

BIENNIAL REPORT

OF THE

STATE BOARD OF FISH COMMISSIONERS

OF THE

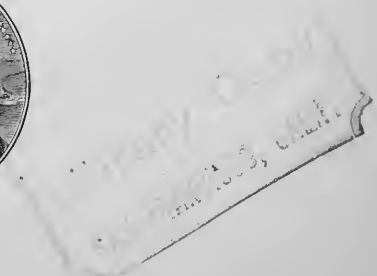
STATE OF CALIFORNIA,

FOR THE

YEARS 1891-1892.

COMMISSIONERS.

JOSEPH D. REDDING, President, San Francisco.
RAMON E. WILSON, Secretary, San Francisco.
JOSEPH MORIZIO, Treasurer, San Francisco.



SACRAMENTO:

STATE OFFICE, : : : : A. J. JOHNSTON, SUPT. STATE PRINTING.
1892.



TABLE OF CONTENTS.

	PAGE.
Report of Commissioners	5
Extracts from Deputies' Reports	17
Report of salmon hatched and distributed from the Sisson Hatchery ..	29
Directory of outside deputies	31
Distribution of Rainbow and Eastern Brook Trout	32
Tables of temperature of the water in hatcheries	35
Expenditures from various appropriations and funds by the Board ...	36
Cost of the Bear Valley Hatchery	41
Table of licenses sold by the Board	42
Bulletins issued by the Commission	43
Description of a New Species of Trout. By David Starr Jordan	60
Description of Golden Trout. By David Starr Jordan.....	62



REPORT.

To H. H. MARKHAM, *Governor of the State of California:*

The State Board of Fish Commissioners herewith present, in compliance with the law, a report of their official operations, commencing with the 17th of March, 1891, and ending with the 1st of September, 1892, being the biennial report of the Board of Fish and Game Commissioners of the State of California.

The State Board of Fish Commissioners, as at present organized, was appointed by your Excellency on the 28th of June, 1891.

The first formal meeting of the Board was held on the 13th of April, 1891. At this meeting a permanent organization was effected, and Mr. Joseph D. Redding was elected President of the Board, Mr. Ramon E. Wilson, Secretary, and Mr. Joseph Morizio, Treasurer.

Since the first meeting as above stated, the present Fish Commission has held twenty-one meetings at the office of the Commission, and upon the following dates:

1891—March 17, formal meeting.
April 13, called meeting.
April 17, called meeting.
April 28, called meeting.
May 11, called meeting.
June 4, called meeting.
June 18, called meeting.
August 8, called meeting.
August 28, called meeting.
September 11, called meeting.

1891—October 8, called meeting.
November 6, called meeting.
1892—January 15, called meeting.
February 15, called meeting.
March 1, called meeting.
April 2, called meeting.
April 27, called meeting.
May 3, called meeting.
May 10, called meeting.
August 2, called meeting.

At each of the above meetings a majority of the Fish Commissioners were present, and a complete minute-book has been kept of all proceedings had, which minute-book is now in the office of the Commission, and open to inspection.

Immediately upon the organization of the Board, they proceeded to appoint assistants. Thomas Tunstead was selected as Chief of Patrol, and John P. Babcock and F. M. Bacigalupi as his deputies. George H. Koppitz was appointed License Collector, and Samuel C. Mills assistant to the Secretary.

The office of the Commission was established at Room No. 27, 419 California Street, San Francisco, where it has since remained.

Having thus organized, the first discovery made by the Board was that all of the funds available to the Commission for the balance of the forty-second fiscal year had been entirely exhausted; and more than that, that there was a large outstanding indebtedness, arising from unpaid bills of the old Board, the amount of which is fully set forth in a detailed statement hereto attached.

The business of the Commission has steadily augmented, and the importance of more stringent fish and game laws is fast becoming appreciated by the great majority of our citizens.

The territory of the State of California is so large in area, and the number and variety of its streams and waters, and diversity of game, so greatly in excess of those of any other State of the Union, and in fact of any number of States, that it is hard to appreciate the volume of work that the Commissioners and their deputies are called upon to perform.

The two chief divisions of our labors are, respectively, the Patrol and the Hatchery Departments. Under the former is included the maintenance of the fish and game laws. For this purpose, under the present law, there is an annual appropriation of \$5,000. With this amount at hand we are supposed to engage competent deputies to patrol the various wharves and fish markets of San Francisco and the other large cities of the State; to watch all of the avenues of ingress, and prevent the importation of certain fish and game when out of season; to keep a vigilant eye on the 250 miles of the bay lines of San Francisco and confluent bays and rivers, and to make continuous trips from one end of the State to the other, and throughout the length and circumference of all of its streams and waters, for similar purposes.

THE PATROL DEPARTMENT.

It is impossible, with the small appropriation allowed us for this department, to properly carry out that portion of the law which makes it the duty of the Commission to protect and preserve the fish and game in this State. It is hardly necessary to give any reasons for this, for they must be apparent to every one who will give the matter one moment's thought. If we undertook to patrol the State in detail, the actual traveling expenses of the deputies alone would exhaust the fund. Appreciating this, the Commission has devoted almost its entire attention to what it conceived would produce the best results, namely:

First—The prevention from sale in the markets of San Francisco of fish and game at the time when it is unlawful to sell the same.

Second—The prevention of illegal fishing in the bay of San Francisco, especially in the catching of the young of fish.

Third—The prevention of illegal fishing in the Sacramento River.

Fourth—The prevention of dumping sawdust and other deleterious substances into the various rivers and streams of the State.

Fifth—The requiring of the construction and maintenance of fish ladders.

What we have been able to accomplish in this direction will be shown in detail by the reports of our deputies and excerpts therefrom, which are attached to and made a part of this biennial report.

It requires a particular fitness to be a competent deputy in this department. The patrolmen are called upon to undergo all kinds of hardships, to be exposed to wet weather at all times of the day and night, and to come in contact with some of the most brutal and irresponsible classes of men. The position demands shrewdness, bravery, and executive ability of high order, besides a thorough familiarity with the topography of our State. In order to properly fulfill the work of this department and to employ a sufficient number of competent men, there should be an annual appropriation of at least \$20,000, to be used entirely in this division of the labors of the Commission. Besides the patrol work and arrest of violators of the fish and game laws, there follows an immense amount of labor in the trial and conviction of the

offenders. The deputies making the arrest have to be present at the trial. This, coupled with the customary delays of legal procedure, demands a great deal of time, and often prevents our employés from doing important service in other directions. Only by a sufficient appropriation can the Commissioners hope to even partially fulfill the duties which are prescribed to them in this behalf under the law.

The exclusive attention of our deputies has been given to the Patrol Department ever since their appointment. We beg to express to you our satisfaction in what has been accomplished in this matter of the prevention of the sale of fish and game in the markets, and especially with the results which has been accomplished in the prevention of the dumping of sawdust into the Sacramento, Truckee, and other rivers and streams, and also in the establishment and maintenance of fish ladders in the Truckee River and other places. Our most difficult labor has been found in the neighborhood of the bay of San Francisco, and in the Sacramento River. We believe that we have accomplished all that our funds would permit us to do. Your attention is called to the fact that the shore line of the bay and the Sacramento River alone covers a distance of more than two hundred and fifty miles. The fishing business is carried on and conducted at all points on the Sacramento River, from the city of Sacramento to the mouth of the river, and all points on the bay. As above suggested, the sum of \$5,000 is absolutely inadequate, if devoted exclusively to this department, to accomplish much active results. The sum of \$20,000 would permit the Commission to not merely threaten the arrest of the violators of the fish laws by infrequent visits, but, on the contrary, to accomplish their arrest and conviction in every instance.

LICENSES.

The Commission early appreciated that the matter of the collection of licenses, owing to the small amount appropriated for the benefit of the Commission by the Legislature, was an important matter, and if properly and successfully conducted, would add materially to the funds of the Commission. Under the law requiring all persons engaged in the avocation of fishing, with boat and net, to pay a license, the Commission is authorized to pay to the collector of licenses a percentage upon the amount of his collections, namely, 15 per cent.

So far as the city of San Francisco is concerned, there is no doubt but what the compensation, so provided, is fair in proportion to the services performed; but when it is considered that all the expenses of collection have to be borne by the collector, such compensation, for collections outside of the City and County of San Francisco, is entirely inadequate. In other words, the percentage thus provided for would not pay expenses, particularly so on account of long distances.

In most of the bays, rivers, and harbors outside of the city of San Francisco, the number of men engaged in the avocation of fishing is comparatively small—as, for instance, in Humboldt Bay, Tomales Bay, Monterey Bay, and San Diego Bay. Appreciating this condition of affairs, the Board concluded to appoint a deputy with a fixed monthly salary, whose principal duty should be to collect licenses.

It was early learned that no provision had heretofore been made for ascertaining or locating the various individuals throughout the different portions of the State who were engaged in the occupation of fishing.

When the vast extent of territory included within this State is considered, it can be readily understood that the accomplishment of this object is a very difficult one, and yet without it the law would be inoperative and useless.

We beg to call your attention to the expense bills which are hereto attached, and particularly to those items thereof which were incurred in the early work of the Commission in the matter of the collection of licenses. When it is considered that that work was absolutely necessary for the purpose of establishing a correct foundation and system for the more perfect collection of licenses, and when the work accomplished at that time is compared with the results as shown by the reports of the License Collector for the year 1890, there can be but one conclusion, and that is that the money has been well expended. The Commission is prepared at the present time to turn over to its successors a fairly complete list of all individuals and sets of individuals who are engaged in the avocation of fishing with boat and net in the waters of this State, with the exception of the extreme southern portion of the State, which, from lack of means, we have not been able to canvass. As will be seen from the amount of moneys which have been collected from this source, the collection of licenses is a very important matter to the Commission. We feel confident in stating that we have inaugurated the proper system for the accomplishment of the end which was intended, and that if this system is followed out for some length of time, the objects of the law will have been fully accomplished, and the funds of the Commission very materially increased. In this connection it is proper for us to call your attention to the fact that the fishing industry in this State has materially decreased in certain localities within the past two years, and this is especially so in the Sacramento and San Joaquin Rivers, although, as hereinafter shown, the salmon-canning industry has revived, owing to the unusually large run of salmon this year.

The collection of licenses from fishermen is a very difficult undertaking, for the reason that almost the entire fish industry of this State is carried on and conducted by foreigners, principally by Italians, Greeks, Slavonians, and Chinese, half of whom neither understand nor speak the English language. With the system already established, and which we intend to more fully perfect, we feel confident in saying that our next report will show a very material increase in the funds of the Commission from this source.

THE SALMON RUN.

An extraordinary increase in the salmon run has been noticed in the Sacramento River this year, and to such an unusual extent that the several canning establishments along that river, which have remained closed for some time past, have reopened and are doing a thriving business. It is difficult to ascribe the proper cause for this unusual run. Whether it is the actual result of the several millions of young salmon deposited by the Commission in the headwaters of the Sacramento and the surrounding streams within the last six years or not, we cannot say. It is generally supposed that the salmon returns from the sea, as near as possible to the headwaters, and, in fact, to the exact locality where it was hatched. On the other hand, the run of the present season is out of all proportion to that of any other preceding year within the last

decade, and does not appear to be the natural increase from the work of the Commission in hatching and depositing these fish in the streams enumerated.

The report of the Norwegian Fish Commissioners for the year 1889 makes note of this same anomaly, namely: the unusual and enormous run of salmon up their rivers during one year after several preceding years of very inferior runs. They seek to account for it on the theory that the salmon, after leaving the fresh waters of its birthplace and gaining the sea, has no fixed or regular period, so far as the years are concerned, for returning to the fresh waters, but is likely to do so at any time after migrating indiscriminately in the deep waters of the ocean.

