

# VI.—REPORT OF OPERATIONS DURING 1872 AT THE UNITED STATES SALMON-HATCHING ESTABLISHMENT ON THE M'CLOUD RIVER, AND ON THE CALIFORNIA SALMONIDÆ GENERALLY; WITH A LIST OF SPECIMENS COLLECTED.

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## A—INTRODUCTORY REMARKS.

### 1.—THE SALMON-HATCHING ESTABLISHMENT ON THE M'CLOUD RIVER.

SAN FRANCISCO, CALIFORNIA, *December 9, 1872.*

SIR: I beg leave to report as follows:

In pursuance of your instructions received in July last, to proceed without delay to the Pacific coast, and make arrangements for obtaining a supply of salmon eggs, I left Boston on the 1st day of August, for San Francisco, with this object. As I was directed in your subsequent letters to obtain, if possible, the eggs of the Sacramento River salmon, I set myself at work at once to ascertain the time and place of the spawning of these fish, but, singular as it seems, I could find no one in San Francisco who was able to say either where or when the salmon of the Sacramento spawned. Those best informed in regard to fishing matters, advised me to locate at Rio Vista, the chief salmon-fishing ground of the Sacramento. This seemed practicable at first, but, on examination, the water at Rio Vista was found to be wholly unsuitable, and this place was given up. Fortunately, a short time after, I was introduced, through the kindness of Hon. B. B. Redding, a member of the board of California commissioners of fisheries, to Mr. Montague, the chief engineer of the Pacific Railroad, who showed me the Pacific Railroad surveys of the upper waters of the Sacramento, and pointed out a place on the map, near the junction of the McCloud and Pit Rivers, where he assured me he had seen Indians spearing salmon in the fall on their spawning-beds. This point is one hundred and eighty-five miles north of Sacramento City. Following this clew, I proceeded to Red Bluff, the northernmost railway station of the California and Oregon Railroad, situated fifty miles from the McCloud River. From inquiries made here, I became so well convinced that the salmon were then spawning on the McCloud River, that as soon as supplies and men could be got ready I took the California and Oregon stage for Pit River ferry, two miles from the mouth of the McCloud. We arrived here at daylight on the 30th of August. Leaving the stage at this point we followed up the left bank of Pit River on foot, to the mouth of the McCloud, and continued thence up the McCloud River. At a distance of about two miles above the mouth of the river, we came upon several camps of Indians with hundreds of freshly caught salmon drying on the bushes. Salmon could also be seen in the river in such

numbers that we counted sixty in one spot, as we stood at the waters' edge. It was evident that this was the place to get the breeding fish, and the next thing was to find water to mature the eggs for shipment. This was not so easy a task as finding the salmon, but we at last discovered a spring stream, flowing a thousand gallons an hour, which I decided to use, this season at least, and on the morning of September 1, 1872, the hatching-works of the first salmon-breeding station of the United States were located on this stream. The location is about three miles up the McCloud River, on its left or western bank. It is one hundred and eighty-five miles from Sacramento City; three hundred and twenty-three miles from San Francisco via Pacific Railroad; four hundred and fifty-three miles from Portland, Oreg.; two hundred and seventy-two miles from Oakland, Oreg.; fifty miles from Red Bluff, Cal.; twenty-two miles from Redding, Cal. The point selected is on the California and Oregon stage-road, which, at the time of our arrival, connected with the railroad at Red Bluff. The railroad has now been continued to Redding, and it is thought that next year it will run within ten miles of the salmon-breeding station. The spawn found in the fish that the Indians were spearing on our arrival indicated that there was no time to spare in getting ready for the hatching-work. We were twenty-five miles from the nearest town or village, fifty miles from a railway station, over fifty miles from an available saw-mill, and in the Sierra Nevada Mountains, where the mule-teams barely made twenty miles a day with supplies; but we went to work, and in fifteen days we had a house built, filtering tanks, hatching apparatus, and flume in perfect running order, and on the 16th of September were catching and corralling the salmon. There were but three of us, and every day for a week the mercury ran from 105° to 112° F. in the shade. But although we worked so expeditiously through the broiling sun of those days, we were too late. The first few hauls of the net showed that the salmon had spawned. In fact, the salmon begin to spawn in the McCloud River some time in August, and are through spawning, or nearly through, by the 12th of September.

We caught plenty of salmon in the seine, but only rarely a female with ova. By hard fishing, and hauling the seine every night and sometimes all night, we succeeded in capturing twenty-six salmon, including both sexes, in spawning condition, by the 28th of September. On the night of the 28th, at midnight, as the returns did not seem to warrant the expense of handling the seine, I stopped fishing. Of the twenty-six breeding salmon caught, twelve were females and yielded about 50,000 eggs. Of this number 20,000 were destroyed by the terrible heat of the last of September; the mercury on some days reaching as high as 112° in the shade. The remaining 30,000 did well, in spite of many dangers from sediment, and from a fungoid growth which seemed to permeate the brook water on hot days, and which rendered constant vigilance necessary; and on the 12th day of October, the most advanced eggs showed the eye-spots. By Friday, October 18, all the

eggs were ready to pack for shipment, but owing to miscarriage of a letter the moss which was to be delivered on the previous Tuesday did not arrive until the evening of the following Tuesday. On the next day, October 23, the eggs were packed and shipped to Sacramento, where I placed them in charge of Wells, Fargo & Co., by whom they were forwarded East on the 25th of October, 1872.

## 2.—THE LOCATION OF THE SALMON-BREEDING STATION ON THE McCLOUD RIVER.

The location which has been selected for this station seems to be the best, all things considered, that could be found for obtaining and maturing for shipment the eggs of the Sacramento River salmon. Although I made a careful exploration of the whole course of the Sacramento River, I found no place which seemed to me to possess equal advantages. The mill-brook at Tehama came the nearest to it, but at Tehama the salmon spawn so late as to throw the transportation of the eggs into December, when there is danger of snow-blockades on the Pacific Railroad; the rainy season commences at Tehama while the eggs are maturing, and renders the brook liable to become roiled by the rains; there is a mill on the stream, the operations of which would interfere with the water-supply of the hatching-troughs; and the fact that Indians, Chinese, and whites congregate there in great numbers to kill the salmon, makes the neighborhood anything but favorable for the delicate work of maturing salmon-eggs.

On the other hand, at the McCloud, the spawning period is such as to place the transportation of the eggs at the best time, viz, in October or November; the eggs will be shipped before the rainy season sets in, and if it did rain, it would not disturb the water of the McCloud river, which it is proposed to use in future. There is no mill nor anything else on the McCloud River to interfere with the water-supply, and, lastly, this river is wholly free from the rough neighborhoods which are found on the outskirts of a town like Tehama. The Tehama brook has the one advantage of being half a day's travel nearer Sacramento, but I do not think this a sufficient offset to the other advantages of the present location.

## 3.—CHANGES PROPOSED FOR ANOTHER SEASON.

I would recommend that next year the house and all the hatching apparatus be moved down close to the edge of the high-water mark of the river, where the seine is hauled for catching the parent salmon, and that the water for hatching be taken from the river itself. This can all be done at a very inconsiderable expense, and the whole thing will then be very compact. The fishing-ground, the dwelling-house, the corral for the parent salmon, and the hatching-works will all be close together, and a vast deal of labor and risk arising from these departments being separated, as they

were this year, will thus be saved. Last fall, when the works were put up, I did not know enough about the McCloud River to risk the proposed arrangement of the works, but I am satisfied now that it is both safe and very desirable. By this arrangement other advantages are gained besides compactness and convenience, for water will be obtained in unlimited quantities, of an even temperature, not varying over five degrees for two months. The water is as clear as crystal, and is *never* roiled from any cause whatever so as to deposit dangerous sediment; and lastly, this cold water of the McCloud, with a temperature of 48° to 53° F., will not grow the insidious fungus which continually showed itself in the warm water of the hatching-works of this last season. With these changes nine-tenths of the trouble and dangers of the past season will be avoided, and I see no obstacles in the way of very large success in obtaining salmon-eggs at this station in the future.

#### 4.—WHY MORE SALMON-EGGS WERE NOT OBTAINED IN 1872.

The simple reason why more eggs were not obtained this season was because the salmon had spawned at the head-waters of the Sacramento before it was possible to get ready for the eggs. A subsequent effort might have been made at Tehama, but the lateness of the season, the uncertainty of the results, and the reduced condition of the appropriations, were sufficient to discourage it.

Although so small a return in the actual number of salmon obtained has been derived from the outlay attending this enterprise, the money can hardly be considered as unprofitably spent, for another and very adequate return is to be found in the actual preparations made for future operations and in the information and experience which have been obtained, and which, in the writer's opinion, are worth all they cost as a guide to future labors.

#### 5.—CONDITIONS OF HATCHING SALMON IN CALIFORNIA COMPARED WITH SIMILAR OPERATIONS AT THE EAST.

The conditions of hatching salmon-eggs in California are wholly different from those which present themselves in similar work at the East.

At the East you have to guard against cold; in California you have to guard against heat; at the East you can usually find a good spring in a favorable locality; here it is out of the question; at the East a brook will usually answer the purposes of hatching-water in the absence of a spring; in California the brooks, as a rule, are wholly unsuitable for hatching; at the East the eggs are hatching in the winter; in California the salmon spawn in the summer; and, finally, most of the hatching work is done in California before the Atlantic fish begin to spawn.

#### 6.—CATCHING THE SALMON IN THE MCLOUD.

I tried three ways of capturing the parent salmon; first, by the Indian trap; second, by a stake-net and pound; third, by a sweep-seine.

The Indian trap consists of a fence of stakes or bushes, built out into the river, at a fall or rapid, in the form of a letter V, having the angle down stream, and a basket-trap at the angle. This method proved perfectly worthless, as of course it must, for catching healthy fish, as this contrivance catches only the exhausted fish that are going down the river, and none of the good fish that are coming up.

The second method of using a stake-net did not work on account of the volume and force of the river-current. I set the stake-net so as to just reverse the form of the Indian trap, that is, so that it formed a letter V with the angle *up stream*, and a trap or pound in the angle. As it happened, it was too late for such a net to be effective, because the salmon were all going down at that time, and none, or at most a very few, were coming up; but even if the salmon had been coming up, this contrivance would not have answered here as a permanency, because the velocity and volume of water in the McCloud are such as would ultimately tear any such net away, in any place where it could otherwise be set to advantage.

The third method, of sweeping with a seine, worked to perfection. In some of the holes, and especially in one large hole near which it is proposed to place the hatching-works next year, any number of parent salmon can be caught in the proper season. The only objection to hauling a seine in these places is, that as the boat taking out the seine turns to come ashore again, it is drawn near the brink of the rapids, over which it would be dangerous to go in the night. This is an objection, however, which skill and nerve can always overcome.

#### 7.—TAKING THE EGGS.

When we fished where the corral or inclosure for the breeding salmon was situated, the salmon were taken carefully from the net as soon as it was hauled ashore, and placed in the corral, and kept there till the last haul was made, just before daylight. The eggs were then taken from the fish and impregnated, so that by the time the last haul was finished, and the net hung up to dry, the eggs were ready to be washed and placed in the hatching-troughs. This was all very simple, but when we hauled the seine at other points, where there was no place to confine the salmon, it was quite different. At these places, as soon as a spawning-fish was hauled to the shore, I took and impregnated the eggs at once, on the beach where we were, and kept the eggs in pails of water during the night, till we had got through seining. It took four men to strip a fish on these occasions; one to hold the head, one to hold the tail of the fish, and a third to take the eggs, while a fourth held a pitch-pine torch for light. On the darkest nights the scene on the river bank was exceedingly wild and picturesque. Behind us was the tall, deep shadow of Persephone Mountain, and before us at our feet ran the gleaming, rapid current of the McCloud, while the camp-fire threw an unsteady light upon the forest, mountain, and river, suddenly cut off by the dense

darkness beyond. The flaming pitch-pine torches, stuck into the sandy beach at intervals of 20 feet, to guide the boatman, the dusky forms of a half-dozen Indians coiled around the fire, or stoically watching the fishing, the net, the fishing-boat, and the struggling fish, added to the effect, and made a picture which, especially when the woods were set on fire to attract the salmon, was one of surpassing interest. It was quite impressive, in the midst of these surroundings, to reflect that we were beyond the white man's boundary, in the home of the Indians, where the bear, the panther, the deer, and the Indian had lived for centuries undisturbed.

The eggs were all taken in a dry pan, according to the new or Russian method of impregnation, and the milt of the male added immediately. Contrary to rule, I took a half a panful at a time instead of one layer, and stirred the eggs up with my hand, as you would stir up a pan of flour. After they were well mixed and had stood a minute or two, I filled up the pan with water, gave them another stirring, and left them from half an hour to an hour, at the end of which time I washed them, and poured them into a pail of water, to be taken to the hatching-troughs. When the eye-spots appeared, three weeks afterward, almost *every* egg was seen to have a fish in it, which proves two things: one is, that the dry method will impregnate almost, if not wholly, a hundred per cent. of the eggs; and the other is, that the old precaution, not to take over one layer of eggs in the pan at a time, is wholly needless. In fact, I believe I could take a ten-quart water-bucket half full of salmon-eggs at a time, without losing any more than by the one-layer method.

I found that the Sacramento River salmon (*i. e.*, the McCloud River salmon) yield their eggs much more readily than the Eastern salmon. It is not half the work to strip the fish, and they are in general more easily handled than the salmon of the Atlantic rivers.

#### 8.—THE EGGS OF THE SACRAMENTO RIVER SALMON.

The eggs of the salmon of the Sacramento are larger and have a more reddish tinge than those of the Atlantic salmon. There are less eggs to the same weight of fish than with the eastern salmon, seven hundred eggs to each pound of the parent fish being a large average. We cannot yet tell how the period of incubation of these eggs compares with those of the Atlantic rivers, as it was impossible, with the varying temperature of the hatching-brook, to get at the exact average temperature of the water. I may say, however, that the eggs first showed the eye-spots in nineteen days, and that they hatched in forty-two days, and the *estimated* average temperature of the water was 58°–60° F.

#### 9.—THE HATCHING-APPARATUS.

Our hatching-apparatus was all that could be wished. It consisted of twenty-four troughs of sugar-pine, 16 feet long, 12 inches wide, and 4½ inches deep, the inside surface of which was converted to a coal by

charring. These troughs furnished almost 400 square feet of hatching space. There were three sets or tiers of troughs, one set below the other, with eight troughs arranged parallel to each other in each tier. There was a fall of three inches from one tier to another. The troughs were covered.

The filtering arrangement was quite perfect. It consisted of what the miners call a sand-box, which is merely an empty box to catch the heaviest of the sediment, and of two filtering-tanks proper. The water, after leaving the sand-box, passed through ten filters of sand and gravel and eight common filters of flannel.

All this provision for cleansing the water did not, however, prevent a fine fungoid growth from coming down with the water on to the eggs, which, when it was first discovered, had got such a start that its results must have been very disastrous had it not been for the ingenuity of my first assistant, Mr. John G. Woodbury, of San Francisco. Mr. Woodbury, on having his attention called to the condition of the eggs, suggested the very bold course of washing off the fungus with sand and water. The plan adopted was to put a few hundred eggs in a pail partly full of water, and having a handful of fine river-sand at the bottom. Upon holding this pail of eggs and sand under a stream of water, the whirling sand was brought into contact with the whirling eggs so constantly and rapidly, and yet so gently, that in a few minutes the fungus was entirely cleansed from the eggs, while the eggs were not injured in the least.

