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REPORT  
OF THE  
COMMISSIONERS OF FISHERIES  
OF THE  
STATE OF CALIFORNIA,  
FOR  
THE YEARS 1874 AND 1875.

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## REPORT.

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To His Excellency,  
ROMUALDO PACHECO,  
Governor of California:

The Commissioners of Fisheries for the State of California, appointed under an Act of the Legislature entitled "An Act to provide for the restoration and preservation of fish in the waters of this State," approved April second, eighteen hundred and seventy, respectfully submit their Third Biennial Report.



## REPORT.

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Your Commissioners detailed in their last biennial report the loss of the aquarium car, in eighteen hundred and seventy-three, by the breaking of a railroad bridge over the Elkhorn River, in Nebraska, by which one year's time was lost in the experiment of stocking the waters of California with new varieties of valuable food-fish.

In eighteen hundred and seventy-four we determined again to repeat the experiment, believing, that if successful, it would in time largely repay the people of the State for the small amount expended. We, therefore, in March, eighteen hundred and seventy-four, telegraphed to Mr. Livingston Stone to prepare another aquarium car, and by letter instructed him with reference to the varieties of fish to be brought across the continent. He arrived on June twelfth, having succeeded in transporting the following fish:

Seventy-three full grown spawning Black Bass from Lake Champlain, which were placed in Napa Creek.

Twelve small Black Bass (*Grystes fasciatus*), from St. Joseph's River, Michigan, which were placed—a portion in Napa Creek, and a portion in Alameda Creek.

Sixteen full grown Glass-eyed Perch (*Lucio perca*), from Missisquoi River, Vermont, which were placed in the Sacramento River, opposite Sacramento City.

Seventy-four Catfish—fifty-six being the large Schuylkill Catfish obtained in the Raritan River, New Jersey, and the remainder, Mississippi Catfish, from Elkhorn River, Nebraska, which were placed in the San Joaquin River, near Stockton.

Seventy Horn-pouts (*Pimelodus*), from Lake Champlain, Vermont, which were deposited in lakes at Sutterville, Sacramento County.

One can—containing twelve—small Silver Eels (*Anguilla*), from Hudson River, New York, which were placed in a lake near Sacramento.

Three hundred and five small Eastern Salmon (*Salmo salar*), which were obtained from the Penobscot River, Maine, and were deposited in the Sacramento River, near Redding.

Four full grown Rock Bass from the Missisquoi River, Vermont, which were deposited in Napa Creek.

Of salt-water fish there arrived twenty-three Tautogs or Black Fish (*Tautoga Americana*), from Woods' Hole, Massachusetts, which were deposited in the Bay of San Francisco.

Of the one hundred and fifty full grown spawning Lobsters, with which Mr. Stone started, and which were obtained in the Bay of Mas-

sachusetts, but three arrived alive. These were placed in the Bay of San Francisco.

One can of small salt-water Eels, about one thousand five hundred, obtained in New York harbor, were deposited in the Bay of San Francisco, opposite Brooklyn.

The details of Mr. Stone's experiments, in gathering and transporting these different varieties of fish on so long a journey, will be found appended to this report, and are a valuable contribution to the new science of fish culture, and will enable the Commissioners of other States to take advantage of Mr. Stone's experiments in the transportation of live fish during long journeys.

Of the new varieties of fish thus introduced into the waters of California, we are satisfied that the greater number have found congenial homes, and have spawned. Black Bass have, during the present season, been caught in Napa Creek, and large numbers of the young have been seen. By another season they could be obtained in limited quantities for the purpose of stocking ponds and streams in other portions of the State, by such persons as desire them. They should only be placed, however, in streams and ponds not adapted to Trout, for the reason that if placed in Trout streams they destroy the Trout. The Black Bass placed in Alameda Creek have been seen, but so far as we can learn, none have been caught. One of the Glass-eyed Perch placed in the Sacramento River has been caught in a slough, to which it was probably repairing for the purpose of spawning. No report has come to us that any of the young have yet been seen.

The Schuylkill Catfish and the Mississippi Catfish, placed in the San Joaquin River, have grown rapidly and spawned, but several of the large fish, and many of the young ones, have been caught by the fishermen near the San Joaquin bridge, and have been returned to the river. The fishermen at that point are much interested in their successful cultivation, and seem desirous that they should be preserved. By another year they will be so numerous that they may be caught with safety and shipped to market, as it would be impossible to exhaust the river by ordinary fishing. The Horn-pouts, a species of small Catfish from Lake Champlain, which were placed in the lakes near Sacramento, have increased so abundantly that nearly one thousand have been caught and transported to the various lakes and sloughs in the Sacramento Valley. We caused several hundred of them to be placed in lakes containing brush and dead trees, in which it would be impossible to seine them. The acclimatization and perpetuation of these fish in the Sacramento Valley is assured, as they are now so situated that no amount of fishing will exhaust them.

Of the fresh-water Eels placed in a tributary of the Sacramento River, we learn that one had been caught in Willow Slough, in Yolo County, which had grown to be more than a foot in length.

None of the Eastern Salmon have been seen since they were placed in the Sacramento River. It is hardly to be expected that they should be, as yet, as without doubt they have gone to the ocean, not to return until the Spring of eighteen hundred and seventy-six, when we hope to hear of some of them being caught on their return for the purpose of spawning. It will be interesting to learn, in after years, if they will cross with the Sacramento Salmon and produce a new variety.

The Rock Bass, placed in Napa Creek, we have not heard from.

We have no knowledge that the Tautogs, salt-water Eels, and spawning Lobsters, placed in San Francisco Bay, have ever been seen. Many

crustaceans, resembling young Lobsters, have, during the present season, been caught in the Bay of San Francisco, which were not before known. It is not yet definitely determined that these are the young of the Lobsters brought from the East.

We feel that this experiment in the importation of new varieties of fish is so great a success that the people of the State are already amply repaid for the small amount of money expended in the undertaking.

#### WHITE FISH.

During the past Winter we received from the United States Government, through the kindness of Professor Spencer F. Baird, United States Fish Commissioner, twenty thousand White Fish eggs from Lake Michigan (*Coregonus alba*). We also purchased, in Charlestown, N. H., sixty thousand eggs of the Eastern Brook Trout. It will be remembered that in eighteen hundred and seventy-three, we received from the Government of the United States twenty-five thousand White Fish eggs from Lake Superior, which were successfully hatched at Clear Lake, and placed in that body of water. Inasmuch as Clear Lake seemed to be well stocked with these fish—several mature fish having been caught during the past Winter—we thought it advisable, if successful in hatching, to place this donation in Tulare Lake; the inhabitants of that vicinity very much desiring it, and the waters of that lake being of the proper temperature and containing their natural food. We, therefore, through the kindness of the Regents of the University, were permitted to erect a small hatching-house on the banks of the stream at Berkeley, where, under the supervision of Mr. J. G. Woodbury, these eggs were successfully hatched. This point was selected because the building erected on the University grounds, when not in use for hatching purposes, would be under the supervision of the officers of the University, and it seemed of importance that the students should have an opportunity, if they so desired, to learn practically the process of fish-hatching. On the twenty-ninth of March, eighteen hundred and seventy-five, the young fish were placed in Tulare Lake, which is the largest body of fresh water in the State, and, we have no doubt, that in a few years it will be abundantly stocked with this most valuable variety of food-fish. Experiments made by filling a vessel with water from the lake, and placing some of the young fish in it, showed that the water is filled with the minute vegetable matter and animalcula on which the young fish feed, as they immediately commenced darting in every direction in search of food. We carried the cans of young fish in a boat some two hundred yards from the shore, and turned them into the lake among large patches of tule where they can hide from their natural enemies. The lake contains, at the present time, but two varieties of fish that are used for food—a Perch, and a large cyprinoid, locally called Lake Trout, and, if these experiments of planting in it White Fish shall prove a success, it will give the people of the San Joaquin Valley an abundance of most excellent fish.

#### TROUT.

The sixty thousand eggs of the Eastern Brook Trout were also hatched at the State hatching-house, at Berkeley, under the supervision of Mr. Woodbury, with a loss of only four per cent, which were distributed in the public waters of the State, as follows:

Twenty thousand in the lakes and streams of Mendocino, Sonoma, Napa, and Yolo Counties.

Ten thousand in the North Fork of the American River, in Placer County.

Ten thousand in Prosser Creek, in Nevada County, and twenty thousand in Calaveras Creek, in Alameda and Santa Clara Counties, and in other streams emptying in the Bay of San Francisco.

#### SHAD.

We were unable to procure from the United States Government any young shad during the past two years. The hatching of them by the Government was not so successful as heretofore, and all that were hatched were required to be turned into the rivers running into the Atlantic. California is promised a large supply if the Government is successful in hatching during the next year. Of the fifty thousand that have been heretofore planted in the Sacramento River, in eighteen hundred and seventy-one, and eighteen hundred and seventy-three, by Seth Green and Livingston Stone, we know that many of the first have returned from the ocean, and, without doubt, have spawned. The last lot of thirty-five thousand will certainly return from the ocean in February and March next for the same purpose. We believe that these experiments of transplanting Shad to the rivers of the Pacific Coast, will prove a success. We know of some sixteen full-grown Shad having been caught at Vallejo and in the Sacramento River, and have heard reports of others having been taken during the present season; but, as under an Act of the Legislature, every person who takes a Shad prior to March, eighteen hundred and seventy-seven, is subject to a penalty of fifty dollars, we find it difficult to obtain information in relation to the catching of Shad, until after the evidence has disappeared.

We believe that after eighteen hundred and seventy-seven, Shad will be found quite numerous in the Sacramento River.