Attached to this report and made a part hereof is the report of the Superintendent of the State Hatchery at Sisson, California, Mr. J. A. Richardson, setting forth in detail the number of salmon eggs received from the United States Government during the last two years, the number hatched and planted, and where planted and distributed during the same period.

SHAD.

The shad planted by the first State Commission, some fifteen years ago, have become one of the most plentiful of our fishes, is a staple article in our markets, and obtainable for less price than in any other portion of our country. Such practical results from the introduction of a fish hitherto unknown in our waters are very gratifying.

This fish in our waters is equal in every particular to the same fish found in its native haunts. In this connection, however, we would call attention to the necessity of shad being handled with great delicacy from the time it is caught until it is placed upon the table to eat. The fiber of the flesh is very tender, easily bruised, and at once softens and loses the quality of its taste by indiscriminate and improper handling. Mr. Blackford, the well-known Fish Commissioner of the State of New York, suggests in a recently published article, that the shad when caught should be packed belly upwards, and handled as carefully as ripe fruit should be for the purpose of transportation.

STRIPED BASS.

The transplanting of striped bass has been equally as successful as that of the shad, and this delicious fish is now found in our waters and has become a permanent source of food supply in our markets. There is an important matter in this connection we beg to call your attention to, and that is that a law should be framed for the protection and preservation of striped bass. This fish seeks the slack waters of the rivers and bay for spawning. The young fish remain for some time in the waters of their birthplace, and during the period of their growth are being caught in large quantities by the fishermen, instead of being protected.

There should be a law passed making it a misdemeanor to catch, take, or have in one's possession a striped bass under two pounds in weight.

BLACK BASS.

The Commission, through the courtesies of the Spring Valley Waterworks, have been enabled to obtain a few black bass, which we have distributed, and we are at this time engaged in the same work.

LOBSTERS.

In May, 1888, the United States Fish Commission at Washington sent a carload of Atlantic lobsters (*Homarus Americanus*) to this coast, consigned, for delivery at Monterey Bay, to two of the State Commissioners. The car was in charge of Mr. Frank Ellis, one of the deputies of the United States Commission, and most experienced in the transportation of fish. Over one hundred and sixty full-grown lobsters were placed in Monterey Bay, off the shore and near Point Pinos. These lobsters arrived in a healthy condition and full of vigor, and when placed in the waters swam away with great rapidity, seeking their natural haunt at the bottom, among the rocks. Over thirty thousand young lobsters also were deposited in and around the same locality.

Since this deposit was made no definite and reliable information has been received that the lobsters have thrived. Reports have come to us that one or two of the mature lobsters were washed up by the waves on the Monterey beach some two years after their transplanting, alive and in good condition. They were at once placed back into the sea, as the fishermen of Monterey Bay were duly informed of the effort made to transplant this most edible of fishes, and have apparently been only too willing to assist the Commission in its labors. None of the young lobsters have been heard from. There is a standing reward for the production of the first live lobster, which at the present time remains unclaimed. There would seem to be no reason why the lobster should not thrive on our coast. The temperature of the waters of the bay is exactly identical with that of Woods Holl, where the lobsters were taken, on the Atlantic Coast. The saline quality is likewise the same. It may be that the lobster fails to find similar food to that to which it is accustomed in the Atlantic, or that there is some unknown enemy which has devastated them. Four years are ample time to mature the young lobster, and if the experiment has been a success we should certainly have definite results at the latest within another year.

FRESH-WATER CRAY-FISH, OR ECREVISSE.

These fish, which are indigenous to our State, and at one time most plentiful in the fresh-water streams around our bay, have become almost exterminated through the unlimited taking of the same for food purposes. We suggest that a law should be passed making it a misdemeanor for the period of the next three years to take, catch, or have in one's possession any of these fish.

STEAM LAUNCHES AND BOATS.

We are compelled to hire during almost every month of the year a steam launch, row boats, and yawls. This we are expected to pay for out of the sum of money appropriated for the Patrol Department, and as above indicated, the same is entirely insufficient. We were particularly fortunate at the outset of our work in having donated to us the steam launch of Commissioner Joseph Morizio, who gave the Commission the use of it without charge for several weeks, thus reducing our expenses considerably.

HATCHING DEPARTMENT.

At the outset of the present Commission's work, there being no funds of any kind available, we were obliged, for the time being, to abandon all attempts to operate the Hatchery Department. The result of this was that the spring run of trout was entirely lost, and no ova were obtained from the trout in this State during the whole of the year 1891, with the exception of 88,000 taken by the Commission under a contract with Messrs. Stevens & McKenney, at Independence Lake, a report of which is hereto attached.

When this Commission took office there were two hatcheries belonging to the State, one located at the town of Sisson, in Siskiyou County, and the other at Tahoe City, Lake Tahoe.

The hatchery at Lake Tahoe is built upon leased ground, Mr. J. G. Woodbury being the owner.

The hatchery at Sisson was also located upon leased ground belonging to Mr. J. H. Sisson. The Legislature of 1891 appropriated from the State's funds \$500 to buy the ground upon which the hatchery is located. This purchase was made, and the deed for the same has been executed and duly recorded. As hereinbefore stated, when we took office there were no funds available for use in this department, and none could be obtained until the coming in of the appropriation for the forty-third fiscal year, which commenced on the 1st of July, 1891; however, we made a contract with Messrs. Stevens & McKenney, at Independence Lake, to take all the spawn they could hatch, at the price of \$2 50 per thousand. They were not very successful in taking a large quantity of spawn, but without any fault on their part. They turned over to the Commission 88,000 fry, which were distributed by the Commission, as will appear by a report of the same hereto attached. No further attempts were made towards getting any spawn or fish until the fall run of salmon commenced, when we received from the United States Hatchery, located on the McCloud River, 2,850,000 eggs.

Mr. J. A. Richardson was appointed by the Board Superintendent of the Sisson Hatchery, and the work of hatching the salmon spawn received from the Government was turned over to him.

The Commission, early appreciating the necessity of having a hatchery in the vicinity of San Francisco, soon after the coming in of the appropriation for the forty-third fiscal year set about to see what could be done towards the accomplishment of that purpose. All the waters of San Mateo, San Francisco, Alameda, and Marin Counties were carefully examined, and finally, Bear Valley, in Marin County, was selected as the site for the new hatchery. The use of the waters of a small mountain stream which empties into Bear Valley Creek, with the right to construct a dam and reservoir, and also ground of sufficient quantity for the purposes of the hatchery, was obtained from Hon. Charles Webb Howard, the owner of the property, and he has given to the Commission a lease for five years, with the privilege of five additional, at a nominal rent of \$1 per year. Having selected the site, the Commission set to work in August to build the hatchery.

We beg particularly to call your attention to the expense account in the construction of the hatchery. All of the lumber, with the exception of the shingles and the underpinning, which are of redwood, was a donation and a gift by the late Hon. James McM. Shafter. The building

itself is a one-story, peaked roof, 40 feet in length by 22 feet in width, and can accommodate 24 12-foot troughs, with a capacity of hatching 1,000,000 eggs. At the present time, however, the Commissioners have in operation only 12 troughs, but expect to put in the other 12 shortly. The water used in the building is taken from a reservoir some 300 feet distant from the building. The dam is about 4 feet high, and is made of concrete. Ever since its construction, and up to the present time, the hatchery has been in constant operation, as will be seen by tables attached hereto.

We have proven conclusively the usefulness and perfect success of this hatchery. About the time of its completion the Commission appointed Mr. Eugene W. Hunt Superintendent of it, and he immediately took charge, and has been in charge ever since. The result of his work is fully set forth in reports and tables hereto attached.

Having failed to procure any trout spawn in the spring of 1891 for the above reasons, the Commission set to work to see what could be done in the matter of obtaining the spawn of the Eastern Brook trout. Application was made to the United States Fish Commissioner, but he was unable to supply us with any. We then placed ourselves in communication with Hon. George T. Mills, Fish Commissioner for the State of Nevada, asking permission to cooperate with him in procuring spawn of the Eastern Brook trout from Marlette Lake, State of Nevada. These negotiations culminated in an arrangement being made between Mr. Mills and this Commission by which each Commission gave the services of one of its deputies, the two Commissions dividing all of the expenses incident to the taking and eyeing of the spawn. By this arrangement, as will be seen by tables and reports hereto attached, we were enabled to distribute 317,000 fry. This arrangement with Mr. Mills was a very generous one on his part, and it is due to him that we should express in this report our appreciation of it. Immediately upon the completion of the distribution of the Eastern Brook trout so obtained, the taking and eyeing of Rainbow trout spawn from the Klamath River was commenced. The bulk of the spawn taken was sent to the Bear Valley Hatchery, and, as will be seen by tables hereto attached, resulted in the distribution of 331,000 Rainbow trout. That work has just been completed. At the present time we have made no definite arrangements with Mr. Mills to secure Eastern Brook trout eggs this fall, but we feel confident that some efficient plan will be made.

The Commission has not used the hatchery at Lake Tahoe for general work, that is, the hatching of spawn for general distribution, as we have concluded in was impracticable, principally for the reason of its long distance from any means of transportation by rail, and for the further reason that it cannot be made available in the winter on account of the snow and ice. It was this fact which prompted the Commission to construct the new hatchery at Bear Valley. As before suggested, and as is apparent from the tables and the reports attached, the Bear Valley Hatchery being located within so short a distance of railroad, and being near the central point for general distribution, is thoroughly practicable. It is not the present intention of the Commission to abandon the hatchery at Lake Tahoe; but we do not think it can be made use of, considering the small amount of the appropriation, for any purpose, other than the taking and hatching of spawn for Lake Tahoe and vicinity. We beg to call your attention to the tables hereto attached showing the

places where trout have been planted. It will be noticed that some of the points are at long distances from railroad, but the distribution in all cases has been successful, and the planting has been attended with extremely small loss.

Mr. W. H. Shebley was appointed a deputy to assist the Superintendents of the Bear Valley and Sisson Hatcheries in the distribution of fish. Since that date he has practically had the entire management of that branch of the work.

Apropos of this subject, the Commission desire to express their gratefulness for the many favors which have been granted to it by all of the various railroad companies in the State, in furnishing transportation to our assistants, and the giving to them of the use of the baggage cars for the transportation of the fish and apparatus.

Without this aid the work of the Commission would have been very much handicapped, and we take great gratification in pointing to this assistance as one of the many courtesies we have received from every class of citizens of our State with which we have come in contact. There seems to be a broader and more liberal appreciation of the work of the Commission in all directions, and from every locality.

Whenever our deputies have proceeded with young fish to deposit them in remote streams, they have been invariably met by enthusiastic citizens only too willing to lend their time and labor to the successful transplanting of the young fry.

The Commission is under many obligations to Dr. David Starr Jordan, President of the Leland Stanford, Jr., University, and we take this opportunity to express our gratitude to him for the interest that he has taken in the work of the Commission, and in supplying us with scientific information, some of which has been embodied in bulletins hereto attached. He has at all times cheerfully responded to all requests that the Commission and its assistants have made.

We beg to call your attention to Dr. Jordan's description of the Golden trout and of a new species of salmon, as well as the drawings of both, which have been furnished to us by him, and with his permission we now publish for the first time. We also desire to express our thanks to Col. Marshall McDonald, United States Commissioner of Fisheries, for many courtesies we have received at his hands in supplying us with salmon spawn, and in sending to us bulletins and publications pertaining to his department.

A SEPARATE HATCHERY FOR YOSEMITE VALLEY AND SURROUNDING TERRITORY.