It would be a long and tedious job to go through this operation with many hundred thousand eggs, but with the few thousands which we had then laid down this ingenious contrivance answered its purpose admirably. It is proper to say that this plan was not tried till the spinal column of the fish had appeared; otherwise, even the gentle contact of the sand and water would probably have injured the less-matured embryo.

#### 10.—PACKING AND SHIPPING THE EGGS.

The only moss that I could find or hear of was nearly seventy miles to the north, at the sources of the Sacramento, and the best of this moss grew just where one of the tributaries of the Sacramento bursts from the earth, at the base of Shasta Butte. This was the moss which I used for packing, and it was admirable. I packed the eggs in two common wooden boxes, holding about a cubic foot each. A soft but dense layer of moss, just as it grows, was first placed at the bottom of the box. A layer of eggs was then spread over the moss carpet, then a thin layer of moss, and so on, alternating to the top, as is the usual manner of packing ova, except that half way up the box a thin wooden rack or partition was put in to break the pressure of the upper layers. These two boxes being filled, and the covers being fastened on with screws, to avoid the concussion of driving nails, a dozen or twenty holes were bored in them to admit the air, and they were packed in an open wooden crate large enough to admit a layer of hay and straw four inches through

on all sides. This open space was filled with hay to weaken the force of concussions and to equalize the temperature inside. The cover of the crate was then put on, and I took them twenty-two miles down the stage-road to Redding, and thence one hundred and seventy miles by rail to Sacramento City, where, after unpacking the boxes and moistening the moss very thoroughly with cold water, I repacked the boxes in the crate, and shipped them East, in care of Wells, Fargo & Co., by way of the Pacific Railroad.

I packed two tin boxes of eggs, also, and inclosed them in pails of sawdust, with the expectation of hanging up the pails in the car, and so avoid in some degree the jolting of the trains; but on examining the car, and considering the number of changes of car between here and the Atlantic, I concluded that it was more dangerous to hang them up than to have them rest on the floor of the car. Accordingly, all the packages of eggs were carried like any other merchandise, on the floor of the express-car.

Permit me to add that, during the fall, I traveled the whole length of the Sacramento River, from its sources around Mount Shasta to its outlet at the bay of San Francisco, and also ascended the McCloud River as far as it is accessible, which is about twenty miles, and collected quite a complete series of specimens of the *Salmonidæ* of the Sacramento and McCloud Rivers, a catalogue of which I transmit herewith. The specimens and accompanying drawings have been forwarded to you, at the Smithsonian Institution.

## B—THE SALMONIDÆ OF THE SACRAMENTO RIVER.

### 11.—THE SACRAMENTO RIVER.

In order to make what follows more clear, permit me to describe briefly the course of the Sacramento River.

The Sacramento River proper has its sources in Mount Shasta, and in the Siskiyou Mountains to the west of Mount Shasta, about four hundred miles by the river channel from its outlet into the ocean at San Francisco. A few miles below Mount Shasta, on Shasta Butte, as it is called in California, the smaller sources form a clear, rocky, and swift-running stream, about a hundred or a hundred and fifty feet across, and so deep that it can just be waded with high rubber boots at its shallowest parts. Its temperature is here very low, and probably does not average over 50° F. the year round. From this point, for nearly eighty miles, it falls at the rate of thirty-seven feet to the mile, running nearly due south, and retains its character of a clear and cold stream all the way. Down to this point it is known as the "Little Sacramento," and receives the waters of many small streams, but no large ones till it reaches its junction with Pitt River. At this stage of its course it has swollen to three times its original volume, and with the addition of the contents of Pitt River makes a stream six times the bulk



which it possessed just below Mount Shasta. It is still a clear river; but soon after passing this point it becomes roily, and continues to grow more and more so to its mouth. Above the mouth of Pit River it flows through a deep cañon, with high hills or mountains on both banks; but a short distance below the mouth of Pit River it enters a more level country, and from thence to the bay of San Francisco it moves slowly, widening every league, through a level country with broad sweeps of prairie on either side, now famous all over the world as the wonderfully productive region of the Sacramento Valley.

About a hundred and fifty miles below the mouth of Pit River it receives the muddy waters of the Feather River, and twenty miles farther down, at Sacramento City, the still muddier waters of the American Fork. From here to San Francisco the Sacramento River is navigable for large vessels and steamers; but receives no other extensive tributaries except the San Joaquin, which empties into it at Rio Vista, forty miles below Sacramento.

It will be seen by the above description that the Sacramento River has but four large tributaries, the San Joaquin, the American Fork, the Feather River, and Pit River. With the San Joaquin we have nothing to do in this report, as it may be regarded as almost an independent river, and has not come within the scope of the present investigation. I will only say in regard to this river that it is much warmer than the Sacramento, but is frequented somewhat by salmon, especially in the fall, which are killed in considerable quantities on some of its tributaries.

The American Fork was formerly a prolific salmon river, but the mining operations on its banks have rendered it so muddy that the salmon have abandoned it altogether, and none ascend it now. Precisely the same thing is to be said of Feather River. The salmon come up in some numbers to spawn in the smaller streams between the American and Pit Rivers, but the returns from these spawning-grounds are probably small. The salmon come up Pit River in great numbers in the spring, but I am informed that they all leave Pit River for the colder waters of the McCloud River in the latter part of June or the first part of July. It is probable that they ascend the upper waters of the Pit River also to a limited extent at this time, but I could obtain no positive information on this point. Above the mouth of Pit River the salmon ascend the Sacramento, now called the Little Sacramento, in great numbers, and make the clear waters of this stream the principal spawning-ground of the salmon of the Great Sacramento River, with one exception. This exception is the McCloud River.

## 12.—THE M'CLOUD RIVER.

This river, which is the great spawning rendezvous of the Sacramento salmon, deserves special notice both on this account, and because it is on this river that the United States salmon-breeding station has been located. The McCloud River heads in Mount Shasta and in the southern

slopes of the mountains, stretching away from Shasta Butte easterly and southeasterly toward the sources of Pit River. Its principal source is an immense spring, which bursts out from the southeastern flank of Mount Shasta, and at once forms a river from its own supply. This spring is fed by the melting snows of Shasta, and accounts for the unusual coldness and clearness of the McCloud River. The McCloud receives, near its source, a tributary about fifteen miles in length, coming from the northeast, but there are no other considerable streams emptying into it below, and it is said to have this peculiarity, that it is almost as large near its source as it is at its mouth. Through all its course it flows rapidly through a deep rocky cañon of the wildest scenery. The rocks and mountains rise up abruptly from its banks, in many places to the height of several thousand feet, and for ten or twenty miles near the middle of the river's course are inaccessible. On this account the river has never been surveyed throughout its whole course, and the river channel, as laid down on the maps, is wholly conjectural, for a considerable extent.

The McCloud River, near its mouth, where the salmon-breeding works are placed, averages about 60 yards in width, although in places it flows through gulches not over 30 feet wide, and in other places spreads out to a width of nearly a hundred yards. The temperature of the water is here, in September,  $48^{\circ}$ – $49^{\circ}$  at sunrise, and  $53^{\circ}$ – $54^{\circ}$  at sunset. It is singularly uniform in its temperature, and does not vary two degrees from these figures throughout October and November. The bed of the river is here rocky, gravelly and sandy, as it is throughout its whole course. The water is as clear as crystal and always rapid. The river begins to rise in December, and swells to a maximum height of 15 feet above the midsummer level. It is another peculiarity of this river, (and it can hardly be said of any other river in California,) that it has been abandoned to the Indians. The miner's pick and shovel have upturned the banks of other rivers, or the farms of white men have stretched along their waters, but, for some reason or other, the civilized races have very singularly left the McCloud River to its aboriginal inhabitants. The consequence is, that the McCloud River presents an instance of what is becoming extremely rare, at least in the more accessible portions of the country, namely, a region which is just as it was before the white man found it, and a race of aborigines, whose simple habits have not been corrupted by the aggressive influence of communication with the whites.

### 13.—THE M'CLOUD RIVER INDIANS.

The Indians themselves are a good-featured, hardy, but indolent race. I found them always pleasant, genial, and sociable, though, like other Indians, very sensitive when their pride was wounded. They at first adopted the plan of ordering all white men out of their country, and were the last of the California Indians to yield to the encroachments of civilization. Even now they are not slow to say to the white stranger, "These

are my lands," and "These are my salmon;" but the stern consequences of conflict with the whites have taught them to abstain from any violent vindication of their rights. They will still always revenge a wrong inflicted on them by their own people, and deem it a duty to avenge a murder of one of their kindred, but I think they are a well-disposed race by nature, and have no malice naturally in their hearts toward any one, and will not injure any one who does not first injure them. Every one told me, before my arrival and during my stay on the McCloud, that the Indians would steal everything that they could lay their hands on. I am glad that this opportunity is afforded me of bearing testimony to the contrary, which I wish to do very emphatically. I would trust the McCloud Indians with anything. We used to leave our things every day around the house, and even down on the river-bank, for weeks together, where the Indians could have stolen them with perfect safety, and where they would not have remained ten minutes in a *white man's settlement*, and yet I do not know of a single instance of theft of the smallest thing on their part, during all our stay of two months among them. On the contrary, in one instance, an Indian traveled six miles one hot day to return me a watch-guard, which he found in the pocket of a garment which I sold him, and which he might have kept with perfect impunity. And on another occasion, on the arrival of some gold coin, when I had reason to expect an attack from *white men*, I gave the gold to one of my Indians, and told him that I depended on him to protect that and me till morning. I slept soundly; and the next morning the faithful Indian handed me the gold just as I gave it to him. I wish on these accounts to be very emphatic in saying that the charges against these Indians of being a race of thieves, are untrue and unjust.

With all their good traits, however, murder did not seem to have the obnoxious character that it has among more enlightened people. Almost every McCloud Indian we met had killed one or more men, white or red, in the course of his life, but it was usually because they were goaded to it by ungovernable jealousy or revenge. It was not from motives of gain or causeless malice.

The McCloud Indians live and sleep in the open air in the summer. In the rainy season they build wigwams or huts of drift-wood and dry logs, which they inhabit pretty comfortably through the winter. In the summer and fall they live mainly on the salmon and trout which they spear. In the winter they live on the salmon which they catch and dry in the fall, and on acorns, which they gather in great quantities in the woods. They hunt with bows and arrows, with which they occasionally kill a bear, though a few of the more enterprising have rifles. They trap a very little, but the salmon of the river are so abundant that they are not obliged to resort to hunting and trapping at all, and do not do much of either.

I have made this long digression about the McCloud River Indians partly because their presence here is so singularly connected with the

abundance of the salmon in the Sacramento River. Had white men come here, and required the salmon for food, this main artery of the supply system of the river would have been stopped; or had white men come and engaged in mining, as they have done on the Yuba and on the Feather and American Rivers, the spawning-beds would have been covered with mud and ruined, as in those rivers, and in less than three years the salmon supply of the Sacramento would have shown a vast decrease. The presence of the Indians, therefore, as far as it implies the absence of the whites, is the great protection of the supply of the Sacramento salmon.

#### 14.—THE CLIMATE OF THE M'CLOUD RIVER.

The rains come on a little earlier here among the mountains than lower down in the valleys, and continue a little later in the spring. It is wet, therefore, from November to May, and dry from May to November. The winters are mild, a very little snow falling occasionally with the rains. The summer and fall days are extremely hot, but the nights are cool, and in the fall are very cold compared with the days. In consequence of this the variations of temperature in the fall during the twenty-four hours are extreme. For many days together in September the mercury ranged from 55° Fabr. at sunrise to 105° in the shade at 11 a. m., making a variation of 50° in five hours. On some days the variation was 60°, and on one occasion nearly 70° in the same length of time. I have seen ice formed in our fishing-boat at night within ninety-six hours of a noon temperature of 110°. The hot days continue till November, and even extend into November. There were many successive days in October when it was over 100° in the shade. The hot hours of the day were usually from 11 a. m. till 4 p. m. From 8 a. m. to 11 a. m. the rise of temperature was very rapid, and from 4 p. m. to 7 p. m. the fall was equally rapid.

I have been speaking of the climate of the McCloud at our salmon station, near its mouth. As you ascend the McCloud the weather grows cooler, the rains last longer, and at its headwaters, in winter, there are deep snows.

#### 15.—THE SACRAMENTO SALMON IN GENERAL.

The Sacramento salmon in its prime is a large, handsome, silvery fish, averaging about 20 pounds in weight, as they are caught at Rio Vista, the main fishing ground of the river.\* These salmon have a darker shade and deeper bodies, and are less delicate in form, and slightly coarser in appearance than the Atlantic salmon. They are also heavier looking, less silvery, and probably less vigorous than the eastern salmon.

It is so difficult to determine whether they differ from the eastern salmon in quality, as food, that it is quite safe to say that if they are not

\* Salmon weighing from 40 to 50 pounds are not uncommon; and once in a great while one is caught exceeding 50 pounds in weight.

fully equal to their eastern kindred, as a table luxury, they are so near it, that the difference, if any, is not an important one. Their flesh in their prime is firm, sweet, rich, and juicy, and is certainly good enough to make them a desirable fish in any river in the world. (See question 79, p. 195.) As a game-fish they are active and powerful fighters, and are only conquered after a hard struggle. They are caught with a hook and line in salt and brackish waters, and also in the fresh waters of the upper tributaries. Salmon roe is the best bait in fresh water; but they will also take the artificial fly. Last July hundreds of salmon, averaging 15 pounds apiece, were caught in the Little Sacramento with a hook and line, near Frye's Hotel, at Upper Soda Springs, in Siskiyou County, California. It is not an uncommon but a common thing to catch salmon here with bait, which settles the question beyond dispute as to the Sacramento salmon biting at a hook in fresh water.

The Sacramento salmon, like all other salmon, fall off in size, weight, quality, and beauty from the time they enter fresh water. A week or two before they spawn they become very black, then smooth and slimy, their scales being absorbed into the skin. Soon after this they become foul, diseased, and very much emaciated, and in the McCloud River, at least, they die a short time after spawning.

#### 16.—GENERAL MOVEMENTS OF THE SACRAMENTO SALMON IN THE LOWER PARTS OF THE RIVER.\*

The prime salmon first make their appearance in the tide-water of the Sacramento, the early part of November. They are then very scarce, only three or four a day being at first caught at the great fisheries. They are at this time 18 cents a pound at wholesale, and 25 cents a pound at retail. They increase gradually in numbers, through November and December, and the retail price falls to 20 cents. By the middle of January they are somewhat more abundant in the bay, but few continue to be caught up the river. They remain scarce, or, rather, not abundant—more all the time being caught in the bay than up the river—until the 1st of March, when they begin to pour up the river in vast quantities. This flood of salmon lasts through March, April, and May, making these months the harvest months of the river fishermen,† both because the salmon are plentiful and because they are in good condition. The run culminates the last of April, or first of May. They are then the most abundant. They fall off from this time gradually in numbers and condition through May, and become comparatively scarce in June and July, and the first part of August. Before the end of August a

\* It should be understood that the account given here and elsewhere in this report of the salmon of the main Sacramento river applies only to the salmon *above tide-water*.

† Eleven thousand three hundred and ninety-four salmon were sent down the river to San Francisco last March (1872) by one line of river-boats. It is estimated that five thousand more were salted on the river. This makes a yield of sixteen thousand three hundred and ninety-four fish, or about three hundred thousand pounds, in the month of March, making no allowance for other sources of outlet, which were considerable.

new run commences, and, to quote the fishermen's words, "the river is full of them." The quality of this fish is very poor compared with the winter and spring runs, which circumstance, connected with their great abundance, makes them a drug in the market at this time. They can now be bought at 3 cents a pound, and even for less, as tons of them are thrown back into the river for want of purchasers. This abundance continues through September, the quality of the fish remaining very poor. In October the numbers fall off again and continue to lessen, till the new winter run begins again in November.