#### SALMON.

The largest establishment in the world, for the hatching of salmon eggs, is that of the Government of the United States, on the McCloud River, in Shasta County, under the superintendence of Mr. Livingston Stone. At this point from six to ten million of young Salmon are hatched each year and distributed to the Fish Commissioners of the various States having rivers suitable for their growth and increase. In eighteen hundred and seventy-three California received from this source half a million fish, which were turned into the Sacramento River. The Government works at this point are so extensive, and conducted with such economy, that it is found that the total cost of hatching one thousand fish from the egg is but one dollar.

We have thought it to be of so much public importance to increase this valuable variety of fish in its native waters, that during the past year we considered it advisable to expend one thousand dollars in the hatching of a million more fish, to be placed in the Sacramento River. We therefore applied one thousand dollars of our small appropriation to this purpose, and the fish have been successfully turned loose.

Our appropriation being about exhausted, we will this year pay for the hatching of but half a million more fish.

The importance of the object of increasing the quantity of Salmon in

the Sacramento River for the public benefit has, however, attracted the attention of some of our public-spirited and wealthy citizens, who are actuated by a desire to increase the food supply of valuable fish. Ex-Governor Leland Stanford has requested your Commissioners to cause to be hatched during the present season (at his expense) one million Salmon, to be turned into the Sacramento River; and Mr. Charles Crocker has also requested your Commissioners to hatch (at his expense) half a million more; some hundred thousands, at his desire, have been placed in Kern River and in Lake Tahoe.

There will, therefore, be placed in the waters of this State, during the present season, and before this report is printed, two million of Salmon; and should the State receive her usual share from the Government, probably half a million more.

We have every reason to believe that the Salmon donated by Mr. Crocker to the public, and turned into Kern River and Lake Tahoe, will thrive and increase, and add largely to the valuable food-fish for the inhabitants of those portions of the State. It seems to be pretty well settled, from experiments made by the Commissioners in other States, that it is not absolutely necessary for Salmon to go to the ocean; if they can reach large bodies of water, containing an abundant supply of food, their purpose is answered, whether the water is fresh or salt. It is reported, on good authority, that the young Salmon, placed a few years since in the rivers of Michigan, found sufficient food in the waters of the lakes, and, during the past year, returned to the rivers in which they were placed and deposited their spawn. The waters of Lake Tahoe empty into Pyramid Lake, whose waters are brackish, and abundantly supplied with food. Kern River empties into Kern and Bucna Vista Lakes, whose waters are slightly alkaline and brackish.

It is hoped that these fish may find these waters suitable for their purpose, for should the experiment be attended with success, it will add materially to the wealth of the State.

Salmon have been more plentiful in the Sacramento River, during the present season of eighteen hundred and seventy-five, than ever before, since Americans had knowledge of the country. This is to be attributed, first, to the "close season," under an Act of the Legislature, which prohibits the catching of Salmon anywhere in the State between the first of August and the first of November; and, secondly, to the quantities of young Salmon turned loose from the artificial hatching establishment, which were donated to the State by the Government of the United States. Whether or not Mr. Crocker's experiment, of placing Salmon in rivers having no outlet to the ocean, shall result in success, it is certain that the million of Salmon, artificially hatched and turned, during the present season, into the Sacramento River, at the expense of ex-Governor Leland Stanford, added to those hatched from the State appropriation, and those donated by the United States Government, will so materially increase the quantity of these fish in that river that, after three years, there will be found more profitable fishing than has heretofore been known.

We believe that if the Legislature, instead of giving to the control of your Commissioners a mere pittance of two thousand five hundred dollars a year, for the purpose of the importation of new varieties of fish and increasing the quantities of native fish, were to make an appropriation of six or ten thousand dollars yearly, that so many Salmon could

be hatched and deposited in the Sacramento and San Joaquin Rivers that, after three years, the fish would be so numerous that they would compel as extensive Salmon canning establishments on those rivers as there are now on the Columbia, and that the increase of wealth and revenues to the State, from these sources, would pay one hundred fold on the outlay.

In this connection, we desire to call attention to Mr. Livingston Stone's report to the Commissioners, hereto appended, on the subject of the Salmon of the Sacramento, and of the increase of wealth that may be derived from this source.

While on the subject of the necessity for increasing the appropriations, your Commissioners may also be pardoned in alluding to the fact that all of the business, in connection with the Fish Commission, is attended to without salary, and that, in the necessary work of receiving and distributing fish, they pay their own traveling expenses. They would, therefore, confidently ask the Legislature for this increase, which, without abatement, would be applied to the objects of the appropriation, in increasing the variety and quantity of food-fish in our rivers, lakes, and bays.

Much attention is given to the Sacramento Salmon (*Salmo quinnat*) by scientists and by fish culturists in other countries, for the reason that it comes into rivers to spawn in latitudes much lower and in waters much warmer than any other variety yet known. Large numbers pass up the San Joaquin River for the purpose of spawning in July and August, swimming for one hundred and fifty miles through the hottest valley in the State, where the temperature of the air at noon is rarely less than eighty degrees, and often as high as one hundred and five degrees Fahrenheit, and where the average temperature of the river, at the bottom, is seventy-nine degrees, and at the surface, eighty degrees. The Salmon of the San Joaquin River appear to be of the same variety as those in the Sacramento, but average smaller in size. Their passage to their spawning grounds at this season of the year, at so high a temperature of both air and water, would indicate that they will thrive in all the rivers of the Southern States, whose waters take their rise in mountainous or hilly regions, and, in a few years, without doubt, the San Joaquin Salmon will be transplanted to all of those States. The fact that the San Joaquin Salmon should be found in a river in one of the warmest portions of California, at the hottest season of the year, for this purpose, is so extraordinary, that we here append the maximum, minimum, and mean temperature of the air and water for the months of August and September, from the record kept at the railroad bridges crossing this river. These statements will be of great service towards determining the fact into what Southern rivers, emptying into the Gulf of Mexico and the Atlantic Ocean, the San Joaquin Salmon may be safely transplanted.



## TEMPERATURE.

*Lower crossing San Joaquin River, months of August and September, eighteen hundred and seventy-five. Latitude 37° 50' N. Longitude 121° 22' W.*

		Air.	Water at surface.	Water at bottom.
		Degrees.	Degrees.	Degrees.
August .....	Maximum.....	98	82	81
August .....	Minimum.....	73	72	71
August .....	Mean .....	88 $\frac{16}{100}$	78 $\frac{67}{100}$	78 $\frac{3}{100}$
September...	Maximum.....	94	78	78
September...	Minimum.....	73	72	72
September...	Mean .....	85 $\frac{63}{100}$	74 $\frac{8}{100}$	74 $\frac{43}{100}$

*Upper crossing San Joaquin River. Latitude 36° 52' N. Longitude 119° 54' W.*

		Air.	Water at surface.	Water at bottom.
		Degrees.	Degrees.	Degrees.
August .....	Maximum.....	107	84	83
August .....	Minimum.....	82	74	73
August .....	Mean .....	100 $\frac{61}{100}$	80 $\frac{67}{100}$	79 $\frac{67}{100}$
September...	Maximum.....	104	82	83
September...	Minimum.....	82	74	73
September...	Mean .....	95 $\frac{53}{100}$	78 $\frac{83}{100}$	77 $\frac{83}{100}$

We have obtained, through the courtesy of the officers of the Central Pacific Railroad Company, the following statistics of the Salmon shipped over their lines, from various points on the Sacramento and San Joaquin Rivers, from November first, eighteen hundred and seventy-four, to August first, eighteen hundred and seventy-five, this being the only portion of the year in which Salmon are, under the law, allowed to be caught:

From Collinsville, New York of Pacific, Rio Vista, Emmaton, Jersey Landing, Antioch, Benicia, Courtland, Martinez, Kentucky, Bradford, Sacramento, Vallejo, and Webbs.	To San Francisco, from Nov. 1, 1874, to August 1, 1875 .....	128,692 loose salmon, weighing	3,217,300 lbs.
		1,874 boxes of salmon, weighing.....	421,650 lbs.
		1,847 sacks and baskets of salmon, weighing.....	184,700 lbs.
		116 barrels cured salmon, weighing .....	23,100 lbs.
		225 barrels and boxes smoked and dried salmon, weighing	45,000 lbs.
From Courtland, Benicia, Rio Vista, Emmaton, and Collinsville...	To Sacramento, from Nov. 1, 1874, to Aug. 1, 1875 .....	1,733 loose salmon, weighing...	43,325 lbs.
		722 boxes of salmon, weighing	83,700 lbs.
		117 baskets and sacks of salmon, weighing.....	11,700 lbs.
From Antioch.....	To Stockton, from Nov. 1, 1874, to Aug. 1, 1875.....	212 barrels of salmon, weighing .....	29,900 lbs.
		96 loose salmon, weighing.....	2,400 lbs.
		73 boxes of salmon, weighing..	16,250 lbs.
Total.....			4,079,025 lbs.

The above statistics only include the Salmon carried from the Sacramento and San Joaquin Rivers, to the Cities of San Francisco, Sacramento, and Stockton, from points below the Cities of Sacramento and Stockton; they do not include the catch of the fisheries at Tehama and the upper Sacramento River, etc., nor of the upper San Joaquin. Neither do they include Salmon brought to market by other conveyances than by the cars and steamers of the Central Pacific Railroad Company, nor those caught and sold during the "close" season. It is, therefore, safe to add one fourth to the above total. This would give, as the total weight of Salmon caught during the past season, in the Sacramento and San Joaquin Rivers, five million ninety-eight thousand seven hundred and eighty-one pounds, which, at the average wholesale price, would make the business yield, annually, a half million dollars.