We earnestly recommend the construction of a hatchery in Yosemite Valley, to be placed under the control and expense of the Yosemite Commissioners. There is a large demand for trout fry from that section of the State, but it is impracticable for the State Commission, on account of the long distances of transportation, to stock those waters. If, however, a hatchery is built by the Yosemite Commissioners, we can always furnish the spawn. The expense of such a hatchery would be only a few hundred dollars.

NECESSITY FOR INCREASED APPROPRIATION IN THIS DEPARTMENT.

Upon reading the above report, we are of the opinion that you will perceive the necessity of an increase of \$5,000 per annum in the appropriation for the Hatchery Department. We are hardly able to reach the remote portions of the State under our present appropriation; besides this, the wants of the State are enlarging with the increase in population. It is but the natural development of the situation. We therefore ask that the appropriation of the Hatchery Department shall be \$10,000 per annum, instead of \$5,000.

GAME AND FISH LAWS.

The Commissioners beg to recommend that certain changes be made in the fish and game laws of this State, and in particular as follows:

First—The sum of \$20,000 per annum should be appropriated for the restoration and preservation of fish, which includes the Patrol Department. With this sum the entire State can be properly and efficiently patrolled by competent deputies, who will enforce and protect the game and fish laws. If you will consider the vast territory under our jurisdiction, this amount will appear to be a very moderate one. In the several Atlantic States extending from Maine to North Carolina, and covering an area in their entire extent less than that of our own State, the combined appropriation per annum for these purposes runs up to over \$100,000; besides, on the Atlantic seaboard there is in that limited territory about twenty million of population, who watch each other and report to the authorities depredations and violations of the fish and game laws. We have about one million of people, but just as many fish and as much game to protect as the Eastern territory has with its enormous population. It is for these reasons we suggest this increase in our funds, and earnestly urge that your Excellency will present our claims for the increase to the coming Legislature.

Second—The law should be so changed as to make possession of any fish or game at a time when it is unlawful to take or kill the same, a misdemeanor, without regard to where the fish or game were taken or killed. As the law now stands, it is claimed that fish or game may be brought into this State from another State, when it is lawful in the other State to take or kill the same, although at the same time it is unlawful to take or kill in this State.

Third—The cold storage system is a matter which demands serious consideration. By this system it is practicable to place in storage either fish or game, taken at a time when it is lawful, and keep them for sale at a time when it is unlawful to take them. By this system it is entirely practical to supply fish and game out of season, and to make a market for both fish and game much in excess of the natural demand for the same during the open season. It is apparent that unless some restrictions and limitations are imposed, it will only be a matter of comparatively a short time when close seasons for fish and game will cease to accomplish any purpose.

Fourth—The close season for salmon should include the month of August, as well as September. In support of this recommendation we beg to call your attention to a letter written by George B. Williams, Jr., Superintendent of the United States Hatchery on the McCloud River,

which was embodied in the biennial report of our predecessors for the years 1888 and 1890, and which we republish:

BAIRD, CAL., July 8, 1890.

Mr. J. G. WOODBURY, *San Francisco*:

DEAR MR. WOODBURY: Yours of the 5th at hand. Two years of experience in charge of this station on the McCloud has convinced me that unless some action is taken by the Legislature and those interested in the propagation of salmon as a food fish, to include the month of August as well as that of September in the close season, not many years will elapse when this valuable food fish will become almost extinct.

On account of the high water we are liable to have at this point during the spring and late fall runs, it is impracticable to secure and spawn by artificial methods the parent fish; but the August run comes at a time when it can be handled successfully. In order to allow this run to reach the headwaters of the Sacramento River, and its tributaries, the months of August and September should be reserved to allow a free passage of salmon.

I draw my conclusions from the fact that in previous years, when there was no fishing with seines in the Sacramento to speak of, thousands of salmon collected here during the latter part of August and during the month of September, and we found no difficulty in securing all the eggs we could handle, 14,000,000 ova having been taken in one season. From the August run in 1888 but 1,568,600 were secured, and in 1889, 1,105,000 were taken. In 1888 the season's take was increased to 5,584,600, by securing ova from the late run in October and November. But this was something unusual, and could not have been accomplished had it not been that the rains did not set in until December of that year. An attempt was made in 1889 to take the late run, but rains in October caused the McCloud to become very high, and racks and dams were washed out, allowing the parent fish to ascend the river and small creeks above the station.

It is very hard to decide how long it takes the salmon to reach their spawning grounds after they leave the seining grounds of the lower Sacramento, but as near as we can tell, from two to three weeks.

As you know, the work done at this station is almost entirely for the State. It seems as if it should be the aim of the people to do all in their power to aid the United States Fish Commission to accomplish its object by making laws that will protect this valuable food fish.

Much more could be said regarding the tremendous decrease in late years of the salmon, but I think I have advanced sufficient reasons to show that a longer close season is necessary to make a success of our work. It is a question that should be seriously considered and acted upon at once.

Yours truly,

GEO. B. WILLIAMS, JR.,
Superintendent of Station.

Section 635 of the Penal Code should be amended so as to make it a misdemeanor to dump shavings into waters.

Fifth—Your attention is called to Section 636 of the Penal Code. As it now reads it is meaningless. The word "fish" in some manner was omitted.

The last section referred to should also be amended so that the possession of the young of any fish, either fresh or dried, be made a misdemeanor.

The same section should be further amended by eliminating therefrom the words "except Brook trout."

Sixth—The Board of Fish Commissioners should be given the right at any time to take any kind of game for propagating purposes.

Seventh—There should be legislation requiring ditch owners to place wire screens at the entrance of the ditches.

Eighth—We beg to call your attention to the fact that game birds are being introduced into this State from other countries, such as pheasants and wild turkeys. The Legislature should make it a misdemeanor to hunt, take, or have in possession any of this game for some period of time, say four years.

Ninth—An increase in the appropriation for the Hatchery Department from \$5,000 per annum to \$10,000 per annum.

Tenth—We recommend that a tax of 4 cents per case be placed and collected upon canned salmon. This Commission is hatching and

planting about 3,000,000 salmon each year in the waters of our State. A small tax of 4 cents per case (which contains four dozen one-pound cans, or, which is the same thing, two dozen two-pound cans) would be willingly paid, we believe, by all persons engaged in this industry, and the revenue to the Hatchery Department of the Commission would be greatly augmented.

DEEP SEA FISHING.

Up to the present time no direct attempt has been made to investigate the extent of the marine fishing banks lying at the outer edge of the Golden Gate and along the coast of our State. On the Atlantic Coast this has become the most important department of the labors of the United States Fish Commission and of the various State Commissions. The number and variety of our marine fishes are supposed to equal, if not exceed, any other locality of equal area on the globe. To properly classify this, and to adopt any of the systems for the spawning and hatching of marine fishes, now so successfully being carried on on the Atlantic seaboard, will require a separate appropriation. The United States Fish Commission has for many years recognized the great importance of our seacoast for these purposes. The United States steamship "Albatross," Capt. Z. L. Tanner commanding, has, ever since the summer of 1888, been constantly along the Pacific Coast, and the reports made by him and his experienced officers and specialists upon the variety and diversity of our marine food fishes, form the most interesting portions of the United States Fish Commission reports for the last three or four years.

We respectfully recommend that the importance of this department of our labors be thoroughly investigated and understood by the forthcoming Legislature, and a sufficient sum allowed by law to not only assist the work of the United States Commission, but to obtain for our benefit a knowledge of the great marine wealth that lines our coast for over seven hundred miles in extent.

Herewith we proceed to present the reports in detail of our expenditures in the various departments, and also the reports of our several deputies, all of which will be found to proceed in conformity to the statements made in our own report.

Respectfully submitted.

JOSEPH D. REDDING,
President.
RAMON E. WILSON,
Secretary.
JOSEPH MORIZIO,
Treasurer.



BEAR VALLEY HATCHERY,—OLEMA, MARIN CO.



EXTRACTS FROM REPORTS OF DEPUTIES.

Under the organization of the departments of the Commission, orders were given to each one of the deputies to file a weekly report with the Board, covering their actions and doings for that time. Such reports have been filed with the Board every week since its organization. A great many of them are of a confidential nature, partaking of detective work, and we do not think it advisable to publish them in full. They are, of course, open at all times to the inspection of the proper State officials. They show exactly where each and all of our deputies were upon every day since they have been in our employ, and are complete records of the work of the Patrol and Hatchery Departments during that time.

REPORT OF THOMAS TUNSTEAD.

[Under date of July 29, 1891.]

We visited every fishing camp on the Sacramento River from Nicolaus to Vallejo, a distance of about one hundred and fifty miles, and found the salmon run very small. At Feather River and vicinity I saw about one hundred fike nets, but they were not in use. These nets, when in use, are a permanent contrivance, which is a misdemeanor. We have no authority under the law to seize these nets. Of the men that I arrested on the 16th for extending their nets more than one third across the river, two were fined \$50 each, and in the cases of the other two the jury disagreed, and upon the advice of the District Attorney, I consented to the dismissal of their cases.

[Under date of August 26, 1891.]

I started on the 28th to San Pablo Bay in search of Chinese, in company with Deputy Babcock. We saw a number of boats on the drift, but they were not working, and they did not work during the thirty-six hours that we lay at anchor in plain view of them.

[Under date of September 29, 1892.]

Visited Belmont, San Mateo County, investigating the reports concerning the trapping of quail, and in company with Mr. Lindsey, the local deputy, I visited the following places: Spanish Town, or Halfmoon Bay, Wrights Creek, Purisima Creek, San Gregorio, Lobitas, Corte Madera, Tornitas, Pescadero, Yazzos, Buteno, White Creek, New Year Creek, and Wardell Creek. We found and destroyed a number of traps at these places, but could not find the persons who set them. At one ranch we found a number of live quail, which the people claimed they had hatched. We released the birds but made no arrests.

At Wardell Creek we made the acquaintance of a former deputy. He reported that he had made a number of arrests in his district while he was connected with the Board, and had prosecuted the cases. After-

wards his store and barns were burned down, and he said that he then resigned from the Commission.

[Under date of January 11, 1892.]

I have to report that on January 4th I went to Cazadero, taking Deputy Babcock with me. We remained there over night. Tuesday morning we went to Duncan's Mills by train, and from there walked to the mouth of Russian River, some six miles. We were dressed as hunters and were accompanied by two dogs. About one mile from the mouth of the river we found a set net placed in the stream; it was fastened at one end to a stake, the other end being anchored in the stream some sixty yards from the shore. We remained in sight of this net for some two hours, when we saw two men come from a cabin near the net, get into a boat and take up the net. We were within four hundred yards of them at the time, and could plainly see what they did; they caught two salmon. After they had replaced the net in the water again we arrested them, taking them to Duncan's Mills on foot, and from there to Guerneville by wagon. We arrived there at 5 P. M. and took them before Justice Bartley, and preferred the charge against them of using a set net. They pleaded not guilty and demanded a jury, and the trial was set for the following Thursday. They were placed in the hands of the Constable. That evening at about 7 o'clock, the hotel at which we stopped was surrounded by a howling mob of men and boys, who blew fish horns and gave many other evidences of their disapproval of our actions; the disturbance was brought even into the public sitting-room of the hotel in which we were. We were told by a number of men about the place that we could never convict the men or any person or persons in that neighborhood of illegal fishing; that it was too general, and public sentiment was opposed to the law. Wednesday evening Assistant Prosecuting Attorney Lупpo, of Sonoma County, came from Santa Rosa to take up our case. He informed us that he thought we had made a mistake in preferring the charges in Guerneville, as conviction there was almost impossible, but that our case was so very strong he hoped we might do so.