The following table, according to months, shows the condition of the Sacramento River, in regard to the salmon, at Sacramento:

| Month.         | Numbers.                             | Quality.      |
|----------------|--------------------------------------|---------------|
| January.....   | Increasing, but not abundant.....    | Prime.        |
| February.....  | Increasing, but not abundant.....    | Prime.        |
| March.....     | Very abundant.....                   | Prime.        |
| April.....     | Very abundant.....                   | Nearly prime. |
| May.....       | Falling off, but still abundant..... | Nearly prime. |
| June.....      | Somewhat scarce.....                 | Inferior.     |
| July.....      | Somewhat scarce.....                 | Inferior.     |
| August.....    | Very abundant indeed.....            | Very poor.    |
| September..... | Abundant.....                        | Very poor.    |
| October.....   | Falling off. New run begins.....     | Very poor.    |
| November.....  | Very scarce.....                     | Very fine.    |
| December*..... | Scarce.....                          | Very fine.    |

#### 17.—GENERAL MOVEMENTS, ETC., OF THE SACRAMENTO SALMON IN THE M'CLOUD RIVER.

It will be seen by the previous notes that there are salmon in the Lower Sacramento every month in the year. It is not so in the upper tributaries of the river, as for instance, in the Little Sacramento, or in the McCloud. The salmon have stated times for arriving in the upper tributaries and for remaining in them, and at other periods of the year there are no salmon in these streams.

The salmon arrive in the mouth of the McCloud in March, but are scarce in that month. In April and May they become plentiful but are not large, the average weight not exceeding ten or twelve pounds. They remain plentiful through June and July, during the latter part of which months they receive an accession from Pit River, the lower part of which river now becomes nearly deserted by the salmon. In August, there is a large run of salmon up the McCloud, composed of larger fish. The salmon are now, in August, the largest and most abundant of any time in the year in the McCloud. They begin to spawn in the lower portions of the McCloud during the last half of August. By the middle of September the salmon begin here to die, and from this till the end of the month they die very rapidly, and there are thousands of dead salmon floating down the stream and being washed up to the banks. The bears

\* In December, January, and February, the salmon are more abundant in the lower parts of the river than further up.

now come down to the river in great numbers to eat the salmon, and the Indians stop spearing and go bear-hunting. About this time—the latter half of September—a new run of salmon makes its appearance in the McCloud, called the “fall run.” They were not by any means plentiful this year, (1872,) but kept the river from being actually deserted by salmon for a month or more. During October there are no salmon in the McCloud, except the few new-comers of the “fall run,” and by the 1st of November all the salmon are gone from the river except one or two individual stragglers here and there. By this time the Indians have all their salmon dried and packed away for winter. Some of the Indians have moved back into the woods, while those that remain on the river have built little wigwams of drift wood, to protect them from the winter rains, and have gone into winter quarters. From November till March there are no salmon in the McCloud River.

All I could learn about the young salmon in the river was that in May the young fry, about two inches long, are very abundant. Soon after this they wholly disappear, and their destination is unknown. During my stay on the McCloud through August, September, and October, I saw no small fish which I recognized as young salmon, nor could I learn from any source where the young salmon were. Their whereabouts at this season still remains a mystery.

#### 18.—CONDITION OF THE SALMON DURING THEIR STAY IN THE M'CLOUD RIVER.

In March, when the salmon first arrive in the McCloud, they are in fine condition. They are now bright and silvery, with shining scales. They are fat and excellent for the table, but not large. The spawn in the females is very small. Their flesh is of a deep-red color. The males and females are almost indistinguishable at this time. This state of things remains till August, except that the salmon gradually deteriorate in quality, and the eggs increase in size. The first marked change in the fish takes place a little before the middle of August. The salmon then become very black. The males grow deep and thin, and the dog-teeth begin to show themselves, and to increase rapidly in size. The females are now big with spawn, and the sexes are easily distinguishable. From this time they rapidly deteriorate. Their flesh shades off to a light, dirty pink. They become foul and diseased, and very much emaciated. Their scales are wholly absorbed into the skin, which is of a dark olive hue, or black. Blotches of fungus appear on their heads and bodies, and in various places are long, white patches where the skin is partly worn off. Their fins and tails become badly mutilated, and in a short time they die exhausted. By the 1st of October most of the fish that were in the river in August are dead. The height of the spawning-season in 1872 was about the 8th of September. The salmon had begun to spawn when I arrived on the McCloud, the 30th of August. By the middle of September nearly all the salmon had spawned, except the “fall run.”

*Table showing the movements, condition, etc., of the Sacramento salmon in the McCloud river in each month of the year :*

| Months.        | Numbers.                         | Quality.                        | Remarks.  |
|----------------|----------------------------------|---------------------------------|---|
| January .....  | None .....                       | .....                           | Trout now spawning.   |
| February ..... | None .....                       | .....                           | River very high.  |
| March .....    | Very few .....                   | Prime .....                     | Do.   |
| April .....    | Abundant .....                   | Prime .....                     | Trout have scarlet bands.                                       |
| May .....      | Abundant .....                   | Falling off slightly..          | Young salmon fry abundant.                                      |
| June .....     | Abundant .....                   | Falling off slightly..          | First appearance of salmon at head-waters of Little Sacramento. |
| July .....     | Abundant .....                   | Considerably deteriorated.      | Begin to spawn at head-waters.                                  |
| August .....   | Very abundant .....              | Large fish, but black and poor. | Begin to spawn on lower McCloud.                                |
| September..    | Very abundant but dying rapidly. | Foul, emaciated, and mutilated. | Gone from head-waters.  |
| October ....   | All dead except fall run.        | Fall run, considered not bad.   | Trout will not bite on McCloud.                                 |
| November ..    | None but one or two stragglers.  | .....                           | First rains.  |
| December ..    | None .....                       | .....                           | Trout ascend small streams in great numbers.                    |

*Table showing the condition of the ova of the salmon at the head-waters of the Little Sacramento, (Mount Shasta;) at the Lower McCloud; at Tehama; at Rio Vista and Sacramento City, and at Eel River, Humboldt County, California.*

| Months.      | CONDITION OF OVA AT—  |                                 |                       |                                |            |
|--------------|-----------------------|---------------------------------|-----------------------|--------------------------------|------------|
|              | Mount Shasta.         | McCloud.                        | Tehama.               | Sacramento City and Rio Vista. | Eel River. |
| January ..   | No salmon.....        | No salmon.....                  | No salmon..           | Very small.....                | Ripe.....  |
| February ..  | No salmon.....        | No salmon.....                  | No salmon..           | Very small.....                | .....      |
| March .....  | No salmon.....        | Small .....                     | No salmon..           | Very small.....                | .....      |
| April .....  | No salmon.....        | Small .....                     | .....                 | Larger.....                    | .....      |
| May .....    | No salmon.....        | Larger.....                     | .....                 | Larger.....                    | .....      |
| June .....   | Quite large.....      | Larger.....                     | .....                 | Larger.....                    | .....      |
| July .....   | Ripe.....             | Well developed.                 | .....                 | Quite advanced.                | .....      |
| August ..... | Ripe.....             | Ripe.....                       | .....                 | Very large .....               | .....      |
| September .. | Spawning season over. | Ripe.....                       | .....                 | Very large .....               | .....      |
| October....  | Spawning season over. | Spawning finished. Salmon dead. | Ripe.....             | Very large .....               | .....      |
| November..   | Spawning season over. | Spawning finished. Salmon dead. | Ripe.....             | Very small.....                | .....      |
| December..   | Spawning season over. | Spawning finished. Salmon dead. | Spawning season over. | Very small.....                | Ripe.....  |



19.—ANSWERS TO QUERIES CONCERNING THE SACRAMENTO SALMON, GIVEN IN THE ORDER OF PROFESSOR BAIRD'S PRINTED LIST OF QUESTIONS ENTITLED "QUESTIONS RELATIVE TO THE FOOD-FISHES OF THE UNITED STATES.

(The capital letters indicate the topics; the figures refer to the questions.)

A.—NAME.

Question 1. What is the name by which this fish is known in your neighborhood? If possible, make an outline sketch for better identification.

Answer. The salmon of the Sacramento River which are caught at or below Sacramento City are known by the name of the Sacramento salmon. The salmon which are caught above Sacramento City take the name of the stream or the locality at which they are caught, as, for instance, the salmon caught in the mill-brook near Tehama are called Tehama salmon. So with the McCloud salmon and Pit River salmon, although all these fish are the proper Sacramento salmon. The grilse is very often called the *salmon-trout*, which confusion of names is likely at first to mislead a new-comer. In every instance which came under my observation on the tributaries of the Sacramento I found that *salmon-trout* invariably meant only a salmon grilse, with the single exception of the *wye-dar-deekit*. (See No. 27 and No. 68 of the catalogue of specimens.)

The spawning male salmon of the tributaries is called the *dog-salmon* or *dog-toothed salmon*, and is supposed by the uninformed to be a different fish from the Sacramento salmon, though it is the same in a different stage.

The Indian names for the McCloud salmon in their different stages are as follows:

Salmon.....Nóo-oolh.  
Male salmon.....Charrk.  
Female salmon.....Kó-raish.  
Grilse.....Kó-ríñleh.  
Black salmon.....Choo-lóo-loo nóo-oolh.  
White (emaciated) salmon.....Aée-teppem.

Late "Fall salmon".....Eée-par-téppem.  
McCloud salmon.....Winni-mámé nóo-oolh.  
Young salmon fry...Kóo-ootét nóo-oolh.  
Salmon eggs.....Poo-oop.  
Salmon skin.....Nóo-oolh irritcha.  
Dead salmon.....Min-nal nóo-oolh.

(For outline sketch of salmon see drawings accompanying the Smithsonian specimens.)

B.—DISTRIBUTION.

Question 2. Is it found throughout the year, or only during a certain time; and for what time?

Answer. Salmon are found in the Sacramento River, at and below Sacramento City, at all times of the year. They are found in the McCloud River from March to November. (See tables, pp. 181 and 183.)

Question 3. If resident, is it more abundant at certain times of the year; and at what times?

Answer. Salmon are most abundant in the Lower Sacramento in March, April, May and August. In the McCloud, they are most abundant in August.

#### C.—ABUNDANCE.

Question 4. How abundant is it, compared with other fish?

Answer. Salmon in the Sacramento are much more abundant than any other fish.

Question 5. Has the abundance of the fish diminished or increased within the last ten years, or is it about the same?

Answer. The fishermen say that the salmon in the river are as plentiful as ever they were, (although I see that the California fish commissioners report differently,) and that if anything they have been more abundant the last three years. The year 1866 was an exceptional year. The salmon were then very scarce, the river being almost destitute of them. The fishermen attributed it to the unusually muddy water of the river, caused by the mining that year. Some thought that there was a falling off in 1864 and 1865, but they are not all agreed on this point. In 1867, the salmon were as abundant as ever in the Sacramento River, and have remained so since.

It should be stated here that the salmon which used to abound in the Feather and American Rivers have been wholly driven out by the mining, without, however, appearing to affect the abundance of the salmon in the main river.

Question 6. If diminished or increased, what is the supposed cause?

Answer. See question 5.

Question 7. What is the amount, or extent, of the change in abundance?

Answer. See question 5.

#### D.—SIZE.

Question 8. What is the greatest size to which it attains, (both length and weight,) and what the average?

Answer. The greatest size to which the Sacramento salmon attain is from 50 to 60 pounds. Mr. S. R. Jones, of Sacramento City, has seen one caught at that point that weighed 51 pounds. He says he has heard of one, at San Francisco, weighing 60 pounds. Salmon weighing between 40 and 50 pounds are not uncommon. The average weight seems to be about 20 pounds for spring-salmon, and 23 pounds for summer-salmon. The longest salmon that I saw, measured 38 inches. This length is probably seldom exceeded much. I should judge the average length of the salmon to be about 30 or 32 inches.

Question 9. State the rate of growth, per annum, if known; and the size at one, two, three, or more years.

Answer. The rate of growth per annum is not known. The grilse in the McCloud River, which were supposed to be eighteen months old, measured from 18 to 24 inches in length. The theory is that salmon are full-grown at the age of about three years. It is also known that the young salmon in the McCloud, in May, are 2 or 3 inches long, from which the following conjectural table may be formed:

|   | <i>Length.</i>   |
|---|------------------|
| Young fry, a few months old.....              | 2 or 3 inches.   |
| Grilse, eighteen months old.....              | 18 to 24 inches. |
| Salmon, about three years old, (average)..... | 30 inches.       |

Question 10. Do the sexes differ in respect to shape, size, rate of growth, etc.?

Answer. During the fresh runs of the winter and spring, the sexes differ very slightly, if any, in shape or general appearance. The male may possibly be a little more curved in the jaws, and a little less plump along the sides of the abdomen, but these differences are but slightly defined. The difference is also very slight through the summer, but in the fall the distinctions of the sexes are very marked. The now fully developed ova of the female gives her sex a peculiarly rounded and plump appearance, and the shape and expression of her head does not change much. On the other hand the male grows very deep and thin. His head flattens, his upper jaw curves like a hook over the lower, his eyes assume a peculiarly sunken and malicious expression. Large, powerful white teeth, like dog's teeth, appear on both jaws, and the whole creature acquires an ugly and ferocious appearance. As to the comparative rate of growth of the two sexes, although I have not noticed that the males are larger than the females in winter and spring, I have always observed that they are considerably larger in the spawning season. Allowing the average age of both sexes to be the same, it would consequently appear that the rate of growth of the males is greater than that of the females.

#### E.—MIGRATIONS AND MOVEMENTS.

Question 11. By what route do these fish come in to the shore; and what the subsequent movements?

Answer. All the fishermen agree that most of the Sacramento salmon come down the coast from the North. On arriving at the mouth of the river they spend some time in the bay of San Francisco. Two weeks after their arrival in the bay, they make their appearance at the head of tide-water. At this point they seem to wait some time, the fishermen being of the opinion that they play about here for a period, and actually go up a little ways into fresh water and return to tide-water again. It is more than four months after their appearance in the bay of San Francisco before they enter the colder tributaries of the river, as, for instance, the McCloud and Little Sacramento, one hundred and seventy miles north of the head of tide-water. They do not reach the sources

of the Sacramento for two or three months after entering the mouth of the McCloud and Little Sacramento. There are, therefore, seven months between the first appearance of the salmon at the mouth of the Sacramento and their arrival at its sources four hundred miles above. They leave the sources of the river by August, the colder tributaries by September, the Sacramento proper by November or December, during which latter months the new winter run is beginning to come up.

Question 12. By what route do they leave the coast?

Answer. Not known.

Question 13. Where do they spend the winter season?

Answer. Mostly in the ocean. There are a limited number in the winter in the bay of San Francisco and tide-waters of the Sacramento.

Question 14. When are the fish first seen or known to come near the shore, and when does the main body arrive; are the first the largest; are there more schools or runs than one coming in, and at what intervals?

Answer. The salmon first appear inshore in November, (the winter run.) The main body arrives at the head of tide-water in March and April, (the spring run.) There is another large run up the river in August, (the summer run.) The first are the smallest; the last run, in August, are the largest. There are three annual runs of salmon up the main Sacramento; the spring run, beginning in March; the summer run, beginning in August, and the winter run, beginning in November. The intervals between the runs are as follows: From winter run to spring run, no interval; from spring run to summer run—May to August—two months, the beginning of the spring run joining on to the end of the winter run. From summer run to winter run—September to November—one month.

Question 15. When do the fish leave shore, and is this done by degrees, or in a body?

Answer. Not known.