(There were shipped by rail from Sacramento to Chicago and New York, during the same period, ninety-two thousand pounds of fresh Salmon in ice. These have not been added to the total of the foregoing statistics, for the reason that they may have been included in the schedule of those forwarded to Sacramento, from points on the river below that city.)

From the same points, by the same conveyances, there were shipped to San Francisco two thousand three hundred and sixty-seven Sturgeon, weighing one hundred and eighteen thousand three hundred and fifty pounds.

#### CARP.

We have received information from United States Fish Commissioner Spencer F. Baird, that he is expending a portion of the appropriation made by the Government in the importation of the European Carp, and especially of the "King" Carp, from the regions of the Upper Rhine, the Danube, and the Po. Some of these fish have arrived and have been placed in ponds near Baltimore. We are promised a portion of the increase of these fish for distribution in the waters of this State.

Some Carp, from Hamburg, which were imported a few years since by Mr. Poppe, of Sonoma, and planted in ponds of that county, have thrived, and the produce is occasionally sold in the San Francisco market. These fish are, of course, private property.

It is the opinion of those best acquainted with the subject that there is no fish that promises so great a return in limited waters. It is eminently adapted to the sloughs, tule lakes, and inland waters of the Sacramento and San Joaquin Valleys. It has an advantage over the Black Bass and Trout, in that it is a vegetable feeder, and, although it will not refuse animal food, it can thrive well on aquatic vegetation alone. On this account it can be kept in tanks and small ponds, and a larger weight obtained without expense than in the case of the other kinds mentioned.

Professor Baird, in his annual report, says: "It is a mistake to compare the flesh of the Carp with that of the ordinary *cyprinidæ* of the United States, such as Suckers, Chub, and the like; the flesh of the genuine Carp being firm, flaky, and in some varieties almost equal to the Trout."

#### LOBSTERS.

Whether the few Lobsters brought in the aquarium car, and placed in the Bay of San Francisco, have lived and cast their eggs which have produced young, is uncertain. Nothing but scientific investigation by

persons familiar with the young of various kinds of crustaceans, will decide whether the so-called young Lobsters which have made their appearance in the Bay of San Francisco, during the present season, are in reality Lobsters. Great interest appears to be felt in the introduction of this variety of shell-fish to the Pacific Coast.

Should the Legislature see fit to increase the appropriation, we will again make the attempt to plant Lobsters in the waters of California. In furtherance of this project, Professor Baird has been making various experiments at Woods' Hole, Massachusetts, during the present Summer, for the purpose of ascertaining by what mode Lobsters can longest be kept alive. When the results of these experiments have been demonstrated, we will again make the attempt.

#### SEA LIONS AND SEALS.

For many years the Sea Lions and Seals which inhabit the cliffs near the entrance to the Bay of San Francisco, have been preserved by special enactment, and penalties imposed on any person who should kill or disturb them. The result is, that they are probably now a hundred times as numerous as they were ten years since, and are to be found there in thousands. When it is considered that they weigh from two to five hundred pounds each, and that they each consume at least from ten to twenty pounds of fish daily, it will be readily seen that the quantity caught at the entrance of the harbor and in the Bay of San Francisco, by fishermen, is small in proportion to that consumed by these animals. If allowed to increase at the same rate for a few more years, it will be difficult for either Shad or Salmon to escape them, while entering our bay. The fishermen at Vallejo and Rio Vista report that they find many of the Salmon to have been torn by the teeth of these animals. They appear now to serve no useful purpose, other than to gratify the curiosity of strangers, and we believe it would be well if the law which now protects them were repealed, and nine tenths of them were allowed to be shot, that their oil might be utilized in the lubrication of machinery. We would recommend that this law be repealed, and, if necessary, again reenacted after nine tenths of them had been destroyed.

#### OVER-FISHING.

The preservation of the fish in the waters of this State is of so much importance that we would advise the appointment of a standing committee by the Legislature, on the subject of the fish and fisheries of California. This committee should take testimony in relation to the different modes of catching fish by nets, traps, etc., and, after information had been obtained, advise as to the size of the mesh of gill nets, and if any of the present modes of fishing should be restrained or regulated. It has come to the knowledge of your Commissioners that the Chinese, for catching Shrimp (which are dried and exported to China), use a net of a mesh so small that hardly any of the young of the valuable varieties of our fish escape; and, when it is remembered that the majority of the young of the salt-water fish of the coast seek their food in the shallow waters near the shore, where the stake-nets for Shrimp are placed, and that all of the young fish thus caught are either thrown on the shore to die, or fed to hogs, it is evident that without legislation many varieties of our fish will soon be exhausted. A great many tons of dried Shrimp are annually shipped to China by the Chinese mer-

chants of San Francisco. There must be several hundred Chinese fishermen engaged in fishing for Shrimp in the Bay of San Francisco, for that market. When it is remembered that many of our most valuable varieties of sea fish come into the bay seeking for Shrimp as their natural food, it is a question whether unrestrained and unregulated fishing for this crustacean will not, in time, seriously affect the fisheries of the bay and harbor.

Under the law, as it at present exists, in relation to Trout, Indians are unrestrained in their mode of catching them. Taking advantage of this, white men, for purposes of gain, employ Indians to catch Trout from the various mountain streams with grab-hooks, baskets, and all the other methods which ingenuity has devised for the trapping and catching of fish, without regard to the season. Legislation should be had to prevent the Indians from taking fish, except in the manner to which they were accustomed before the advent of white men.

#### FISHWAYS.

We have adopted a plan for a fish ladder, and caused the same to be lithographed, and distributed copies to all persons who were erecting dams on streams containing fish. Those that have been erected work satisfactorily, and we continue to furnish plans to all who may ask them. So far, we believe, all parties who have been notified to construct fishways have done so.

#### OBSERVANCE OF THE FISH LAWS.

The duties of your Commissioners involve a vast amount of correspondence—especially with people who see some violation of the laws for the preservation of fish. We desire to call attention to the fact that it is not, especially, the duty of the Fish Commissioners to see the laws observed, but it is also the duty of every citizen; and if, when persons see a violation of the law, they will notify the District Attorney of the county, giving him the information and the facts, and informing him where the witnesses can be found, he will prosecute without waiting for a request from the Commissioners.

#### SAWDUST.

At one time Salmon were quite numerous in the American, Yuba, and Feather Rivers. In eighteen hundred and fifty and eighteen hundred and fifty one, large quantities were taken by the miners and by Indians at Salmon Falls, on the American River, as far up as Downieville on the Yuba, and at various points on the Feather River. No Salmon visit these streams at the present time. This is not because of the earthy matter from mining held in suspension in the water of these rivers, for the Salmon pass readily through the lower part of the Sacramento River, which is as muddy as any of these streams, but because the deposit from mining covered the gravel beds where the fish spawn. It seems to be necessary for Salmon eggs to mature and hatch out the young fish, that they should be deposited in beds of clean gravel over which pure water is passing.

The Salmon readily go through muddy water to reach their spawning beds, but there must be no mud or sediment where their eggs are laid. The Salmon certainly passed up these streams for a few years after ex-

tensive mining was prosecuted, but their spawning beds being covered by sediment, their eggs would not mature; and as the old fish died or were killed (no new ones taking their place), they became extinct in these streams. A similar condition of things exists with regard to sawdust; neither Salmon nor Trout object to passing through water in which sawdust is floating, and if their spawning beds are above the sawmills, the fish in the streams on which sawmills are situated will continue to breed; but if the sawmills are situated above the spawning beds of the fish, the sawdust is deposited on their beds, and the fish in a few years become extinct.

In Canada and other of the British Provinces where there are extensive lumber interests, by provision of law each sawmill is required to have a furnace attached, in which the sawdust as fast as made is consumed. The expense of such a furnace is but trifling, and in those countries the fish is preserved and the law obeyed without objection. We would recommend that a similar law be enacted in this State, and, while great objection is made to it on the part of mill owners, yet, probably, the millmen on the Truekee River and its tributaries have already expended more money in the publication of pamphlets, and in other means to defeat legislation on this subject, than would be sufficient to build furnaces for all the mills on that river.

#### TRANSPORTATION OF SALT-WATER FISH.

We are frequently asked to expend a portion of the appropriation in bringing to this coast some of the salt-water fish of the Atlantic. As will be noticed from Mr. Stone's report, the only salt-water fish which he succeeded in bringing through alive were Tautog. The truth is, that the science of fish culture is so young that the preservation alive, and the transportation of salt-water fish is, as yet, entirely experimental, and our appropriation is so small that we have not felt authorized to expend any portion of the money in doing California's share in ascertaining how best salt-water fish may be successfully transported. For two seasons past the Governments of the United States and Germany, with the benefit of all the knowledge and intelligence yet acquired, have been unable to successfully transport young Shad from the Hudson to the rivers of Germany emptying into the Northern Ocean. Professor Baird has during the present Summer been expending a portion of the Government appropriation in determining how long various salt-water fish, including Lobsters and other shell-fish, can be kept alive in small bodies of sea water. When the result of these experiments is ascertained, if found practicable, it would be of much advantage to import several of the fish of the Atlantic coast, as well as the Chinese Shad (called by them *Samlai*) from the Yang-tze Kiang River, which is said to be much larger and of finer flavor than the Shad of the Atlantic coast; also, the Gourami, a large fresh-water fish from Cochin China, which is very valuable for food, and living, as it does, on aquatic plants, would thrive in the sloughs and stagnant waters in the southern portion of the State.