The trial came off Thursday. The jury was composed of middle-aged men. One of the defendants admitted, on cross-examination, that he fastened the net at 5:30 A. M. Tuesday to a post which was securely driven into the bank of the river, and that while the net was so fastened they caught two salmon. The other defendant claimed that he did not know whether the net was fastened to the stake or not while they were fishing. The Justice, at the written suggestion of the prosecuting attorney, instructed the jury to the effect that if they found from the evidence that either of the defendants fastened or assisted to fasten either end of the net to any stationary object, it is constituted a set net, and they must find the defendants guilty, etc. The jury was only out of the room some ten minutes, when they returned a verdict of not guilty. From the court-room to the hotel, and from the hotel to the station, we were followed by a howling mob of thirty or forty men and boys. It was a most insulting demonstration. Attorney Lупpo and Superintendent Korberly of the San Francisco and North Pacific Railroad, who came away with us on the train, denounced the affair as being the most disgraceful of anything they had ever witnessed, and they did not believe such a demonstration could take place in any American town.

[Under date of February 1, 1892.]

We drove along the coast of San Mateo County, and spent several days in the vicinity. The waters were full of Steel-heads, but none are being killed contrary to the law, so far as we could find out. The stories one gets from San Gregorio and Pescadero are without number, but we could not get any evidence to substantiate any one of them; though we visited and talked with all of the people in the vicinity for two days, few of them knew our business. * * *

Deputy Lindsey, of Belmont, has been of great service to the Commission, in my opinion, by having posted Bulletins Nos. 1-3 throughout his district. All the people in the coast country seem to be posted upon the Steel-head, and are very shy of killing them. We found no foundation for any of the deer stories, and believe them to be without fact.

[Under date of February 29, 1892.]

This endless patrol of the markets goes on each day, and it is very necessary, but it is almost always without results. Since I have been in the employ of the Fish Commission the markets of the city of San Francisco have been visited every day by some one of the deputies in your employ, and the patrol of these markets I consider to be very complete. In this way we have destroyed the market for illegally caught game or fish. * * *

The almost entire absence of public sentiment for the enforcement of the fish laws in such places as Glen Ellen, Napa, and other well-known localities is most marked, so that the local aid the Commission may expect in these places is but slight.

[Under date of May 6, 1892.]

On April 15th, accompanied by Deputies Babcock and Koppitz, I went to the Sacramento River to make the annual spring examination and collect licenses. On the way up we overhauled and arrested eight Chinese fishermen for catching the young fish with set nets. We took the men to San Rafael, and resumed the trip, visiting Vallejo, Martinez, Benicia, Antioch, Collinsville, Rio Vista, and Sacramento, besides all the islands and sloughs on the way up the river.

On April 22d we arrested a Greek for fishing with a 5-inch-mesh net. He plead guilty at Martinez, and paid a fine of \$50.

On April 26th we arrested four men below Rio Vista for having their nets more than one third across the width of the river. The local sentiment is strongly against the law, and a conviction is doubtful.

We finished the trip and returned to the city on May 5th. We collected some two hundred and ten licenses, a report of which is made to the Board by Deputy Koppitz. The spring run of salmon is light. The canneries are not open on the river, and the prospects of their opening is poor. The necessity of the close season in the spring, of at least one month, seems to me very necessary if the salmon are to be preserved to the waters of the Sacramento River. The number of boats engaged in the fishing grows less each year, and the men engaged in the business have a hard struggle for existence. The Saturday and Sunday close season is well observed, but does the salmon run but little good, as it is not long enough to let the fish pass up that part of Suisun Bay and the river covered by the fatal seines. A close season in April and Septem-

ber would be of much greater benefit to the fish, and would help materially to prevent their destruction. There cannot be too much effort made to have such a close season established. The launch that we used worked well most of the time.

[Under date of May 11, 1892.]

Went to Rio Vista, taking Deputy Babcock with me, to look after the fishermen arrested on April 25th. The defense put in a demurrer that the Code did not cover the case. The demurrer was sustained. It is the old question of "every person who shall cast, extend, or set any seine or net of any kind for the catching of," the word "fish" being omitted from Section 636. This section should be amended, as it is meaningless, owing to the omission of the word "fish."

[Under date of June 17, 1892.]

Taking Deputy Babcock with me, I went to Belmont, where we were joined by Deputy Lindsey. We took a boat from Belmont to the Morgan Oyster Co.'s camp at the mouth of the slough, and we sailed from there in one of the company's oyster boats, dressed as fishermen, and overhauled the Chinese at South Belmont. Their catch was free of fish, and the shrimps were the smallest I have seen. From South Belmont we sailed to the mouth of Redwood City Slough, and overhauled the two boats of the Quan Man Lee & Co., and arrested the ten men, as their catch was fully one third small fish. The head man, Ah One, offered Babcock and myself the money they would have to pay if fined, and used every endeavor to get us to take the money and let them go. We took them before Justice Welch, who held them to answer.

[Under date of June 29, 1892.]

With Deputy Babcock in the launch "Rustler," we went to Hunter's Point and overhauled the Chinese camp. We overhauled one junk on the bay that had Chinese sturgeon lines and sturgeon freshly caught. There were three men in the boat. I left the launch and took the Chinamen to Pacific Wharf in their own junk. * * *

I would suggest that the Commission request the next Legislature to pass a law prohibiting the catching of shrimps in set nets, and also prohibiting the catching of shrimps for the purpose of drying, and prohibiting the shipping, having in possession, or offering for sale, or exporting any dried shrimps.

[Under date of July 1, 1892.]

Upon several occasions your honorable Board has requested a more detailed report of my visits to the markets. It is, however, a rather monotonous form to give the names of all the stalls visited each week. I visit them all, each morning or during the day when I am in the city, and have found no violation of the law in any of them for months. The work is very necessary and is carefully done, and I am unable to give any facts or information from these visits, other than to report that the law, so far as the dealers are concerned, is observed. I cannot arrest any of the dealers because they have sturgeon that have been caught with Chinese sturgeon lines. The law does not cover the offering for sale of any such fish. I hope, therefore, that you will not hold me as being indifferent to your instructions that I did not mention the name of each stall each week.

[Under date of July 2, 1892.]

I accompanied Deputy Koppitz to Harbor View for the purpose of collecting licenses from fishermen at that point. We had very poor success, as many of them refused to pay, and dared us to make an arrest. We arrested five men, and locked them up, with the charge of fishing without a license. They gave bail to appear on the 5th, and on paying their licenses they were discharged.

Mr. Koppitz reports that since then he has collected from all the fishermen at that place without trouble.

[Under date of July 13, 1892.]

Accompanied by Deputy Babcock we went down the bay and arrested two Chinamen who were catching sturgeon with sturgeon lines, and took them to Redwood City to await trial. Their cases come up at San Mateo on the 22d. We have made almost weekly trips to the Chinese shrimp-fishing stations during the season of 1891-92, and the constant howl that we do not enforce the law as regards the Chinese, is done for some other purpose than is apparent upon the surface. These camps are regularly and systematically overhauled, and all that we can do with the means at our hands is being done, to see that they do not destroy the young of fish. The drying beds at all these camps are mostly free of small fish. I do not believe that the law is violated to the extent that is complained of.

[Under date of August 29, 1892.]

We took up a lot of sturgeon lines at Roe Island, Suisun Bay, and ordered the Italians who run the camp to move away. We could not arrest these men, as we could not catch them in the act of using the lines. We have taken no less than four miles of line and twelve anchors from these men during the year, so that their business cannot have been very profitable to them.

REPORT OF JOHN P. BABCOCK.

[Under date of July 13, 1891.]

I went to Port Reyes on July 7th, as directed. I saw Mr. ———; he repeated to me the story that he had told to Mr. ———, and gave me so good a description of the Swiss that he saw with the deer on July 1st, that I had but a few hours' search before locating the man at Millerton. I took Mr. ——— there to identify him, but he failed to do so, though he admitted the man answered the description to a nicety. I am fully convinced that "the little sawed-off Swiss, with small, black eyes, and a long, black-haired mustache so thin that you can see all of his upper lip," is the man at Millerton, and that ——— did not want to identify him, for fear that the large Swiss element in the neighborhood would resent his information and burn his valuable property.

[Under date of August 17, 1891.]

Mr. Storey, of Chip's Island cannery, told us that he would pay the orders given on him by fishermen who had any money due them; that the last spring run of salmon had been the poorest in his experience for years; that most of the fishermen quit in the spring in his

debt, and that the poor fellows had not made their salt during the summer; that he would not open the cannery for salmon until the last week in August, unless the run of fish was strong.

[Under date of August 26, 1891.]

It is needless for me to add that the license-collecting trip on the Sacramento River should be made early in April, during the spring run, and pressed to a finish. The fall run is too short and uncertain.

[Under date of October 9, 1891.]

I went to Santa Cruz. Left the train at Rincon and went down to the California Powderworks, on the San Lorenzo River, and in company with Mr. W. C. Payton, Superintendent, went over the company's dams, flumes, and tunnel. They take all the water from the river and carry it for a mile or more in flumes before it is again returned to the river, leaving the bed of the stream dry at this season of the year for at least a mile and a half. During the winter there is plenty of water in the bed of the stream. The company has agreed to put in three ladders at points in their flumes that I selected. With the aid of these ladders, I believe that every ambitious fish can go around the break. I am pleased to find the matter so simple of solution.

[Under date of October 10, 1891.]

I went to Branceforte Creek and saw the Hihn Company dam. It is about twelve feet high and has plenty of water running over it, even at this time of the year, to support a ladder. I interviewed the manager of the company, and he agreed to put in a Commissioner's ladder.

[Under date of November 15, 1891.]

I visited the new hatchery at Bear Valley, and found the hatchery admirably located, a good, strong, and suitable building for its important purpose. Bear Valley Creek is an ideal stream, its waters being abundant, cool, and clear. It flows for its entire length over rocks and gravel, through a deep, closely wooded cañon. All persons familiar with its history say that it is always clear, subject to no floods, and in mid-winter rises but a foot or so. I gave the plans and drawings to Andrew, the carpenter, for the tanks and the troughs.

* * * * *

I had a long talk with George Hall, of the McCloud River, during the week, and he says that the fishing on the McCloud River has never been so fine as this season; that he has not seen nor heard of any carp being in the upper waters of that most beautiful stream. He says that there has been no deer killed in his vicinity that he knows of, and that the laws have been well observed, and that there are no complaints from any one there; that he never saw the upper Sacramento so clear and fish so plentiful. There is no sawdust dumped in the Sacramento River.

[Under date of January 18, 1892.]

I overhauled the Chinese shrimp-fishing station at San Pedro Point. The fishermen are mostly idle at this season, as they cannot dry shrimp during the wet weather.

[Under date of February 15, 1892.]

I do not visit the markets at any regular time, so that the dealers may not expect me. There were a few Tahoe trout shown by _____ during the week, but they had been in cold storage since last season. They are shriveled and uninviting specimens, and trade in them cannot amount to much. The question of cold storage, however, may some time become a matter of great annoyance to the Board. * * * The only deer hides I found during the week were from Colorado. I took the address of the shipper, and have written the Colorado Game Commissioners, informing them that hides were being shipped into this State.

[Under date of February 29, 1892.]

Mr. George Denison, of Boulder Creek, called at headquarters this morning. He gives a fine report of the workings of the fish ladders in all the dams near his place. He says the Perry dam at Boulder Creek has a fine ladder that works well, and the one that he has put in his own dam was a success in every way; that he had seen hundreds of fish pass over it, and that he had never seen so many or such large fish in Boulder Creek.

[Under date of June 5, 1892.]

Went over the hatchery and buildings at Tahoe. Everything was in good order, save the nets, which the field mice seemed to have ruined. J. A. McKenney, of Tahoe City, made application to me for the use of the house and grounds connected with the hatchery. He agrees to take good care of the same, rent free. I would recommend that his request be granted.