Question 16. Is the appearance of the fish on the coast regular and certain, or do they ever fail for one or more seasons at a time, and then return in greater or less abundance? If so, to what cause is this assigned?

Answer. The appearance of the salmon at the mouth and at different points of the river is quite regular, a variation in the runs of two weeks, depending on the rains, (early and copious rains bringing early runs,) being the greatest irregularity. Their appearance is also very certain, the year 1866 being the only year since California was settled when the salmon did not run up the river as usual. This year they were very scarce. The fishermen, in their wish to represent it strongly, say, "There were no salmon in the river in '66." They attribute the extraordinary dearth of salmon that year to the muddy water, occasioned by the mining. The rains affect the running of the salmon to a limited degree, in two ways—the earlier the rains come, the earlier the salmon ascend the river, and the greater the rain-fall, the longer the run of fish.

Question 17. How do the runs differ from each other in number and size?

Answer. The winter run is small, and consists of comparatively small fish. The spring run is larger, and contains larger fish. The summer run is the largest of all, and is composed of the largest fish.

Question 18. Which sex comes in first; and how far advanced is the spawn in the female on first arriving?

Answer. It is not known which sex comes first. The spawn is exceedingly small when the first salmon come in from the ocean in November. It is larger in the spring run, and still larger in the summer run.

Question 19. Will either sex, or both, take the hook on first arriving; and if so, is there any period of the stay of the fish when they refuse it?

Answer. The salmon of both sexes take the hook in salt and brackish water and at the fresh and cold sources of the tributaries, but at no intermediate place that is now known.

Question 20. If they refuse the hook at first, how soon do they begin to take it after arriving?

Answer. See 19.

Question 21. Do the schools of fish swim high or low; and is their arrival known otherwise than by their capture; that is, do they make a ripple on the water: do they attract birds, &c.?

Answer. In winter the salmon swim low; in summer they are in all depths of the water. The water is so muddy in the Sacramento that they are only discovered by their capture. In the cold tributaries forming their spawning-grounds they are seen by thousands in the water, and jumping out of the water, and swimming with the dorsal fin cutting the surface.

Question 22. What is the relation of their movements to the ebb and flow of the tide?

Answer. The salmon are generally moving against the tide. The fishermen watch the tide, and fish *with* it, so as to encounter the salmon swimming toward the net.\*

Question 23. Does spawn ever run out of these fish taken with a hook?

Answer. The spawn sometimes runs from the salmon taken with a hook at the head-waters of the Little Sacramento.

Question 24. Answer same question in regard to fish taken in nets or pounds; is the spawn ever seen in any quantity floating about inside of nets?

Answer. The spawn never flows from the salmon caught in nets, except when they are taken on their spawning-beds.

Question 25. Are these fish anadromous; that is, do they run up from the sea into fresh water for any, and for what, purpose?

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\*The water of the main Sacramento is so muddy that the fish cannot see the net till close upon them; consequently the fishing in this river can be done in the day-time, while in all other clear rivers the nets must be drawn at night.

Answer. Yes. They run up into fresh water to spawn.

Question 26. If anadromous, when are they first seen off the coast when do they enter the mouths of the rivers, and what is the rate of progression up stream?

Answer. See question 11, p. 186.

Question 27. If anadromous, what is the length of their stay in fresh water, and when do they return to the sea?

Answer. See question 11, p. 186.

Question 28. Do the different sexes or ages vary in this respect?

Answer. Not known.

Question 29. Do these fish come on to the breeding-grounds before they are mature; or do you find the one or two year old fish with the oldest?

Answer. Male grilse, small and large, are found on the breeding-grounds, with the mature fish, but I have never seen a female grilse on the spawning-grounds or anywhere else.

Question 30. What are the favorite localities of these fish; say whether in still water or currents; shallow or deep water; on the sand; in grass; about rocks, &c.?

Answer. As a rule, I think the salmon keep in holes, and in deep and sheltered places. When they are spawning, or getting ready to spawn, they leave the holes and stay on the rapids.

Question 31. What depth of water is preferred by these fish?

Answer. They prefer generally the deepest water they can find in the rivers, except when spawning, and then they are seldom found in more than four or five feet of water, and are satisfied with less than will cover their dorsal fins.

Question 32. What the favorite temperature and general character of water?

Answer. In spawning they seek a temperature below 55° F., and do not avoid a temperature as low as 45°. The temperature of the lower McCloud was 48° at sunrise and 53° at sunset, during the spawning-season. The mercury falls two or three degrees below these figures on the spawning-grounds of the sources of the Little Sacramento. The water in the McCloud and Little Sacramento is very clear, swift, and cold. The water of the main Sacramento is always muddy.

#### F.—RELATIONSHIPS.

Question 33. Do these fish go in schools after they have done spawning; or throughout the year; or are they scattered and solitary?

Answer. The salmon always go in schools. Whenever they are found solitary and scattered it is because there are too few to make a school.

Question 34. Have they any special friends or enemies?

Answer. The seals and sea-lions are very destructive to the salmon in the salt water. Cuts and scars are often seen on the salmon, where they have been bitten by seals. They eat the bodies and leave the

heads. Eleven salmon-heads were once caught at Wood's Island, from which the bodies had been eaten by seals. Fishers and otters, and fish-hawks, also destroy them in fresh water, but not enough to affect their numbers much. They have no friends that I am aware of, except fish-culturists and fish-commissioners.

Question 35. To what extent do they prey on other fish; and on what species?

Answer. Their food is similar to that of the Atlantic coast salmon while they are in the salt water; but they eat nothing in fresh water.

Question 36. To what extent do they suffer from the attacks of other fish, or other animals?

Answer. See question 34, p. 189.

### G.—FOOD.

Question 37. What is the nature of their food?

Answer. See question 35.

Question 38. Are there any special peculiarities in the manner of feeding of these fish?

Answer. They eat nothing in fresh water, but probably eat voraciously in the ocean, their growth in salt water being so extremely rapid.

Question 39. What amount of food do they consume?

Answer. See question 38.

### H.—REPRODUCTION.

Question 40. Is there any marked change in the shape or color of either sex during the breeding-season; or any peculiar development of or on any portion of the body, as the mouth, fins, scales, &c.?

Answer. At the spawning-season the changes, especially in the male salmon, are very marked. Both sexes lose their bright and silvery coat. Their scales become absorbed into the skin, which grows very slimy and perfectly smooth, like that of a catfish or horn-pout. Their color changes into a dirty black, and then into a dark, unclean olive color. Blotches of fungus, and large patches of white, caused by abrasion of the skin, appear all over them. Their fins and tail become mutilated. Their bodies grow foul and emaciated. (The head of the male changes as described under question 32.) Their eyes get more or less injured; they often become blind; swarms of parasites gather in their gills, and stick to their fins. Their bodies reach the extreme point of attenuation, and, as soon as the spawning is accomplished, they die.

Question 41. Are there any special or unusual habits during the spawning-season?

Answer. They lose their shyness at the spawning-time, so that they will not avoid a person standing a few feet from them, at the water's edge. I attributed this to their state of great exhaustion.

Question 42. Is spawning interfered with by lines or nets, or otherwise?

Answer. Not at all on the McCloud and "Little Sacramento." At Tehama the salmon are *all* destroyed by fishermen, or nearly all.

Question 43. At what age does the male begin to breed; and at what age the female?

Answer. Probably the male begins to breed eighteen months after hatching. The female probably does not breed till one year later. (See question 29, p. 189.)

Question 44. For how many years can these fish spawn?

Answer. No one knows. It is certain, however, that the salmon of the McCloud and Little Sacramento do not spawn but once in *those rivers*, for they all die after spawning. If they ever spawned before, it must be somewhere else, and they can never spawn again. There were fish in the McCloud this fall, 1872, that seemed to be several years old. They died like the rest, and it is a puzzling question where they spent the two or three previous years. Other puzzling questions are called out as, for instance, Why did they not come into the McCloud last year? If they went elsewhere last year, why did they not go to the same place this year? If all the salmon die after the first spawning, how is the stock of mature fish kept up? &c., &c. These questions must remain unanswered for the present. The fact alone remains that ninety-nine one-hundredths, if not all of the salmon in the upper tributaries of the Sacramento River, appear to die immediately after their first spawning in those streams, unless the few stragglers of the "full run" be an exception.

Question 45. Does the act of spawning exert an injurious effect?

Answer. Whatever the effect of the spawning may be, it is certain that the spawning fish die as soon as it is over.

Question 46. Where do these fish spawn, and when?

Answer. The Sacramento salmon spawn as follows: At the sources of the river, in July; in the Little Sacramento and in the McCloud rivers, in August; at the mouth of the McCloud, in September; in smaller tributaries of the main river at and below Tehama, in October and November.

Question 47. Can you give any account of the process: whether males and females go in pairs, or one female and two males; whether the sexes are mixed indiscriminately? &c.

Answer. The fish pair off and spawn very much according to the common descriptions of the spawning of other salmon. The males are very aggressive at this season, and are always attacking other fish near them.

Question 48. Is the water ever whitened or colored by the milt of the male?

Answer. Never to a noticeable extent.

Question 49. What temperature of water is most favorable for hatching?

Answer. 45° F. to 50° F.

Question 50. At what depth of water are the eggs laid, if on, or near the bottom?



Answer. The eggs are laid on the bottom, usually in from 1 foot to  $\frac{1}{4}$  feet of water.

Question 51. What is the size and color of the spawn?

Answer. The spawn are very large, being not far from a quarter of an inch in diameter. Their color is a deep salmon-red.

Question 52. What is the estimated number for each fish; and how ascertained?

Answer. In the McCloud the number of eggs averaged about 700 to each pound of the parent fish; a 10-pound fish giving 7,000 eggs. This was ascertained by weighing the fish and counting the eggs.

Question 53. Answer the question for one season, and for the lifetime?

Answer. See question 52.

Question 54. Do the eggs, when spawned, sink to the bottom, and become attached to stones, grass, &c., or do they float in the water until hatched?

Answer. See question 55.

Question 55. Do the fish heap up or construct any kind of nest, whether of sand, gravel, grass, or otherwise; and, if so, is the mouth, the snout, or the tail used for the purpose, or what; and, if so, how is the material transported; or do they make any excavation in the sand or gravel?

Answer. The parent salmon dig a nest in the gravelly and stony bed of the river, with their tails and heads, and, having laid their eggs, they cover them over with stones and gravel in the same way. The McCloud salmon did not pile up the gravel and stones over their nests as much as the eastern salmon, but left them more level.

Question 56. Do they watch over their nest, if made, either singly or in pairs?

Answer. They do not watch over their nests.

Question 57. When are the eggs hatched, and in what period of time after being laid?

Answer. The salmon-eggs in the McCloud probably hatch in October and November, or about sixty days after being deposited.

Question 58. What percentage of eggs laid is usually hatched?

Answer. No one knows.

Question 59. What percentage of young attains to maturity?

Answer. No one knows.

Question 60. What is the rate of growth?

Answer. See question 9, p. 185.

Question 61. Do the parents, either or both, watch over the young after they are hatched?

Answer. The parents are dead long before the young are hatched.

Question 62. Do they carry them in the mouth, or otherwise?

Answer. See question 61.

Question 63. What enemies interfere with, or destroy, the spawn or the young fish? Do the parent fish devour them?

Answer. Water insects, water fowl, trout, suckers, white-fish, and possibly the water ouzel. See question 61.

Question 64. Are the young of this fish found in abundance, and in what localities?

Answer. The young fish are found in great abundance in the neighborhood of the spawning-ground in May, and probably before. After the month of May they suddenly and mysteriously disappear.

Question 65. On what do they appear to feed?

Answer. They probably feed on crustacea, water-insects, and smaller fish.

#### I.—ARTIFICIAL CULTURE.

Question 66. Have any steps been taken to increase the abundance of this fish by artificial breeding?

Answer. No steps have been taken to increase the Sacramento salmon in the Sacramento river by artificial breeding. The United States has a salmon-breeding station on the McCloud river, one of the tributaries of the Sacramento, but the object of this station is to obtain salmon-eggs for the Atlantic rivers, and not to replenish the Sacramento. Several thousand impregnated salmon eggs were successfully sent to the Atlantic coast from this place this fall, 1872, and have been hatched successfully. The destination of these young salmon is the Susquehanna river.

#### K.—PROTECTION.

Question 67. Are these fish protected by law, or otherwise?

Answer. The Sacramento salmon are protected by a law imposing penalties on the use of weirs, pounds, or other fixed engines of capture, giant powder, and small-meshed nets. The Rio Vista and Sacramento fishermen wish for a law prohibiting salmon-fishing with nets, from the 1st of June till the beginning of the winter run in November. This seems to me to be a very judicious way of regulating the fishing, whenever it is thought best to regulate it by law. During the time mentioned, from June to November, the salmon are very poor, the fishermen make poor wages at fishing, and tons of spoiled salmon are thrown back into the river for the want of a market.

The supply of the Sacramento salmon has a singular natural protection arising from the fact that the McCloud river, containing the great spawning-grounds of these fish, is held entirely by Indians. As long as this state of things remains, the natural supply of the salmon stock of the Sacramento may be considered as guaranteed. That this protection is one of no slight importance may be inferred from the fact that the appearance of the white man, on the American and Feather rivers, two great forks of the Sacramento, has been followed by the *total destruction* of the spawning beds of these once prolific salmon-streams, and the spoiling of the water, so that not a single salmon ever enters these rivers now where they used to swarm by millions in the days of the aboriginal inhabitants. I earnestly hope that the policy which has been pursued

with the Modoc Indians, against whom a war of extermination is now going on, just north of the McCloud river, will never be adopted with the McCloud River tribe. It would be an inhuman outrage to drive this superior and inoffensive race from their river, and I believe that the best policy to use with them is to let them be where they are, and if necessary, *to protect them from the encroachments of the white men.*

#### L.—DISEASES.

Question 68. Has any epidemic, or other disease, ever been noticed among them, such as to cause their sickness or death in greater or less number?

Answer. No particular epidemic or disease has been observed, that I am aware of, among the Sacramento salmon. The breeding-salmon in the upper tributaries all die after spawning, but this is to be attributed to their great emaciation and exhaustion, consequent upon having been so long away from salt water, and not to disease, properly so called.

Question 69. When have these epidemics taken place, and to what causes have they been assigned?

Answer. See Question 68.

#### M.—PARASITES.

Question 70. Are crabs, worms, lampreys, or other living animals found attached to the outside, or on the gills of these fish?

Answer. A worm-like parasite attacks the salmon in fresh water, and gathers in vast multitudes in their gills toward the close of the spawning-season. They also fasten on their fins to some extent. I have not noticed other parasites on the salmon.

#### N.—CAPTURE.

Question 71. How is this fish caught; if with a hook, what are the different kinds of bait used, and which are preferred?

Answer. The Sacramento salmon is caught with nets, spears, Indian traps, and with the hook. In the smaller tributaries of the main river, as at Tehama, they are killed with shovels, pitch-forks, clubs, and every available weapon. In the upper tributaries, as the McCloud, the Indians catch them in traps, arranged to capture the fish going down the river exhausted, but not those ascending the river. At the sources of the river, near Mount Shasta, they are caught by legitimate angling with a hook. Salmon roe is almost exclusively used for bait. Some have been taken with the artificial fly.

Question 72. If in nets, in what kind?

Answer. The salmon-fishing at the great fisheries in the main river is done wholly with drift-nets. These are gill-nets, which, when stretched across the river, are drawn or drifted up or down *with* the tide. The salmon are caught, of course, by the gills in the meshes of the net.

Question 73. At what season and for what period is it taken in nets, and when with the line?