In conclusion, we desire again to call attention to the valuable reports of Mr. Stone hereto appended, as giving information valuable for preservation, and to again ask through you of the Legislature an increased appropriation for the purposes of the Commission. We may be permitted to refer (without laying ourselves open to the charge of egotism)

to what has already been accomplished during our tenure of office with the very limited appropriation at our command.

The observations we have made upon the food fish of our rivers, and the statistics we have gathered from various sources for the information of those who are interested in the science of fish culture, have involved a large amount of labor which, on the part of your Commissioners, has been altogether gratuitous. A liberal appropriation by the Legislature will enable us to extend our operations and carry out to completion the objects for which this Commission was created. We feel that the work we are engaged in, and in the promotion of which we are willing to devote our time and labor in the future, is deserving of a more liberal support from the State than it has hitherto received.

SACRAMENTO SALMON.

UNITED STATES FISH COMMISSION,  
DEPARTMENT OF THE PACIFIC COAST,  
McCLOUD RIVER (Shasta County, Cal.), September, 1875. }

S. R. THROCKMORTON, Esq., *Chairman of California Fish Commission, San Francisco:*

SIR: I beg leave to report as follows:

In the Summer of eighteen hundred and seventy-four, an agreement was entered into between the California Fish Commission and myself, with the approval of the Hon. Spencer F. Baird, United States Commissioner of Fish and Fisheries, to the effect that, in consideration of the payment of one thousand dollars by the California Commissioners, towards defraying the expenses of the United States Salmon-breeding establishment on the McCloud River, California, one million young Salmon should be hatched and placed in the McCloud River by the United States Fish Commission.

In pursuance of this agreement, a large number of young Salmon were hatched on the McCloud River last Fall, for the purpose above mentioned, and eight hundred and fifty thousand were placed in the river in fine condition, during the months of October and November, and the balance—one hundred and fifty thousand—are now in process of being hatched, and will be deposited in the river this Fall.

In presenting the report of these operations in Salmon breeding, it may not be out of place, perhaps, to say a few words concerning fish culture in general, and the increase of Salmon in the Sacramento River in particular.

The preservation or increase of any of the original sources of the food supply of the human race would, from its inherent character, be naturally a subject of universal interest. This has proved to be eminently true of the efforts which have been made in various countries with a view to the preservation and increase of the food-fishes of the world. The single circumstance that all the world eats fish, has commended the culture of fish to the sympathies of almost every one, and would alone sustain an interest in anything that is done to secure or augment the supply. But the cultivation of fish, besides its general recommendation to the world's attention, has additional and special points of interest—such, for instance, as its novelty, and the very peculiar character of its methods of operation. But chief among its special claims is the promise of its vast returns. Nowhere above the

domains of insect and vegetable life is found the vast possible increase from generation to generation that exists in the culture of fish. For a good illustration of the possibilities in this direction, we might take the case of the Sturgeon, which is said to deposit three million eggs each season. Supposing that the embryo in all these eggs should hatch out and mature into full-grown fish, and that each pair of these, when matured, should produce a similar number of offspring, what would be the result? It would be, that in two generations forty-five hundred thousand million Sturgeon would be brought into the world, or enough fish, when grown to an average size and placed lengthwise in a line, to reach one hundred and fifty thousand times around the world, or, with an average weight of one hundred pounds apiece, to make two hundred and twenty-five thousand million tons of fish. This, of course, is merely a conceivable, and, very fortunately, not a practicable example, but it strikingly illustrates the almost fabulous rate of possible increase in the generation of fishes.

It is this feature of it which forms one of the special merits of fish culture, and one of its strongest claims to public attention and support. A consideration, hardly less forcible in its favor, is the circumstance that the growth and increase of the fish cost the community nothing after they are once fairly introduced into suitable waters. Legislatures are not obliged to pass appropriations to provide food for the fish, or inclosures within which to confine them. After a river or lake is once properly stocked with a valuable variety of fish, then all expense ceases. The fish have natural inclosures. Nature supplies their food, and man is relieved from any further trouble about them. This very simple fact, that the fishes cause no expense or trouble to the community, has an importance which is not generally recognized. To bring this out more fully, I will present one illustrious example—the Salmon of the Columbia River. The annual Salmon yield of this river, as is well known, is enormous. In eighteen hundred and seventy-four there were put up and exported from the Columbia River, upwards of twenty million pounds of canned Salmon. We will say that half as much more was cured or eaten fresh. This makes a total of thirty million pounds of fish-food furnished by one river alone. Now, the whole thirty million pounds of food has not cost the community a single dollar for its raising or keeping. Rating the Salmon at an average price of twenty cents a pound, we have six million dollars worth of food produced without the cost of a dollar to mankind, either for rent of grounds, for inclosures, for care, or for food. The subsistence required to sustain this enormous amount of fish does not even make any diminution whatever of the resources of the community. They get their food entirely in the sea, where it costs no one anything, and where it is not even missed.

This instance illustrates, in a striking way, what is true of all varieties of fishes, and brings out a point in fish culture the value of which can be hardly overestimated. The Fish Commissioners, when they give the community living fishes in return for their appropriations, give them once for all, and pay the bills once for all. The fish become at once a portion of the public property, in regard to which all expenditures are at an end. The community will not have to feed the fish, or take care of them, or do anything more about it, except to take out the fish as they are wanted. Even if the efforts of the Fish Commissioners, in many instances, are failures, it will cost the State or country nothing

beyond the first outlay, which in most cases is comparatively very small indeed.

To these two facts just mentioned, of the marvelous increase of fishes, and the absence of any cost in the keeping and growing of them, should be added a third, in order that the merits of fish culture should be fully brought out. This third fact is the one just alluded to, viz: the very slight comparative extent of the original outlay. Two or three thousand dollars, for instance, will place twenty million young Shad in the Hudson or Connecticut Rivers. A thousand dollars will place a million Salmon in the Sacramento River. Millions of White Fish—not the White Fish of California, but the very valuable "*Coregonus Albus*," of Lake Superior—can be hatched at an expense of not many hundreds of dollars. I saw, this Spring, some handsome young Salmon, of about two pounds each, that were caught with a hook and line in Merced Lake—as fine looking fish as I ever saw. Two hundred dollars, expended by the State, will put one hundred thousand of these fish into any lake of California. These instances are, perhaps, sufficient to show how small is the original outlay, in fish culture, compared with the returns. Now, if these three facts are taken into consideration, viz: the marvelous annual increase of fishes, the absence of any cost of keeping and growing, and the insignificant character of the original expenditure, it will be seen that the cultivation of fishes promises advantages that eminently commend it to the public approval.

If, in answer to this last statement, it should be objected that the Fish Commissioners do not make a success of all their enterprises, a simple reply may be found in the fact that when they do succeed, it more than offsets all their failures. They can afford to fail a great many times if they make a success at last, for that success will pay over and over again for all that the failures cost. For example, the United States Fish Commission is introducing California Salmon into many places in the Eastern States, where they will, undoubtedly, be a total failure, but should the Commission make a success of a single river of the size, or half the size of the Sacramento, it would pay for all that has been expended in this direction on all the other waters of the United States. To come a little nearer home, let us see what bearing the foregoing remarks have upon the work of the California Fish Commission. Their appropriation for this year and last, has been two thousand five hundred dollars a year. With this small sum, they have introduced various kinds of Eastern fish, including among others, Lobsters and Shad, into California waters, and have added a million Salmon to the stock of the Sacramento River, besides distributing many thousand Eastern Trout throughout the State. Now I do not suppose that every branch of these enterprises has been a success, but I venture to say that if Lobsters alone were successfully planted on this coast, or if Shad were introduced with success into the Sacramento River, the returns to this State from either enterprise would be such that the paltry outlay of two thousand five hundred dollars a year would sink into insignificance in comparison. If everything the Commission undertakes is a failure, even then the loss has not been much, and the risk has been more than justified by the brilliant character of the promised results, and if one considerable success is achieved, it will more than compensate for all losses.

In this connection it may be mentioned that the people are in great danger of being misled on this point, by inferring that the work of any specified Commission is a failure because it has failed in some insignifi-



cant locality that they are familiar with, while, perhaps, this was one case out of twenty, the other nineteen of which had been successful. Then, again, what the public in many cases considers a failure, is not by any means a failure in point of fact, but the successful trial of an experiment, although, perhaps, it has failed to produce practical results, the object of the effort having merely been to acquire information. In such cases, if the information is obtained the effort is equally a success, whether in practical results it fails or succeeds. For example, the California Fish Commission wants to ascertain whether a specified variety of fish will live in water like that of Tulare Lake. The fish are accordingly introduced there. They do not thrive, we will suppose. The neighboring inhabitants immediately set the thing down as a failure, while in point of fact the experiment has been an entire success—the Commissioners having acquired the information which was the object of the undertaking.

