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SALMON-BREEDING.

The Establishment on McCloud River--John Muir, the Naturalist,
Gives a Graphic Description of What Is Being Done.

[SPECIAL CORRESPONDENCE OF THE BULLETIN.]

U.S. SALMON-BREEDING ESTABLISHMENT ON THE MCCLOUD RIVER,
SHASTA CO., October 24, 1874.

ESCAPING TO THE MOUNTAINS.

Icy Shasta is a noble mark for a mountaineer, and I may soon reach it. Glaciers and pine-trees are in all my thoughts, but just at this moment they are decidedly fishy, a fact readily explainable by my contact with Commissioner Stone and his schools of McCloud river salmon. I was called upon to undergo some of the more characteristic of the processes and vicissitudes of civilization through a period of three hundred days, beginning in the November mists of 1873, and ending with the first ripe goldenrods of 1874. At the close of this season of fog and refinement I fortunately made good my escape to the mountains, proceeding up the Merced to Yosemite, thence across the summit, through Bloody Canyon Pass, and along the eastern base of the range, over the wide basins and valleys of the Mono, Walker, and Carson; thence up into the lake district of Donner and Tahoe, and northward toward icy Shasta. But Shasta's white cone is still eighty miles away, and I have made no advancement for a week, being caught and scholared in the fish schools of the Commissioners. It is stormy now, but the weather was calm a week ago, and I winnowed my way through the weeds and bushes of the foot-hills softly as a salmon in deep waters. Most of the summer flowers are dead, but interesting work was easily found in comparing the pines, and the rock forms, and general aspects of these Shasta hills with those of corresponding position and elevation in the southern portion of the range. The discovery of a new species of woodpecker and three new species of eriogonum, together with a finely fruited and finely colored wild grape-vine that I had never met before made my first day in this region especially joyous, and, of course, night overtook me ere I was aware. A teamster, into whose good graces I found my way by telling a Bret Harte story, directed me to "Allen's," half a mile above this place, where I was assured of finding food and a bed. It was late in the afternoon when I crossed the Pitt river, and dusky twilight was stealing over all the landscape when I reached the banks of the McCloud. The fire of an Indian encampment blazed on a hill to my left, while in front and close to the water's edge I caught sight of a broad expanse of white canvas, which at first appeared to be a shining pool belonging to the river, but on being approached closely, proved to be a large tent with a pair of small pine cabins by its side; and from a tall pole in front the stars and stripes were emphatically displayed.

At Allen's I lost no time in making inquiries concerning the strange camp, and was gladly surprised to learn that it was the McCloud Salmon-egg establishment, and that Stone

himself was present. Hastening back next morning, I was received with genuine kindness by the Commissioner, who at once began to initiate me into the workings of the establishment, and moreover promised to accompany me on my excursion to Mt. Shasta, provided I would wait a few days until he could make the necessary arrangements. Fortunately, the season's work was well nigh completed--the last installment of eggs were being packed for shipment, when he would be entirely free. Livingston Stone has long been known as a scientific cultivator of fishes, and knows how to breed and handle perch, bass, shad, salmon, eels, and hornpouts, as well as Illinois farmers do hogs and cattle.

OBJECTS OF THE COMMISSION.

The objects of the United States Fish Commission, briefly stated, are: First--To prevent the unnecessary destruction of food-fishes; second--To restore wasted waters to their primitive or more than primitive fruitfulness; and, third--To extend the geographical range of the more important food-fishes, such as shad, salmon and trout, by naturalizing them in new waters. When the New England pilgrims began to fish and build, it seemed incredible that any species of destruction could ever be made to tell upon forests and fisheries, apparently so boundless in extent; but neither our "illimitable" forests or ocean, lake or river fisheries are now regarded as inexhaustible.

Uncle Sam seldom manifests any disposition to look very far into the future; nevertheless, Congress has at length been convinced that our stores of trees and fishes may be exhausted, and has therefore commenced the manufacture of laws for their protection or restoration. Some fifteen years ago, individual States began to consider the permanent welfare of their fisheries; but it was not until the year 1872 that Congress began to move in the matter. The appropriation for the wants of the Commission for the present year amounts to $30,000.

OBJECT OF THE M'CLOUD RIVER ESTABLISHMENT.

The chief object of the establishment at this place is to procure the eggs of the fine large salmon (*salmo quinnat*) for shipment, with a view to the creation of new fisheries and the restoration and improvement of old ones.

WORK ACCOMPLISHED.

One million five hundred thousand eggs were shipped from here in the season of 1873, which was the first season of the present establishment.

In the season of 1874, just ended, 5,752,500 were taken, of which 5,100,000 were hatched, and the following quantities shipped. To

Bangor, Me.	100,000
Winchester, Mass.	200,000
Providence, R.I.	100,000

Middletown, Conn.	300,000
Rochester, N.Y.	500,000
Bloomsbury, N.J.	225,000
Marietta, Pa.	300,000
Baltimore, Md.	375,000
Niles, Mich.	750,000
Clarkstown, Mich.	150,000
Boscobel, Wis.	100,000
St. Paul, Minn.	150,000
Ammosa, Iowa	300,000
Salt Lake City, Utah	150,000
Newcastle, On., Can.	25,000
New Hope, Bucks Co., Pa	150,000
Georgetown, Col	25,000
Randolph, N.Y.	25,000
Rockford, Ill.	50,000
Lynchburg, Va.	50,000
New Zealand	25,000

HOW THE EGGS ARE PROCURED.