Answer. The salmon are always caught in the main river with nets, all the year round. They are taken with the hook at the sources of the river, chiefly in July.

Question 74. What would be the average daily catch, of one person, with the hook, and what the total for the season?

Answer. The average daily catch, at the head-waters of the Sacramento, near Upper Soda Springs, with the hook and line, is about a dozen salmon, weighing, on the average, 15 pounds apiece.

Question 75. Answer the same question for one seine or pound, of specified length.

Answer. Mr. William Hamilton, of the Schwartz fishing-grounds—a fair specimen of the smaller fishing-grounds of the main river—caught 15 salmon a day during the regular fishing-season, from March 1 to June 1, with a common drift-net.

Question 76. Is the time of catching with nets or pounds different from that with lines?

Answer. Nets are used all the year round. Hook and line are used in fresh water only, in July.

Question 77. Is it caught more on one time of tide than on another?

Answer. I believe the fishermen draw their nets chiefly at the turn of the tide.

#### O.—ECONOMICAL VALUE AND APPLICATION.

Question 78. What disposition is made of the fish caught, whether used on the spot or sent elsewhere; and if so, where?

Answer. All the salmon that are caught in the main river, including the bay, are sold *fresh* in the San Francisco, Sacramento City, and other home markets, if possible. This includes, probably, about all that are caught in the winter and three-fourths of those caught in the spring. Those that do not find a sale as fresh-salmon, are to some extent salted down, and the rest are thrown back into the river.\*

The Indians on the upper tributaries dry their salmon and store them up for their winter food. It is unnecessary to say what the anglers do with theirs.

Question 79. What is its excellence as food, fresh or salted?

Answer. The Sacramento fresh salmon, when prime, is a fish of great excellence as food. The flesh is firm, juicy, rich, and delicious. After taking pains to form a careful and correct opinion on the subject, I am unable to say that it is in any degree inferior, when in its best condition, to the Atlantic salmon, in its best condition. I think the common opinion is the other way, and I account for it as follows: The Atlantic

\* On the 26th day of August, I saw 600 pounds of spoiled salmon at one fish-market at Sacramento City, which were about to be thrown into the river.

salmon are only sent to market in June, July, and August, when they are in their very best condition. The *average*, therefore, is of a very fine quality. On the contrary, the Sacramento salmon are in the market every month in the year, whether prime or not, and are the cheapest and *most common* when they are the poorest, in consequence of which the *average* Sacramento salmon of the markets the year round is a very ordinary fish. Now, people generally, unless their attention is specially called to the subject, when forming their opinion of the comparative merits of the two kinds of salmon, involuntarily compare the *average* Sacramento salmon with the *average* Penobscot salmon, and are compelled to decide in favor of the latter. I think this is the reason why the Sacramento salmon is held to be an inferior fish. I was myself, before my arrival here, much prejudiced in favor of the Atlantic fish, and the Sacramento salmon, which I ate in August, confirmed my prejudice; but now, having eaten and carefully judged of the quality of the winter run or prime salmon of the Sacramento River, I resign my prejudice against these salmon, and state with confidence that I do not consider them in any respect inferior in quality to their Atlantic kindred.

The same remarks apply in general to the salted salmon of the Sacramento.

Question 80. How long does it retain its excellence as a fresh fish ?

Answer. These salmon do not differ from other salmon in respect to the length of time that they will remain fresh and sweet. They can be kept fresh two weeks, and even more, on ice, especially when prime.

Question 81. To what extent is it eaten ?

Answer. The Sacramento salmon are universally eaten, and the extent of their consumption is very great.\* One line of steamboats brought 400,000 pounds of Sacramento salmon into San Francisco in March, 1872.

Question 82. Is it salted down, and to what extent ?

Answer. It is estimated that 25,000 salmon were salted down on the Sacramento River last spring, (1872,) and 9,000 last fall. This, however, includes all that were salted, both from the catch above tide-water and below it.

Question 83. Is it used, and to what extent, as manure, for oil, or for other purposes, and what ?

Answer. It is not used to any extent as manure, for oil, or other purposes than for food.

Question 84. What were the highest and lowest prices of the fish, per pound, during the past season, wholesale and retail, and what the average, and how do these compare with former prices ?

Answer. The highest price during the last year for Sacramento salmon was 25 cents per pound, wholesale, and 18 cents, retail. The lowest price, wholesale and retail, ran from 5 cents to nothing. The average price

\* See note at bottom of page 197.

through the year has been about 10 cents. These are gold figures. The price has not varied much the last few years.

Question 85. Are these fish exported; and if so, to what extent?

Answer. The Sacramento salmon are not exported at all, or only in a few exceptional instances, the home demand being sufficient to exhaust them.

Question 86. Where is the principal market of these fish?

Answer. The principal market for them is the City of San Francisco.

## 20.—OTHER SALMONIDÆ OF THE SACRAMENTO RIVER.

The other *Salomonidæ* of the Sacramento (main) River are confined to one variety, which some call a salmon, but which the fishermen think is a mountain-trout, which has dropped down the river farther than usual. It is described in my catalogue of Smithsonian specimens under Nos. 12 and 13. It is quite rare in the Lower Sacramento.

The common mountain-trout is found in abundance in all the cold tributaries of the main river, and probably other varieties which have not been reported.

## 21.—OTHER SALMONIDÆ OF THE M'CLOUD RIVER.

Besides the salmon, there are, in the McCloud, three other varieties of *Salmonidæ*: 1, the common mountain-trout; 2, the *rye-dar-decket*; and, 3, the "silver-trout." A full series of specimens of the first variety has been collected and sent to the Smithsonian Institution. (See catalogue of specimens.) This fish is delicious eating, when prime, and is quite abundant in the river, and ascends the small tributaries of the river in vast quantities, to spawn, in the winter.

The second variety is very rare in the Lower McCloud, but abundant at its head-waters, and being a very handsome and delicious fish, is the favorite fish for fifty miles around. (See No. 27 and No. 68 of Catalogue of Smithsonian Specimens.)

The third variety I only heard of as being at the sources of the McCloud. It was described to me as a round, plump, silvery trout, and not rare.

I will here add that the other fish of the Sacramento (main) River are the white-perch, Sacramento pike or white-fish, (a cyprinoid,) sturgeon, chub, hard-heads, split-tails, (herrings,) suckers, mud-fish. Of these the white-fish, sucker, and mud-fish are found in the McCloud River. (See Catalogue of Specimens.)

## 22.—LIST OF INDIAN WORDS OF THE M'CLOUD DIALECT.

Although it does not properly come within the scope of this report, I take the liberty to append a few words of the dialect of the McCloud

\* I am informed by the fish-dealers in San Francisco that 10,000 fresh salmon a week are sent into that city from the San Joaquin and the Sacramento Rivers in August, when salmon are the cheapest and most abundant.

Indians, for the sake of preserving something of a language which will soon become extinct. Without expecting to save them, I picked up these words casually from the Indians last fall, (1872,) while getting the salmon-eggs, and, meager as the list is, I believe it is the only collection of words of the McCloud Indians that has been made:

## LIST OF WORDS.

|                      |                 |                     |                      |
|----------------------|-----------------|---------------------|----------------------|
| Indian.....          | Wintoon.        | Fish.....           | Déek-et.             |
| White man.....       | Yi-patoo.       | Salmon.....         | Noo-oolh.            |
| No.....              | Éllo.           | Trout.....          | Syee-oolott.         |
| Yes.....             | Ho. "           | Salmon-trout.....   | Wye-dar-deeket.      |
| Yes, (emphatic)..... | Urmāno.         | Salmon-eggs.....    | Poo-oop.             |
| Very.....            | Bóo-ya.         | Sacramento white    | Chóo-sfs.            |
| A great many.....    | Bóo-ya.         | fish.               |                      |
| Large.....           | Bo-hā-ma.       | Male salmon.....    | Charrk.              |
| Small.....           | Koo-oo-tett.    | Female salmon.....  | Kō-raisch.           |
| Cold.....            | Teém-ma.        | Black salmon.....   | Choo-lóo-loonóo-oolh |
| Warm.....            | Peó-lár-ma.     | White, (emaciated)  | Aée-teppem.          |
| Live.....            | Móoruch-béer.   | salmon.             |                      |
| Dead.....            | Min-nál.        | Late-fall-salmon... | Eée-par-teppett.     |
| I, me, mine, my..... | Nett.           | McCloud salmon...   | Winny-māme hoo-      |
| You, your, him, her, |                 | oolh.               |                      |
| his, hers.....       | (Non ego) mutt. | Grilse.....         | Kóo-rilsh.           |
| North.....           | Wy-ee.          | Salmon-fry.....     | Kóo-ootett noo-oolh. |
| East.....            | Pón-cy.         | Dorsal-fin.....     | Khō-rōhl.            |
| South.....           | North.          | Adipose-fin.....    | Toohw-keeh.          |
| West.....            | Num.            | Pectoral.....       | All-āle-i-kóbol.     |
| Day.....             | Sannie.         | Anal.....           | Kén-tec-kóbol.       |
| Morning.....         | Horn-heema.     | Caudal.....         | Pwár-tohl.           |
| Evening.....         | Nó-monnie.      | Gills.....          | Khár-nee.            |
| Night.....           | Ken-wahnie.     | Man.....            | Wintoon.             |
| Dark.....            | Chéepy.         | Woman.....          | Mō-hālee.            |
| Sleep.....           | Kéen-na.        | Boy.....            | Wéetah.              |
| Sleepy.....          | Keen-ka.        | Girl.....           | Pochtílah.           |
| Breakfast.....       | Himnár-bar.     | Infant.....         | Pickaminy.           |
| Dinner.....          | Sannie-bar.     | Wife.....           | Póich-ta.            |
| Supper.....          | Kenwannie-bar.  | Sweetheart.....     | Póich-ta.            |
| To-morrow.....       | Himmar.         | Hand.....           | Semm.                |
| Yesterday.....       | Íender.         | Foot.....           | Semm.                |
| Head.....            | Pill-yoak.      | Arm.....            | Khée-dett.           |
| Eye.....             | Toohio.         | Horse.....          | Horse.               |
| Mouth.....           | Oó-ool.         | Cow.....            | Cow.                 |
| Face.....            | Toom.           | Bear.....           | Cheekh.              |
| Hair.....            | Tom-moi.        | Grizzly bear.....   | Wée-mar.             |
| One.....             | Két-tett.       | Hog.....            | Hor-róichta.         |
| Two.....             | Párr-la.        | Deer.....           | Nopp.                |
| Three.....           | Pahn-oulh.      | Beaver.....         | Só-chett.            |
| Four.....            | Clów-ett.       | Otter.....          | Māme-tóolich.        |
| Five.....            | Sánsigh.        | Mink.....           | Bies-syous.          |
| Six.....             | Sct-panoullh.   | Coon.....           | Ca-ráillett.         |
| Seven.....           | Ló-lochett.     | Fisher, (cat).....  | Yúpokos.             |
| Eight.....           | Sét-clow-ett.   | Water-dog, (lizard) | Hée-sollett.         |
| Nine.....            | Kétett-élless.  | Water-ouzel.....    | Souf-sunny.          |
| Ten.....             | Tickalouss.     | Gun.....            | Kó-lool.             |

|                         |                              |   |                    |
|-------------------------|------------------------------|---|--------------------|
| Bow .....               | Kō-lool.                     | To bring .....                          | Wérrell.           |
| Arrow .....             | Nott.                        | To pay .....                            | Doo-ya.            |
| To shoot .....          | Yoopcha.                     | To give .....                           | Doo-ya.            |
| Will shoot, (future) .. | Yoopcha.                     | To stand .....                          | Hick-i-yah.        |
| Have shot, (past) ..    | Yoopcha.                     | To give .....                           | Kóot-eh.           |
| Spear .....             | Káy-ell.                     | To want .....                           | Squeca.            |
| To spear .....          | Dídt-ley.                    | To eat .....                            | Bar.               |
| To spear a salmon ..    | Noo-oolh dídt-ley.           | To be hungry .....                      | Bar-squeca.        |
| To shoot a deer .....   | Nopp yóop-cha.               | To drink .....                          | Boolah.            |
| To catch .....          | Perri-mahn.                  | Intoxicated .....                       | Whisky-Boolah.     |
| To catch a trout ....   | Syco-oolott perri-mahn.      | To drink spirits .....                  | Whisky-bár.        |
| House .....             | Boss.                        | To strike .....                         | Kóopah.            |
| River .....             | Même.                        | To chop .....                           | Kóopah.            |
| Water .....             | Même.                        | To steal .....                          | Khí-yah.           |
| Salt .....              | Welche.                      | To remain .....                         | Pomadilly.         |
| Ocean .....             | Welcho même, or bohama même. | To reside .....                         | Pomadilly.         |
| Sacramento River ..     | Bohaima même.                | To sit down to rest ..                  | Kéltmah.           |
| Fire .....              | Pohrr.                       | To buy .....                            | Poolah.            |
| Bread .....             | Chów-tráss.                  | To work .....                           | Kléet-ich.         |
| Flour .....             | Chów-tráss.                  | To be tired .....                       | Klee-tieh-et.      |
| Acorns .....            | Klich-ly.                    | To sew .....                            | Hoóray.            |
| Wood .....              | Chásse.                      | To skin .....                           | Írriticha.         |
| Tree .....              | Mee.                         | To skin a deer .....                    | Nopp Írriticha.    |
| Tobacco .....           | Lo-ole.                      | To be afraid .....                      | Khée-lup.          |
| Knife .....             | Kelly-kelly.                 | To like .....                           | Hi-hina.           |
| Acorns, growing .....   | Peurmah.                     | To love .....                           | Hi-hina.           |
| Blanket .....           | Jackloss.                    | To kiss .....                           | Ell-chóopcha.      |
| Looking-glass .....     | Ken-wiúnas.                  | To swim .....                           | Même-tulich.       |
| Shirt .....             | Winnem-coddie.               | To row (a boat) ....                    | Même-tulich.       |
| Rain .....              | Lóo-hay.                     | To understand .....                     | Tipna.             |
| To rain, (verb) .....   | Lóo-hay.                     | To know .....                           | Tipna.             |
| Sand .....              | Pomm.                        | To know .....                           | (Spanish) sáp-beh. |
| Country .....           | Pomm.                        | To talk .....                           | Teen.              |
| Flowers .....           | Lóo-lich.                    | All .....                               | Komm.              |
| Buckskin, tanned ..     | Táy-ruch.                    | Same .....                              | Pée-yanny.         |
| Buck-eye, (nut) ....    | You-nott.                    | Other side .....                        | Poo-yelty.         |
| Money .....             | Péss-sús.                    | Opposite bank of Poo-yelty máme. river. |                    |
| Mountain .....          | Bo-haima pil-yokh.           | This side .....                         | Num-íltý.          |
| Long .....              | Charrua.                     | Chief .....                             | Wee-ee.            |
| Short .....             | Wor-óhter.                   | Stars .....                             | Kláo-yook.         |
| Good .....              | Chálla.                      | Straight .....                          | Kéllar.            |
| Bad .....               | Chíp-kálla.                  | Bye and bye .....                       | Póp-ham.           |
| New, (clean) .....      | Illa.                        | Black .....                             | Choo-loo-loo.      |
| Dirty .....             | Bóo-koolah.                  | White .....                             | Kí-yah.            |
| To see .....            | Winn-nch.                    | To have .....                           | Bemen.             |
| To come .....           | Widder.                      | How .....                               | Ren-nónie.         |
| To go .....             | Harra.                       | How many .....                          | Híssart.           |
| Have gone .....         | Harra.                       | When .....                              | Héssan.            |
| Will go .....           | Harra.                       | How long .....                          | Héssan.            |
| Stay .....              | Bóoha.                       | Where .....                             | Hécky.             |
| Rest .....              | Bóoha.                       | Here .....                              | Éh-wch.            |
| Sunday, (rest day) ..   | Sannie booha.                | What .....                              | Páy-ee.            |
| A week .....            | Ketett sannie booha.         | Say, (tell me) .....                    | Hád-die.           |
|                         |                              | I don't know .....                      | O-oo.              |



|   |   |
|---|---|
| I don't care.....Héster.                | One month; next Ketett sass.            |
| Deer-skin .....Nopp-nickol.             | month.                                  |
| Deer-stew .....Nopp-clummiss.           | Thank you—(simply Chálla.               |
| North star .....Wye-dar-werris.         | “good.”)                                |
| Sick, (at the stomach) Técklich-kóolah. | Bring a salmon to Mut widder net boss   |
| Thread.....Thee-put.                    | my house.                   noo-oolh.   |
| McCloud River.....Winnie-máme.          | Good Indian.....Chálla winton.          |
| My land.....Nét Pomm.                   | Bad white man.....Chípkalla yí-patoo.   |
| When you come....Hessan mut widder.     | Do you want to see Mut winner sqoos     |
| Atlantic Ocean, (far Kéll-ale-poo-ay    | my gun?                   net kolool.   |
| east salt water.) welkh mame.           | Coming .....Well-árbo.                  |
| Come again.           Way-á-worr-ry.    | Come in and sit down.Éll-ponah kéltuah. |
| Good bye, (the idea Harrá-dar.          | San Francisco, New Kéll-ale pomm. .     |
| of going, simply.)                      | York, or any dis-                       |
| Let us go; come on..Harrá-dar.          | tant place, (far-off                    |
| Moon .....Sass.                         | land.)                                  |