Leaving this point, let us consider a special objection that has been made to the efforts of the Fish Commission of this State. The objection I refer to is that which some people put forward because they do not like *all* the varieties that have been brought here from the East. Some object because they do not care anything about Horn-pouts; others object because they do not like Eels; others because they do not like Catfish, and so on. But what is it that ought to govern the character of an enterprise of this sort? Certainly not the peculiar tastes of some individuals. The wishes of all should be met if possible, and if some like Shad, they ought to have Shad; if some like Catfish, they ought to have Catfish, and so on with the rest—Bass, Eels, Lobsters, and so forth—as a caterer preparing a dinner for a large number of people places on the table all kinds of dishes, so that all may find something that they like. I have heard individuals abuse the Fish Commission for introducing (as they said) such an insufferable fish as the Catfish into California, as if their individual tastes on this point should be the guide of the Commission. How foolish the objection was may be seen from the fact that I have had more requests from persons in this State for Catfish than for any other variety. The fact is, that a fish that is highly valued in one locality frequently has a poor reputation in another, and it often happens that a certain variety of fish is of fine quality in some waters and a very poor fish in others; as, for instance, the very Catfish of which we have been speaking, which is esteemed a great luxury in the neighborhood of Philadelphia, while in the warm and turbid tributaries of the Mississippi it is nearly worthless. A good deal of confusion and misapprehension is caused also by the same name being applied in different places to fishes of widely different quality. For example: the very ordinary fish known in some places as the Sacramento Pike, is, in many localities in California, called the White Fish, which is also the name of a most valuable fish of the great lakes, which ranks in commercial importance, hardly second to the Codfish of the Atlantic. In consequence of these two very different fish being called by the same name, there are many people in California who think that when the Commissioners introduced into the State the very valuable White Fish of the Great Lakes, they were importing the almost worthless Sacramento Pike, and formed their estimate of them accordingly.

The Commissioners, it is quite probable, have made some mistakes, as is very natural in a new work of this sort, but I think it will be found on examination that they have used their means in the wisest way pos-

sible, and have introduced into the State the fish which are at the same time the most valuable and the most generally liked.

Before closing these remarks, let me say a few words about increasing the Salmon of the Sacramento River, by artificial means.

The commercial value of the Salmon of the Sacramento is undoubtedly capable of great extension. Just beyond the minimum limit of the prices of Sacramento Salmon, lies a double trade in these fish, each branch of which, with fair opportunity, would exceed the extent of the present business of the fisheries of the river. The only reason why larger quantities of fresh Salmon are not sent East in the Winter from the Sacramento River, both in cans and in ice, is because the prices of Salmon in California are too high. If the prices were reduced a little, by increasing the abundance of the fish, both these trades would then open up in very large proportions. The case is exactly parallel with that of most exportable merchandise: The moment the cost of the goods declines beyond a certain limit, so as to make exportation profitable, a large exporting business immediately springs up. So it would be with California Salmon. They can be taken to Truckee any time in the Winter, and frozen in a few hours, and then shipped with perfect safety to Chicago and New York, and sold there at remunerative prices and in great quantities, if the original cost of the fish in California is not too great.

The same is true in regard to canned Salmon—a form of preserving Salmon which has brought enormous returns to operators on the Columbia River. Salmon cost too much at present on the Sacramento River, but if they could be increased so as to sufficiently reduce the first cost, canning Salmon could be carried on, on the Sacramento, at a profit, and with this advantage over the Columbia River, that the freight from Oregon to California would be saved—an item in the Columbia River trade which alone amounts to hundreds of thousands of dollars annually. To show what a canning business could be done on the Sacramento River, if Salmon could be obtained cheaply enough, it is only necessary to say that there were, in round numbers, twenty million pounds of canned Salmon exported from the Columbia River last year, at a cost value of two million dollars. The canning business on the Columbia employs one thousand eight hundred men. The cost of the tin alone consumed by the canners on the river, amounts to several hundred thousand dollars. It is unnecessary to speak of the advantages that such a business would bring to the State of California. I do not say that the canning of Salmon would ever be brought up to the same proportions on the Sacramento that characterizes the business on the Columbia River, but if Sacramento Salmon would be made abundant enough to be cheap, something of very considerable importance could undoubtedly be done in this direction, which, added to the shipping of frozen Salmon, would make the exporting of Sacramento Salmon a very valuable branch of industry in the State.

That the Salmon can be thus increased in the river so as to be made cheap enough to export in the Winter, seems to be a matter of very great certainty. The artificial propagation of Salmon has been carried to such a point of proficiency that with any given number of fish, ninety-five times as many young Salmon can be brought into existence as would be naturally produced by the Salmon themselves, for, in artificial propagation, ninety-five per cent of the eggs are hatched, while by the natural process not over one per cent is hatched. A moment's consideration will show that with this enormous advantage the Salmon can be in-

creased to an almost incredible extent, if it is practicable to employ the artificial method successfully.

That it is practicable, has been already proved beyond a doubt, by the success of the United States Salmon breeding establishment on the Mc-Cloud River, in Shasta County, of this State. This station of the United States Fish Commission has now been in operation four seasons, and last year contracted to place in the tributaries of the Sacramento River one million young salmon, at a cost of one thousand dollars, or one dollar per thousand. Eight hundred and fifty thousand young Salmon under this contract have been delivered, and the remaining one hundred and fifty thousand will be placed in the river this Fall. At this rate, it will be seen at once that the Salmon of the Sacramento can be increased indefinitely, and at a very slight expense. Five million young Salmon could be placed in the Sacramento River, any year, at a cost of five thousand dollars. A comparatively small annual expenditure would keep the river constantly stocked, so that Salmon would become plentiful enough to make it profitable to can them and send them fresh to the East in the Winter. With the river well stocked, instead of the small business that is now carried on in Salmon on the Sacramento River, a large industry would spring up on the river, employing hundreds of men, and bringing in a large revenue to the State. This increase of Salmon in California could not only be effected at a very inconsiderable expense, but it would, as far as the State Treasury is concerned, be a self-supporting institution, for the augmented business of the Salmon fisheries would, by its revenue to the State, pay the appropriation required; and besides this, there would be the vast increase of fish food to the community, which would offset the appropriation many times over.

The money that is appropriated by the State for fish culture is not invested in a non paying object, like a monument or a building, but in a work that not only pays an immensely remunerative interest to the State in one way, but actually returns the money to the Treasury in another way.

I have spoken particularly thus far in regard to the improvement of the regular Salmon fisheries of the Sacramento by artificial propagation, but there are incidental results brought about by this agency which, though not of so much importance, should not be overlooked. Most sportsmen, at least of the State, have heard of the great numbers of Grilse (young Salmon) that were caught by hook and line in the Bay of San Francisco last Spring, and the fish of the same kind that were caught in Lake Merced in the same way. These afforded a great amount of sport to the anglers of the city and the neighborhood, besides yielding a very considerable amount of excellent fish-food. The abundance of Grilse in these waters was the direct effect of the labors of the Fish Commissioners. With so auspicious a beginning, who can say what cannot be accomplished in time in this direction by the Fish Commission, with reasonable encouragement. Such encouragement ought certainly to be given them. Massachusetts, New York, Connecticut, Pennsylvania, Michigan, Virginia, and many other States, have made ample provision for their Fish Commission, and have considered themselves well repaid. There seems to be no reasonable course left for the State of California but to go and do likewise.

LIVINGSTON STONE.

## THE CALIFORNIA AQUARIUM CAR OF EIGHTEEN HUNDRED AND SEVENTY-FOUR.

S. R. THROCKMORTON, Esq., *Chairman of California Fish Commission:*

SIR: I beg leave to report as follows:

On the morning of the first day of April, eighteen hundred and seventy-four, I received the following telegram:

“SAN FRANCISCO, March 31st, 1874.

“LIVINGSTON STONE: We want you to bring out another aquarium car.

“S. R. THROCKMORTON.”

Acting on this intelligence I went to Boston that afternoon to begin preparations for the trip in general, but particularly to inaugurate a series of experiments in the transportation of Lobsters, it being very difficult to keep them alive, away from the ocean, long enough to make the overland trip.

I obtained twelve live Lobsters, some sponges, and a barrel of ocean water, and, having made arrangements for future supplies, as occasion might require, I returned to Charlestown, N. H. The points which were brought out by these Lobster experiments, which I continued for several weeks, are substantially as follows:

First—Lobsters can be kept alive, away from the ocean, twelve days, under the most favorable circumstances.

Second—They will not stand exposure to the dry air, at all, whether warm or cold.

Third—They will not live in still sea water, whether warm or cold. [NOTE.—The motion of the tides is probably essential to their health in their natural state.]

Fourth—Fresh water kills them very soon.

Fifth—Artificial sea water (salt dissolved in fresh water) is not nearly as favorable to life as the genuine article from the ocean.

Sixth—The confinement of several together in one apartment is injurious, as they will bite off each other's claws.

Seventh—Rubber bands around the claws to prevent their biting each other is unfavorable to life.

Eighth—The best way yet found for keeping Lobsters alive, in confinement, is to pack them in separate compartments in sponges wet with ocean water. They should be kept as cold as possible, and the ocean water should be renewed twice a day.

A description of an experiment by Mr. F. W. Webber is appended.

“On Wednesday, the fifteenth day of April, eighteen hundred and seventy-four, thirteen live Lobsters arrived at the Cold Spring Trout Ponds, Charlestown, N. H., and were divided into four lots as follows:

“Three Lobsters were packed in a box among sponges wet with sea water, and kept in a cold temperature with ice. Four Lobsters, having rubber bands on their claws to prevent their injuring each other, were packed in a similar manner, and kept without ice at a warmer temperature. Three Lobsters without bands on their claws were packed in the same way, and kept at a similar temperature. Three Lobsters were packed among sponges wet with a little artificial brine made from coarse salt and spring water, and kept at a mild temperature. The boxes all

had large cracks in them through which the water from the sponges would easily run off, and thus prevented from becoming stagnant in the bottom of the boxes.

"Results: Of the three Lobsters kept in the artificial brine one was found dead on Thursday morning, April sixteenth; one on Saturday morning, April eighteenth; and one lived till Monday morning, April twentieth.

"Of the four kept at a mild temperature with the bands on their claws, in sponges wet with sea water, one was found dead on Saturday morning, April eighteenth; one on Saturday night, April eighteenth; one on Sunday night, April nineteenth; and one on Monday morning, April twentieth.

