

XXXIII.—REPORT OF OPERATIONS AT THE UNITED STATES
SALMON-HATCHING STATION ON THE M'CLOUD RIVER, CAL-
IFORNIA, IN 1878.*

BY LIVINGSTON STONE.

CHARLESTOWN, N. H.,
December 31, 1878.

Prof. SPENCER F. BAIRD,
United States Commissioner:

SIR: I beg leave to report as follows: The winter of 1877-78 was an extremely rainy one, and in this section of California it rained almost incessantly from the 6th of January till the end of February. In consequence of these rains the McCloud River rose to an unprecedented height, and swept down through the cañon which incloses it with terrible volume and velocity. When it was 14 feet 9 inches above the summer level, it was just even with the floor of the fishery mess-house. From that time till the waters began to subside the fishery buildings were in great danger. The excessive rise in the river brought down drift-wood that had been undisturbed for years, and in immense quantities. This drift-wood coming down with great force in the swift current and composed sometimes of the trunks of huge trees, endangered the buildings to a most serious degree. The water was not high enough to carry away the buildings by the mere force of the current, although it was in itself very powerful, but the momentum of the drift-wood was sufficient to carry everything before it.

During all the time of the high water, the men in charge, viz, Myron Green, Patrick Riley, and J. A. Richardson, together with four or five Indians who helped them, worked with great resolution and courage. During the whole of two days and one night they were in the water, sometimes up to their necks, and often in danger of their lives, guiding the drift-wood so that it would pass through the fishery premises with the least danger. They worked so persistently and skillfully that the houses were saved, but everything else was swept away. All the fences, flumes, chicken-coops, door-steps, hatching-troughs, filtering-tanks, everything that was on the ground that would float, were carried off. The whole of the interior of the hatching-house was cleared out and left as clean as the dry bed of a river, which indeed it literally became. The damage done to the fishery was so considerable that I applied to the

* The species referred to in the accompanying report is the Quinnat or California salmon—*Salmo quinnat*.

United States Commissioner of Fish and Fisheries for a sum of money for the purpose of making repairs. This being furnished out of the deficiency appropriation voted by Congress in the spring of 1878 for the propagation of food fishes, I went to the McCloud River in May and immediately entered upon the work of putting the fishery in repair. There was an immense deal of work to be accomplished to set things to rights, and to get the place ready for the season's operations in hatching salmon-eggs. The main things to be done were to place the old buildings as they were before the freshet, to build a new building to serve both for a dwelling-house and a post-office, to replace the fences and flumes, to build the spawning-house and the corrals for the parent salmon, to repair the current wheel and the two flat-boats that it rested on and to put them in place in the river, to build a solid wall of rock from the high land to the river to protect the buildings against the force of the current in future floods, to build the rack, &c., and to reconstruct almost the whole of the interior of the lower part of the hatching-house, every portion of which was swept away so clean that not a single thing was left in it, not even the heavy grindstone. In order to make as rapid progress as possible, I put on a large force of men at once, and began work simultaneously on several of the undertakings just mentioned. The getting out of the timbers for the buildings, for the hatching-house floor, for the fences, and for general purposes, occupied the time of most of the men for two or three weeks. As we have no horses at the fishery, it becomes necessary to cut our timbers somewhere on the river above us. The first year that we settled here we found enough suitable trees close by, but each subsequent year we have had to go higher and higher up the river, till this year we found it necessary to go nearly four miles up to find such timbers as we required. This involved the consumption of a good deal of time, not only in getting the timber but especially in floating it down to the fishery, the river being tortuous in its course and very rapid. It was over a month before all the timbers were delivered at the places where they were wanted, and if it had not been for the very efficient help of the Indians, who seemed as much at home in the water as on the land, we probably should not have succeeded in getting the logs down the river at all. As soon as the timbers were ready, we built the bridge and rack across the river to obstruct the ascent of the salmon.

The demand for California salmon-eggs being now very large, I wished to take ten million eggs or more this season, and was, consequently, anxious to get the rack in as soon as possible. The water was still much higher than usual, and the difficult undertaking of bridging the stream was made still more difficult this year by the high water. By the 10th of July, however, it was accomplished, and the river was closed to the upward migration of the salmon. I was the more willing to close the stream as early as this because vast numbers of full-grown salmon, taking advantage of the high water in the Sacramento River, had escaped the

nets of the Sacramento fishermen and had already fully stocked the upper waters of the McCloud with spawning fish.

The bridge and rack were hardly completed before the salmon in immense quantities made one of those fierce raids on the rack which I have described in previous reports. For two or three hours thousands of them threw themselves against the rack with all their strength in their fierce but useless attempts to effect a breach in the dam. Finally, finding their efforts ineffectual, they desisted and fell back into the deep pools below.

In the mean time, while the dam was being built, work had progressed very satisfactorily in other directions. On the 20th of June, by the aid of a Spanish windlass, we returned the current wheel and boats to the river. By the 10th of July the post-office building was finished, and the fences, flumes, doorsteps, and most of the smaller things that had been injured or destroyed had been repaired or restored. By the 1st of August the west piazza of the large dwelling-house was finished, together with an additional room. All the buildings had been whitewashed or painted. The large corral for confining the spawning fish was put in place at the fishing-ground, the solid water-wall of rock to protect the fishery-buildings against future floods was nearly finished, the first line of troughs in the hatching-house was laid, the current-wheel and flatboats put in complete repair, the packing-boxes were made, and a new fishing-boat had been built.

During the first twenty days of August we gave our attention chiefly to finishing up the hatching-house and hatching apparatus, building the spawning-house at the fishing-ground, making the smaller nets to catch and confine the parent salmon in while taking the eggs, and in general to perfecting every part of the preparations for taking eggs; and I may add here that never since the United States Fish Commission began work on the McCloud River have the appointments of the fishery and all the arrangements for carrying on operations here been so complete and entirely satisfactory. From the bridge and rack, which are the first steps taken towards securing the season's supply of salmon-eggs, to the minutest points connected with the taking and hatching of the eggs, there was hardly a thing left to be wished for, thanks to the liberal allowance made by the United States Fish Commissioner of Fish and Fisheries for the operations of this station.

On the 20th of August we took the first eggs of the season, numbering 30,000, and from that time till the 5th of October, when the last ice-car was loaded with salmon-eggs for their eastern destinations, our time was taken up with spawning the salmon, taking care of the eggs, preparing the moss for packing, and making the crates for shipping the eggs in.

Having now given a general *résumé* of the work which was done at the McCloud Fishery in the season of 1878, I will mention a few incidents which came under my observation, some of which may be worth

recording, and, as they are mostly disconnected, I will take them up in the order in which they occurred.

On the 19th of May, when I arrived at the fishery, the country looked magnificently. All the foliage was fresh and green, owing to the recent heavy rains. Azalias, roses, the beautiful golden poppies of this region, with a thousand other gorgeous California flowers, were in bloom in vast profusion; and so thoroughly saturated with water was the earth, from the excessive rainfall of the winter, that it was long after the usual time when the desiccating influence of the dry season began to show its withering effect upon the vegetation.

On Sunday, May 26, an incident occurred which, though resulting in nothing of importance, seems to illustrate the uncertainty with which life in remote and unsettled regions like this is accompanied. About midnight we were awakened by the dogs barking violently in the direction of the hill behind the house. Upon sending them out to see what was the matter, they went about ten rods to some thick brush, and returned yelping. At the same time we could distinctly hear stones being thrown at them. It was dark. There was only one man in the house besides myself, and we only had one gun between us. With the exception of the hostler at the stage station, a mile distant, there was not a white man within three miles. We were in a country which we knew was often frequented by desperadoes, and where the stage has been robbed six times in a month, and where murders are not of infrequent occurrence. It might be only one or two burglars in the bushes, but how did we know that they were not a gang of cut-throats who were taking advantage of our weakness to overpower us, and secure the money which is supposed to be at a government station like this. It was impossible to help thinking that if that were the case, how easy it would be for a few determined men to set fire to the buildings, and then to pick us off, one by one, as we endeavored to escape. That has been the fate of a great many persons in unsettled portions of California, and why should it not be ours? I follow out this line of thought merely to illustrate the uncertainty which attends this sort of life. In point of fact the only result was that we remained awake the rest of the night, and in the morning we saw where the men, whoever they were, had thrown the rocks at the dogs. That was all.

A very natural sequel to this incident took place just a week later, and also illustrates the uncertainty which I have just mentioned. About nine o'clock one evening we heard a great deal of noise, accompanied with some quarrelling among the Indians about a quarter of a mile below the house. The noise continuing, two of our men started down the road to see what the matter was, and on arriving at the fishery stable found one or two men engaged in robbing a teamster who was stopping there over night. One or two shots were fired by our party, but the robbers escaped. We found, however, that the rascals had not only robbed the teamster of his money, but had taken from his wagon twenty

demijohns of whisky, which they had distributed indiscriminately among the Indians. The result was such as no one can realize who has not been in an Indian country. The Indians were all more or less intoxicated, were very noisy and quarrelsome, and were inciting each other to make a descent on the fishery, and, as they expressed it, "to sweep it clean with the ground." Our men, in the highest degree indignant at this outrageous villany of the robbers, armed themselves for the occasion and determined to give chase to them that very night. They found them about daylight at an Indian lodge, and placing the muzzles of their revolvers close to the robbers' heads, they captured them without resistance. One is now in the State's prison, the evidence against him being conclusive. The other was discharged for want of sufficient proof of his guilt. This furnishes another instance of our insecurity. It is true it resulted in nothing, but had the Indians been sufficiently intoxicated or sufficiently bold to make an attack on the fishery that night, they could have carried everything before them.