*Spanish words used by McCloud River Indians.*

These words are spelt as the Indians pronounce them.

|                       |                               |
|-----------------------|-------------------------------|
| Much .....Móocha.     | Cluster of Indian...Ranchery. |
| Small .....Chikéeta.  | lodges.                       |
| To know .....Sáh-beh. | Money .....Pès-sous.          |
| Man .....Moochácha.   |                               |

**C--CATALOGUE OF NATURAL HISTORY SPECIMENS, COLLECTED ON THE PACIFIC SLOPE, IN 1872, BY LIVINGSTON STONE, FOR THE UNITED STATES FISH COMMISSION.**

No. 1. Skin and head of fish, caught in Green River, near Green River Station, (Pacific Railroad,) August 6, 1872. Weight about three-quarters of a pound. Common name, “Buffalo-fish,” “White-fish,” “Green River Sucker.” (See note.) (See drawing.)

No. 1. Green River, at this station, has an elevation of 6,140 feet. The surrounding country has a very barren and desolate appearance, as if nothing could live there. Fortunately for the few inhabitants of the place, this fish, together with suckers, abound in the waters of Green River, and are here caught in considerable quantities with a small sweep-seine.

No. 2. Common California brook-trout; San Pedro brook, twenty miles south of San Francisco. Yearling. August 17, 1872. These fish spawn in the San Pedro brook in March and April. Abundant. (See note.) Contributed by California Acclimatizing Society.

No. 2. The California Acclimatizing Society has its headquarters at San Francisco, and its ponds at San Pedro Point, in San Mateo County, twenty miles south of San Francisco. Its officers for 1872-73 are: Dr. W. A. Newell, 632 Mission street, president; John Williamson, 632 Mission street, secretary. This society has successfully introduced from the East the black bass (*Grytes fasciatus*) and the brook trout, (*Salmo fontinalis*.) They have also succeeded in hatching and raising artificially a large number

of Lake Tahoe trout and California brook-trout, (*Salmo irideus*.) The society has received several orders recently from Australia and New Zealand for a large number of the eggs of the California *Salmonidæ*.

No. 3. Same as No. 2.

No. 4. Lake Tahoe trout. Common name, (Tahoe) "shore-trout." Yearling. August 16, 1872. Very abundant at Lake Tahoe. This one was hatched artificially at the ponds of the California Acclimatizing Society in April or May, 1871. Contributed by California Acclimatizing Society.

No. 5. Same as No. 4.

No. 6. Six specimens of young fry, hatched in April, from parents taken from San Andrea's reservoir, and reared at California Acclimatizing Society ponds. August 17, 1872. Contributed by California Acclimatizing Society.

No. 7. Six specimens of California brook-trout. San Pedro brook. Young fry, August 17, 1872. (See drawing.) (See note.)

No. 8. Skin and head. Common name, San Andrea's lower reservoir trout. Weight, 8 pounds. Length, 26 inches. Girth, (just in front of dorsal,) 17 inches. Peculiar to the lower reservoir of the San Andrea's ("Spring Valley") water-works. (See note.) The fattest and heaviest trout of its length that I ever saw. Easily landed, and died very quickly. There were about 500 separated and fully-developed eggs of last spring's roe lying loosely in the abdomen. The natural spawn of the next season were quite small—perhaps the size of pin-heads. This fish is rare, and is the only large trout caught in the lake. Silvery. No colored spots. Caught with *chub* bait. August 20, 1872.

No. 8. This was a fine specimen of its kind, and one of the largest ever taken. The "reservoir" in which it was caught is an artificial body of water, several miles long, formed by building a dam across the San Andrea's brook, and used to supply the city of San Francisco with water. The appearance of this fish in the reservoir was a surprise, as no fish of that size had ever been known about there before. It is thought by some to be a salmon, accidentally shut in from the sea by the dam, and by others to be a trout, which favorable circumstances bring to this unusual size. The reservoir absolutely swarms with *chubs*, about six or eight inches long, which form the food of these large fishes. It is a singular fact that the upper reservoir, a short distance above on the same stream, contains only the common trout of the usual size.

No. 9. Silver trout. San Andrea's lower reservoir. Rather rare. Very much resembles salmon smolt. Never caught large. Beautiful form.

No. 10. Viscera of No. 8.

No. 11. Two specimens. Utah mountain-trout. Young fry. Salt Lake City trout-ponds. Hatched artificially. Parents taken in Bear River. Abundant in Bear River and Bear Lake, and other cold mountain waters in Utah. Hatched in April, May. Period of incubation, very short. August 9, 1872. (See note.) Contributed by A. P. Rockwood, superintendent fisheries Salt Lake City.

No. 11. The Salt Lake City trout-ponds are fed by springs and spring streams, which contain the *clearest* and *purest* water that I have ever seen. Indeed, in these respects, the water is very extraordinary. It will run for six months without depositing sediment or growing fungus. Water-cress and other water-plants grow in this water with a rankness and luxuriance that is wonderful. Although the water must contain alkali, it is vastly superior to any water that I have ever seen on the Atlantic or Pacific slopes for breeding and rearing trout.

There is a fine lot of the native Utah trout at this establishment, which is confined at present to the hatching and rearing of the native varieties, viz, Utah mountain-trout and Utah Lake trout. The place is carried by the city government, and is in charge of the Mormon superintendent of fisheries, Mr. A. P. Rockwood.

No. 12. Sacramento River trout. Sacramento River at Sacramento City. Rare. Female. August 26, 1872. (See drawing.) This variety sometimes attains a large size, being occasionally as large as the smaller salmon. They are called salmon by some. Mr. S. R. Jones, of the Sacramento fish-market, and a good authority, thinks that they are mountain-trout which have accidentally dropped down the river to this point. They are caught here chiefly in the fall, and when the winter rains come on they disappear again.

No. 13. Sacramento River trout. Male. August 26, 1872. See No. 12. (See drawing.)

No. 14. Pharyngeal teeth of "Sacramento pike." August 26, 1872.

No. 15. Viscera of No. 12.

No. 16. Viscera of No. 13.

No. 17. Salmon grilse. September 3, 1872. McCloud River. Very deep and thin. Head, tail, back, and fins black. Very black all over when dry, except on belly.

#### *Dimensions.*

|                                  | Inches. |
|----------------------------------|---------|
| From snout to fork in tail ..... | 18      |
| From snout to end of tail.....   | 19      |
| Girth.....                       | 8½      |
| Head.....                        | 4       |

Abundant. Scales absorbed into skin, and skin very slimy. Flesh soft, but eatable. Many parasites in gills. (See drawing.) (See note.)

No. 17. The word "girth" in the catalogue, when used without explanation, means the measurement taken just in front of the dorsal fin.

No. 18. Viscera of No. 17. Testes, or milt glands, were not saved; but they were very large and full, with milt flowing copiously from them.

No. 19. Salmon grilse. Male. Body deep and thin. McCloud River, California, September 5, 1872. Very black and slimy. Gills full of parasites. Looked foul. Greenish yellow sores in flesh, under the skin. Weight, 4 pounds. (See drawing.)

*Dimensions.*

|  | Inches. |
|--|---------|
| Length, snout to tip of tail.....      | 24      |
| Length of head.....                    | 4       |
| Girth.....                             | 11      |
| Girth of head.....                     | 10      |
| Girth of tail, (at smallest part)..... | 4       |
| Weight, 4 pounds.                      |         |

No. 20. Viscera of No. 19. Milt well developed and prime.

No. 21. Trout. Indian name, *syóolott*. McCloud River. Female. September 7, 1872. Small head and beautiful form. Capital eating. Quite common.

*Dimensions.*

|  | Inches. |
|--|---------|
| Length, from snout to tip of tail..... | 15½     |
| Length of head.....                    | 1½      |
| Girth.....                             | 8½      |
| Girth of head.....                     | 5½      |
| Girth of tail.....                     | 3       |

Spawn considerably developed. There were nearly one-half pint of salmon eggs in this trout's stomach when caught. This was the best fish for eating that we found while on the McCloud. (See drawing.)

No. 22. Trout, *syóolott*, McCloud River, September 7, 1872. In poor condition compared with No. 21; but in better condition than No. 23. Stomach one-quarter full of salmon-eggs, which is the bait used by the Indians for catching them. Eggs less developed than those of No. 21. On the whole a lank-looking fish, with comparatively large head, but not bad eating. This one, I believe, was speared by the Indians. (See drawing.)

No. 23. Trout. (Indian) *syóolott*. Said by the Indians to be the common mountain-trout, like the previous specimens. McCloud River, September 7, 1872. Thin, emaciated, and in very bad condition. Very large head, compared with body. Dorsal fin mutilated. Flesh looked unhealthy. Eggs very small and diseased. Organs of exit ulcerated and swollen. NOTE.—Fish (trout) similarly diseased are occasionally found at artificial trout-breeding ponds. The Indians said that Nos. 21, 22, and 23 were the same fish, though found in such different condition. (See drawing.)

No. 24. Viscera to No. 21.

No. 25. Viscera to No. 22.

No. 26. Viscera to No. 23.

No. 27. Common name, salmon trout; Indian name, *wye-dar-déekit*. McCloud River, September 7, 1872. Also called at Soda Springs the "Varden" trout. (See No. 68.)

*Dimensions.*

|                                   | Inches. |
|-----------------------------------|---------|
| Length, snout to tip of tail..... | 17½     |
| Girth.....                        | 9       |

Meat firm and hard, but rather dry; tasted very much like No. 8. The handsomest trout, and, on the whole, having the most perfect form of all the trout we saw on the McCloud. Also, the only fish that had colored spots. This one was profusely spotted over most of the body with reddish golden spots. (See drawing.) Possibly the *Salmo spectabilis*, Pacific Railroad Reports, vol. xii, p. 342-3. (See note.) Only a medium table-fish, at this season. Rare.

No. 27. This trout is rare in the lower waters of the McCloud, but common at its head-waters. Fishermen say that this trout is caught nowhere else in California. It is considered a great luxury at Soda Springs, on the Little Sacramento, from which place parties often travel the fifteen-mile trail to the Upper McCloud to catch it. Mr. I. F. Frye, of Soda Springs, once caught a mountain-trout of two pounds on his hook, and as he was just in the act of pulling it out of the water, it was seized by a monstrous *roye-dar-déckit*, which Mr. Frye says could not have weighed less than 20 pounds. The latter fish was lost, but the mountain-trout showed the marks of his teeth on both sides.

No. 28. Viscera to No. 27.

No. 29. Male salmon. McCloud river, California, September 23, 1872. A clean, healthy, nice-looking fish, but not silvery. This fish belongs to a class which are just beginning to come up the river, in limited numbers, called the fall run. Their flesh is quite palatable and good, and there is considerable fat on them still. Their scales have usually been absorbed, and the surface of the skin is smooth and slimy. These are the only salmon now coming up the river. All the others are floating down the river, dead or dying. The milt of this fish was well developed and flowing. Girth, 15 inches. (See drawing.)

No. 30. Large, full-grown male salmon. September 25, 1872, McCloud River, California. Weight, 20 pounds; girth, 21 inches; girth at anus, 16½ inches; length, 38 inches. (Consult *Salmo canis*, W. Pacific Railroad Report, vol. xii, p. 341.) (See drawing.) (See note.)

No. 30. This fish was *one of the largest, if not the largest*, which we saw on the McCloud. He was thin and worn, but would have weighed nearly 40 pounds when in good condition.

No. 31. Viscera to No. 30.

No. 32. Male salmon. McCloud River, September 25, 1872. Girth, in front of dorsal, 16 inches; at anus, 13 inches. No drawing was taken of this fish.

No. 33. Viscera to No. 32.

There is no No. 34.

No. 35. Grilse. The skin was accidentally scraped somewhat with a knife. September 25, 1872, McCloud River, California.

- No. 36. Grilse. McCloud River, September 25, 1872.
- No. 36. Head of male salmon. McCloud River, September 25, 1872.
- No. 37. Head of male salmon. McCloud River, September 25, 1872.
- No. 38. Head of male salmon. McCloud River, September, 25, 1872. Probably an old fish.
- No. 39. Head of female salmon. September 25, 1872.
- No. 40. Trout. The common mountain-trout of California. Indian name *syóolott* McCloud River, September 27, 1872. This is a beautiful specimen of the species.
- No. 41. Mountain-trout. McCloud River, September 26, 1872. (See note.)
- No. 41. The common mountain-trout is easily caught at most seasons of the year, with almost any seasonable bait, and also, and quite as successfully, with the artificial fly. The Indians also spear them. It is, however, hard to catch them on the Lower McCloud after the 1st of October. (See report on salmon-breeding.)
- No. 42. Same as 41.
- No. 43. Female salmon. McCloud River, September 28, 1872. This fish had spawned; was foul, emaciated, and with tail almost worn off. A fair specimen of the fish which are now floating down the river, dead or exhausted. Weight 10 pounds. (See drawing.)
- No. 44. Female salmon. McCloud River, September 27, 1872. Weight, 7 pounds. This fish had not spawned when caught. The drawing was taken after spawning the fish. She had 4,500 eggs. (See note.) (See drawing.)
- No. 44. The less number of ova in the McCloud salmon, compared with the eastern salmon, was very noticeable. I never found over 700 eggs to the pound in the McCloud salmon. On the other hand, the eggs were larger than those of the Atlantic salmon.
- No. 45. Male grilse. McCloud River, September 27, 1872. Foul, but a fair specimen. Abundant, though not so much so as the full-grown salmon. (See note.)
- No. 45. I did not find a single female grilse among the great numbers of grilse which I examined and saw on the McCloud; nor have I ever seen a female grilse elsewhere, although I have seen persons who said they had seen them.
- No. 46. Young trout. Indian name *kóo-ootét syo-lott*="small trout." McCloud River, September 29, 1872.
- No. 47. Yellow sucker. McCloud River, September 29, 1872. Abundant. (See note.)
- No. 47. The other fish of the McCloud River besides the (1) salmon are the (2) common mountain-trout, (3) *wye-dar-décket*, (see No. 48,) (4) white-fish, (cyprinoid?) (5) common sucker, (6) yellow sucker, (see No. 72,) (7) mud-fish, (8) silver-trout? Headwaters of McCloud.
- The above are all the fish that are found in the McCloud River in September, October, and November.