"Of the three which were kept in the sponges wet with sea water at a moderate temperature, without bands on their claws, two were found dead on Tuesday evening, April twenty-first, and one lived till the evening of April twenty-sixth.

"Of the three kept at a cold temperature, among the sponges moistened with sea water, one died Monday morning, April twentieth; one died Wednesday morning, April twenty second; and one died Thursday morning, April twenty-third.

"In all the above experiments the water in the sponges was renewed twice a day; ocean water being used throughout in the three first experiments, and artificial brine in the last.

"It will be observed that the Lobsters treated with artificial brine began to die first.

"Of those kept cold and treated with ocean water, one lived seven days, and one eight days. Of those treated with ocean water, and kept at a moderate temperature, without ice, one lived eleven days.

"On the arrival of these Lobsters, some of the spawn was taken from one and packed away in sponges wet with sea water, which wetting was renewed every day. On Tuesday, April twenty-eighth, a few of them were examined under a microscope, and the pulsations of the blood could be distinctly seen in the region of the little filament which connects the eggs."

While these experiments were in progress, I made preparations in various directions for securing several varieties of fresh-water fish. On the twelfth of April I received a letter containing the following extract:

"Bring especially Shad, Eels, Lobsters, Black Bass, and, perhaps, Catfish. Bring Blue Fish and Striped Bass. No Perch, nor Trout.

(Signed:)

"S. R. THROCKMORTON."

This was the first information I had received that salt-water fish were wanted, and I hesitated at undertaking to carry them, for, as will be easily seen, to combine salt water fish, *e. g.* Blue Fish, shell fish, *e. g.* Lobsters, fresh-water fish that required warm water, *e. g.* Shad, and those that required cold water, *e. g.* Bass, was very much complicating an enterprise which, even in its simplest form, was an exceedingly difficult and critical one. I concluded, however, to take the salt-water fish (though somewhat against my better judgment), and immediately went to New York to make arrangements for obtaining them alive. I also put myself in communication with Professor Baird on the subject,

and with Captain Vinal Edwards, of Woods' Hole. I then went to Lake Champlain for the Black Bass and Glass-eyed Perch.

Meanwhile I exerted myself to the utmost to secure a suitable car for the purpose, but, to my great dismay, could not get one. I was very particular that the car should be just what was wanted. Such a car must be forty feet long—a passenger baggage car—with twelve wheels, air brakes, Miller platform, and wide tread. The difficulties that now arose, in the way of getting such a car, were legion.

I applied to the Central Vermont Railroad, the Boston and Albany, the Great Western Railroad, the New York Central, the Central Pacific, and other railroad companies, but with unfavorable results in every case. All kinds of cars were offered, from the plainest box freight car to the regular passenger car, but all presented some objections which prevented them from meeting the requirements. Some had not the air brakes, some were not long enough, some had too narrow a tread, and so on. I was about giving up in despair, and had actually telegraphed to California for parties there to get a car if they possibly could, when I received a dispatch from Mr. Sargent, Superintendent of the Michigan Central Railroad, to the effect that he would furnish a car exactly suitable for the purpose. A bargain was immediately closed with him, and on the eleventh of May, the car was at Charlestown, New Hampshire. It was a large, strong, well built, and handsome car, with wide tread, twelve wheels, Miller platform, and air brakes, and was in every way adapted for the purpose.

By this time I had collected large supplies of fresh-water fish at Charlestown, New Hampshire, and parties at work in various quarters were securing the proper sizes of other fish for the expedition. The main thing now remaining was to fit up the car for the journey. With the great variety of fish which I had now arranged to take, it was obviously impossible for any force that I could carry with me to keep the water aerated by hand; I therefore turned my attention to devising some machinery which would do the aerating automatically. Three plans presented themselves. The first was to catch the air in large funnel-mouthed pipes, placed on the top of the car, and to trust to the motion of the car to force it into the tanks. One of these was accordingly rigged on the car, and we made a trial trip to Bellows Falls. The experiment was an entire failure, for, though a large volume of air was carried through the pipe into the car, it did not come with force sufficient to displace the water when the inside end was inserted in a tank. The next plan was to force the air in, by means of fans or small wind-mills on the top of the car, to be kept in motion by the progress of the train. Upon further examination, however, this was given up as impracticable. The third plan, and the one finally adopted, was to attach machinery to one of the axles of the car, in such a way as to acquire sufficient power to work a pair of air pumps. This was done by passing a belt around the axle, and continuing it, through a hole in the car, to a counter-shaft inside. The counter-shaft was provided with two pulleys, around each of which a belt was passed, which connected with the crank-wheel of the air-pumps. Attached to each air-pump were two main pipes, passing through the entire length of the car, from which led, at suitable intervals, a dozen or so smaller pipes, of flexible rubber hose, and of sufficient length to reach all the tanks, and in fact every part of the car. Whenever the train was in motion the rotation of the axle revolved the counter-shaft, which in turn worked the air-pumps. These pumps, at every stroke of the piston rod, forced the air through

each piece of hose with great power, so that when the end of the hose was inserted into a tank the water boiled violently. The operation of this plan of aerating the water was perfect. The belting being adjusted and the hose dropped into the tanks, as soon as the train got under headway the wheels on the counter-shaft revolved briskly, the piston rod of the air-pump worked with great rapidity, and the water in every receptacle in the car fairly boiled with the commotion caused by the fresh air forced through it. Nothing more perfect or more entirely answering its purpose could be asked or wished, and it is a convincing confirmation of the efficiency of the apparatus, though it sounds somewhat paradoxical to say it, that the Bass and many other fish were, at the end of their journey, in better condition, owing to their unusual supply of oxygen in transit, than when they started from New Hampshire. At all events, it is true that only one out of seventy-five full-grown spawning Bass was lost during their long confinement of eight days and nights, and that one was killed by the falling of a cake of ice.

The mechanical working of the machinery was perfect, and never once got out of order during the trip, or failed to do its duty. I have no doubt that all full-grown fresh-water fish requiring aerated water, such as Trout, Black Bass, Glass-eyed Perch, land-locked Salmon, Perch, and the like, could be taken to California and brought back with the help of this apparatus, with perfect security, and without any deterioration in the condition of the fish.

The belting around the axle passed up nearly perpendicularly through the bottom of the car. The counter-shaft and air pumps were placed as near the ceiling as possible, so that the whole thing took up very little room, and was very little in the way.

To resume the chronological order of my narrative: The first two plans of aerating the water having been abandoned, I proceeded at once to make arrangements for testing the third plan, just described. The pumps, shaft, belting, and pipes were procured, a hole made through the bottom of the car over one of the axles, each part of the machinery put in its place, and permission obtained from the Central Vermont authorities to run the car to North Charlestown, on a trial trip.

Everything being ready, the trip was made, several friends and persons interested in the expedition accompanying us. No sooner was the train in motion than it became obvious that the much sought for object was accomplished. The moment the hose was dropped into a tank of water it became a boiling spring. A load of anxiety was taken from my mind, and I returned to Charlestown that night for the first time confident of success.

Nothing now remained but to complete the furnishing of the car, and to concentrate the various collection of fishes. As long as it was decided to try salt-water fish, I concluded to improve the opportunity by experimenting with several kinds, the same salt-water arrangements in the car answering as well for several varieties as for one. This considerably increased the number of varieties to be gathered together. There were Black Bass, Glass-eyed Perch, and Horn-pouts, from Lake Champlain, now quartered at the Cold Spring Trout Ponds, at Charlestown, New Hampshire. There were Lobsters and Oysters, at Boston. Lobsters, Salt-water Eels, Tautog, and Striped Bass, at Woods' Hole, Massachusetts. Shad and Fresh-water Eels, at Castleton, on the Hudson River. Catfish, at the Raritan River, New Jersey. Kingfish, Weak-

fish, and Striped Bass, at New York Harbor. Alewives, at the Mystic River, Massachusetts. Additional Bass, at Niles, Michigan, and Mississippi Catfish (*Grystes Salmonides*), or Mississippi Bass, at the Elkhorn River.

I dispatched Mr. M. L. Perrin to New Jersey, for the Catfish, and having stowed them safely away at the Cold Spring Trout Ponds, detailed him again, to take charge of the Woods' Hole and Boston fish, which were to be brought from Boston in a special car, with the reserves of ocean water, the night previous to the departure of the aquarium car for California. I then sent Mr. Myron Green and Mr. Waldo Hubbard for the New York fish, and Mr. E. C. Forbes was sent to Castleton, to get the Shad and Eels. Mr. Richard Hubbard I retained at Charlestown, to assist me there. I also telegraphed to Mr. George H. Jerome, of Michigan, to intercept the train at Niles, with the Michigan fish, and Mr. George Bemis, of Omaha, to do the same at the Elkhorn River, with the Nebraska fish.

In the meantime I devoted myself to completing the arrangements of the aquarium car. These, when finished, may be described as follows: At the forward end of the car, and occupying the entire width of it, was a large fresh-water tank, made of two-inch pine plank, lined inside with tin and bound firmly on the outside with iron rods. It was nine feet square and three feet high, and held upwards of sixteen hundred gallons, or about seven tons of water. The top of the tank, which was also of two-inch plank—was provided with doors which could be opened and shut, and air holes for ventilation. Just over the tanks and passing horizontally through a circular hole in the forward end of the car, was a large tin pipe, arranged on the outside to receive water from the railway tanks along the road. By this arrangement we could throw into our large tank a ton of water a minute. The tank was also provided with an outlet through the bottom of the car for draining off the waste water. The top of the tank was provided on each side with racks for holding ice.