On the 21st of June a post-office was established at the fishery, which I named Baird, after Professor Baird, United States Commissioner of Fish and Fisheries.

During the first week in July an Indian named Chicken Charlie called on me and said his father was going to die soon, and he wanted a coffin made. We made the coffin, and after a while, when they supposed the Indian was dead, they put him in the coffin and proceeded to bury him; but before they had finished burying him he came to life again, and they took him out and waited a while longer. The next time he really died, and the following day he was buried over again.

As soon as the dam was completed across the river, the salmon showed signs of being very thick in the river below. On the 11th of July we made a haul with the seine, which confirmed our impressions of the abundance of the salmon, the number taken at this haul being nearly a thousand. About this time the Indians employed at the fishery did some very fine work under water in repairing the rack. We discovered one day that the salmon, by their violent and repeated attacks on the dam, had at last forced a passage-way underneath the rack and were escaping. I immediately put three Indians on the break to repair it. The water was very cold and very swift, and it would have been extremely difficult for white men, unless experienced divers, to do the work; but the Indians, diving down to the bottom of the river and bracing their feet against the dam to resist the force of the current, worked with great skill and perfect self-possession, although remaining sometimes a very unpleasantly long time under water. I will add here that the assistance of the Indians during the work which we have to do in the water is perfectly invaluable. I do not know how we should get along without them, particularly as the snow-water of the McCloud is so cold that white men cannot stay in it any great length of time. The Indians will remain in it till they get so cold that they build

a fire when they come out of the water to warm themselves by, as I have often seen them, when the surrounding air is already at 130° Fahrenheit from the natural heat of the sun.

Salmon-jumping.—Soon after the salmon were shut off from ascending the river, I frequently took a boat and went out into the river* below the dam to watch the salmon jumping. On the 21st of July I counted 75 a minute (4,500 an hour) jumping in a space perhaps a hundred yards long by thirty yards wide. On the 28th of July I counted 100 a minute (6,000 an hour). On the 31st of July I counted 145 a minute (8,700 an hour). This is the largest number of salmon that I have ever seen jumping in the McCloud River in a minute.

Heat of the sun.—For some unknown reason there are usually one or two days, but no more, during the summer when it is exceptionally hot in the sun. In 1875 this peculiar day came on the 22d of July, when the temperature was 153° in the sun. This year it came on the 26th of July. The thermometer on that day in the sun at 4 o'clock p. m. rose to 149°.

The eclipse of the sun.—On the 29th of July an eclipse of the sun took place. I had told the Indians two months before that it was going to happen, and from that time till the day of the eclipse they came to me every little while to inquire how many days before the “grizzly bear would eat the sun,” that being their explanation of the darkening of the sun at an eclipse. When the day arrived, twenty or thirty of them came to the fishery and looked at the sun with the greatest interest through pieces of smoked glass which we prepared for them, and which enabled them to watch the progress of the eclipse much better than they could do in their own way, which is by observing the reflection of the sun in the water. It is a great mystery to them how the white man is able to predict so long beforehand the coming of the “grizzly bear that eats the sun.”

On the 25th of March, 1876, an eclipse of the sun occurred, and, at the height of the obscuration, an otter came out of the water in front of the house, looked around, and disappeared. The Indians remembered it, and kept on the watch for the otter during the eclipse this year (1878). No otter came; but it was a singular fact that the next day an otter—the only one we saw during the season—swam down past the house and back again, and disappeared. I think that the Indians who saw these otters will always think that an otter, as well as a grizzly bear, is required to accomplish an eclipse of the sun.

The Indian scare.—On the 21st of July an Indian messenger came in great haste from Copper City, on Pitt River, about eight miles from the fishery, with a letter from the superintendent of the silver mines there, stating that alarming rumors had reached that place about large numbers of northern Indians having been seen on the McCloud, and that the people there had heard that the Indians were meditating an attack on their settlement; and asking if we knew anything about it. About the

same time we read in the papers that the Pit River Indians had been making hostile demonstrations on their river. Our McCloud River Indians, who by this time had heard of the alarm at Copper City, were very much excited. We wrote back to the superintendent that we thought there was nothing in it, and that there was no danger. The next morning, however, an Indian squaw told us that the Yreka and Upper Sacramento Indians were coming down to the McCloud to kill the McCloud Indians and what white men there were on the river, meaning ourselves at the fishery. We heard farther that Outlaw Dick, who murdered George Crooks here in 1873, and Captain Alexander, an Indian of very warlike disposition, had urged the northern Indians at a recent council to make a descent upon the McCloud and "clean out," as they expressed it, all the white men and McCloud Indians on the river. To add to the excitement, a Piute chief had visited our Indians the past week to stir them up to make war on the whites.

Three days after, a McCloud Indian came down in hot haste from Alexander's camp and told our Indians that Alexander had gone north to "call" his Indians, and that they would be down next month to make war on the McClouds. Some of our Indians were very much alarmed, and for several days a good deal dejected over this news, and they told us stories of ancient fights that they had had with the northern Indians, and how the Modocs and Yreka Indians had made war on them and burned their children and carried off their squaws. All this occurred just at the time when the San Francisco papers were full of the murders and depredations of the Oregon Indians, and we began to think that there might be something serious in the excitement in our neighborhood. At all events, as we had only one rifle at the fishery I thought it prudent to be at least better armed, and accordingly telegraphed for arms and ammunition. The excitement, however, gradually died away. The Piute chief returned to his own tribe; the Oregon Indians began to surrender and come in to deliver themselves up to the soldiers; the McCloud Indians recovered from their alarm, and about three weeks after the first excitement they informed me that Captain Alexander and his Indians had changed their minds and were not coming. This was the end of our Indian scare, and after this we thought nothing more about it. We might not have been in any danger whatever. It is very likely that we were not, and yet when a few white men are in an Indian country where the Indians outnumber them ten to one, as in our case, their very helplessness creates a feeling of uncasiness if there is only the slightest suspicion of danger. We did not know that we were in great danger, but we knew that if we were, with but one rifle among us, we were perfectly powerless to avert it; and that reflection was an unpleasant one in itself.

Hot weather.—Between the 8th and 14th of August, inclusive, we had a hot week, during which the heat was so continuous and excessive that I think it is worth mentioning. The temperature on those days at 3 o'clock in the shade was as follows: August 8, 102°; August 9, 108°;

August 10, 110°; August 11, 110°; August 12, 112°; August 13, 106°; August 14, 102°.

I will also call attention here to the striking contrast between the temperature of the air and that of the water. On the 11th of August the air in the sun was 134°, and the water was 60°, consequently when our men went into the water to work on that and similar days, they experienced a change of temperature of 74°. This is very trying to the health, and some who have worked here in the water have suffered very severely from the effects of it.

Roily water.—About the 10th of August we noticed that the river water was beginning to be turbid, and to look in color like the Missouri at Omaha. This created no alarm, because we had often noticed, after very hot days, that the McCloud water was turbid, the cause being that the unusual heat melts an unusual amount of snow on Mount Shasta, which swells the smaller streams at the head of the river and roils the water. The turbidness of the water, however, continued for several days and increased every day till, on the 15th of August, the water was so muddy that one could not see more than 18 inches below the surface. Then we began to think that there might be some other cause for it than melting snows, and horrible visions of Chinamen mining at the head waters of the McCloud arose in our minds. Every other good salmon-spawning river in California has been spoiled or nearly spoiled for the salmon by mining operations, and to think of the McCloud, the last hope of the Sacramento salmon being ruined in the same way was intolerable. The universal sentiment at the fishery was that if our suspicions were true, “the Chinese must go,” and it would not have been difficult to find men enough to carry the decree into execution.

On Saturday, August 17, I decided if the water did not become clearer to send an expedition up the river to ascertain the cause of its turbidness. On Monday, however, it began to get a little clearer, and continued to grow clearer till the 24th of August, when it was about as clear as usual. In the mean time I discovered the cause of the turbidness, which proved to be a very peculiar one at the same time that it entirely relieved the Chinamen from our very unjust suspicions. We discovered that when there is an unusual amount of melting snow on Mount Shasta, the water seeks a new channel through what is generally in summer a dry gulch. This gulch, called Mud Creek, is composed of fine, white, ashly earth, and when the melting snows on Shasta overflow into it, they carry vast quantities of whitish mud into the McCloud. This is what made the river so roily; and the reason that it continued roily so much longer than usual was because there was more snow than usual on Shasta, and the heat for a week was very excessive.

The salmon.—The salmon, as before remarked, were found to be extremely abundant below the dam, and as soon as it was finished they gathered there in vast numbers. Indeed they were more numerous than I have ever known them to be before at that time, viz, the first half

of July. This abundance of salmon continued through the season. At first they were very small, smaller than we have ever known them to be before, but about the 13th of August a new run came up of very large fish. This run with the earlier run of small ones made the river swarm with salmon. I have never seen anything like it anywhere, not even on the tributaries of the Columbia. On the afternoon of the 15th of August there was a space in the river below the rack about 50 feet wide and 80 feet long where, if a person could have balanced himself, he could actually have walked anywhere on the backs of the salmon, they were so thick. I have often heard travelers make this remark about salmon in small streams, so I know that it is not an uncommon thing in streams below a certain size, but to see salmon as thick as this in a river of so great volume as the McCloud must, I think, be a rare sight. About this time I kept a patrol on the bridge every moment, night and day, and this precaution, though an expensive one, was well rewarded, for this vast number of salmon continually striking the bridge with sledge-hammer blows were sure, in the course of time, to displace something and effect a passage through to the upper side, and when one did succeed in getting through, the others would follow with surprising rapidity one after another, like a flock of sheep going through a break in a fence. If they were not watched a hundred or even a thousand could easily slip through unobserved, but by the aid of the patrol, who was always provided with material for repairing the dam, a breach was discovered as soon as it was made, and was repaired as soon as it was discovered. This swarm of salmon just alluded to remained at the bridge and kept up the attack at one point or another for three days, and then fell back to the pools below, where, with occasional renewals of their attacks, they remained until they were caught in the seine.