[Under date of June 6, 1892.]

We visited the Pacific Lumber and Wood Company's Mill at Burkhalter Station. They have as fine a fish ladder in their dam as I saw anywhere in the Truckee River, and their arrangements for disposing of their sawdust are by far the best I have seen in the State. Their furnace and conveyors cost over \$8,000.

[Under date of June 7, 1892.]

The Truckee Lumber Company have a bulkhead on the opposite side of the river from their mill, where they dump their sawdust. They claim to have spent \$10,000 on it. It takes good care of all the sawdust from the mill, but the shavings from their door, sash, and blind factory are, however, all dumped into the river. I protested against this, and am in hopes that we may yet come to a satisfactory conclusion in the matter. The Legislature should be petitioned to prohibit the dumping of shavings as well as sawdust into streams of the State. * * *

The Sierra Nevada Sportsman Club, recently organized in Truckee, has a membership of over thirty. Stewart McKay is the President, and Wm. O'Neill is the Secretary, and all the local fishermen—not professionals—are members. They have printed notices of the fish and game laws stuck up all around the lakes and rivers in that vicinity, and seem to be organized for business.

[Under date of June 11, 1892.]

From the mill we drove to Griff's Creek, a tributary of Lake Tahoe. O'Neill had located an Indian fish trap on the creek several days before, but was in doubt as to his powers in the matter. We found the trap in place. It was a most ingenious contrivance for catching fish, made from woven green willows. The Indians who were working this engine of destruction for numberless spawn fish, were camped beside the creek. We ordered them to leave the lake and took out their trap. We worked over an hour and a half to get it out of the water. The Indians made no objection, as O'Neill told them that I was a Government man, and would put them in jail if they did not leave.

[Under date of June 16, 1892.]

This endless round of the markets each day is, of course, very necessary, but it has been without result for months, other than to keep them free from game and illegally caught fish.

[Under date of June 23, 1892.]

In the launch "Rustler," in company with a "Call" reporter, I visited the shrimp-fishing station at San Pedro. We overhauled some ten fishing junks. They were full of shrimp, but contained no small fish. The drying beds on the hillsides at this large station are without shrimp or fish. The "Call" man said I had proved to him that the Chinese could catch shrimp without taking small fish.

[Under date of June 29, 1892.]

I went to Hunter's Point in the launch "Rustler." We first overhauled a Chinese boat, with sturgeon lines and fresh sturgeon. Tunstead accompanied this junk to the city. After he left the launch I overhauled another junk, and arrested the five Chinese fishermen it contained for having caught the young of fish. After a good deal of a row, I landed them in the county jail in San Francisco. This is the first time that I have found at Hunter's Point Chinese with the young of fish in their boats.

[Under date of July 5, 1892.]

I called upon Mr. Smurr, of the Southern Pacific, and he assures me that the railroad will not move the deer skins for ———, or any one else, without a permit from the Commission. No such permit should be granted, as the position the railroad people have taken will be of great help to the Commission.

[Under date of July 21, 1892.]

Spent the day in the markets, and went to Harbor View. One may visit these places every day, and so long as there are no arrests to make one cannot do more than mention that the places were visited; from the fact that nothing else is reported, seems sufficient to cover our action. The market men know that some time during the day we will carefully inspect their stalls, and that knowledge has the desired effect.

[Under date of July 22, 1892.]

Went to San Mateo. The Chinamen were tried and convicted. Herald the fact that one jury has not shirked its duty.

[Under date of July 31, 1892.]

The month has been a good one for us. The number of convictions were larger than usual. I believe there can be no just fault found with the work that we have done, when one knows the extent of shore line and territory we have to patrol. The most effective thing that we can do, is to see that the sale of illegally killed fish or game is prevented, for by destroying the market we destroy the business.

[Under date of August 17, 1892.]

The improvement in the condition of the Truckee River is most marked, and when the factories cease dumping their shavings into the river, the Commission may feel satisfied over the situation here. Every one agrees that the fishing in the Truckee River was never so good. There are no dams in the Truckee River without good and efficient fishways, and no sawdust is dumped into the river.

REPORT OF W. H. SHEBLEY.

[Under date of January 6, 1892.]

We began receiving the Eastern Brook trout spawn from Carson on January 6th, and received shipments on the 15th and 23d, and on February 1st. The total amount of spawn received in the four shipments was 362,000. The total loss of transporting was 18,882, or an average loss per cent of .0521+.

All, or nearly all, of these eggs that became addled in transportation were unfertilized. * * *

As the spawn neared the period of hatching, quite a number of the eggs hatched out and died. The embryo would burst from the shell, or membrane, and die soon after. These were all organically weak, the result unquestionably of carrying the green spawn so far over the rough road. After the eggs were hatched there was an unusual number of malformed embryos in the troughs, the effect of the jolting the ova received on the way from the lake to Carson. Those embryos that came from the eggs in a healthy condition developed into fine healthy fish.

[Under date of April 4, 1892.]

We started for the San Gabriel River on the 29th and arrived on the evening of the 1st, after a continuous journey of over sixty hours. The fish arrived in good condition, considering the length of the trip and the smallness of the fish. We lost about two hundred and fifty, or about 1 per cent. They died from exhaustion. The length of time they were without food, and the continual motion of the water from the use of the aerators wears them out on such a long trip. The Eastern Brook trout should do well in the San Gabriel Cañon.

[Under date of June 13, 1892.]

I returned to Beswick to take charge of the work of securing ova during the remainder of the spawning season. I found that the spawn fish were not running any better than they were in March, when I left to commence distributing the fish from the Bear Valley Hatchery. Mr. Richardson had 29,600 eggs in the building, and 221 large fish—106 females and 115 males. He had them shut up in an impounding weir in the creek. I manipulated them and found that they were unripe, and would not mature for quite awhile. I changed them to a larger reservoir near the hatchery, where they would have more room and less chance to injure themselves in their efforts to escape. These fish were smaller, and in appearance different from those that we took last year. Those taken last year in the traps were ripe, or nearly so, and we did not have any difficulty in securing all the spawn that we wanted. From June 14th to July 1st we caught 388 fish—271 females and 117 males. There were more fish caught with rod and line, and put into this new reservoir, than we took with our trap. The number of fish caught and put in this pond during the interval from June 14th to July 1st was at least 500. With those Mr. Richardson had when I came, and those we caught in the trap, made a total of over 1,100. We manipulated these fish every few days, and only secured 53,600 ova.

The last time that we stripped the fish we took about 5,000 eggs. The females were healthy and in good condition, but the males were diseased and nearly spent. I did not count this lot of ova at all. The appearance and general condition of the fish this season showed plainly that they inhabited the river above the dam, and did not belong to the great run of fish that come from the ocean and the lower waters of the river during the spawning season. The fish ladder over the dam at Pokegama is too small for a river of the size of the Klamath.

REPORT OF E. W. HUNT.

[Under date of September 9, 1891.]

I left San Francisco for Independence Lake, where I was to accept the young trout hatched by Messrs. Stevens & McKenney for the Commission under contract. I arrived at the lake on the 10th at 2 p. m., met Messrs. Stevens & McKenney, and went to their camp at the head of the lake where their hatchery is situated; saw the young fish, which apparently looked in good condition and ready for distribution. Their hatchery is very nicely arranged under the circumstances. * * *

The water is supplied by several springs, and the average temperature while hatching was 48°, the coldest being 44° and the warmest 52°. They took about forty days to hatch. They took about 83,000 Independence Lake spawn and 16,000 White Rock Lake spawn. The loss of the Independence was about 10 per cent and the White Rock about 5 per cent. The color of the White Rock spawn is a cherry red, about one quarter smaller than the Independence. The color of the Independence is lemon, and about the same size as the Tahoe and Donner spawn.

[Under date of September 12, 1891.]

I left Webber for the Fordyce Dam with Captain Burton, over the new road which has been completed at the head of the lake. We went to ascertain if it was possible to take spawn there. * * * There

is no place on either shore of the lake where a seine could be hauled or the fish trapped.

[Under date of September 26, 1891.]

In pursuance to orders, I started for Carson to see Fish Commissioner Mills, of Nevada. I had a conversation with him about taking Eastern Brook trout spawn from Marlette Lake. He says that we could have one half of the spawn if the Commission would pay half of the expenses, and send one man to assist in obtaining it. He does not think it advisable to ship the green spawn to the Tahoe Hatchery, as we would take too many chances of losing it after the long trip it would have from the lake to Carson. He stated that it would be better to eye them at the Nevada Hatchery in Carson. This will take from forty to fifty days. By that time we can readily ship them to the Bear Valley Hatchery without injury. The Carson Hatchery has six troughs and twenty baskets, enough to eye 1,000,000 spawn.

[Under date of September 30, 1891.]

I have been making inquiries about the land-locked salmon planted in Donner and Independence Lakes. There have been two or three caught in Independence Lake during the spring and summer, weighing from $1\frac{1}{2}$ to 3 pounds. The professional fishermen on the lake do not think that they hybridize. They are decreasing instead of increasing. None have ever been caught in Donner Lake that I can hear of. I have also made inquiries about the Eastern white fish in the Little Truckee River. No one seems to know anything about them. They say that some have been planted in the Truckee River, Prosser Creek, and Lake Tahoe. A great many of the fishermen say that the white fish caught in these waters are natives, and not the Eastern white fish. I did not know that they could distinguish the difference. These fish have been caught from small fry up to 2 pounds in weight in the Truckee River and in Lake Tahoe. * * *

They are catching Rainbow trout in the Truckee River, and all of the anglers say that these fish are the best and most game in the river.

[Under date of August 1, 1892.]

I would respectfully suggest to your honorable Board the necessity of building a cabin near the Bear Valley Hatchery before beginning work this fall. We lose from an hour to an hour and a half each day in coming from town to our work. The time thus lost is precious, for early in the morning and evening is the time young fish most like to feed. Another reason why the person in charge of the hatchery should live close to it, is the danger of an accident happening to the water supply. If anything should happen to the water the labor and expense of months may be lost in a very short space of time. I would also recommend that the hatchery be completed by putting in eight more hatching troughs before more spawn is put into the building. We are now in the middle of the dry season, and the water is as low as it will be. There is an ample supply of water to run this hatchery to the full capacity.

REPORT OF J. A. RICHARDSON.

[Under date of September 15, 1891.]

I arrived at the United States Fishery, and was met by George B. Williams, Deputy United States Fish Commissioner. Mr. Williams accompanied me over the works. He has made many improvements in the last two years. Everything is working perfectly, and the right man is in the right place. The mode of raising water from the river, by combining a current wheel and a centrifugal pump, works without danger or accident. There were 2,544,000 eggs in the hatchery. The temperature of the water was 53°. I watched the men seining in the evening. The salmon are not running very numerous, but are large in size, the females predominating 6 to 1. As fast as the salmon are caught they are put in corrals, where they get much scarred and battered trying to free themselves. There is no way to prevent this. They seine from 5 P. M. to 10 P. M., with one hour for dinner, and again from 5 A. M. to 8:30 A. M. The system of working is perfect. From three to fifteen is the average catch. Early in the season sometimes two hundred salmon are taken at one catch. The stripping does not commence until 9 A. M.; 140,000 eggs were taken from 31 fish, giving a total of 2,684,000 to date. The fish average large this season, 148,000 eggs from 31 fish, giving an average of 4,516 eggs. They have taken as many as 8,000 eggs from one fish this season. The smallest fish caught this season was a female, weighing 3½ pounds, and the largest weighed 40 pounds, and was a male. * * *

I saw a Leather carp in the reservoir by the house, which was one of two that were taken in the seine a few days ago, which would go to show that the carp are working up into the McCloud River.