In the center of the car and occupying about six feet of the length of it, were four berths, built up against either side, and extending out from the wall about two feet, leaving a passageway of five feet between. Beyond the berths, cupboards and shelves were constructed on one side, the other being left vacant for the boxes of Lobsters. At the rear end of the car, were two salt-water tanks, of two-inch plank, each nine feet long, four feet wide, and three feet high, holding about seven hundred and fifty gallons, or upwards of three tons of water each. These were covered at the top with two-inch plank and furnished with doors like the fresh-water tank. Just in front of the salt-water tanks were the revolving belt and counter-shaft, and about eight feet back and nearly at the roof of the car, were the two air-pumps, from which extended forward again, through the car, the system of aerating hose. All the spare space was occupied with movable tanks containing the different varieties of fish.

Besides these larger objects of the furniture of the car, there were a hundred smaller articles for the emergencies of the journey, as, for instance, thermometers, pails, nets, etc.

The fourth of June was set for the day of our departure. On that day and the day previous there were at least fifty men working at Charlestown, and at the other points of rendezvous, for the expected journey. Through the help of telegraphic communication every man was at his post at the required moment, and every man performed his



part at the proper time, so that, with all the myriad separate details that had to be combined in one whole that morning, not one was overlooked nor forgotten, nor was there a delay or a drawback of any sort to prevent a perfectly successful departure.

Mr. Perrin arrived at midnight of the third of June, with his car of fish, lobsters, oysters, and ocean water. The next morning they were transferred to the aquarium car, and the Charlestown collection of fishes put aboard. The tanks were filled; two tons of ice were taken on, and at two o'clock in the afternoon of Thursday, June fourth, the second California aquarium car started westward. We were accompanied by a party of friends as far as South Vernon. All went very smoothly up to this point, but soon after the journals of the car wheels began to heat, and we were kept at work all night and until noon the next day to keep them cool enough to prevent the car being dropped. We arrived at Albany at midnight of the same day, June fourth. Mr. Green, Mr. Waldo Hubbard, and Mr. Forbes joined us here with the New York fish, and the Shad and Eels which Mr. Monroe Green had very kindly brought from Castleton himself. I must not forget to state here that this lot of Eels—amounting to two thousand—was procured by Mr. Monroe Green, and that the Shad—numbering thirty-six thousand—as well as the Shad which I took to California last year, were contributed by the State of New York, from the State hatching works, on the Hudson River, at Castleton, in charge of Mr. Seth Green, and under the immediate care of Mr. Monroe Green, from both of which gentlemen this enterprise, and the similar one of last year, received a great deal of assistance.

Mr. Willard T. Perrin, one of the aquarium car force of last year, who had accompanied the car to Albany, left us here. Our party now consisted of Myron Green, E. C. Forbes, Waldo Hubbard, Marshall L. Perrin, and myself, all of whom continued with the car to California.

Leaving Albany at half-past twelve, we arrived at Rochester an hour late, the journals heating very badly. At this point Seth Green came aboard and brought us some circular belting, for which I had telegraphed previously. We took on a ton of ice, and left Rochester twenty minutes after our arrival. Reached Suspension Bridge at two P. M. of June fifth. Here we were furnished with a new set of wheels, which delayed us till nine forty-five P. M., when we again resumed our journey, having taken on four tons of fresh water and two tons of ice. It became evident to-day that the salt-water fish would not survive the journey—in fact most of them had not reached the car alive. The carrying of them was a new thing and had not been experimented upon, and really did not form a part of the original plan of the aquarium car, so that the loss did not seem so discouraging as it might otherwise have done. The fresh-water fish continued in splendid order. We reached Niles, Michigan, the next day, at four o'clock and twenty minutes P. M., where we met the Hon. George H. Jerome, who had with him a fine lot of Black Bass, which he had very kindly collected at my request. We all felt under great obligations to Mr. Jerome for the pains he had taken to procure the fish, and also for the very kind interest and sympathy which he expressed for the success of the expedition. Mr. H. H. Sargent, the Superintendent of the Michigan Central Railroad, who provided the car, also came aboard at Niles. We owe this gentleman many thanks for the courteous and accommodating spirit which he manifested from beginning to end, in all our dealings with him.

We arrived at Chicago at eight o'clock and thirty minutes p. m., of the same day, Saturday, June sixth. Here we had to wait all night for a train direct for San Francisco. The pumps, of course, ceasing to work while the car was still, I kept two men at the cranks all night turning them by hand. At Chicago we took on five tons of water, and two tons of ice, and left there the next morning at ten o'clock and forty-five minutes a. m.; crossed the Mississippi at four o'clock and twenty-five minutes p. m., the same day, and put a few Salmon and Shad in the river as an experiment. Took on four tons of water at Cedar Rapids, and reached Omaha at ten o'clock and thirty minutes the next morning, Monday, June eighth. Up to this time the fresh-water fish had done splendidly, no loss of any kind occurring except among the small Eels. The Black Bass, Glass-eyed Perch, Catfish, Horn pouts, Penobscot Salmon, and larger Eels, were in fine condition—about half of the Lobsters had died. The Oysters for Great Salt Lake, and the Tautog for the Pacific, and the Shad, were all in good order. The other salt-water fish had given up the battle.

We came into Omaha with the journals of our forward pair of wheels very hot. An examination showed them to be so badly cut, that it was necessary to put in another new pair of wheels—the authorities of the Union Pacific Railroad very kindly consenting to hold the train till it was done, for which we felt extremely grateful, as, otherwise, there would have been another day lost. At Omaha we met Mr. George Bemis, who had very obligingly consented to have some Nebraska fish in readiness for us at the Elkhorn River, and I must not neglect this opportunity of saying that from the very beginning of my correspondence with Mr. Bemis on the subject, he manifested the most cordial disposition to assist the enterprise, and exerted himself to the utmost to do his part towards helping it along. While the new wheels were being attached to the car we took on three tons of ice, and some more circular belting kindly procured for us by Mr. Bemis, who accompanied the car as far as Fremont, Nebraska. Leaving Omaha we arrived at the Elkhorn River at two o'clock and thirty minutes p. m., exactly a year, within a half an hour, from the time when we went through the bridge into that river with the first aquarium car.

Through the courtesy of Mr. C. B. Havens, the train dispatcher of the Union Pacific Railroad Company, at Omaha, we were permitted to stop the train at the river, and to hold it there till we had taken on some Western Bass and Mississippi Catfish, procured through the agency of Mr. Bemis, and fifty gallons of water which we brought up from the river in pails. By a sort of poetic justice the very river which had swallowed up our car-load of fishes last year was made to contribute to the success of this year's expedition.

Thus far the weather had been very hot. To-night (June eighth) it was quite cool, and about midnight we encountered a terrific storm, which stopped the train awhile. The next morning dawned cool and rainy, and in the course of the forenoon there came a furious hail storm.

We now thought we had a fair prospect of getting through with all we had on board, and every thing prospered through the day, but at night a calamity happened which appalled us. It was the loss of the Shad. The circumstances were these: between the Elkhorn River, Nebraska, and the Weber River, Utah, a distance of nine hundred and fifty miles, there is no suitable water for Shad, except at the Laramie River.

When Seth Green crossed the continent in eighteen hundred and seventy-one, and when I crossed it with Shad, in eighteen hundred and seventy-three, the water in the Laramie River was good, and up to to-day, we had received no information to lead us to think anything to the contrary. We were consequently depending on keeping the Shad on Laramie River water, from Laramie to the Weber. As we approached Laramie, however, we heard various rumors to the effect that the recent rains had washed a good deal of alkali into the river. There was no alternative for us, however, and when the train stopped there, we took a supply of Laramie River water for the Shad. This was about dusk on Tuesday evening, June ninth. I stayed with them till midnight, and left them in the hands of the long watch, who were to take them through till morning. When I got up the next morning, at daybreak, every Shad was dead. They had not been neglected an hour, nor a moment, since they left the Hudson River, and the two young men who had charge of them that morning were among my most zealous and trusted assistants, so that I am confident it was not through neglect or want of faithful care that they died. Knowing no other cause for their loss, we united in attributing it to the unusual amount of alkaline matter in the water of the Laramie, caused by the recent extraordinary rains.

All that day it seemed as if there had been a funeral on board, so depressing was the influence of this calamity to all in the car. It was a terrible disappointment to me, but knowing that every one had done his duty, I endeavored to cheer up the others by turning their attention to the fishes which were still living. We took on four tons of water at the Weber River, and reached Ogden, Utah, a thousand miles from San Francisco, at six o'clock on the evening of Wednesday, June tenth. Here I left a barrel of Oysters and two spawning Lobsters, in first-rate condition, for Great Salt Lake. Our supply of Atlantic Ocean water was exhausted to-day. I had previously telegraphed to the California Fish Commissioners for a supply of Pacific Ocean water, which we heard to-day would meet us at Winnemucca. We now had on board, all in good condition, Black Bass, Horn-pouts, Glass-eyed Perch, Rock Bass, Penobscot Salmon, fresh-water Eels, Schuylkill Catfish, Mississippi Catfish, Tautog, Lobsters, and salt-water Eels, with which varieties—ten in all—we hoped to get through alive, and, as the sequel will show, did actually succeed in bringing through safely. Leaving Ogden about dark, we arrived at Carlin, Nevada, at ten o'clock and fifteen minutes A. M., June eleventh, and took on a small supply of water. At eleven o'clock and twenty-five minutes A. M. we met the Central Pacific freight train, with the supply of Pacific Ocean water, which was transferred to our car, and immediately used on the salt-water fish, which showed every sign of being greatly refreshed by the change. Took on more fresh water at Humboldt, Nevada, at six o'clock and fifteen minutes P. M., and ten tons of ice at Wadsworth, at midnight. At Truckee, California, B. B. Redding, of the California Fish Commission, came on board, and accompanied us to San Francisco. This was the last day of the trip (Thursday, June twelfth), and no one can tell the immense relief it was to our party to know it. For seven days and eight nights, with only three or four hours rest out of the twenty-four, we had kept incessantly at work over those fishes. Want of sleep was beginning to break us down. We had lived in a car full of water and melting ice, which had, literally, hardly a dry spot in it. The long journey itself, with the constant jar and rattle of the train, is enough to nearly wear one out. We had taken on board and cut up into suitable pieces and packed away,

fifteen tons of ice. The unusual chill and dampness that pervaded the car, together with the immense labor and loss of sleep, had made nearly all on board sick, for a greater or less time; and altogether, the trip had been one of such extreme hardship and severe labor, that we hailed this last day with a sense of the greatest relief.