No. 48. Common name on the McCloud, "white-fish;" common name on the Sacramento, "Sacramento pike." McCloud River, September 29, 1872. Abundant.

No. 49. Viscera to No. 48.

No. 50. Same as No. 48. These fish are caught with salmon roe, and are very abundant at this season. (See drawing.) They grow here to an average weight of one or two pounds; but in the warmer waters of the Lower Sacramento, say at Sacramento City, they attain a very large size. Their flesh is sweet and good, but soft and bony.

No. 51. Viscera to No. 50.

No. 52. Female salmon. Indian names, *mohalie no-oolh* = she or woman-salmon, and *kōraisch* McCloud River, September 30. Weight, 18 pounds. Girth, 18 $\frac{3}{4}$  inches. This is a "fall run" fish, and is larger than the average of the "fall run," but not larger than the average of the summer-salmon.

No. 53. Red-headed woodpecker. McCloud River, California, October 8, 1872. Contributed by Hon. B. B. Redding.

No. 54. Snake. Head-waters of Sacramento, October 10, 1872. Contributed by B. B. Redding.

No. 55. Trout. Indian name, *syóo-lott*. Sometimes called the red-banded trout. Little Sacramento River at Upper Soda Springs, October 10, 1872. This trout has an almost scarlet band, extending the whole length of the body, and about as wide as one-fourth the depth of the fish. The band overlies the lateral line, and is about evenly divided by it. The Indians say that it is the common mountain-trout, and that the scarlet band is found on some, but not on others. (See note.)

No. 55. The scarlet-banded trout appears to be the same as the common mountain-trout, the scarlet band being an accidental feature, dependent upon seasons and localities. For instance, on the coast it is rarely seen in its full brightness; in the Lower McCloud, the trout have it in June, and it continues to grow more vivid and deeper-colored till the middle of August, when it leaves them altogether, and does not show itself at all in September and October. Again, at the head-waters of the Sacramento, the golden band is on the trout all the year round, and it is probably the same with the trout at the head-waters of the McCloud. The bright scarlet band is so rare on the coast that the trout fishermen call it a different variety, and esteem it an unusual prize. (See No. 64, catalogue.)

No. 56. Red-banded trout. Head-waters of Sacramento, near Mount Shasta. Temperature of water, 46° F. The trout caught in these cold waters are very fine. October 10, 1872.

No. 57. Red-banded trout. Head-waters Sacramento, near Mount Shasta, October 10, 1872.

No. 58. Same as No. 57.

No. 59. Red-banded trout. Little Sacramento. Upper Soda Springs, October 10, 1872.

No. 60. Same as No. 59.

No. 61. Same as No. 59.

No. 62. Same as No. 59.

No. 63. Same as No. 59.

Among these specimens of red-banded trout, is one skin and head not designated, of which there is a drawing.

No. 64. Red-banded trout. Little Sacramento, at Frye's Upper Soda Springs, October 9, 1872. Abundant. Caught all the months in the year. All the trout at this part of the Sacramento have the red band at all seasons of the year. These trout are caught with artificial fly, and the ordinary trout-fishing bait; salmon roe being found the most effective of the natural bait. Mr. Sisson says that the flesh of these fish is sometimes white and sometimes red. Mr. Frye says that this is the same trout that he has caught all the way up and down the California coast.

No. 65. Red-banded trout. October 9, 1872. Little Sacramento River, near the hotel kept by Mr. Isaac F. Frye, at Upper Soda Springs.

No. 66. Same as No. 65.

No. 67. Same as No. 65.

No. 68. Common name, salmon-trout. McCloud. Indian name, *wye-dar-déek-it*, which means the fish from the North, this variety being caught only in the head or northern waters of the McCloud. The local name at Soda Springs is the "Dolly Varden" trout. Head-waters of the McCloud River, September 1, 1872. This specimen is salted, and is the same as No. 27, but in the lower waters of the McCloud, where No. 27 was caught, it is rare and exceptional, while at the head-waters of the river it is common. (See note.) The spawn in this fish were large and almost ripe. These fish are thought to sometimes attain a size of 20 pounds. One was caught which weighed 5 pounds; another which weighed 11 pounds. They are considered very fine eating at Soda Springs. The salted one which I ate was certainly very fine. (See No. 27.)

No. 68. I was told that at the head-waters of the McCloud, there is a beautiful silvery trout beside the "Dolly Varden," called the "silver-trout." (See note to No. 47.)

No. 69. There is no number 69.

No. 70. Trout. October 10, 1872. Head-waters of the Sacramento.

No. 71. Water-ouzel. October 10, 1872. Indian name *sours-sinny*. Head-waters Sacramento, October 10, 1872. At a distance the water-ouzels seemed to be almost the color of the rocks on which they stand and look for food. They have a peculiar note like a child's rattle, but at times sing beautifully.

No. 72. Mud-fish. McCloud River, October 31, 1872.

No. 73. Small mud-fish. McCloud River, October 31, 1872.

No. 74. Young trout. McCloud River, October 31, 1872.

No. 75. Same as No. 74.

No. 76. Trout. Wentworth's brook. This brook empties into the



McCloud on its east side, about thirteen miles above its mouth. There are a ranch and cabin here, occupied by the only white resident of the McCloud River, Mr. Frank Wentworth. November 1, 1872.

No. 77. Same as No. 76.

No. 78. There is no No. 78.

No. 79. Salmon. Female. Mill-brook, near Tehama, on the Sacramento River, November, 7, 1872. Abundant. This is a small stream, where the salmon rush up to spawn in great numbers, in October and November. They also come up this brook in April, May, and June. They resemble in many particulars, in outward appearance, the "fall run" of the McCloud River. This point is fourteen miles below the head of navigation of the Sacramento River, which is here quite deep and broad. The water of the main river is roily here. (See note.) (See drawing.) Girth, 20 inches. Weight  $16\frac{1}{2}$  pounds.

No. 79. At Tehama, in the fall, the salmon are speared and trapped in great numbers, and many are sent to the San Francisco and Sacramento markets, salmon from other sources being very scarce at this time. These spawning-fish, however, are seldom offered for sale in the first-class markets, and are not eaten by the initiated. They are in demand, however, at the more common restaurants and eating-saloons.

No. 80. Salmon. Male. Mill-brook, near Tehama, on the Sacramento River. Abundant. November 7, 1872. These fish were in their prime for spawning the last week in October. At this date many had spawned, but many, also, of this run, had spawn and milt in them. Weight,  $5\frac{3}{4}$  pounds; girth,  $13\frac{3}{4}$  inches. (See drawing.)

No. 81. Same as No. 80. Male, weight 13 pounds; girth  $18\frac{1}{2}$  inches. (See drawing.)

No. 82. Salmon. Female. Mill-brook, near Tehama. Weight,  $10\frac{3}{4}$  pounds; girth,  $16\frac{1}{2}$  inches. November 7, 1872. (See drawing.)

No. 83. Salmon grilse. Male. Mill-brook, near Tehama, November 7, 1872. Weight,  $4\frac{1}{2}$  pounds; girth,  $12\frac{3}{4}$  inches. (See note.) (See drawing.)

No. 84. Salmon. Female. Mill-brook near Tehama, on Sacramento River, November 7, 1872. Weight,  $10\frac{3}{4}$  pounds; girth, 16 inches. This fish had perfect or nearly perfect scales, and a somewhat silvery appearance. The eye will be seen in this specimen to be larger than that of the other specimens. Salmon with unabsorbed scales are very rare at this season, and at this distance from the sea. I did not find one on the McCloud from September 1 to November 1 that had scales like those on this specimen. (See drawing.)

No. 85. Tom-cods. San Francisco Bay, November 16, 1872.

No. 86. Common name on Pacific coast is smelts. San Francisco Bay, November 16, 1872.

No. 87. Shrimps. San Francisco Bay, November 16, 1872. (These creatures lived longer in the alcohol than anything I have seen except lizards.)

No. 88. Octopus. Common name among the fishermen is squid. I

suppose this is the *pieuvre* of Hugo's "*Les Travailleurs de la Mer*," or *poulps*. Farallone Islands, November 15, 1872. Occasionally caught on this coast. The fishermen speak of it with dread, and evidently consider it very formidable. This specimen was not considered a very large one; yet it must have been much larger than the one Hugo describes, as this one has over 1,200 suckers to 400 of his specimen. Adams speaks of one caught near the Meia-cashimah Islands as a very large one, because it could cover an area of 12 feet in circumference. The arms of this one were about  $4\frac{1}{2}$  feet long, and could cover an area at least 28 feet in circumference. The Italian fishermen consider them good to eat, and very good, too. The ink-bag was quite full, and had, I should say, over a half a pint of fluid in it.

No. 89. Trout. McCloud River, November 2, 1872.

No. 90. Rock-perch. Near Goat Island, San Francisco Bay, November 18, 1872.

No. 91. Porgée. Near Goat Island, San Francisco Bay, November 18, 1872.

No. 92. Salt-water trout. San Francisco Bay, November 18, 1872.

No. 93. Rock-perch. San Francisco Bay, November 18, 1872.

No. 94. Rock-perch. San Francisco Bay, November 18, 1872.

No. 95. Salt-water trout. San Francisco Bay, November 19, 1872.

No. 96. Salt-water trout. San Francisco Bay, November 19, 1872.

No. 97. Spider. Near Mount Shasta, October 10, 1872.

No. 98, No. 99. There are no Nos. 98 and 99.

No. 100. Three specimens. White-fish, Russian River, Mendocino County, California, September, 1872. Contributed by J. Williamson.

No. 101. Herring. Five specimens. San Francisco Bay, November 22, 1872. Males very full of milt.

No. 102. Rock-fish, rock-cod. Three specimens. San Francisco Bay, November 22, 1872.

No. 103. Rock-fish, rock-cod. Yellow. San Francisco Bay, November 22, 1872.

No. 104. Water-dog. Tributary of McCloud River, California, October 21, 1872.

No. 105. Salmon head. A fresh-run fish. Caught at Rio Vista, Sacramento River, November 21, 1872. Female. Rare at this season. Prime condition. Fat, silvery, and fine eating. Eggs very small. A true Sacramento River salmon. (See drawing.) The Sacramento salmon command this month the highest price in the market—25 cents, retail; wholesale, 18 cents—being more rare this month than at any time. There is another salmon (see No. 106) which is sold in the San Francisco market at this time, much inferior, and not commanding so high a price.

No. 106. Salmon head. November 21, 1872. Male.

Point Arena, Mendocino County, California. The fish referred to under the last number. It resembled in *form* the "fall run" of the McCloud males, in their best condition. It was, however, bright and silvery, with

scales very much as in a prime fish. The scales were smaller than those of the Sacramento salmon, and brushed off easily, as with a smolt. Both jaws had large teeth, but, as will be observed in the specimen, they are smaller than in the McCloud River males and are fitted loosely and flexibly into the jaw, as if set loosely in a piece of rubber lining. The teeth are, also, unlike the McCloud River fall run male, dark and dirty-looking. The teeth seemed to be in a transition state, and raised the question whether they were *coming* or *going*. A female of the same variety being found the next day with nearly ripe eggs, the inference seemed to be that the teeth of the fish must be *coming*. The milt of this fish was copious and prime. The eye, it will be observed, is larger than that of the Sacramento salmon. It also has a less forked tail. The fishermen say that it will not compare in table qualities with the true Sacramento salmon at this season. There were less fin-rays in the dorsal, pectoral, and anal fins than in the respective fins of Sacramento salmon. (See drawing.) There were grilse of this variety caught at the same place, in the San Francisco market to-day, bright silvery, and of very graceful form. These commanded a high price. (See drawing of No. 128.)

No. 107. Young cod-fishes. November 24, 1872. San Francisco Bay.

No. 108. Spawn of Point Arena salmon, showing stage of development. (See No. 106.) I learned from parties living at Eel River, north of Point Arena, that the salmon of that river come up to spawn in December and January, and if the rains are early, that the salmon spawn in those months in Eel River. It is possible that No. 106 was on his way to Eel River to spawn, as was also the female, having the eggs (No. 108). It is obvious from the advanced stage of the milt and eggs of these fish, that they were on their way to their spawning-grounds. If it is true that the Eel River salmon deposit their eggs in December and January, we have then seven months of the year now known to be salmon-spawning months, namely, July, August, September, October, November, December, and January.

No. 109. Pelican. (*Pelicanus fuscus*.) San Pedro brook. November 22, 1872. Contributed by J. Williamson.

No. 110. Dried salmon. This is a fair specimen of the dried salmon, which the McCloud River Indians live on chiefly through the winter. Most of the salmon used for drying are taken in August and September, when they are spawning or falling down the river exhausted, after spawning. They are then easily captured by spearing, or by traps. The spears are very long, and carefully made. The traps are merely baskets of bushes, placed at a fall or rapid, and winged on each side by a fence of stakes or bushes running at a slight angle *up* the river, so that the exhausted fish *coming down* the river, finally find their way into the basket and are there trapped. The McCloud Indians do not try to trap the fish *coming up the river*, but only those *going down*, which is just the contrary of the principle of the white man's trap and nets. The In-

dians, very singularly, *prefer* the exhausted and dying salmon for drying to the fresh and prime ones. As soon as a salmon is speared or taken from the trap it is opened—the spawn always being saved as a luxury—and split and hung on a bush or fence made for the purpose, in the open air. In the dry air of California, the drying process is sufficient to preserve them without salt. The Indians *never* use salt in preserving their salmon, and will not eat salt meat of any description. When the salmon are sufficiently dried, they are tied together in bundles, and packed away around the sides of the lodges. These specimens were presented by one of the McCloud chiefs, and, repulsive as they seem, they represent the main support of the Indians during the winter, and are highly valued by them.

No. 111. A deer-skin, tanned and dressed by the McCloud Indians. Used for making moccasins, and sometimes for clothes. Some of the deer-skins dressed by the McClouds are very white and soft. October, 1872.

No. 112. Deer-skin blanket. Prepared and sewed by the McCloud Indians. This is the common blanket of these Indians. October, 1872.

No. 113. Heavy buck-skin blanket. Tanned by the McCloud Indians. Large and heavy skins like this are used alone, as blankets. This one is nearly as large as the two sewed together of the last specimen.

No. 114. Seeds, stalk, and leaf of plant used and highly valued by the Sacramento River Indians, for making thread and nets. It will be observed that it has a good fiber. Near Mount Shasta, October 10, 1872.

No. 115. White-perch. San Francisco Bay, December 2, 1872.

No. 116. Nuts of the "Digger" pine. Highly valued by the Indians as food. October, 1872.

No. 117. Soap-root. McCloud River, November, 1872. Used by Indians for making brushes.

No. 118. Stones of which arrow-heads are made by the McCloud Indians. McCloud River, October, 1872.

No. 119. Acorns and leaves of mountain live-oak. These acorns, together with the acorns of other oaks, form the next important staple of food to the dried salmon, among the McCloud Indians. The squaws gather them in great quantities, and make a kind of paste or soup of them, in which form they are eaten, almost exclusively. McCloud River, October 7, 1872. Contributed by B. B. Redding.

No. 120. Parasite on pine-tree. McCloud River, October 31, 1872. Contributed by J. G. Woodbury.

No. 121. Skate. San Francisco Bay, December 2, 1872.

No. 122. Skate. Bay of San Francisco, December 2, 1872.