The spawning season.—The spawning season began the 20th of August, with the taking of 30,000 eggs from seven fish. Every haul of the net brought an enormous quantity of salmon. Without our trying to capture many, the net would frequently bring in a thousand at a haul. We found very few ripe fish, however, until the 28th of August, when the spawning season set in in good earnest, and from this date to the last day of taking eggs the yield was very large and remarkably regular.

This leads me to say that the most extraordinary feature about the fishing season this year was that the salmon in the river did not seem to be diminished any by our constant seining. We made enormous hauls with the net every day, spawned a large number of salmon, and gave a large number to the Indians for their winter supply, but always the next day the spawning salmon seemed to be as thick as ever. This abundance of the salmon was a daily surprise to us. Every day we were regularly, though agreeably, disappointed. It was three weeks before we made any impression on the spawners in the river. At last, about the 15th of September, the females with spawn began to fall off a little, but only a little. We had enough eggs by this time, however, and

stopped fishing on the 18th of September, not because of any scarcity of salmon, but because we did not want any more eggs. We had in the hatching-house on the evening of that day 12,246,000 salmon eggs, according to our recorded count, though without doubt over 14,000,000 in reality, as our method of counting purposely leaves a large outside margin for emergencies. Had we continued to fish and take eggs till the close of the fishing season, we could probably have taken 18,000,000 eggs, and perhaps more.

It is a fact worth noticing here, that the salmon were smaller this year than usual, the eggs were smaller, and the number of eggs to the fish was smaller. I doubt if the female salmon which we spawned averaged for the season over nine or nine and a half pounds, while in previous years they have averaged twelve or fourteen pounds. Sometimes we spawned twenty salmon in succession, of which not more than three out of the twenty would vary a half a pound from seven pounds. The weights of the salmon which we tagged and set free, given in the table below, are a fair sample of the weights of the females for the whole season.

Table showing the weight of several McCloud River salmon which were tagged with a silver tag and turned loose in the river in September, 1878.

	Weight.		Weight.
	Pounds.		Pounds.
No. 1.....	7	No. 12.....	7
No. 2.....	8	No. 13.....	8
No. 3.....	7	No. 14.....	11
No. 4.....	9	No. 15.....	9
No. 5.....	10	No. 16.....	6
No. 6.....	6	No. 17.....	7
No. 7.....	7	No. 18.....	6
No. 8.....	9	No. 19.....	6
No. 9.....	7	No. 20.....	9
No. 10.....	8		
No. 11.....	6		153

Average weight, 7.65 pounds.

It will be seen by the above record that twenty salmon, taken indiscriminately, weighed 153 pounds, giving an average weight of 7.65 pounds each. The small size of the salmon in the McCloud River this year was undoubtedly caused, in whole or in part, by the fishing at the canneries on the Sacramento, where the 8-inch meshes of the innumerable drift-nets stopped all the large salmon and let all the small ones through. The eggs when taken proved to be at least a third smaller than those of most previous years, and the average number of eggs to the fish was about 3,500, against 4,200 last year.

I adopted a new and rather unique method this year of driving the fish to the fishing-grounds. As may be readily supposed, the constant drawing of the net over the seining-hole had the effect of frightening the salmon off the ground. Of course it was necessary to get them back again before they spawned, as otherwise we should have lost the eggs. I have hitherto been in the habit of sending a gang of white men and

Indians down the river for this purpose. By going over the fish with boats, by throwing in rocks, by stirring up the holes with long poles, by floating down trees and brush over them, we have usually succeeded in driving back the fish that have *gone down* the river from the fishing-ground. This, however, did not enable us to get at the fish that *went up* the river and that lay in the rapids, and particularly in the deep holes between the seining-grounds and the bridge above. Here vast quantities of salmon collected, which we had never hitherto been able satisfactorily to reach. This year I accomplished it in this way: I had several Indians go up to the bridge armed with long poles. At a given signal three Indians jumped into the foaming rapids below the bridge, and by splashing the water with their arms and limbs and making as much of a disturbance in the water as possible did everything they could to frighten the salmon out of the rapids. On reaching the deep holes, where the fish lay collected by hundreds and perhaps thousands, the Indians dove down in the very midst of the swarms of salmon, and, stirring them up with their long poles, succeeded in driving them out.

In order to co-operate most effectively with the Indian divers, I had the seining-boat, with the boatmen all ready in it, stationed just at the point where the boat starts across the river with the net. On the beach also, where the net is drawn in, the fishermen were stationed at the ropes, seven men at the lower rope, and four men at the upper one, ready to pull in the seine at the proper moment. On the other side of the river, nearly opposite the fishing-boat, was stationed a boatman with a second boat, whose duty it was when the net was payed out to pull down close to the opposite shore where the net itself could not reach, in order to prevent the salmon from skulking there away from the seine. Still lower down on each side of the river were men stationed on the banks to throw rocks into the rapids below, with the intention of driving the fish out of the rapids into the net.

On these occasions the hauling of the seine was quite an exciting event. The Indian swimmers, their dark heads just showing above the white foam, screaming and shouting in the icy waters and brandishing their long poles, came down the rapids at great speed, disappearing entirely now and then as they dove down into a deep hole. As soon as they approached within about four rods of the fishing-skiff, the boat shot out from the shore, the second boat man braced himself and his oars for a quick pull down along the bank. The man at the stern of the first boat began paying out the seine, the fishermen on the beach gathered at their respective ropes, the men on shore began throwing rocks in the rapids, and in a few moments the net was drawn to the beach with an enormous mass of struggling, writhing salmon, often weighing in the aggregate not less than four or five tons. Then the fishermen sprang into the water and examined the fish, taking the ripe ones to the corral and throwing the unripe ones back into the river until the net was emptied. Then all was quiet again and the men proceeded to take the eggs from the ripe fish which they had captured.

I ought to add here that the water is too cold for white men to endure swimming and diving and remaining in it as long as is necessary to drive the salmon from the rapids. Indeed, the mere work of examining and spawning the salmon is altogether too severe an exposure for white men, and almost every one of my men gets more or less prostrated with sickness the first week of the spawning season. And it is not to be wondered at, for we run the seine every night until twelve o'clock, and the water and night air are sometimes 80° colder than where the men have been accustomed to work during the day. For instance, after hewing timbers or building a corral in a sun temperature of 130° in the daytime, they will frequently work in the water and night air in the evening in a temperature of 50°, their clothes wet through all the time. Here the difference in temperature is just 80°. This is obviously exceedingly trying to the most robust constitution, and the result always is that most of the men get sick the first week, though it is also true they usually rally—that is, those who can stand it at all—and are all on duty the next week, attacking their work with renewed zeal and vigor.

The actual spawning of the salmon this year was conducted on the same general plan as last year, except that I made arrangements for doing the work somewhat more systematically, and on a scale corresponding to the great number of eggs which we hoped to take, and which we actually did take. I think other salmon breeders will be inclined to smile an incredulous smile when I say that we frequently took from 700,000 to 900,000 eggs and upwards in one day before four o'clock in the afternoon. Yet this my men actually accomplished several times. The physical exertion required to do it is enormous.

On the evening of the 18th day of September all the eggs were taken and placed in the hatching-houses in good order, the whole work of the spawning season having been done this year, notwithstanding the large number of eggs taken, more smoothly and easily than ever before.

Maturing and hatching the eggs.—The maturing and hatching of the eggs also passed off more smoothly this year than usual. No disasters or drawbacks occurred during the whole season that I remember. Everything worked well, and when the time came for shipping the eggs, there were as fine a lot in the hatching-houses as was ever collected together. There was not an egg shipped, that I am aware of, that had been in the least degree injured by fungus, sediment, insufficient air, or any other cause whatever. All were in a perfect condition of health and vitality.

In confirmation of the above statement I quote below from some of the letters which I received from consignees of the eggs concerning the condition of the eggs on arrival at their destinations.

MADISON, WIS., *December 20, 1878.*

DEAR SIR: Your receipt for freight on California salmon eggs received this day.

The eggs *were very fine; hatched out beautifully.*

Very truly yours,

WILLIAM WELCH,
President Wisconsin Fish Commission.

L. STONE.

MOUNT CARROLL, CARROLL COUNTY, ILLINOIS,
October 16, 1878.

DEAR SIR: The two crates of California salmon eggs, of which you notified me from California, reached me on the 14th instant. They are *in fine condition, only about 3 per cent.* being found faulty.

Very truly yours,

SAMUEL PRESTON.

LIVINGSTON STONE, Esq.

GLOUCESTER, MASS., *October 18, 1878.*

MY DEAR SIR: My man writes me of the safe arrival of the salmon eggs *in good condition.* Out of the lot of 250,000 he picked out 6,000 bad eggs, $2\frac{4}{10}$ per cent.

Yours, very respectfully,

FRANK N. CLARK.

LIVINGSTON STONE.

SAINT PAUL, MINN., *October 23, 1878.*

DEAR SIR: The California salmon eggs from McCloud River came to us in the evening of the 14th, and I am glad to say they open up in better order than any we have ever received before. The packing and carriage were a complete success, and up to this time *the loss has not been over 5 per cent.*

Very respectfully,

R. O. SWEENY.

Hon. S. F. BAIRD,

*United States Fish Commissioner, Smithsonian Institute,
Washington, D. C.*

PEMBROKE, ME., *October 8, 1878.*

DEAR SIR: I received the case of salmon eggs that you shipped to me. The eggs were *in good condition*, there being only 823 dead eggs, which is a small percentage.