[Under date of Beswick, May 17, 1892.]

The total number of trout eggs taken to date is 402,000. During this month a new run of trout have put in an appearance. We have about 100 on hand; they are slow in maturing. It will be from one to three weeks before the above have reached that condition. These trout are thick set and rather short, and are in good condition. They are highly colored, and especially is this the case with the fins. I have noticed a few specimens that were so highly colored that it seemed unnatural. The pectoral, ventral, and anal fins were bright scarlet, tipped with white. We are catching more angling than with the traps. Until about the 10th instant the males were very scarce, and even now only about one in ten is matured, although there are plenty of them. The season has been unusually cold and backward. Fly fishermen are taking from ten to twenty pounds of trout here a day. * * *

I think a great many trout ran up the creek last winter, for this reason: For the past two months spent trout have been coming down the creek, but could not pass the corrals or traps which extended entirely across the stream. These trout would collect in the pools above by the hundred, and would die if not allowed to return to the river. A narrow lane, or pass, one foot wide was built through the corral, or trap, connecting the creek above with that below, and in twenty-four hours scarcely a trout could be seen above in the creek.

These trout are silver-sided, long and slim, in good condition, but

poor; the flesh is almost white. When collected in the pools above the trap they take the fly readily. The salmon fly are here by the thousand.

[Under date of Sisson, May 15, 1892.]

Hon. RAMON E. WILSON, Secretary State Board of Fish Commissioners:

SIR: I herewith transmit a statement of the salmon spawn hatched during the season of 1891-92:

These salmon eggs were received from Superintendent G. B. Williams, of the United States Fishery, on the McCloud River, with a per cent loss in shipping, as follows:

September 30, 1891	.....454,750.	Loss .018 per cent.
October 2, 1891	.....450,000.	Loss .02 per cent.
October 6, 1891	.....460,000.	Loss .025 per cent.
October 7, 1891	.....460,000.	Loss .03 per cent.
October 8, 1891	.....332,000.	Loss .015 per cent.
October 10, 1891	.....440,000.	Loss .02 per cent.
December 1, 1891	.....255,000.	Loss .033 per cent.

The entire shipment of salmon eggs was hatched at a loss of 7 per cent, or about 200,000 eggs (not fry). Regarding the loss of fry during the months of October and November, I selected four compartments at random from the forty compartments containing the same number, 70,000, of fry. The loss was as follows for each day in the six weeks: 200, 150, 50, 30, 65, 76, 176, 102, 120, 140, 155, 140, 125, 123, 35, 76, 54, 82, 90, 45, 33, 46, 54, 30, 25, 37, 73, 29, 70, 41, 29, 20, 18, 21, 27, 15, 30, 22, 12, 8, 21, 7; total, 2,800, or, for the forty compartments, 28,000, which is less than 1 per cent.

All of the fry in this loss were mostly malformations. You will notice that the loss gradually decreases from day to day to the end of the six weeks. The following six weeks I made a second test of the loss; every fifth day I made a careful count of the loss of the fry in all of the forty compartments, and found the loss to be 221.5 on an average for each day, or 9,303 for the six weeks.

This loss is less than one third of 1 per cent for these six weeks. This would give a loss of $1\frac{1}{3}$ per cent for the three months up to the time when we commenced to distribute the fry.

When we commenced to distribute the fry in the streams, and make the transfer to the nursery ponds, the number on hand was changing and diminishing every day, and it was difficult to get at the exact per cent loss, but it was much less than one half of 1 per cent for the remaining time, and I have allowed $1\frac{2}{3}$ per cent, which is more than the actual loss for that time, or a total loss of fry of about 3 per cent.

There never were over 500,000 fry in the nursery ponds at one time, as a few were allowed to escape each day, while others were added from time to time to make up the difference.

The fry in the nursery boxes are not so large as fry reared in the nursery ponds. The fry in the nursery boxes are never at rest from the constant current, which is gentle, but continuous. In the ponds they can seek still water to rest, which they will do a portion of the day. I made the first transfer of fry to the nursery ponds on November 30, 1891. The fry were transferred to the nursery ponds as follows:

1891—November 30.....	150,000	1892—March 8.....	20,000
1892—February 4.....	50,000	March 9.....	25,000
February 15.....	50,000	March 10.....	25,000
February 18.....	50,000	March 11.....	25,000
February 20.....	80,000	March 12.....	25,000
February 24.....	20,000	March 13.....	25,000
February 27.....	20,000	March 15.....	50,000
February 29.....	80,000	March 17.....	50,000
March 2.....	20,000	March 18.....	25,000
March 4.....	72,000	March 20.....	50,000
March 5.....	50,000		
March 6.....	24,000	Total.....	1,036,000
March 7.....	50,000		

After February 1st the screens of the nursery pond were removed for an hour each day, to allow a portion to escape into the creek. After March 10th the screens were removed entirely, which allowed the fry to escape at their pleasure. May 1st there were still 200,000 fry on hand at Sisson, the loss being from one to three per day. A careful count is being kept of the loss.

Salmon fry were distributed in creeks which are tributary to the Sacramento River, as follows:

1892—January 7—School House Creek.....	25,000
January 7—Suloway Creek.....	70,000
January 3—"3" Creek.....	70,000
January 13—Cold Creek.....	70,000
January 14—Suloway Creek.....	70,000
January 15—Stevens Creek.....	70,000
January 16—Suloway Creek.....	70,000
January 17—Cold Creek.....	70,000
January 18—"3" Creek.....	70,000
January 20—Wagon Valley Creek.....	70,000
January 23—Stevens Creek.....	70,000
January 25—Suloway Creek.....	70,000
January 26—Cold Creek.....	70,000
January 27—School House Creek.....	70,000
January 29—Suloway Creek.....	70,000
January 30—"3" Creek and School House Creek.....	70,000
February 1—Wagon Valley Creek.....	70,000
February 2—Cold Creek.....	70,000
February 3—School House Creek.....	70,000
February 7—Root Creek.....	50,000
February 8—Little Castle Creek.....	50,000
February 10—Slatonis.....	50,000
February 13—Klamath River.....	60,000
February 16—Klamath River.....	60,000
February 19—Klamath River.....	60,000
Total.....	2,651,000

The above lot of fry were as fine a lot of fish as ever were turned out of any hatchery in the world. I have hatched over 24,000,000 salmon, and I think my judgment good in this matter. The eggs varied greatly in size this year; the average diameter was .307 of an inch, a 4-inch square containing 86. Many eggs of the second run were as small as trout eggs, being but .22 of an inch in diameter.

DIRECTORY OF DEPUTY PATROLMEN, STATE BOARD OF FISH
COMMISSIONERS, WHO SERVED WITHOUT PAY.

William Lindsey	Belmont.
A. W. Scott	San Francisco.
E. A. Dakin	San Francisco.
H. H. Brittan	Stony Ford, Colusa County.
H. W. Smith	Placerville.
Thomas W. Hobson	San José.
Donald Ross	San Francisco.
Howard Black	Livermore.
S. H. Bolander	San Francisco.
James Hanley	San Francisco.
George McCrimmon	Oakland.
Victor Poncellett	New Almaden.
Alexander Murphy	Mountain View.
George Denison	Boulder Creek.
J. H. Mansfield	Spanishtown.
James Haynes	Marysville.
Wm. O'Neill	Truckee.
Trividio Trumbo	Santa Cruz.
F. G. Laird	Santa Cruz.
H. S. Loveland	Las Uvas.
Mason Bradfield	Filmore.
C. R. Woods	Selma.
Thomas A. Varian	Ferndale.
Charles F. Hargitt	Avalon.
Wm. Mossop	Olema.
A. C. Maude	Bakersfield.
George Bement, Jr.	Oakland.

DISTRIBUTION OF FISH BY THE STATE FISH COMMISSION.

DISTRIBUTION OF LAKE TAHOE TROUT FRY.

Distributed during the month of September, 1891.

Date.	Location.	Number of Fish.
1891.		
Sept. 19.	Donner Creek, 2 miles west of Truckee.....	10,000
Sept. 19.	Cold Stream, 7 miles southwest of Truckee.....	15,000
Sept. 21.	Little Truckee River, 3½ miles from Webber Lake.....	25,000
Sept. 22.	Mortis Creek, 3 miles southeast of Truckee.....	6,000
Sept. 22.	Union Mill Creek, 9 miles east of Truckee.....	4,000
Sept. 23.	Little Truckee River, 2 miles from Webber Lake.....	13,000
Sept. 23.	Webber Lake (White Rock trout).....	15,000
	Total.....	88,000

The spawn from which these fish were hatched was taken by Stevens & McKenney, under contract, and was hatched by them at Independence Lake in their own hatchery.

DISTRIBUTION OF EASTERN BROOK TROUT.

FROM BEAR VALLEY HATCHERY.

Date.	Location.	Number of Fish.
1892.		
April 1.	Islips Creek, tributary San Gabriel River, Los Angeles County.....	2,500
April 1.	Browns Cañon, tributary San Gabriel River, Los Angeles County.....	5,000
April 1.	Persingers Gulch, tributary San Gabriel River, Los Angeles County.....	9,600
April 1.	Creech Club Creek, tributary San Gabriel River, Los Angeles County.....	400
April 1.	West Fork San Gabriel River, Los Angeles County.....	7,500
April 10.	Garcia River and tributaries, Mendocino County.....	25,000
April 14.	Olema Creek, Marin County.....	10,000
April 17.	Austin Creek and tributaries, Sonoma County.....	25,000
April 22.	Pescadero Creek, San Mateo County.....	13,000
April 22.	Smith Creek, tributary to Pescadero Creek.....	3,000
April 22.	Buteno Creek, San Mateo County.....	9,000
April 25.	San Lorenzo River and tributaries, Santa Cruz County.....	30,000
April 26.	Branceforte Creek, Santa Cruz County.....	7,000
April 26.	San Lorenzo River, Santa Cruz County, below powderworks.....	7,000
April 26.	Laguna Creek, Santa Cruz County.....	7,000
April 26.	Soquel Creek, Santa Cruz County.....	14,000
April 30.	Calaveras Creek, Santa Clara County.....	12,500
April 30.	Austin Gulch, tributary Los Gatos Creek, Santa Clara County.....	12,500
May 4.	San Antonio Creek, tributary Calaveritas River, Calaveras County.....	25,000
May 12.	Halleck Gulch, tributary Nicasio Creek, Marin County.....	6,000
May 14.	San Vicente Creek, Santa Cruz County.....	3,500
May 14.	Granite Creek, Santa Cruz County.....	3,500
May 14.	Scott Creek, Santa Cruz County.....	7,000
May 14.	Glen Cañon Creek, Santa Cruz County.....	3,500
May 14.	Zayanto Creek.....	3,500
May 14.	San Lorenzo River.....	14,000
May 16.	Sulphur Creek, at confluence with Squaw Creek, Sonoma County.....	10,000
May 18.	Pieta Creek, Sonoma County.....	10,000
May 21.	Dry Creek, Placer County.....	6,000
May 21.	Applegate Creek, Placer County.....	10,000
May 31.	Golden Gate Park.....	5,000
May 31.	Inman Creek and Adobe Creek, Sonoma County.....	10,000
	Total.....	317,000

The spawn from which these fish were hatched was taken jointly by the Nevada Fish Commission and this Board, from Marlette Lake, in Nevada.

DISTRIBUTION OF RAINBOW TROUT FRY.

FROM BEAR VALLEY HATCHERY.