Toward the end of August the McCloud river salmon are ready to spawn and are then seen pushing their way up toward the sources of the river to deposit it. Mr. Stone has constructed a salmon dam at this place which stretches across the river from bank to bank. In front of this dam the salmon collect in great numbers and keep up a constant plashing in their efforts to leap over it. Most of them are unsuccessful and fall back wearied and glad to rest in the first slow-currented eddy. This eddy is a few yards below the dam, and here the tired salmon are captured and the eggs stripped from them into suitable vessels. The eggs are then impregnated by pressing the milt of the male salmon upon them and stirring them gently so as to bring every egg in contact with it. The eggs thus artificially spawned and artificially fecundated are then placed in troughs through which a stream of pure water, carefully filtered, is kept flowing. The eggs measure about 1/3 of an inch in diameter--are pink in color, and look like ripe currants. After they have been in the hatching-troughs about sixteen days the eye-spots of the coming salmonets begin to appear, and they are now ready for shipment. They are packed in boxes, in layers spread upon mosquito-netting, between layers of green, living moss, and these boxes are packed in crates with ice, to keep them cool. In this way, with adequate care and skill in handling, they may be sent safely by ship, wagon, or rail, to great distances. After arriving at their destination they are replaced in hatching-troughs similar to those from whence they were taken, and the hatching process continued until the young fry break the

shell and swim. In procuring the 5,572,500 eggs mentioned above about 5,008 salmon werh taken, more than half of which were males.

Thus it will be seen that the berry-like eggs or seeds are stripped from the salmon like peas from a pod. The empty fish-husks average about fifteen pounds, and fall to the share of the Indians, who dry them for winter. It is supposed that all salmon die after yielding their spawn even in the natural way. This destruction, therefore, of so many handsome fish legumes need not be deplored. Here the question is sure to arise, why not capture the breeding salmon and transport them alive to the waters where they are wanted, and allow them to spawn and hatch in their own natural way? Before the discovery of artificial fecundation by Jacobi, this method was the only one known, and is still in practice to some extent. The troutless streams that rush out from cool canyons of the Sierra in the Owens River Valley were stocked last year by a German, who packed trout in cans on the backs of mules from the King's river, Yosemite, over a pass 12,000 feet high. But this more natural method is too slow. Nature does not seem to think of hatching more than one or two in a hundred of the eggs that are spawned, whereas Mr. Stone hatches more than 95 per cent. by the artificial method. In every hundred Nature gives one to the frog, one to the mink, one to the snake, and one to the water-ouzel, etc., and hatches one into a salmon. In like manner the nut-eggs of pine-trees, contained in burrs, are sufficient for the food of many a bird and squirrel as well as for the wants of reproduction.

DESTRUCTION OF FISH--TAMING FISH.

Artificial destruction has made lakes and rivers as barren as deserts, so far as fish-food is concerned. Prior to the gold period the Tuolumne abounded in salmon, but the mud of mining destroyed them, or drove them away. The Connecticut was also a salmon stream until obstructed by dams, and poisoned by those strangely-complicated filths for which our civilization is peculiar. When fish-ladders are constructed over dams and the sewage of towns and factories is consumed upon the land instead of being poured into the water, leaving paths from the ocean to the spawning grounds free and clean, then our valuable migratory food fishes, such as the shad and salmon, will again become abundant, and that ere long, provided artificial destructions be compensated by artificial reproductions.

Fish may be tamed, and many engage in their culture for the novelty of the thing, or for a natural love of playing and choring in an ichthyological atmosphere, but Stone and his fishy co-workers mean bread and business, and their practical success, considering the infancy of the piscicultural art and the magnitude of the obstacles which had to be overcome, is truly remarkable.

OTHER FISH--HATCHING, ETC.

Besides the harvesting and distribution of McCloud salmon ova, Commissioner Stone brought shad, bass, white fish, eels, horn-pouts and oysters, from the East, mostly for the fructification of California waters. The first aquarium car destined for this State tumbled through the railroad trestle-work into the Elkhorn river, with all its precious fry, much to the discomfiture of Commissioner Stone, who had not the slightest intention of thus

casting his shad upon the waters, though some may grow and be found again after many days.

Nearly a million of the eggs taken here this season have been fully hatched and turned into the McCloud river, from whence they were derived, and for this host of wriggling fry the State of California pays the Commission $1,000.

The eggs hatch out into finned fishes in about fifty days, more or less, according to the temperature of the water. When they break the shell they seem eager to try life, and immediately ply their fins. They are then only half an inch long, frail, and semi-transparent, and utterly incapable of gaining an independent livelihood; but nature makes that all right by providing each youngling with a bag of provision big enough to last six or seven weeks, and at the end of this period they are grown sufficiently strong to shift for themselves. Their provision-sacks are twice as heavy and bulky as their bodies, and they cannot swim far with them at a time. In resting, they frequently lean back, or lie down upon their provision, just as mountaineers do when weary and heavy laden. Long may McCloud salmon swim!

Meantime glaciers and pine-trees rise in vision, and I go to icy Shasta.

JOHN MUIR.