 7	1,000
Connecticut	Poquonock	Shaker Pond	Connecticut River	Enfield		5,000
		Housatonic River		New Milford		5,000
		Twin Lakes	Housatonic	Salisbury		10,000
		Wanouscoponous Lake	Housatonic River	Lakeville		10,000
		Square Pond	Connecticut River	Ellington		10,000
		do	Willimantic	Stafford		10,000
		Canterbury Pond	Quinnebaug River	Plainfield		10,000
		Bantam Lake	Connecticut River	Moodus		10,000
		Ball's Pond	Housatonic River	New Fairfield		10,000
		Bride Pond		East Lyme		11,449
		Snipsic Lake	Connecticut River	Rockville		10,000
Indiana	Northville, Mich	Lake		Laporte	May 15	1,000
Iowa	Anamosa	Clear Lake	Shell Rock and Cedar River	Clear Lake, Cerro Gordo County		7,500
		Okiboji Lake	Little Sioux River	Spirit Lake, Dickinson County		7,500
Maine	Enfield	Cold Pond	Penobscot River	Enfield		10,000
	Grand Lake Stream	Grand Lake	Schoodic River	Hinkley, Washington County	May 22 to June 26	213,097
	Mount Kineo	Moosehead Lake	Kennebec River	Piscataquis County	June 1	21,000
	Rangely	South Bog Stream	Rangely Lake	Franklin County	June 15	5,000
		Kennebago Stream	Mooselucmaguntic Lake	do	June 15	4,560
		Rangely Stream	do	do	June 15	5,000
		Bemis Stream	do	do	June 15	3,000
		Androscoggin River	Richardson Lake	Oxford County	June 15	5,000
Maryland	Baltimore	Deer Creek	Susquehanna River	Harford County	Apr. 22	9,474
Massachusetts	Winchester			Stockbridge		14,030
				Worcester		14,000
				Falmouth		21,000
				Great Barrington		14,000
				Northampton		14,000
				Wayland		7,000
				Scituate		7,000
				Harvard		11,000
Michigan	Northville	Long Lake		Mecosta County	Apr. 27	6,000
		Higgins' Lake		Roscommon County	Apr. 28	3,000
		Chippewa Lake		Lake County	Apr. 27	6,000
		Goguac Lake		Battle Creek, Calhoun County	May 1	3,000
		Union Lake		Pontiac, Oakland County	May 15	8,000
Minnesota	Saint Paul	White Bear Lake		Ramsey, Washington County	May 16	2,000
		Lake Minnetonka		Hampshire County	May 17	2,000
		Cedar Lake		Rice County	May 18	2,000

Minnesota	Saint Paul	Lakes		Fillmore and Olmstead Counties	May 19	2,000
		Streams		Winona County	June 16	5,000
Missouri	Saint Joseph	Contrary Lake		Buchanan County	Feb. 19	12,500
		Bean Lake		do	Feb. 19	5,000
		Sugar Lake		do	Feb. 19	5,000
New Hampshire	Plymouth	Pleasant Pond		Francestown, Hillsborough County	May 24	4,000
		Three Ponds		Milton, Strafford County	May 27	5,000
		Sunapee Lake		Newbury, Merrimack County	May 27	5,000
		Star Pond		Springfield, Sullivan County	May 27	5,000
		Newfound Lake		Hebron, Grafton County	May 30	12,000
		Long Pond		Hancock, Hillsborough County	May 31	5,000
		Mount William Pond		Weare, Hillsborough County	May 31	2,500
		Squam Lake		Holderness, Grafton County	May 31	12,000
		North Pond		Sandwich, Carroll County	May 31	5,000
New Jersey	Bloomsbury	Greenwood Lake		Cooper	May 1	5,000
		Strubel Lake		Sussex County	May 3	16,274
New York	Roslyn	Waters of South Side Sportsmen's Club				5,350
		Skaneateles Lake		Onondaga County		5,350
	Caledonia	Caledonia Creek		Mumford, Monroe County		(?)10,000
Ohio	Northville, Mich	Waterworks reservoir		Piqua	May 3	6,000
Pennsylvania	Corry	A small lake	Delaware River	Near Hawley and Carbondale		9,133
Tennessee	Paris	Private pond		Paris		8,500
Vermont	Rutland	Shrewsbury Pond		Near Rutland		9,900