Date.	Location.	Number of Fish.
1892.		
July 27	San Geronimo Creek, Marin County	12,500
July 27	Lagunitas Creek, Marin County	12,500
July 29	Cold Creek, Mendocino County, tributary Russian River	9,000
July 29	Reeves Creek, Mendocino County, tributary Russian River	6,000
July 29	Walker Creek, Mendocino County, tributary Russian River	10,000
July 29	Mark West Creek, Sonoma County, tributary Russian River	15,000
Aug. 3	Stevensons Creek, Fresno County, tributary San Joaquin River	45,000
Aug. 3	Rush Creek, Fresno County, tributary Kings River	5,000
Aug. 9	Limekiln Creek, Santa Clara County	9,000
Aug. 9	Guadalupe Creek, South Fork, Santa Clara County	13,000
Aug. 9	Guadalupe Creek, West Fork, Santa Clara County	3,000
Aug. 9	Guadalupe Creek, main branch, Santa Clara County	7,000
Aug. 9	Montoyo Creek, Santa Clara County	3,000
Aug. 12	Corta Madera Creek, San Mateo County	9,000
Aug. 12	Tornitas Creek, San Mateo County	6,000
Aug. 12	Purisima Creek, San Mateo County	10,000
Aug. 16	Napa Creek, Napa County	7,000
Aug. 16	Milliken Creek, Napa County	6,000
Aug. 16	Hinchica Creek, Napa County	6,000
Aug. 16	Dry Creek, Napa County	3,000
Aug. 16	Recta Creek, Napa County	3,000
Aug. 18	Santa Ysabella Creek, San Luis Obispo County	25,000
Aug. 22	Santa Rosa Creek, Sonoma County	15,000
Aug. 22	Lynch Creek, Sonoma County	6,000
Aug. 22	Carson Creek, branch of Paper Mill Creek, Marin County	7,500
Aug. 25	Dry Creek, Sonoma County	12,000
Aug. 25	Little Sulphur Creek	10,500
Aug. 26	San Gregorio Creek, San Mateo County	10,000
Aug. 28	Squaw Creek, Placer County, tributary Truckee River	5,000
Aug. 29	Scott Creek, Placer County, tributary Truckee River	5,000
Aug. 29	Deep Creek, Placer County, tributary Truckee River	5,000
Aug. 29	Cold Creek, Nevada County, tributary Truckee River	5,000
Aug. 29	Cold Creek, Nevada County	2,500
Aug. 29	Martins Creek, Nevada County	2,500
Aug. 30	Alder Creek, Marin County	2,500
Aug. 30	Ness Creek, Marin County	2,500
Sept. 1	Mill Valley Lake, Fresno County, tributary Kings River	25,000
	Total	331,000

The spawn from which these fish were hatched was taken from Shovel Creek, Siskiyou County, California.

DISTRIBUTION OF RAINBOW TROUT.

FROM SISSON HATCHERY.

Date.	Location.	Number of Fish.
1892.		
May 30..	Shovel Creek, Siskiyou County	10,000
Aug. 4..	Cold Creek, Siskiyou County	500
Aug. 5..	Soda Creek, Castle Crag, Siskiyou County	20,000
Aug. 5..	Cache Creek, Capay Valley	20,000
Aug. 12..	Placerville, tributary American River	20,000
Aug. 24..	Squaw and Bear Creek, tributary Truckee River	25,000
Aug. 29..	North Fork American River, above upper falls	25,000
Sept. 6..	Golden Gate Park	4,600
Sept. 8..	Bridal Veil Creek, above Yosemite Valley	1,700
Sept. 8..	Illillonthe Creek, seven miles from Yosemite Valley	1,700
Sept. 9..	Ostromder Lake, twelve miles from Yosemite Valley	6,800
Sept. 9..	Rush Creek, tributary South Fork Merced River	1,700
Sept. 9..	Laurel Creek, tributary South Fork Merced River	1,700
Sept. 9..	Wawona Creek, tributary South Fork Merced River	3,400
Sept. 9..	Chilualno Creek, tributary South Fork Merced River	3,400
Sept. 9..	Soda Creek, tributary Sacramento River	25,000
Sept. 11..	Scott Creek, Mt. Shasta	5,000
	Total	175,500

The spawn from which these fish were hatched was taken from Shovel Creek, Siskiyou County, California.

TEMPERATURE OF WATER.

IN BEAR VALLEY HATCHERY—SEASON OF 1892.

Month.	Lowest.	Highest.	Mean.
January	35°	50°	41½°
February	42	53	47½
March	46	54	50
April	46	53	48
May	49	58	53
June	49	58	53½
July	52	59	53
August	53	60	56½

IN SISSON HATCHERY—SEASON OF 1892.

Month.	Lowest.	Highest.	Mean.
January	40°	47°	43½°
February	44	49	44½
March	40	52	46
April	40	52	46
May	40	57	48½
June	42	57	49½
July	43	56	50
August	44	55	50

FINANCIAL STATEMENT.

RESTORATION AND PRESERVATION FUND.

Expenditures during Forty-second Fiscal Year, ending June 30, 1891, Chargeable against the Appropriation for Restoration and Preservation of Fish in the Waters of the State.

Appropriation March 21, 1889.....		\$5,000 00
Warrant No. 443.—M. J. O'Reilly.....	\$1 00	
No. 478—J. Routier.....	30 00	
No. 1621—W. S. Harris.....	147 80	
No. 1623—Perkins & Stevens.....	1 05	
No. 1624—J. A. Richardson.....	119 65	
No. 1625—M. J. O'Reilly.....	30 00	
No. 1626—Tug "Roberts".....	52 00	
No. 1628—J. D. Ennis.....	159 25	
No. 1629—J. D. Harvey.....	9 00	
No. 1630—J. Routier.....	30 00	
No. 1817—F. P. Callandun.....	115 60	
No. 2581—F. P. Callandun.....	147 60	
No. 2582—M. J. O'Reilly.....	30 00	
No. 2583—W. S. Harris.....	140 50	
No. 2599—J. D. Harvey.....	5 00	
No. 2600—J. Routier.....	30 00	
No. 2601—J. D. Ennis.....	135 00	
No. 2602—Wells, Fargo & Co.....	75	
No. 3872—Wells, Fargo & Co.....	1 05	
No. 3870—W. S. Harris.....	100 00	
No. 3871—W. S. Harris.....	37 50	
No. 3873—M. J. O'Reilly.....	30 00	
No. 3874—F. P. Callandun.....	179 80	
No. 3874—J. D. Ennis.....	146 50	
No. 4701—W. S. Harris.....	100 00	
No. 4720—W. S. Harris.....	48 40	
No. 4723—M. J. O'Reilly.....	30 00	
No. 4724—F. P. Callandun.....	155 85	
No. 5085—Perkins & Stevens.....	70	
No. 5086—J. Routier.....	61 00	
No. 5087—J. D. Ennis.....	144 15	
No. 5088—Britton & Rey.....	75 00	
No. 3856—F. P. Callandun.....	129 00	
No. 5837—M. J. O'Reilly.....	30 00	
No. 5838—J. L. Curley.....	10 00	
No. 5948—W. S. Harris.....	100 00	
No. 5960—W. S. Harris.....	43 90	
No. 5978—J. D. Ennis.....	137 00	
No. 5979—W. S. Schittger.....	5 00	
No. 5980—J. Routier.....	30 90	
No. 6579—J. F. Curley.....	20 00	
No. 8034—F. P. Callandun.....	136 50	
No. 10376—J. M. O'Reilly.....	30 00	
No. 11642—J. D. Ennis.....	140 50	
No. 12575—F. P. Callandun.....	130 50	
No. 13302—J. F. Curley.....	15 00	
The above bills were approved by the previous Board, and paid out of the appropriation for the forty-second fiscal year.		
No. 13303—F. P. Callandun.....	136 45	
No. 13747—J. D. Ennis.....	306 00	
No. 14915—M. J. O'Reilly.....	93 00	
No. 14934—J. W. Hartley.....	34 00	
No. 14935—Geo. A. Arnold.....	22 00	
No. 14936—S. Kaufman.....	10 00	
No. 16020—J. A. Richardson.....	81 85	
No. 16021—J. A. Richardson.....	52 70	
No. 16119—S. C. Wells.....	73 51	
No. 16297—J. P. Babcock.....	110 30	
No. 16375—A. Carlisle & Co.....	12 50	
No. 16376—S. Kaufman.....	21 50	
Balance on hand June 30, 1891.....	753 74	
Totals.....	\$5,000 00	\$5,000 00

To balance brought down		\$753 74
To balance from forty-first fiscal year		37 00
Warrant No. 286—Whittier, Fuller & Co.	\$14 00	
No. 531—J. P. Babcock	106 40	
No. 532—S. C. Mills	59 60	
No. 659—F. M. Bacigalupi	251 69	
No. 660—Geo. H. Koppitz	359 05	
Totals	\$790 74	\$790 74

Expenditures during Forty-third Fiscal Year, ending June 30, 1892, Chargeable against the Appropriation for the Restoration and Preservation of Fish in the Waters of the State.

Appropriation April 6, 1891		\$5,000 00
Warrant No. 2036—J. A. Richardson	\$142 35	
No. 2037—S. C. Mills	63 50	
No. 2038—F. Bacigalupi	130 50	
No. 2039—J. W. Hartley	15 00	
No. 2040—J. P. Babcock	114 45	
No. 2041—R. E. Wilson	38 40	
No. 2071—J. P. Babcock	168 35	
No. 2472—Thos. Tunstead	251 70	
No. 2473—Benicia Agricultural Works	3 65	
No. 2474—S. C. Mills	60 00	
No. 4126—G. H. Koppitz	159 70	
No. 4127—F. Bacigalupi	133 25	
No. 4128—Thos. Tunstead	126 00	
No. 4362—S. C. Mills	60 15	
No. 4363—A. Haywood	25 00	
No. 4364—A. Haywood	25 00	
No. 4365—J. W. Hartley	15 00	
No. 4366—G. H. Koppitz	143 60	
No. 4441—Whittier, Fuller & Co.	29 25	
No. 4442—F. Bacigalupi	104 55	
No. 4443—G. H. Koppitz	104 65	
No. 4444—J. P. Babcock	113 65	
No. 5135—Thos. Tunstead	137 25	
No. 6016—J. P. Babcock	133 75	
No. 6017—S. C. Mills	69 10	
No. 6018—G. H. Koppitz	168 50	
No. 6019—Thos. Tunstead	136 50	
No. 6020—A. Haywood	25 00	
No. 6021—F. Bacigalupi	102 95	
No. 6061—J. W. Hartley	15 00	
No. 7715—S. C. Mills	62 40	
No. 7716—F. Bacigalupi	101 75	
No. 7717—Thos. Tunstead	142 45	
No. 7718—G. H. Koppitz	175 15	
No. 7719—J. P. Babcock	103 45	
No. 8156—J. W. Hartley	15 00	
No. 9170—F. Bacigalupi	102 25	
No. 9171—S. C. Mills	65 10	
No. 9172—G. H. Koppitz	123 40	
No. 9173—J. P. Babcock	100 95	
No. 9308—S. Kaufman	24 60	
No. 9309—A. Haywood	50 00	
No. 9310—J. W. Hartley	15 00	
No. 9556—Thomas Tunstead	110 00	
No. 10205—G. H. Koppitz	108 25	
No. 10206—Thomas Tunstead	139 70	
No. 10207—J. Batcheller	15 32	
No. 10208—S. C. Mills	59 15	
No. 10209—J. Nunan	15 00	
No. 10210—F. Bacigalupi	107 75	
No. 10211—J. P. Babcock	128 55	
No. 10615—J. W. Hartley	15 00	
No. 10616—A. Haywood	25 00	
No. 11325—S. C. Mills	76 25	
No. 11326—A. Haywood	25 00	
No. 11327—J. P. Babcock	115 90	
No. 11328—Thomas Tunstead	126 50	
No. 11398—F. Bacigalupi	11 25	
No. 14319—G. Jepson	41 13	
Totals	\$5,000 00	\$5,000 00

STATE HATCHERIES FUND.