Yours, respectfully,

LORENZO S. BAILEY.

LIVINGSTON STONE.

TRENTON, N. J., *October 14, 1878.*

DEAR SIR: In accordance with your request of September 23, you are informed that the shipment of salmon eggs for the State of New Jersey, and others (total, 475,000), was received in due time, and that the condition of the eggs on arrival *was most excellent.*

Very respectfully,

E. J. ANDERSON,
Commissioner of Fisheries of New Jersey.

LIVINGSTON STONE, Esq.

ROCHESTER, N. Y., *October 8, 1878.*

DEAR SIR: The eggs arrived at destination October 4. They *were in very good condition.* The first time going over them 4,945 were picked out. They are looking well.

Yours,

SETH GREEN.

LIVINGSTON STONE.

ELGIN, ILL., *October 12, 1878.*

DEAR SIR: The California salmon eggs came *in excellent shape.*

Very truly,

W. A. PRATT.

LIVINGSTON STONE.

PLYMOUTH, N. H., *October 8, 1878.*

DEAR SIR: The eggs arrived here at noon the 7th, *in good condition.*

Yours, &c.,

A. H. POWERS.

LIVINGSTON STONE.

COUNCIL BLUFFS, IOWA, *October 17, 1878.*

DEAR SIR: The 50,000 California salmon eggs shipped me per express were duly received on the 14th instant, and in unpacking the same I find them *in excellent condition.*

Yours, respectfully,

WM. A. MYNSTER.

LIVINGSTON STONE.

The only large loss experienced in the shipment of the eggs this year was in the case of a lot of 500,000 consigned to Hon. Samuel Wilmot, Newcastle, Ontario, Canada. These, as Mr. Wilmot's letters which follow will show, were almost a total loss. There cannot be much doubt that the injury to the eggs occurred on the express car between Chicago

and Newcastle. As Mr. Wilmot's eggs were handled at the McCloud River fishery in precisely the same way, were packed in the same way, were shipped in the same way, and, in short, received precisely the same treatment that the other eggs received, from the time of their leaving the parent fish on the McCloud till they were unloaded from the ice-car at Chicago, and as all the other eggs went safely, it does not seem possible that the injury to the eggs could have occurred west of Chicago, because if it had, the same disastrous agency which destroyed his eggs must inevitably have affected some of the other eggs, which was not the case. It will also be seen from Mr. Wilmot's letters that the injury could not well have occurred after the eggs reached Newcastle. The obvious inference then is that the mischief must have taken place between Chicago and Newcastle.

NEWCASTLE, October 9, 1878.

PROF. SPENCER F. BAIRD,

United States Commissioner of Fisheries, &c., Gloucester, Mass.:

DEAR SIR: I hasten to inform you, as mentioned in my telegram of yesterday, of the loss of the California eggs that you were kind enough to have sent to me from the McCloud River. The real cause of their death I cannot fully comprehend, but I am inclined to believe that they must have got overheated on the road.

I got a letter from Mr. Stone in September, stating that half a million of eggs would be sent me, and that they would be shipped on or about 28th September, from Redding to Chicago in a refrigerator-car, thence by express to their destination, and that the express company would notify me by telegram when the eggs left Chicago. I also got a postal card from Mr. Stone, dated 23d September, notifying me that 5 per cent. more than the number of eggs ordered would be added to the shipment.

The express agent here, on the morning of the 5th instant, informed me that five crates of eggs had arrived by the morning train and that they were at his office. (This was the first and only notice I received of their coming since receipt of Mr. Stone's letters.) I immediately sent my assistants for them, giving them instructions to handle them carefully and walk the horses slowly from the office to the fishery (about a mile); in the mean time I had my men clean out the hatching-troughs, through which a full flow of water had been running for some time, and also rinse off the trays, to be in readiness for the coming eggs. I was present at this time, and when the eggs arrived I saw them carefully taken off the wagon and carried to the end of the fishery. I then opened the first crate myself. Before doing so I examined the manner in which it was arranged, which was most satisfactory. The outer covering of the inner boxes was well packed with fern leaves, and there was a center chamber dividing the two inner boxes, in which a quantity of fresh ice still remained. This ice must have been put in only a short time before, as some of the pieces were quite large and almost filled up the entire width of the chamber.

Before opening the inner boxes containing the eggs, I pushed a thermometer into the fine moss round and about the eggs, to ascertain its temperature, so that no sudden change would be made in unpacking the ova. The moss gave a record of 54° ; the air inside and outside the building (it was a dark, cloudy day) gave a record of 54° also. I then tried the water in the stream and in the hatching-troughs, and found it, after several trials, to show 53° to $53\frac{1}{2}^{\circ}$. This being so very favorable, I set to work with the most satisfactory anticipations for success.

To make matters as equal as possible, I also sprinkled water on the inner boxes containing the eggs before unscrewing the slats, and allowed the water to percolate through the moss and amongst the eggs. The ova was then taken out by gently lifting each layer with the muslin cloth under them, and immersing the eggs slowly in the hatching-troughs; these were 12 feet long, 12 inches wide, 5 inches deep, with a full flow of water running constantly through them; in opening out the eggs, my assistant, who has been with me several years, drew my attention to the eggs, or the embryo inside, beginning to turn a whitish color; this I noticed clearly. In opening and removing the moss, they presented a healthy appearance, with the usual dark, red color, but almost immediately began to show a faint opaque white streak along the back of the embryo; some showed it more than others. We got through with the operation of unpacking on the evening of Saturday. Some of the eggs were placed loosely on the bottom of the troughs, with a couple of inches of water running over them; others were placed on hatching-trays. A very few, indeed, in removing gave evidence of life or motion inside. I picked out a few dozen that showed life and put them by themselves; these turned out in the course of a few hours just the same as the others, with the opaque white line. As I had a similar loss the previous season, I concluded there was no hope for their safety. I examined the troughs and trays after night, and found the lines of mortality more plainly visible, and on Sunday morning I concluded the result to be almost a total loss. To-day, whilst writing, I can notice a few eggs here and there yet looking as if they were all right, but I fear the white fever, not the *yellow*, has struck them, with no hope of recovery. Every day since Saturday I have picked out a dozen or so that I hoped were healthy, as they gave some signs of life, and put them carefully by themselves, but with the same result—a few hours afterwards, death—and to-day I fear we shall have none left.

Now, the question arises, what has caused this mortality? Has it occurred with other lots sent elsewhere? Or am I alone the unfortunate one? I hope the latter may be the case, as it would be sad, indeed, if a similar fate has befallen all the rest. I am very anxious to learn the fate of the other shipments, and will be pleased to hear from you concerning them. Whether the cause of death took place before reaching Chicago, in the refrigerator-car, or since their redistribution there, I cannot say. The facts are, however, just as I have related, and I feel very sad at the

loss, as I had contemplated sending a number of the eggs to our establishment on the Saguenay River, 300 miles below Quebec, from which place I distributed some thousands of the California fry, two years ago.

I am very fearful now that my expectations in reference to the California egg enterprise will be wholly frustrated.

The first lot of eggs I got from you previous to last fall came to hand in the best possible shape, not more than 2 per cent. or 3 per cent. being lost till time of hatching out. How matters have turned out wrong since I cannot tell. I may, however, state my belief that last year's loss was undoubtedly from overheating on the road, as the moss and eggs were steaming hot when they were opened. This year's shipment did not show that state of things on arrival here. Yet the overheating may have taken place before reaching Chicago, and the replenishment of ice may have cooled them off, but the stroke of death did not culminate till the opening out and exposure to the air and water here.

* * * * *

THE FISHERIES, NEWCASTLE, ONT.,

November 9, 1878.

LIVINGSTON STONE, Esq.,

Assistant United States Commissioner of Fisheries, &c.,

Charleston, N. H. :

DEAR MR. STONE: I received your favor of 4th instant, in reference to the California eggs which you were kind enough to forward (from your establishment on the McCloud River) to me in October last, and I can assure you that no one can feel more disappointed than I do at the loss of them, for I had set my mind upon going largely into the rearing of these Pacific salmon. However, the misfortune occurred in losing them all save about 1,000, and the question now to be solved is, how did the calamity happen? What was the cause of it?

You ask me certain questions concerning the death of the eggs. These I will answer *seriatim*, and if, from the replies I give you, you can form any correct idea why the loss should have occurred, no one will be more pleased than myself, as it will not only solve the mystery, but will also probably give a clew whereby similar disasters may be prevented in the future in connection with getting California ova from you.

I wrote Professor Baird on the 9th October, giving him particulars of the loss, &c. In all probability he has sent you the letter or a copy of it. I will, however, recapitulate a portion of it by saying, "that I got a letter from you in September saying that half a million of eggs would be shipped to me on or about 28th September," and that, when they arrived at Chicago, the express agent there would notify me by telegram when they would be expressed from that place. I also got a postal card from you, dated 25th September, that 5 per cent. more than the original number would be shipped. To make matters short in this letter, I have concluded to send you a copy of that portion of the letter

referring to the loss, written on 9th October to Professor Baird, in which the particulars are minutely given. (See copy attached hereto.) You will observe in it that I did not receive any notice from the express company at Chicago when the eggs were sent on from there. My first knowledge of the ova after your letter and postal card was from the express agent here sending word to me that five crates of salmon had arrived. This notice was on Saturday morning, the 5th October. I will now take up your questions.

Question. At what hour did the eggs arrive at Newcastle?

Answer. The express train from the West arrives at 9.25 a. m.; and very shortly after this time I was notified of the arrival of the eggs.

Question 2. What express company delivered them?

Answer. The Canadian and American Express Company.

Question 3. Was there ice on top of the crates and in the ice-chambers?

