

reservoirs and grew to weigh, frequently, as much as ten pounds; these reproduced until the reservoirs have been stocked. As the supply of fish increased the quantities of food lessened, so that the salmon have gradually decreased in weight until now, after nine years, they do not average more than two pounds. From the fact that, when food was in abundance, they grew to weigh from eight to twelve pounds, and that, as they increased in numbers, they averaged less in size, but still continued to spawn and produce young fish, it would seem that the Sacramento salmon may be successfully introduced into large lakes in the interior of the continent, where, in consequence of dams or other obstructions, they would be prevented from reaching the ocean. The history of this fish in these small reservoirs shows that all that is requisite for their successful increase is the abundant supply of food, to be found in large bodies of fresh water. Salmon, fully mature, weighing two pounds, and filled with ripe eggs, were taken, in September, 1877, in the waters of San Leandro reservoir. These fish were hatched in the stream which supplies the reservoir, and by no possibility have ever been to the ocean. The San Leandro is a coast stream, not exceeding fifteen miles in length, and empties into the Bay of San Francisco. It contains water in the winter and spring, at which time, before the reservoir was constructed, the salmon sought its sources for the purpose of spawning. There was never sufficient water in the months of August or September to permit the fish to reach their spawning grounds. After the construction of the reservoir, large numbers of the salmon that came in from the ocean in January and February were caught at the foot of the dam and transported alive and placed in the reservoir above. The descendants of these fish thus detained in fresh water and not permitted to go to the ocean, have so far modified the habits of their ancestors that they now spawn in September, instead of in January and February. Inasmuch as these fish spawn in the McCloud, in the headwaters of the Sacramento, and at the sources of the San Joaquin, in the Sierra Nevada, in September, and in short coast range rivers, in January and February, and as, when changed to other waters, their eggs ripen at a time when the conditions of their new homes are most favourable for reproduction, they show a plastic adaptability, looking to their future distribution, of much practical, as well as scientific, importance.

3. The statistics hereafter given of the temperature of the water through which the Sacramento and San Joaquin salmon pass to reach their spawning grounds, show that they swim for hundreds of miles through the second hottest valley in the United States, during the hottest portion of the year, where the mean temperature of the air is 92° Fahrenheit, and of the water, 75°. These statistics have been obtained from the record kept by the Central Pacific Railroad Company, and are for the months of August and September of the years 1875-6-7. They are of importance as showing that the Sacramento salmon will enter rivers for spawning purposes, where the water is so warm that the eastern salmon (*salmo salar*), if it were to meet it, would turn back to the ocean. They are also of importance as illustrating the probability that there are many streams on the Atlantic Coast, from the Potomac to the Rio Grande, into which this fish could be successfully introduced.

4. Mr. Livingston Stone, Deputy United States Fish Commissioner, in charge of the Government hatching establishment on the McCloud river, reports officially that, in his opinion, all of the salmon of that river die after depositing their spawn. This is possibly true, but it does not account for the fact, that in the spawning season the McCloud contains grilse and fish evidently of three, four, and five years old, unless we are to imagine that some salmon, after being hatched and going to the ocean, remain there two, three, or more years without returning to the parent stream for purposes of spawning. Beyond doubt the salmon that spawn in the coast streams go back to the ocean, as they are frequently taken in the lagoons at the mouths of these rivers on their return. Somewhere on the tributaries of the Sacramento or San Joaquin, there are salmon that do not die after the act of spawning, for they are frequently taken in the nets of the fishermen in the brackish waters at Collinsville and Rio Vista, on their return from their spawning grounds. If it were a fact that the Sacramento salmon so widely differed from other fish that it spawned but once and then died, it would detract from its value. This subject is one of importance, but at present the facts are so obscure that we have made considerable effort to obtain the opinions and the result of the observations of the men who are practically engaged in the taking of salmon in the Sacramento river.

5. The following, from the letter of a fisherman who has pursued the business of taking salmon for the San Francisco market during more than fifteen years, gives some facts and his theory, based on his observations. In reply to an inquiry on the subject, he says "As to the return of the seed salmon to the sea after depositing the spawn, I am inclined to the opinion of Mr. Stone, so far as the greater part of the female fish is concerned. I think very few of these, but many, though not all of the males return. I should judge that 5 per cent. of females, and 20 per cent of males might be an approximation. I express this opinion diffidently. It is based on the style of fish caught in the lower part of the river (from Sacramento to Collinsville). After about the 20th of September, of the fish then dropping down, the nets catch but few, for the reason that the net is drifting with the current and the fish are doing the same thing, and in consequence, as a rule, the two do not come together, and the greater part of the return fish escape. When the run is upward, the net drifts with the current, and the fish swim against it, and the rule is reversed. The per centage named above is not that of return fish caught, but of fish that I estimate may have returned, judging by the very few return fish that are caught. It is a very cloudy subject to all fishermen. I have heard, perhaps, a thousand discussions on the river, at all times of day and night, at the head of the 'drift,' among men of the largest experience—men right in the teeth of the business—men born to a boat and net, and grown gray and grizzled in their use—upon the point you raise, and the average conclusion always was that nobody quite knew how it was. Of one thing I am convinced, to wit, that return fish need no protection from the drifting gill net. Not one fish in ten could be caught in that way. No such thing as a run of salmon down the river ever occurs. The normal position of salmon is head to the current. Though drifting with the current, his head is toward it. In the light (or darkness) of these facts, you see how difficult it is to say, positively, what proportion of these fish that have delivered seed, return to the ocean. No man can say positively that the mass do not return. That some return is beyond doubt of a reasonable nature. If they all perish, it is certain that many survive long enough to reach the fishing grounds lying in the bays nearest the ocean. But I fail to see why the value