As soon as we had finished our hearty breakfast, all hands went to work to transfer the fishes into the various portable tanks in which they were to be taken to their destinations. This occupied all the time till the train reached Sacramento, at one o'clock and thirty minutes p. m., June twelfth. Here we met Mr. S. R. Throckmorton, of the California Fish Commission, and others, who took charge of the large Black Bass, the Horn-pouts, the Rock Bass, Glass-eyed Perch, and Penobscot Salmon, all being in first-rate order.

Mr. Green, Mr. Perrin, and Mr. Richard Hubbard accompanied these fish to their destinations, while Mr. Forbes, Mr. Waldo Hubbard, and myself continued with the car to San Francisco.

Upon reaching the San Joaquin River, we deposited the Schuylkill and Mississippi Catfish safely in that river, in the presence of quite a large number of people, who left the train to see the deposit made. At Alameda Creek we deposited the small Black Bass; at an inlet of the Bay of San Francisco, near Oakland, we left the Tautog and salt-water Eels; and the Lobsters we deposited in the bay itself. In the meantime, the remainder of the party, who left the car at Sacramento, placed the Glass eyed Perch in the Sacramento River; the Horn-pouts and freshwater Eels in an inlet, or slough, of the Sacramento River; the Penobscot Salmon in the same river, at Redding; and the Black Bass in the upper waters of Napa Creek. The car was left at Oakland.

So ended the expedition of the second California aquarium car, just eight days and nine hours from the time it left Charlestown, New Hampshire. In all the features of the original plan of the expedition it was a success. The eleven varieties of fish which this plan contemplated, were brought through alive, and successfully deposited. The taking of the salt-water fish was an afterthought, and can only be regarded in the light of an experiment. The Shad were lost, it is true, but I had already brought the year before five thousand Shad to Great Salt Lake, and thirty-five thousand to the Sacramento River. The fish which did survive, except the Lobsters, arrived in splendid order, it being a fact (as before mentioned) that the Black Bass, and others, seemed in better condition than when they left New Hampshire. The Lobsters were in a feeble condition, but had a vast quantity of impregnated spawn with them in good order. The result of the expedition was to introduce into the public waters of California eleven varieties of fish not native to the State. The attempt to carry salt-water fish across the continent need not necessarily be abandoned as impracticable because it was not a success on this particular occasion. The circumstance that the salt-water fish did not live, finds a very simple explanation in the fact that nothing was known about transporting them, and no time was afforded this season for finding out by experiments. This difficulty can, of course, be avoided on a subsequent expedition, by taking ample time beforehand to discover how the sea fish of the Atlantic can be kept alive sufficiently long to survive the overland journey, and by giving them the treatment which it has been found they require; then the enterprise can be made successful.

Respectfully,

LIVINGSTON STONE.

## LIST OF PLACES WHERE ICE WAS TAKEN ON BOARD.

		Tons.
1874.		
June 4th....	Charlestown, New Hampshire.....	2
June 4th....	Albany, New York .....	1
June 4th....	Rochester, New York .....	1
June 5th....	Clifton, Canada.....	2
June 7th....	Chicago, Illinois .....	2
June 8th....	Omaha, Nebraska.....	3
June 11th...	Wadsworth, Nevada.....	2
Total.....		13

## LIST OF PLACES WHERE WATER WAS TAKEN IN.

		Ocean water— tons.	Fresh water— tons.
1874.			
June 4th .....	Charlestown, New Hamp- shire.....	5	7
June 5th .....	Clifton, Canada.....		4
June 7th, (A. M.)..	Chicago, Illinois. ....		5
June 7th, (P. M.)..	Cedar Rapids, Iowa .....		3
June 8th .....	Elkhorn River, Nebraska..		½
June 9th .....	Laramie, Wyoming Terri- tory.....		2
June 10th .....	Ogden, Utah.....		4
June 11th, (A. M.)	Carlin, Nevada.....		1
June 11th, (P. M.)	Winnemucca, Nevada.....	1	
June 11th, (P. M.)	Humboldt, Nevada.....		2
		6	28½

AQUARIUM CAR, 1874.

List of fishes which arrived alive at their destinations, and the waters into which they were introduced.

Number started with.	Fresh-water fish.	Where procured.	Number deposited.	Place of deposit.
75	Full-grown Black Bass.....	Lake Champlain, Vermont.....	73	.....Napa Creek.
24	Small Black Bass ( <i>Grysetes fasciatus</i> ).....	St. Joseph's River, Michigan.....	12	.....Alameda Creek.
18	Full-grown Glass-eyed Perch ( <i>Lucto perca</i> ).....	Missisquoi River, Vermont.....	16	.....Sacramento River.
76	Large Schuylkill Catfish.....	Raritan River, New Jersey.....	74	.....San Joaquin River.
.....	Mississippi Catfish.....	Elkhorn River, Nebraska.....	.....	.....San Joaquin River.
71	Horn-pouts ( <i>Dumetatus</i> ).....	Lake Champlain, Vermont.....	70	Ponds and sloughs near Sac'to.
4 (cans).	Small Silver Eels ( <i>Anguilla</i> ).....	Hudson River, New York.....	1 (can).	.....Sacramento River.
450	Small Penobscot River Salmon ( <i>Salmo salar</i> ).....	Penobscot River, Maine.....	305	.....Sacramento River.
6	Full grown Rock Bass.....	Missisquoi River, Vermont.....	4	.....Napa Creek.
.....	<i>Salt-water fish.</i>	.....	.....	.....
24	Small Tautogs ( <i>Tautoga Americana</i> ).....	Woods' Hole, Massachusetts.....	23	.....San Francisco Bay.
2 (cans).	Small Salt-water Bels ( <i>Anguilla</i> ).....	New York Harbor.....	1 (can).	.....Lakes at Sutterville.
150	Full grown spawning Lobsters.....	Massachusetts Bay.....	2	.....Great Salt Lake, Utah.
1 (barrel).	Oysters.....	Massachusetts Bay.....	4	.....San Francisco Bay.
.....	.....	.....	1 (barrel).	.....Great Salt Lake, Utah.

The following is an account of the receipts and expenditures since the last report:

1874.	By cash on hand—last report.....		\$17 22	
March 5...	By freight returned from Railroad Companies on account of loss of aquarium car.....		1,250 00	
July 11....	By appropriation for fiscal year.....		2,500 00	
July 20....	By error on purchase of ice.....		12 50	
1875.				
July 9.....	By appropriation for fiscal year.....		2,500 00	\$6,279 72
1874.				
May 27....	To cash paid—Stone's draft (aquarium car)...	\$539 69		
June 5.....	To four barrels for salt water.....	7 50		
June 8.....	To cash paid—Stone's draft aquarium car and telegraphing, etc.....	1,122 75		
June 13....	To cash paid Stone on account of aquarium car, telegraphing etc.....	300 80		
June 19....	To cash paid U. P. Railroad Co., fare of Stone and assistants, accrued in 1873.....	270 75		
June 22....	To cash paid Fenton for transporting Trout to American River.....	15 50		
June 22....	To cash paid Graham—cleaning cans and cartage of same.....	7 00		
July 3.....	To cash paid Stone on account of aquarium car.....	200 00		
Sept. 30....	To dravage of cans.....	3 46		
Nov. 8.....	To telegram.....	25		
Nov. 8.....	To cash paid Stone's order on account of aquarium car.....	200 00		
1875.				
March 1....	To postage stamps.....	1 00		
March 5....	To cash paid H. H. Haight, attorney's fees...	100 00		
March 5....	To cash paid for ice used in transporting fish to American River and Prosser Creek.....	4 40		
March 11..	To lumber for hatching house at Berkeley...	97 55		
March 11..	To gas pipe and labor on hatching house at Berkeley.....	67 45		
March 11..	To J. G. Woodbury's wages on same, and hatching Whitefish and Trout.....	307 80		
March 15..	To cash paid S. R. Throckmorton on account of expenditures.....	119 00		
March 30..	To expenses of putting Whitefish in Tulare Lake.....	5 00		
March 30..	To J. G. Woodbury's salary and expenses in March.....	158 40		
April 28...	To printing circular.....	6 00		
May 28....	To cash paid on account of purchase of Trout eggs.....	200 00		
June 14....	To cash paid on account of hatching one million Salmon.....	500 00		
July 6.....	To cash paid on account of hatching one million Salmon.....	400 00		
August 4..	To cash paid on account of hatching one million Salmon.....	350 00		
	Cash to balance.....	1,295 42		\$6,279 72

This balance of \$1,295  $\frac{42}{100}$  will be consumed by debts owing and expenses necessary to be incurred prior to the meeting of the present Legislature.

All of which is respectfully submitted.

B. B. REDDING,  
S. R. THROCKMORTON,  
J. D. FARWELL,  
Commissioners.





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