Answer. I am not aware of any ice being *on top* of the crates and think there was not, but there was ice in the ice-chambers of the crates.

Question 4. Was the express-car warm in which they were brought to Newcastle?

Answer. This I cannot answer, nor can the agent here tell me, as the cars only stop a moment or so at the station, and no observation was taken at the time.

Question 5. How long after arrival at Newcastle were they unpacked?

Answer. The unpacking commenced between 10 and 11 o'clock a. m., and the work was completed about 4 p. m.

Question 6. Were they likely to grow cooler or warmer in the place where they were kept at Newcastle before unpacking?

Answer. There could be only a very little change, as the day was a very dark, lowery one and pretty cool, the thermometer inside and outside the building ranging at 54°; there were no fires on the premises, neither was there sunshine.

Question 7. Did the eggs appear to be dead on being opened, or was it after they were placed in the water that they showed that they were spoiled?

Answer. At the first glance, when moss and muslin were removed, the eggs looked bright and red, but upon close examination life and motion were only noticed in a few, and my assistant (who has been engaged in the general work in connection with fish hatching, &c., in the establishment for several years) drew my attention to this, stating at the same time that he was fearful that they were going to turn out as those did last year, as he could see a faint whitish line along the embryos in the eggs. I noticed this also. This gave us cause to take extra care in unpacking. A thermometer was put amongst the moss between the layers, which gave a temperature of 54°. The water in the troughs stood at 53° to 53½°, and the air outside and inside the building was 54°. These were very favorable circumstances, and each of us began to remove the eggs, first sprinkling water over the moss in the boxes,

then gently removing the upper layer of moss with the muslin, and lifting up the eggs with the muslin underneath them, and carefully immersing the eggs in the trough immediately alongside the packing boxes, so that in each case the eggs in the muslin cloth were not carried beyond 3 or 4 feet before immersing in the water. It was observable that little or no life was noticed by movement of the embryos as is usually the case when handling them, but the faint opaque white line became more apparent when placed in the water. I took part personally with my men in opening two of the crates, noting the above particulars. The opening of the other three crates was performed by my assistants in the same manner and with precisely the same results.

Question 8. Did all the crates open just alike, or were some in worse condition than others?

Answer. There was no perceptible difference in the crates. My assistant thought one slightly better looking, but in the end all proved alike.

Question 9. Did any of the eggs appear to have hatched on the way?

Answer. I may say, no. There were, however, just half a dozen or so that gave signs of premature hatching, but the number was so trifling as hardly to deserve notice.

Having answered your queries as clearly as I possibly can, I hope you may glean something from them that may give a clew to the loss. I must say that I cannot imagine the real cause. What strikes me with great surprise, is how it was that all the other consignments turned out so well and mine so badly. The inference would be that the difficulty must have taken place at Chicago in reshipping, or on the road from that place to this. From what I can learn, the time taken between Chicago and here by express is about 48 hours. At what time the eggs reached Chicago from Sacramento I have not precisely learned, but I think I saw some notice of the arrival of a car load of California eggs at that place about the 2d or 3d of October. If this were the case, and it was the same shipment by which mine came, no time would have been lost between Chicago and here for their carriage.

The next question arises, how many transshipments were there between the places, and could injury have been caused whilst transshipping? Not getting any bill of lading of their shipment at Chicago or upon their arrival here, I cannot particularly answer this; but there would no doubt be a transshipment at Detroit from the American road to the Canadian or Great Western Railway to reach Hamilton and Toronto. At Toronto there would be another transshipment from the Great Western line to the Grand Trunk Railway in order to reach Newcastle. This would make *two* changes of cars (or *three* if a change was made at Hamilton for Toronto), with new express carriers at each change, and from the great monopoly of the express company, and consequent carelessness of many of its employés, roughness of handling the crates, on account of their size and weight, might be the cause of injury, or heated

cars (though this could not be the case, as there was plenty of ice in the chambers). It may be that these crates have been tumbled out of the cars like cord-wood, or barrels of pork, or crates of hardware, and the eggs became injured by concussion in falling, and thus killing them. Yet I am doubtful whether this theory will hold good, as it is perfectly astonishing the knocking about that eggs sometimes get and yet receive no injury. If the injury did take place from the last-mentioned cause, it would be impossible to find out where the blame was to be placed, from the many changes in transshipment and no one in particular looking after them. In opening some of the crates the layers were very much displaced, some being quite to one side, as if forced there by some pressure or shock. There were no labels or directions on the crates-giving special instructions for "careful handling," or "keeping this side up with care," so that they may have been carried in the cars or in express wagons on their "sides" or "ends." There was a painted address on each, *Sam Wilmot, Newcastle, Ont., 105,000 fish-eggs.*

As you will find in my note to Professor Baird (copy herewith), the crates were brought from the village of Newcastle, which is about three-quarters of a mile from the fishery, in my own wagon, walking the team all the way; they were unloaded in my presence and under my directions, with every possible care. I opened two of them myself and helped remove the eggs, as described, taking, as far as my experience and judgment were concerned, every precaution to prevent any possible injury to the ova; yet the consequences have been as related. I was not present at the opening and laying down of the three last crates, being called away to make the customs entries, &c. My assistants, however, followed the same course I did with the first crates. About 6 p. m. my head man informed me that he was afraid the eggs would all be bad; when I saw them a couple of hours later I came to the same conclusion. On the following morning (Sunday) I saw the white mark on almost every egg. Now and then an egg was noticed with the embryo in it alive, giving rapid, jerky-like motions; these few were picked out and put by themselves, but they died too. During the following few days the men kept close watch and were constantly looking out to find any eggs that might prove sound; and out of the whole half million we managed to get between one and two thousand that had not succumbed to the malady, or whatever else you may call it; these few hatched out in about five or six days after, and we have them yet (looking well) as the last remnant of the *Livingstone* consignment.

In connection with the history of these five *large crates*, and the one *large crate* of last year, it is strange that they should *all* have gone in a somewhat similar way, whilst the former smaller packages of 10,000 and 50,000 in previous years all came to hand in the very best of condition; in fact, the loss in them was extremely trifling. None of these latter-mentioned good consignments hatched out for five or six weeks after being laid down. In the crate of the fall of 1877 there was *not one good egg.*

These, without doubt, were killed from overheating, as the moss and eggs when opened were *steaming hot*. The five crates this fall did not present this steaming or overheated appearance upon opening, yet this opaque white line became visible almost immediately after opening and being put in the troughs, and the one or two thousand that we saved or picked out from the lot, hatched out in a few days after. This, to a certain extent, would show that they must have had more than ordinary warmth for their safety; otherwise they would not have hatched out so prematurely.

In order to get every good or apparently living egg from the large mass on the trays and in the troughs, we kept them on hand as long as we could, in fact till they became unpleasant to the smell; but during this time there was no growth of fungus or byssus upon them. The embryo or young fry inside (which was quite visible in all of the eggs) turned that pallid or opaque white color which always denotes death. I sent a lot of the eggs to Professor Baird that he might examine them; I did not hear of the result.

I have packed and unpacked a very great many fish eggs, sometimes with losses, but as a rule pretty successfully. The loss with these five crates I must confess upsets me; the more so, when you report all the other consignments as unusually good. This being the case, my lot must have come to grief in some one of the following ways, presuming they arrived all safe at Chicago:

- 1st. By detention or injury received at Chicago before transhipment.
- 2d. By overheating or exposure, or both, in transitu here.
- 3d. By rough, improper handling of the crates in transhipment from place to place and on the cars.

There was one thing which struck my attention in opening the first crate, namely, the perfect state the ice was in in the ice chambers, the appearance almost denoting that it had only just been put there; the pieces of ice were large, almost filling up the chamber; in others it was not so apparent. I was under the impression at first that forty-eight hours on an express car would have almost melted any ice put in at Chicago, yet the weather was cool in the beginning of October, and the ferns in the boxes may have kept the ice in the good condition in which it came here.

I must congratulate you upon your success in procuring the immense number of eggs you did this season—some 12,000,000, I believe—and I have much pleasure in acquainting you of my success at the several establishments under my control, the returns from my assistants showing up to the present time upwards of 8,000,000 of salmon eggs laid down. The salmon, trout, and white-fish season being now in its prime, and being busily engaged in collecting the eggs, I cannot yet tell you the result; but I am fearful, the weather having been so very unfavorable, we shall not secure the supply we should like to get.

Let me hear from you, not only on this unpleasant subject of the loss

of eggs, but on any other kindred matter in fish culture, in all of which you are so thoroughly conversant.

Excuse my very long and somewhat prosy letter, but when details are to be given, both time and paper must be sacrificed.

Believe me to be yours, very truly,

SAMUEL WILMOT,

Superintendent Fish Culture for Canada.

I may mention here that the supplementary hatching-house did excellent service in helping us to eke out the quota of eggs for the two ice-cars. For illustration, all the eggs going into the first car had to be taken within a period of about a week, because those that were taken before that were in danger of being too far advanced to go in the car, and those taken after that were likely to be not far enough advanced. The supplementary hatching-house, which matured the eggs eight days quicker than the regular hatching-house, by virtue of its warmer water-supply, here came very conveniently to our aid by furnishing the additional half million eggs just when they were wanted.

On the 3d of October the balance of the eggs were sufficiently matured to load the second car. About two millions and a half (2,500,000) still remained in the hatching-house after both the cars were loaded and sent off. These were afterward hatched by Mr. Myron Green and Mr. James Richardson and placed by them in excellent order in the McCloud, Pit, and Little Sacramento Rivers, all tributaries of the Sacramento.