No. 123. Young smelts. (*Atherinopsis californiensis*?) Bay of San Francisco, December 3, 1872. These are universally sold in California for smelts, and the people generally suppose that they are smelts. Three specimens.

No. 124. Flounders. Three specimens. Bay of San Francisco, December 4, 1872.

No. 125. Soles. Three specimens. Bay of San Francisco, December 4, 1872.

No. 126. *Drawing*. A fine specimen of a Sacramento River salmon, in prime condition. This was a fresh-run fish, bright, plump, and silvery. Spawn very small. Caught at Rio Vista. Weight, 14 pounds. November 11, 1872. Winter run. These fish have just begun to ascend the Sacramento, this one being among the first that were caught this season, of the "winter run." Only a very few are taken as early as this; they are consequently rare in the markets and command a high price, (for California,) viz, 25 cents a pound, retail, and 18 cents a pound, wholesale. This is the beginning of a run of prime fish which does not slacken, nor much depreciate in quality, till June. (See Report on Sacramento Salmon.)

No. 127. *Drawing*. Male salmon. McCloud River, October, 1872. Foul, emaciated, and tail partly worn off. Compare with last drawing, No. 126.

No. 128. *Drawing* of grilse frequently seen in San Francisco market in November. This fish is taken at Point Arena, (a point on the coast of California, in Mendocino County,) and is sent to the San Francisco market when the Sacramento salmon are scarce. It is a beautiful fish, in form and general appearance, and commands a high price. They are all about the size of this specimen. They are bright and silvery. The scales are small and brush off very easily, as in salmon smolt. November 20, 1872.

No. 129. *Drawing*. Sacramento salmon, in prime condition. Female. Rio Vista, November 11, 1872. Weight, 18 pounds. "Winter run." Compare No. 126.

No. 130. Snake. Menlo Park station, Southern Pacific Railroad, San Mateo County. October, 1872. Contributed by Mr. Williamson.

No. 131. Salmon eggs. Dried by Indians for food. Esteemed a luxury. Presented by Indian chief. McCloud River, California, October, 1872.

No. 132. Arrows without points. Six specimens. McCloud Indians, McCloud River, California, October, 1872.

No. 133. Arrows, with stone points. McCloud Indians, McCloud River, California. Six specimens. October, 1872.

No. 134. Arrows, with steel points. Two specimens. Sacramento River Indians, (Upper Sacramento,) October, 1872.

No. 135. Arrows, with glass points. McCloud Indians, McCloud River, California, October, 1872. Six specimens.

No. 136. Arrows. Pitt River Indians. Pitt River, California, October, 1872.

No. 137. Indian bow, made by Con-choo-loo-la, chief of McCloud Indians, McCloud River, California. The bow is made of yew, and is cov-

ered on the back with salmon skin, which is prepared by a secret which the Indians will not disclose. The salmon skin imparts a wonderful elasticity to the bow, which will bend back, when it is unstrung, several years after it is made. Con-choo-loo-la is probably the last of the great chiefs of the McCloud Indians.

No. 138. Sprig of yew, from the wood of which the Indians make their bows. October 12, 1872. Upper Sacramento River.

No. 139. Salmon-eggs. McCloud River, California, September, 1873.

No. 140. Salmon-eggs, showing eye-spots. McCloud River, California, October, 1872.

No. 141. Young salmon, just hatched and hatching. McCloud River, California, October, 1872.

No. 142. *Shapaulle*, (Indian name.) Clear Lake, Lake County, California, February 5, 1873. Four specimens.

No. 143. Trout. Clear Lake, Lake County, California, February 5, 1873. Twenty-one specimens.

No. 144. *Chy?* (Indian name.) Clear Lake, Lake County, California, February 7, 1873.

No. 145. Male trout. Supposed to be two years old. Milt flowing. Cold Creek, Clear Lake, Lake County, California, February 8, 1873.

No. 146. Perch. Soda Bay, Clear Lake, California, January 25, 1873.

No. 147. ———? Clear Lake, California, February 8, 1873.

No. 148. *Shy*, (Indian name.) Clear Lake, California, February 10, 1873.

No. 149. Indian cake, made of the nuts of the *pepper-tree*. Used as food by the Clear Lake Indians. February 10, 1873.

No. 150. Spawn of mountain-trout, showing its stage of development in this variety. Cold Creek, Clear Lake, California, February 10, 1873.

No. 151 Salmon-trout. Kelsey Creek, Clear Lake, California. Girth, just in front of dorsal fin, 9 inches. Milt ripe. Formerly abundant, now becoming scarce.

*Color*.—Dark gray on back, shading off to lighter gray and pink, toward the lateral line. Gill-covers bright vermilion-red. Band of same color, about  $\frac{3}{4}$  inch wide from gills to tail; brightest and broadest near the middle. Grayish-pink below red band. Abdomen white underneath, with blotches of grayish-pink. The fishermen say that this is the only variety of trout caught in or about the lake, besides the common mountain-trout. The body of the fish was deep and thin; and very thickly dotted above the lateral line and on the caudal, dorsal, and adipose fins with black spots. There were a very few black spots below the lateral line, chiefly near the head and tail. The pectoral, ventral, and anal fins were of a dark-gray color, and without spots.

No. 152. Sucker. Male. Clear Lake, California. Milt ripe. February 10, 1873. *Mem*.—Suckers and trout in this locality spawn at the same

time, while in New England they spawn at exactly opposite seasons of the year; the suckers in May and the trout in October.

No. 153. Skin of mud-hen. Clear Lake, California, February 13, 1873. Very abundant and very tame.

No. 154. Skin of white heron. Clear Lake, California, February 2, 1873. Not abundant.

No. 155. Water-lizard. February 10, 1873. Kelsey Creek, Lake County, California.

No. 156. Spawn of salmon-trout. Kelsey Creek, near Clear Lake, California, February 11, 1873.

No. 157. Pyloric appendages and milt-glands of No. 158.

No. 158. *Muraena*. (Italian name.) Farallone Indians, December 14, 1872. Spawn nearly ripe, and about the size of trout-spawn.

No. 159. Lake-trout or salmon-trout. Burtnett's mills, Kelsey Creek, Lake County, California, March, 1873. Contributed by J. G. Woodbury.

No. 160. *Shy* or *chy*. (Indian name.) Five specimens, (tag says six.) Cold Creek, Lake County, California, March 8, 1873. Contributed by J. G. Woodbury.

No. 161. *Nic-coosh*, or *mukh-ush*. Cold Creek, Lake County, California, March 8, 1873. By J. G. Woodbury.

Numbers 161 to 167 omitted.

No. 167. *Shapaulle*. Burtnett's mills, Kelsey Creek, Lake County, California, March 9, 1873. By J. G. Woodbury.

Nos. 168 to 208 omitted here; resumed further on.

No. 208. Trout. Independence Lake, on Sierra Nevadas, California, February 24, 1873.

No. 209. Same as No. 208.

Nos. 210 to 216. Chubs. Sacramento River, near mouth of San Joaquin, February 25, 1873.

Nos. 217 to 231. Perch. Sacramento River, Rio Vista, February 25, 1873.

Nos. 232 to 236. Hardheads. Sacramento River, near mouth of San Joaquin, February 25, 1873.

Nos. 237 to 243. Sacramento pike. Sacramento River, Rio Vista, February 25, 1873.

Nos. 244 to 250. Viviparous perch. Local name "sun-fish." Sacramento River, Rio Vista, February 26, 1873.

Nos. 251 to 262. Split-tails. Sacramento River, near Courtland, February 26, 1873.

Nos. 263, 264. Suckers. Sacramento River, Rio Vista, February 26, 1873.

Nos. 265 to 270. Herrings. Sacramento River, Rio Vista, February 26, 1873.

Nos. 271 to 273. Sturgeons. Sacramento River, Rio Vista, February 26, 1873. Saw one, February 27, at Rio Vista that weighed 200 pounds,

and was 9 feet long. Was told of one caught here that weighed 600 pounds.

No. 274. Herring. Sacramento River, Rio Vista, February 26, 1873.

No. 275. Lobster, (local name.) Sacramento river, Rio Vista, California, February 26, 1873.

No. 168. Small fish. Cold Creek, Lake County, California, February, 1873.

No. 169. Small fish. Cold Creek, Lake County, California, February, 1873.

No. 170. Two specimens from Chinese fish-market at San Francisco, February, 1873.

No. 171. Heads of male salmon; two specimens. Point Arena, California, December 1872.

No. 172. Yellow rock-fish. Bay of San Francisco, November 22, 1872.

No. 173. Small *Muraena*. (See No. 158.) Farallone Islands, March 12, 1873.

No. 174. Red-headed woodpecker. McCloud River, California, November 1873.

No. 175. Blue-jay. McCloud River, November, 1873.

No. 176. Salmon-spawn, showing stage of development. Rio Vista, February 26, 1873.

No. 177. Salmon-spawn. Sacramento River, near Rio Vista, March 10, 1873.

No. 178. One bottle containing seven small fish, from Clear Lake, Lake County, California, February, 1873.

No. 179. Salmon-spawn. Near Rio Vista, December, 1873.

No. 180. Salmon-spawn. Near Rio Vista, January 25, 1873.

No. 181. Spawn of lake-trout. Clear Lake, February, 1873.

No. 182. Young trout. Spawned and bred artificially from parents caught in the San Andreas reservoir, near San Francisco. (See No. 8 of first catalogue.) Three specimens.

No. 183. Small water-dogs. McCloud River, California, November, 1872. The bottle also contains two 1000-legged worms, and an unknown insect.

No. 184. Supposed to be the "steamboat-bug." Sereno Lake, Sierra Nevada Mountains, California, altitude 7,000 feet, November 9, 1872. This insect was found swimming in the water, under ice an inch thick or more. It seemed, says Mr. Redding, to gather water within its body by some process, and to propel itself along by ejecting it again from behind. It was observed some time in order that the pumping process of the insect might be well ascertained. Contributed by Hon. B. B. Redding.

No. 185. Twig of pepper-tree. See No. 149. Clear Lake, Lake County, California, February, 1873.



## VII.—NOTES ON THE SALMON OF THE MIRAMICHI RIVER.

BY LIVINGSTON STONE.

The salmon begin to arrive in the Miramichi River about the 10th of June. There is, I believe, only one or two days difference between the time of their arrival at the mouth of the river and at the head of tide-water, about sixty miles above. The salmon continue to run from the 10th of June to the spawning-season, (the middle of October,) and there is said to be one run after that, called by the fishermen the November run.

The flesh of the June runs of fish is very much the best; very fat, rich, and delicious. The quality of their flesh deteriorates steadily from this month till they spawn; but the size of the later runs of fish seem to be about the same, except in the November salmon, which are smaller. This November run does not, I think, make its appearance every year, but usually. These fish seem to be in a great hurry, and make a rush for the spawning-beds without any of the delays on the way up which are noticed in the earlier runs.

In June the salmon are all, males and females, bright and silvery, with small, gentle-looking heads, and plump and gracefully-formed bodies. At this time males and females look alike, and can hardly be distinguished. As the spawning-season approaches, both sexes, but especially the males, change their silvery coat and put on gorgeous colors; the spots varying from a pale blue and straw color in some fish to a deep red, purple, and gold in others. Their colors are mingled with all the other tints of the rainbow. Nothing can exceed the beauty of coloring of some of the handsomest male fish at the height of the spawning-season. The head of the male, however, has changed for the worse. It has grown long and low: the ugly-looking tush of the lower jaw has protruded its full length, and the whole expression of his head and eye is malicious and savage in the extreme. We found a few exceptional salmon of both sexes, of a dark silvery hue, without spots. They were usually the most difficult to handle; next to these in this respect came the deeply-colored males. The milder-colored fish were the easiest to manage. The distinction of the sexes was very marked at this time. The ugly head of the male and the swollen ovaries of the female furnished unmistakable indications of the respective sexes.

The salmon in the Miramichi begin to spawn about the 15th of October, or, according to the Indians' almanac, when the juniper turns red. The spawning-season seems to be quite short, as the fish were all through spawning in the river in 1868, (except the November ones,) on the 20th of October. On that day and the three succeeding days I swept the

river thoroughly, over nine miles of spawning-ground, with a very long sweep-seine, and of all the salmon we caught, which were a great many, there were only two which had not spawned, and one of these had been injured by a spear-wound. The juniper having now faded, the Indian chief pointed to it again, and said, "Salmon all spawned; no more salmon spawn this year." This was not true, however, of our captured salmon in the ponds, two of which continued to hold their eggs till the 15th of November. Floating ice made its appearance in the river in large quantities as early as the 20th of October, and by the first week in November the river was entirely closed, and fishing through the ice began. The salmon of the Miramichi average about nine or ten pounds in weight. The largest two which we caught weighed 30 pounds each. One was a male, the other a female. As a rule the males were the largest. There are no spring runs of salmon in the Miramichi that I am aware of; but in the Saint John a variety of salmon comes up the river in the spring, and spawns in the spring. They are always expected and regularly fished for at this time. They are a little smaller than the fall fish of the Saint John, and weigh, I believe, eight or nine pounds each. The number of these fish is quite limited.

The salmon of the Restigouche are larger than those of the Miramichi, averaging perhaps twelve pounds. Very large salmon, weighing fifty or sixty pounds, are caught in the Restigouche.

Opinion is very much divided among the fishermen as to the migratory movements of the Miramichi salmon. Some say that there are salmon that go to the sea twice a year; others that they come from the sea but once in two years. It is certain that some remain through the winter in the river, and that there are salmon going down the river in the spring. It is generally agreed that, as a rule, they spawn in October; that the young are hatched in the spring; that they remain in the river until the next spring or succeeding summer, when they put on the smolt-coat and go to the sea. They are then about six inches long. It is thought that they return to the river the same fall as grilse, weighing from three to eight pounds. This, I think, is the common opinion, but I do not consider that the belief is by any means fully established. I saw thousands of smolts going down the river in July, which I cannot believe were the grilse that we caught the following fall. Is it not possible that some of the smolts remain in the ocean till the next year? One-half the parrs of each year, without doubt, remain two years as parrs in fresh water before going to the sea.

#### FRAGMENTARY NOTES.

Salmon are very abundant in the Miramichi and in all the rivers east of it. Messrs. Stone and Goodfellow shipped 60,000 pounds of fresh salmon from this river to Boston and New York from June 10 to July 10, 1869. I never saw a fisherman who had found food in the stomachs of the salmon taken in the river. Our salmon in the artificial breeding-

pond had no food while in confinement, which, in some instances, lasted from the 1st of September to the middle of November, two months and a half. Of the fall runs of fish from tide-water to the spawning-beds the most numerous were between September 27 and October 4. We twice caught a hundred salmon a night at this time in our stake-net set across the river.

The eggs of these salmon vary very much in size, some not being larger than small trout-eggs, others being a third larger than the average size of salmon-eggs. The fishermen claim that they can distinguish a Restigouche salmon from a Miramichi salmon, when one of the former strays into the Miramichi.

In September large numbers of salmon lie in the holes a few miles below the spawning-beds, waiting for a rise of water. When the rain comes and the water rises, they rush up over the rapids to their spawning-grounds in great numbers. The salmon on the Miramichi were caught in 1868 by the whites, mostly in stake-nets running out from the shore about 250 feet. The Indians speared them. We found good and abundant milt in the male grilse. I never saw a female grilse in the Miramichi. If I recollect rightly, I have seen milt in a salmon-parr.

The habits of these salmon about spawning, and in general, resemble those of eastern salmon elsewhere. The number of eggs in a fish is about 1,000 to the pound. See Canadian fishery reports for information about modes of capture, &c, &c.