Packing and shipping the eggs.—The packing and shipping of the eggs, as well as the taking, maturing, and hatching of the eggs, passed off more smoothly this year than usual. The packing was done with marvelous rapidity and reflects great credit on all concerned in it, particularly Mr. James Richardson and Mr. Patrick Riley, who placed the layers of eggs in the boxes. Had not the character of the packing, as shown by the way in which the boxes finally opened, been made the subject of unusual commendation from the parties who were engaged in unpacking the eggs at their destination, I should hardly venture to say how rapidly they were packed, lest it might be thought to imply undue haste or want of care. I will, however, under the circumstances, state that the eggs were actually packed at the rate of half a million an hour, and I will add my own testimony also, that I never saw eggs packed with more care, fidelity, and pains, the rapidity with which the work was dispatched being wholly the result of experience and skill and the enthusiasm with which every one employed did the part of the work which fell to his share.

The manner of packing the eggs was in general the same as last year, the only difference being that this year the packing-boxes were made an inch larger both in length and width in order to give more room for the eggs. I, however, took especial pains this year to send large measure, in most instances giving from 5 per cent. to 50 per cent. more than were ordered.

One circumstance must be mentioned here which, though at first it seems unimportant enough, would be attended with the most serious consequences if not provided against. I refer to the diminution of the moss supply. Little by little, each year for seven years, we have encroached upon the supply of moss within our reach. This year we had to go away beyond the Sierra Nevada range to the sage-brush region of Shasta Valley to get our moss, and I am informed by the moss-gatherers that even that source of supply is now exhausted. To a New Englander, at least, the question of the moss-supply would seem trivial enough, and if, as is very unlikely, he could not get moss within a mile he would be willing to go two miles for it if necessary. But the question is not so easily settled in a dry country like California, and it is undoubtedly a fact that there is not within a hundred miles of the United States fishery on the McCloud River an accessible spot where moss can be obtained next year in any considerable quantity. It may, therefore, become necessary next year to meet the subject in some new manner, probably by shipping the moss from the Eastern States or Oregon, or sending an expedition to the neighborhood of Lake Tahoe for it, a distance by the traveled route of about five hundred miles.

I will close this report by making a crude statement of the work which was done at the fishery the last forty days preceding the loading of the second car on the 5th day of October. During this time we caught and examined, one by one, nearly 200,000 salmon. We took and impregnated at least 14,000,000 eggs. We went over almost daily the 14,000,000 eggs and picked out the dead ones. We washed and picked over, almost sprig by sprig, 220 bushels of moss. Our Indians collected and brought in on their backs four tons of ferns for outside packing, sometimes going two miles to get them, and we packed and crated, and loaded into the car at Redding eight or nine million salmon eggs, in addition to making new wire trays, packing-boxes, &c., &c., and doing the thousand little things which are constantly coming up to be done at a place like the fishery. All this work required an average of ten white men and twenty Indians for the forty days referred to.

Supplementary to this report will be found the following tables :

- (1.) Table showing the observations taken of wind, weather, and temperature for the season of 1878.
- (2.) Table showing the daily number of salmon eggs taken and salmon spawned.
- (3.) Table showing the weights of salmon spawned.
- (4.) Table showing the distribution of the eggs.
- (5.) Catalogue of collection made for the Smithsonian Institution.

LIVINGSTON STONE.

764 REPORT OF COMMISSIONER OF FISH AND FISHERIES.

TABLE I.—Table of temperatures taken at the United States salmon-breeding station, McCloud River, California, during the season of 1878.

Month.	Air.				Lowest night temperature.	Water.			Wind.	Weather.
	Shade.			Sun.		7 a. m.	3 p. m.	7 p. m.	3 p. m.	
	7 a. m.	3 p. m.	7 p. m.	3 p. m.						
May 20.....	o	o	o	o	o	o	o	o		Cold rain.
21.....	55	56½	52			50	50	50		Do.
22.....	54	69	59			51	51½	52		Rainy, a. m.; clear, p. m.
23.....	60	86	66	106		52	55	54		Clear.
24.....	62	95	78	120		53	56	57		Do.
25.....	58	100	76	124		53	57	56		Do.
26.....	56	93	70	116		54	57	57		Do.
27.....	63	80	66	96		54	55	55		Do.
28.....	53	66	62			50	51	51		Showers, p. m.; rainy, night.
29.....	52	64	56			50	51	51		Showers, p. m.
30.....	50	67	57	80		49	52	51		Do.
31.....	53	66	64	93		50	53	53		Clear, a. m.; cloudy and showery, p. m.
June 1.....	58	76	68	102		52	54	54		Cloudy, a. m.; clear, p. m.
2.....	58	89	72	112		52	54	54		Clear.
3.....	56	92	69	114		52	56	50		Slightly cloudy, p. m.
4.....	56	98	77	120		54	57	57		
5.....	58	103	81	122		54	56	56		
6.....	72	103	82	130		55	58	59		
7.....	64	92	79	114		56	59	58		Slightly cloudy, p. m.
8.....	63	99	80	112		56	59	58		
9.....	72	103	79	126		56	59	58		Slightly cloudy, p. m.
10.....	72	97	80	114		56	59	58		
11.....	64	92		114		56	59	58		Cloudy; after 4 p. m., clear.
12.....	72	100	70	124		56	58	58		Clear.
13.....	68	100	76	124		56	58	58		Do.
14.....	61	101	77	128		56	58	58		Do.
15.....	67	86	76	109		56	58	58		Cloudy, a. m.
16.....	67	84	72	106		56	58	58		
17.....	67	87	76	87		56	59	58		Cloudy, p. m.
18.....	66	96	79	128		56	59	58		Clear.
19.....	65	95	78	122		56	59	58		Do.
20.....	63	88	78	88		57	59	58		Cloudy.
21.....	72	103	81	124		56	59	58		Clear.
22.....	64	103	87	126		56	59	59		Cloudy, p. m.
23.....	66	92	75	118		58	66	59		Clear.
24.....	70	94	80	124		57	59	58		Do.
25.....	72	102	80	123		56	59	58		Do.
26.....	76	108	81	130		56	59	59		Do.
27.....	62	96	83	109		57	60	59		Cloudy; rain, p. m.
28.....	56	88	74	108		57	59	58		Clear.
29.....	66	97	78	118		55	58	57		Do.
30.....	70	105	70	128		57	58	57		Do.
July 1.....	64	98	83	122	51	56	59	58	N.	Light clouds; clear.
2.....	58	85	72	114	47	56	59	58	N.	Light clouds.
3.....	58	78	68	102	50	56	57	56	N.	Do.
4.....	60	80	73	112	42	53	57	56	N.	Do.
5.....	65	95	73	116	53	54	58	57	N.	Clear.
6.....	58	97	73	120	42	54	58	57	N.	Light clouds.
7.....	60	97	74	122	50	55	59	58	SW.	Clear.
8.....	57	100	78	128	45	55	59	58	SW.	Do.
9.....	62	99	80	127	50	56	59½	58½	SW.	Cloudy.
10.....	67	85	76	116	57	56	59½	58½	SW.	Clear.
11.....	62	82	75	112	51	56	59	58	SW.	Do.
12.....	67	102	78	120	50	56	60	58	N.	Do.
13.....	59	104	80	123	57	56	60	59	SW.	Do.
14.....	61	103	84	120	54	57	60	59	SW.	Do.
15.....	61	98	84	118	67	57	60	59	SW.	Light clouds.
16.....	62	81	74	90	60	57	58	57	S.	Cloudy.
17.....	75	78	68	84	58	55	56	56	N.	Do.
18.....	65	93	73	113	47	55	58	57	N.	Clear.
19.....	64	95	76	112	40	55	59	58	W.	Do.
20.....	57	97	77	112	40	56	60	59	SW.	Do.
21.....	57	95	76	115	54	56	60	59	SW.	Do.
22.....	67	100	75	118	47	56	59	58	SW.	Do.
23.....	64	97	76	114	46	56	59	58	SW.	Do.
24.....	55	96	78	114	46	56	60	59	SW.	Do.
25.....	62	102	80	126	47	56	60	59	N.	Do.
26.....	54	104	80	126	54	56	60	59	N.E.	Do.
27.....	56	101	83	123	54	56	60½	59	SW.	Do.
28.....	62	102	82	124	58	56	61	60	SW.	Do.
29.....	64	99	80	118	53	57	60	58½	SW.	Do.

SALMON HATCHING ON M'CLOUD RIVER, CALIFORNIA, 1878. 765

TABLE I.—Table of temperatures, &c.—Continued.

Month.	Air.				Lowest night temperature.	Water.			Wind.	Weather.
	Shade.			Sun.		7 a. m.	3 p. m.	7 p. m.	3 p. m.	
	7 a. m.	3 p. m.	7 p. m.	3 p. m.						
July 30.....	57	104	80	124	52	56	59	58½	NE.	Clear.
31.....	56	98	80	116	50	56	59	58	N.	Do.
Aug. 1.....	55	99	78	115	51	56	60	59	E.	Do.
2.....	55	100	79	118	50	56	59½	59	NE.	Do.
3.....	55	97	80	114	50	56	60	59	SW.	Do.
4.....	60	95	79	112	53	56	60	59	SW.	Do.
5.....	55	91	77	108	51	56	60	59	SW.	Do.
6.....	55	98	76	121	49	56	60	59	SW.	Do.
7.....	56	97	76	120	56	56	59	58	SW.	Do.
8.....	56	102	77	126	51	55	59	58	SW.	Do.
9.....	58	108	79	128	49	56	59	58	N.	Do.
10.....	58	110	80	128	50	56	59	58	NE.	Do.
11.....	59	110	83	134	51	56	60	59	NE.	Do.
12.....	60	112	83	133	50	56	60	59	SW.	Do.
13.....	62	106	84	132	52	56	60	60	S.	Light clouds.
14.....	64	102	88	122	59	57	60	61	S.	Cloudy.
15.....	75	98	80	121	61	57	59	61	N. & S.	Do.
16.....	60	94	80	110	50	56	59½	59	NE.	Fair.
17.....	58	93	76	96	50	56	58	58	NE.	Light clouds.
18.....	57	99	73	120	49	56	58	58	N.	Hazy and smoky.
19.....	55	96	78	110	47	55	58	58	.....	.....
20.....	54	92	77	108	49	57	59	59	.....	Clear.
21.....	58	76	68	80	49	55	57	56	S.	Cloudy.
22.....	60	83	72	102	56	64	57	57	SW.	Light clouds.
23.....	52	84	66	104	.....	64	57½	56	.....	Clear.
24.....	47	88	70	114	43	53	57	56	.....	Do.
25.....	51	100	75	121	48	64	58	57	NE.	Do.
26.....	.....	98	78	110	.....	58	57	58	SW.	Do.
27.....	56	102	84	118	52	56	59	60	SW.	Do.
28.....	58	99	77	105	53	56	60	60	SW.	Do.
29.....	62	109	78	122	59	57	60	60	NE.	Do.
30.....	58	109	83	118	54	56	60	59	NE.	Do.
Sept. 31.....	60	107	82	120	59	57	59	59	.....	Do.
1.....	56	96	76	117	50	56	59	58	SW.	Fair.
2.....	52	98	76	114	48	56	58	58	N.	Do.
3.....	64	97	83	108	59	56	58	58	N.	Do.
4.....	60	99	76	109	55	56	58	57½	N.	Do.
5.....	52	100	76	120	47	56	58	58	N.	Do.
6.....	52	97	76	114	47	56	58	58	N.	Do.
7.....	56	99	78	108	47	55	58	58	N.	Do.
8.....	52	97	.....	104	45	.....	.....	.....	N.	Do.
9.....	52	.....	72	.....	44	54	.....	56	N.	Do.
10.....	52	.....	71	.....	47	54	.....	56	N.	Do.
11.....	52	66	73	96	47	53	56	56	N.	Do.
12.....	50	63	67	97	44	53	56	56	SE.	Do.
13.....	45	90	65	95	40	53	56	56	.....	Do.
14.....	45	.....	64	.....	38	52	.....	55	.....	Do.
15.....	41	70	.....	82	37	51	55	.....	.....	Do.
16.....	49	72	60	72	44	52	54	54	S.	Cloudy.
17.....	.....	76	63	80	.....	54	54	54	S.	Do.
18.....	45	76	64	81	40	52	55	54	.....	Fair.
19.....	44	85	65	90	40	52	55	54	.....	Do.
20.....	46	86	65	93	42	51	55	55	.....	Do.
21.....	46	62	66	101	41	51	55	55	SE.	Do.
22.....	44	96	67	108	39	51	55	55	.....	Fine.
23.....	46	94	69	111	41	51	55	54	.....	Do.
24.....	44	92	65	103	39	50	54	54	.....	Do.
25.....	44	98	65	112	40	51	54	53	.....	Do.
26.....	.....	70	.....	79	.....	53	.....	.....	S.	Cloudy.
27.....	54	73	59	81	48	52	54	53	S.	Do.
28.....	54	56	54	56	49	51	52	51	S.	Rain.
29.....	50	52	52	52	49	50	51	51	.....	Do.
30.....	52	60	56	60	47	50	51	50	.....	Do.
Oct. 1.....	48	84	64	98	40	50	53	53	N.	Fair.
2.....	47	90	64	102	44	50	54	53	N.	Do.
3.....	50	96	64	110	45	51	54	53	N.	Do.
4.....	48	96	63	106	44	50	54	53	N.	Do.
5.....	40	92	64	111	41	50	53½	53	N.	Do.
6.....	52	100	63	115	48	51	54	54	N.	Do.
7.....	50	.....	.....	.....	46	51	.....	.....	N.	Do.
8.....	.....	92	.....	108	.....	54	.....	.....	N.	Do.
9.....	43	79	.....	80	37	51	54	.....	N.	Cloudy.
10.....	43	88	.....	101	38	50	53	.....	N.	Fine.
11.....	40	79	52	80	39	50	52	52	SW.	Cloudy.

TABLE I.—Table of temperatures, &c.—Continued.

Month.	Air.				Lowest night tem- peratures.	Water.			Wind.	Weather.
	Shade.			Sun.		7 a. m.	3 p. m.	7 p. m.	3 p. m.	
	7 a. m.	3 p. m.	7 p. m.	3 p. m.						
Oct. 12	52	55	50	55	49	50	50	S.	Rain.	
13	47	52	51	52	44	49	51	SE.	Cloudy.	
14	48	40	49	49	49	40	49	SE.	Rain.	
15	43	72	46	82	37	48	50	S.	Fine.	
16	53	83	53	96	39	47	50	S.	Do.	
17	40	84	54	94	37	47	51	SE.	Do.	
18	41	84	54	103	36	47	51	SE.	Do.	
19	40	76	64	75	38	48	51	S.	Cloudy, a. m.; fine, p. m.	
20	39	80	50	91	36	47	51	SW.	Fine.	
21	46	88	57	105	42	47	51	SE.	Do.	
22	42	91	57	105	37	47	50	SE.	Do.	

TABLE II.—Table of salmon-eggs taken at the United States salmon-breeding station, Mo-Cloud River, California, during the season of 1878.

Date.	Number of eggs taken.	Total number of eggs taken.	Number of salmon spawned.	Total number of salmon spawned.
August 20	30,000	30,000	7	7
22	30,000	60,000	8	15
23	62,000	122,000	10	34
24	54,000	170,000	17	51
26	110,000	280,000	20	80
27	152,000	438,000	46	126
28	302,000	740,000	83	209
29	306,000	1,046,000	82	291
30	444,000	1,490,000	106	397
31	496,000	1,986,000	138	535
September 2	682,000	2,668,000	202	737
3	348,000	3,016,000	112	849
4	374,000	3,390,000	118	967
5	422,000	3,812,000	130	1,097
6	582,000	4,394,000	179	1,276
7	578,000	4,972,000	163	1,439
8	740,000	5,712,000	233	1,672
9	578,000	6,290,000	190	1,862
10	714,000	7,004,000	211	2,073
11	804,000	7,808,000	258	2,331
12	722,000	8,530,000	213	2,544
13	853,000	9,383,000	218	2,762
14	920,000	10,303,000	208	3,030
15	509,000	10,898,000	154	3,184
16	643,000	11,541,000	195	3,379
18	700,000	12,241,000	221	3,600
Total number of eggs taken			12,246,000	
Total number of salmon spawned				3,600

STONE—SALMON FISHING ON M'LOUD RIVER IN 1878. 767

TABLE III.—Table showing the weights of salmon spawned on various days at the United States salmon-breeding station, McCloud River, California, during the season of 1878.

[The salmon were weighed after the eggs had been taken from them.]

AUGUST 28, 1879.

Number.	Weight in pounds.	Number.	Weight in pounds.	Number.	Weight in pounds.	Number.	Weight in pounds.	Number.	Weight in pounds.	Number.	Weight in pounds.	Number.	Weight in pounds.
1	6	12	8	22	6	32	8	42	7	52	9	62	7
2	7	13	7	23	10	33	8	43	8	53	6	63	7
3	8	14	8	24	14	34	5	44	8	54	6	64	7
4	8	15	9	25	14	35	8	45	6	55	7	65	8
5	10	16	10	26	11	36	7	46	7	56	11	66	7
6	10	17	10	27	10	37	14	47	7	57	7	67	7
7	5	18	6	28	14	38	7	48	7	58	7	68	7
8	6	19	7	29	14	39	9	49	10	59	15	69	9
9	10	20	14	30	8	40	7	50	10	60	7	70	8
10	10	21	14	31	8	41	17	51	10	61	7	71	8
11	15												

81 fish weighed; average weight, 8½ pounds.

AUGUST 29, 1878.

1	10	12	15	23	7	33	7	43	5	53	9	63	8	73	7
2	8	13	7	24	7	34	17	44	5	54	6	64	5	74	7
3	10	14	8	25	8	35	13	45	7	55	6	65	6	75	7
4	9	15	6	26	15	36	8	46	7	56	8	66	8	76	7
5	14	16	8	27	9	37	7	47	8	57	8	67	7	77	6
6	12	17	7	28	8	38	0	48	7	58	7	68	7	78	11
7	6	18	7	29	7	39	14	49	7	59	7	69	5	79	5
8	7	19	7	30	11	40	5	50	6	60	7	70	5	80	7
9	8	20	8	31	14	41	7	51	6	61	10	71	6	81	8
10	7	21	7	32	14	42	17	52	8	62	6	72	7	82	5
11	8	22	17												

82 fish weighed; average weight, 8½ pounds.

AUGUST 30, 1879.

1	14	15	8	29	7	42	0	55	0	68	7	81	5	94	9
2	9	10	7	30	8	43	0	56	12	69	8	82	7	95	8
3	17	17	8	31	7	44	6	57	7	70	13	83	6	96	8
4	12	18	7	32	6	45	8	58	9	71	9	84	8	97	7
5	16	19	7	33	7	46	8	59	8	72	14	85	7	98	7
6	8	20	14	34	8	47	8	60	6	73	8	86	7	99	8
7	8	21	10	35	6	48	5	61	6	74	8	87	8	100	7
8	8	22	11	36	7	49	6	62	11	75	6	88	6	101	6
9	7	23	8	37	7	50	6	63	7	76	15	89	7	102	6
10	8	24	8	38	6	51	10	64	6	77	14	90	0	103	6
11	7	25	6	39	6	52	8	65	11	78	8	91	11	104	8
12	5	26	7	40	6	53	7	66	13	79	9	92	15	105	8
13	8	27	7	41	9	54	6	67	11	80	7	93	7	106	6
14	8	28	8												

106 fish weighed; average weight, 8 pounds.

AUGUST 31, 1878.

1	17	10	6	37	0	54	7	71	14	88	8	105	4	122	7
2	5	20	0	38	7	55	0	72	13	89	8	106	5	123	6
3	7	21	6	39	8	56	7	73	7	90	7	107	4	124	8
4	8	22	13	40	17	57	15	74	8	91	9	108	7	125	8
5	14	23	4	41	6	58	7	75	15	92	7	109	5	126	6
6	6	24	7	42	5	59	8	76	7	93	7	110	7	127	7
7	7	25	8	43	9	60	7	77	11	94	8	111	7	128	6
8	7	26	3	44	6	61	6	78	7	95	6	112	7	129	7
9	13	27	6	45	6	62	6	79	13	96	6	113	6	130	6
10	6	28	7	46	7	63	7	80	7	97	6	114	6	131	5
11	7	29	7	47	8	64	7	81	5	98	7	115	6	132	8
12	7	30	6	48	0	65	6	82	10	99	7	116	12	133	17
13	8	31	12	49	7	66	7	83	13	100	6	117	7	134	8
14	8	32	12	50	7	67	9	84	8	101	6	118	6	135	8
15	5	33	10	51	8	68	7	85	6	102	8	119	6	136	8
16	7	34	6	52	6	69	8	86	6	103	6	120	8	137	7
17	9	35	7	53	6	70	7	87	8	104	7	121	6	138	6
18	8	36	7												

188 fish weighed; average weight 7½ pounds.

768 REPORT OF COMMISSIONER OF FISH AND FISHERIES.

SEPTEMBER 9, 1878.

Number.	Weight in pounds.	Number.	Weight in pounds.	Number.	Weight in pounds.	Number.	Weight in pounds.	Number.	Weight in pounds.	Number.	Weight in pounds.	Number.	Weight in pounds.	Number.	Weight in pounds.
1	7	7	7	13	7	19	6	25	9	31	7	36	0	41	8
2	8	8	8	14	13	20	7	26	8	32	7	37	14	42	6
3	8	9	8	15	10	21	7	27	8	33	7	38	7	43	7
4	5	10	6	16	8	22	7	28	6	35	7	39	6	44	7
5	6	11	8	17	5	23	8	29	7	35	8	40	8	45	4
6	6	12	7	18	7	24	0	30	7						

45 fish weighed; average weight 74.

TABLE IV.—Table of distribution of salmon eggs from the United States salmon-breeding station, McCloud River, California, during the season of 1878.

State.	Commissioner or applicant.	Number asked.	Number forwarded.	Destination.
California.....	B. B. Redding.....	2,500,000	2,500,000	Sacramento River and tributaries.
Illinois.....	Dr. W. A. Pratt.....	100,000	100,000	Elgin.
Do.....	N. K. Fairbank.....	100,000	100,000	Chicago.
Do.....	Samuel Preston.....	200,000	200,000	Mount Carroll.
Iowa.....	B. F. Shaw.....	250,000	250,000	Anamosa.
Do.....	W. A. Mynster.....	50,000	50,000	Council Bluffs.
Kansas.....	B. F. Shaw.....	100,000	100,000	Cedar Rapids.
Maine.....	Lorenzo Bailey.....	15,000	15,000	Pembroke.
Maryland.....	T. B. Ferguson.....	1,000,000	1,000,000	Baltimore.
Massachusetts.....	A. H. Powers.....	100,000	100,000	Plymouth, N. H.
Do.....	E. A. Brackett.....	100,000	100,000	Winchester.
Michigan.....	Frank N. Clark.....	250,000	250,000	Northville.
Do.....	George H. Jerome.....	200,000	200,000	Niles.
Minnesota.....	Dr. R. O. Sweeney.....	1,000,000	1,000,000	Saint Paul.
Missouri.....	B. F. Shaw.....	200,000	200,000	Anamosa, Iowa.
Nebraska.....	J. G. Romaine.....	100,000	100,000	South Bend, Ill.
Nevada.....	H. G. Parker.....	250,000	250,000	Carson City.
New Hampshire.....	A. H. Powers.....	250,000	250,000	State hatching-house, Plymouth.
New Jersey.....	Mrs. J. H. Slack.....	300,000	300,000	Bloomsbury.
Do.....	West Jersey Game Protective Society.....	150,000	150,000	Mrs. J. M. Slack.
Do.....	Abram S. Hewitt.....	25,000	25,000	Do.
New York.....	Seth Green.....	100,000	100,000	Caledonia.
North Carolina.....	S. G. Worth.....	350,000	350,000	Honry's Station.
Ohio.....	Castalia Springs Association.....	50,000	50,000	Cleveland.
Pennsylvania.....	James Duffy.....	150,000	150,000	Marietta.
Do.....	Seth Weeks.....	100,000	100,000	Corry.
Rhode Island.....	C. F. Reed.....	20,000	20,000	Reedburg.
Utah.....	A. P. Rockwood.....	50,000	50,000	Salt Lake City.
Virginia.....	Prof. M. McDonald.....	300,000	300,000	Lynchburg.
West Virginia.....	C. S. White.....	500,000	500,000	Romney, W. Va.
Wisconsin.....	Wisconsin State hatching-house.....	100,000	100,000	Madison.
Do.....	A. E. Lytle.....	100,000	100,000	Geneva Lake.
Canada.....	Samuel Wilmot.....	500,000	500,000	New Castle.
England.....	Prof. S. F. Baird.....	100,000	100,000	England.
France.....	do.....	100,000	100,000	France.
Holland.....	do.....	100,000	100,000	Holland.
Germany.....	do.....	250,000	250,000	Germany.
New Zealand.....	Auckland Acclimatation Society.....	200,000	200,000	Auckland.
Total.....		10,310,000	10,310,000	

TABLE V.—*Catalogue of Natural History Collection made for the Smithsonian Institution in 1878, by Livingston Stone.*

- 475° to 500° are all from McCloud River, California.
- 475°. Trout. September, 1878.
- 478°. Trout. September, 1878.
- 479°. Salmon skin. September, 1878.
- 480°. Salmon skin. September, 1878.
- 481°. Trout. September, 1878.
- 482°. Trout. September, 1878.
- 483°. Salmon skin. September, 1878.
- 484°. Trout. September, 1878.
- 485°. Trout. September, 1878.
- 486°. Salmon skin. September, 1878.
- 487°. Salmon skin. September, 1878.
- 489°. Trout. September, 1878.
- 490°. Trout. September, 1878.
- 492°. Salmon skin. September, 1878.
- 493°. Trout. September, 1878.
- 494°. Salmon skin. September, 1878.
- 495°. Trout. September, 1878.
- 496°. Trout. September, 1878.
- 497°. Trout. September, 1878.
- 498°. Salmon skin. September, 1878.
- 499°. Trout. September, 1878.
- 500°. Rat. September, 1878.
570. Trout. McCloud River, California. July 1, 1878.
571. Trout. McCloud River, California. July 1, 1878.
572. Trout. McCloud River, California. July 3, 1878.
573. Trout. McCloud River, California. July 6, 1878.
574. Trout. McCloud River, California. June 30, 1878.
575. Trout. McCloud River, California. June 27, 1878.
576. Trout. McCloud River, California. June 30, 1878.
577. Trout. McCloud River, California. June 27, 1878.
578. Trout. Dolly Varden (Indian, Wye-dai-deek-it). McCloud River, California. July 6, 1878.
579. Salmon skin (female). McCloud River, California. July 14, 1878.
580. Trout. McCloud River, California. July 3, 1878.
581. Sacramento Pike. McCloud River, Cal. July 6, 1878.
582. Trout. McCloud River, California. July 14, 1878.
583. Trout. McCloud River, California. July 14, 1878.
584. Trout. Dolly Varden (Indian, Wye-dai-deek-it). McCloud River, California. July 14, 1878.
- 585 to 591. Salmon skins. (Males, 585, 586, 587, 588, 589, 590). McCloud River, Cal. July 15, 1878.
- 591 to 596. Salmon skins (females). McCloud River, California. July 15, 1878.

596. Trout. McCloud River, California. July 15, 1878.

597. Trout. McCloud River. July 15, 1878.

598. Trout. McCloud River, California. July 15, 1878.

599 to 604. Salmon skins (males). McCloud River, California. July 16, 1878.

604 to 611. Salmon skins (females). McCloud River, California. July 16, 1878.

Jar No. 1. Two Dolly Vardens. Clackamas River, Oregon. Winter 1877 and 1878.

Jar No. 2. Two Trout, one Dolly Varden. McCloud River, California. July, 1878.

Jar No. 3. Five Trout, one Dolly Varden, one Snake. McCloud River, California. July, 1878.

Jar No. 4. Birds. McCloud and Pitt Rivers, California.

611. Trout. McCloud River, California. August 17, 1878.

613 and 614. Trout. McCloud River, California. August 19, 1878.

615 and 616. Trout. Dolly Varden (Indian, Wye-dai-deek-it). McCloud River, California. August 15, 1878.

617. Trout. Dolly Varden. (Wye-dai-deek-it). McCloud River, California. September 1, 1878.

618, 619, 620, 621. Trout. McCloud River, Cal. August 23 and 26, 1878.

622, 623. Salmon heads (male). McCloud River, California. September 3, 1878.

624, 625. Salmon skins (females). McCloud River, California. September 3, 1878.

627, 628, 629, 630, 631, 632, 633, 634. Trout. McCloud River, California. August, 1878.