Expenditures during the Forty-second Fiscal Year, ending June 30, 1891, Chargeable against the Appropriation for the Support and Maintenance of State Hatcheries.

Appropriation March 21, 1889.....		\$5,000 00
Warrant No. 1631—J. G. Woodbury.....	\$257 25	
No. 1632—J. M. Short.....	19 31	
No. 1633—E. M. Hunt.....	86 40	
No. 1634—J. A. Richardson.....	75 00	
No. 1635—J. Lowe.....	67 50	
No. 1636—B. Denton.....	9 00	
No. 1637—E. D. Stewart.....	53 25	
No. 1638—W. H. Schittiger.....	5 00	
No. 1639—P. M. McMahon.....	32 50	
No. 1640—W. H. Shebley.....	60 00	
No. 1812—J. Shebley, Jr.....	50 00	
No. 1813—E. W. Hedson.....	13 00	
No. 1814—T. E. Sullivan.....	4 50	
No. 2586—Fireman's Insurance Co.....	30 75	
No. 2587—E. W. Hunt.....	90 75	
No. 2588—W. H. Shebley.....	106 40	
No. 2589—J. G. Woodbury.....	188 77	
No. 2590—Holbrook, Merrill & Stetson.....	9 00	
No. 2591—J. Earle.....	16 50	
No. 2592—W. H. Schittiger.....	5 00	
No. 2593—J. Shebley, Jr.....	50 00	
No. 2594—J. A. Richardson.....	82 65	
No. 2595—E. D. Stewart.....	50 00	
No. 2596—A. Russi.....	7 50	
No. 2597—G. M. Fulsom.....	39 64	
No. 2598—J. A. Richardson.....	75 00	
No. 3839—W. H. Shebley.....	112 80	
No. 3840—J. G. Woodbury.....	171 00	
No. 3841—J. H. Eigerman.....	25 00	
No. 3842—R. J. Waters.....	10 00	
No. 3843—J. A. Richardson.....	75 00	
No. 3844—J. A. Richardson.....	62 95	
No. 3845—E. W. Hunt.....	128 90	
No. 3846—J. Shebley, Jr.....	47 70	
No. 3847—E. D. Stewart.....	50 00	
No. 5089—L. J. Griffin.....	38 14	
No. 5090—A. B. Morton.....	23 25	
No. 5091—E. W. Hunt.....	103 00	
No. 5092—W. H. Shebley.....	72 15	
No. 5093—J. G. Woodbury.....	149 80	
No. 5094—J. A. Richardson.....	75 00	
No. 5095—J. A. Richardson.....	32 10	
No. 5096—W. C. Tibbett.....	10 00	
No. 5097—Sisson, Crocker & Co.....	88 57	
No. 5098—W. H. Hines.....	58 00	
No. 5099—E. D. Stewart.....	39 88	
No. 5100—J. H. Sisson.....	51 45	
No. 5968—J. Tonge.....	34 00	
No. 5969—E. Sullivan.....	18 00	
No. 5970—E. W. Hunt.....	78 55	
No. 5971—J. A. Richardson.....	75 00	
No. 5972—E. D. Stewart.....	18 45	
No. 5973—R. E. Wilson.....	55 00	
No. 5674—Leibenbaum Bros.....	24 00	
No. 5975—A. Gallavan.....	7 38	
No. 5976—Fireman's Insurance Co.....	31 80	
No. 5977—J. G. Woodbury.....	174 22	
No. 6062—G. Medson.....	44 00	
No. 6063—J. D. Harvey.....	1 35	
No. 10347—S. C. Wilson.....	8 00	
No. 10348—E. W. Hunt.....	80 25	
No. 10349—L. J. Griffen.....	23 23	
No. 10350—J. A. Richardson.....	10 50	
No. 10351—J. A. Richardson.....	75 00	
No. 10352—J. A. Richardson.....	4 75	
No. 10355—J. F. Moody.....	9 93	
No. 10375—Ward & Bailey.....	6 00	
No. 10747—J. G. Woodbury.....	134 85	
Amounts carried forward.....	\$3,885 45	\$5,000 00

Amounts brought forward	\$3,885 45	\$5,000 00
Warrant No. 13253—Lloyd Stone	12 50	
No. 13254—J. A. Richardson	75 00	
The above bills were passed by the previous Board, and paid out of the appropriation of the forty-second fiscal year by the present Board.		
No. 13255—Justinian Caire	1 68	
No. 13256—J. A. Richardson	8 25	
No. 13257—Sisson, Crocker & Co.	5 40	
No. 13258—E. W. Hunt	82 25	
No. 13259—L. C. Wilson	2 00	
No. 13260—L. J. Griffen	18 44	
No. 13704—J. G. Woodbury	132 25	
No. 14320—J. G. Woodbury	144 85	
No. 14388—J. A. Richardson	8 55	
No. 14389—J. A. Richardson	75 00	
No. 14390—L. L. Stone	30 00	
No. 14391—L. J. Griffen	23 98	
No. 14392—E. W. Hunt	91 00	
No. 14931—E. W. Hunt	54 60	
No. 14932—W. H. Schittyster	10 00	
No. 14933—Justinian Caire	3 99	
No. 15011—J. G. Woodbury	129 95	
No. 16018—J. A. Richardson	100 00	
Balance on hand June 30, 1891	104 86	
	<hr/>	
	\$5,000 00	\$5,000 00
	<hr/>	
To balance brought down		\$104 86
Warrant No. 530—Ramon E. Wilson	\$42 60	
No. 1168—J. A. Richardson	62 26	
	<hr/>	
	\$104 86	\$104 86

Expenditures during the Forty-third Fiscal Year, ending June 30, 1892, Chargeable against the Appropriation for the Support and Maintenance of State Hatcheries.

Appropriation April 6, 1891		\$5,000 00
Warrant No. 2475—J. G. Woodbury	\$50 00	
No. 4361—Stevens & McKenney	220 00	
No. 4440—Whittier, Fuller & Co.	22 62	
No. 3136—C. B. Guin & Co.	81 75	
No. 3137—J. A. Richardson	153 80	
No. 5138—E. W. Hunt	155 75	
No. 6022—L. Griffen	9 00	
No. 7448—J. A. Richardson	147 50	
No. 7449—E. W. Hunt	149 50	
No. 7450—Sisson, Crocker & Co.	9 33	
No. 8152—L. C. Neilson	51 00	
No. 8153—G. T. Mills	178 53	
No. 8154—E. W. Hunt	141 90	
No. 8135—L. Griffen	20 50	
No. 8321—J. A. Richardson	132 00	
No. 9553—L. Griffen	37 75	
No. 9554—E. W. Hunt	152 30	
No. 9555—J. A. Richardson	134 75	
No. 9864—J. Keboe	47 01	
No. 10217—E. W. Hunt	187 50	
No. 10218—G. T. Mills	13 00	
No. 10617—Whittier, Fuller & Co.	5 50	
No. 10618—W. W. Montague & Co.	7 05	
No. 10619—Huntington-Hopkins Co.	9 00	
No. 10620—Thos. Wood & Goldsack	5 00	
No. 10621—J. A. Richardson	144 00	
No. 10622—W. H. Shebley	126 25	
No. 11321—J. A. Richardson	149 15	
No. 11322—E. W. Hunt	134 10	
No. 11323—W. H. Shebley	110 75	
No. 11441—L. A. Griffen	33 75	
No. 11442—W. H. Schittyster	35 00	
No. 11443—J. P. Chamber	20 00	
No. 11444—Angel Ditzzitgo	84 00	
No. 14153—J. M. Bowers, Jr.	15 22	
No. 14154—A. Howe	45 00	
No. 14137—T. E. Sullivan	58 00	
Amounts carried forward	\$4,084 26	\$5,000 00

Amounts brought forward	\$4,084 26	\$5,000 00
Warrant No. 14318—Lloyd Stone	10 00	
No. 14422—J. P. Chambers	5 00	
No. 14423—E. W. Hunt	146 50	
No. 14424—J. A. Richardson	144 90	
No. 14425—T. E. Sullivan	62 00	
No. 14426—C. B. Green	8 50	
No. 14427—L. Griffen	12 00	
No. 14428—G. H. Fuller	35 00	
No. 14429—A. Haywood	25 00	
No. 14430—J. W. Hartley	15 00	
No. 14431—W. H. Shebley	134 20	
No. 14432—S. Grandy	108 58	
No. 14734—S. C. Mills	61 20	
No. 15603—T. E. Sullivan	60 00	
No. 15604—W. Massop	22 65	
No. 15605—W. H. Shebley	120 40	
No. 15606—S. Nelson	33 00	
No. 15607—E. W. Hunt	141 82	
No. 15608—S. C. Mills	58 10	
No. 15609—J. W. Hartley	15 00	
No. 15610—L. Griffen	46 50	
No. 15611—J. A. Richardson	143 60	
No. 15612—S. Neilson	72 00	
No. 16040—J. P. Chambers	7 00	
No. 17953—J. W. Hartley	15 00	
No. 17954—S. C. Mills	64 40	
No. 17990—W. H. Shebley	127 95	
No. 17991—E. W. Hunt	148 30	
No. 18715—T. E. Sullivan	72 14	
Totals	\$5,000 00	\$5,000 00

FISH COMMISSIONERS' FUND.

Expenditures during the Forty-second Fiscal Year, ending June 30, 1891, Chargeable against the Fish Commissioners' Fund.

By balance on hand July 1, 1891	\$47 26
Receipts into fund by old Board	1,723 03

Expenditures.

Warrant No. 283—Wells, Fargo & Co.	\$0 50
No. 284—J. D. Harvey	5 00
No. 441—M. J. O'Reilly	30 00
No. 3439—E. W. Hunt	78 50
No. 3440—H. Liddell	12 50
No. 3441—E. D. Stewart	40 40
No. 3442—E. D. Stewart	50 25
No. 3443—H. D. Burton	70 00
No. 3444—H. D. Burton	39 00
No. 3445—Carson Lumber Co.	17 20
No. 3446—T. W. O'Neill	70 00
No. 3857—F. P. Callandun	123 50
No. 5295—J. D. Harvey	5 00
No. 5491—J. E. Todman	6 00
No. 5497—J. E. Todman	20 00
No. 5498—Jack Earle	67 50
No. 5499—Justinian Caire	7 01
No. 5500—Jack Earle	62 50
No. 5501—J. D. Ennis	126 50
No. 5502—Samuel Nicholls	65 00
No. 5503—W. Schittyger	5 00
No. 6709—J. F. Curley	228 05
No. 6779—J. Shebley, Jr.	50 00
No. 6780—W. H. Shebley	63 00
No. 6781—W. H. Shebley	22 00
No. 6782—E. W. Hunt	80 50
No. 6783—J. Earle	21 00
No. 6784—A. F. Caswell	27 50
No. 6785—J. A. Richardson	100 30
No. 6786—J. A. Richardson	95 05
No. 6787—J. A. Richardson	135 00
Balance on hand	46 53
Totals	\$1,770 29

Expenditures during the Forty-third Fiscal Year, ending June 30, 1892, Chargeable against the Fish Commissioners' Fund.

By balance on hand July 1, 1892.....	\$46 53
Receipts into fund, forty-third fiscal year.....	4,461 42

Expenditures.

Warrant No. 2433—C. W. Neill.....	\$189 00	
No. 2434—J. H. Sisson.....	47 15	
No. 2435—Sisson, Crocker & Co.....	97 81	
No. 2436—J. G. Woodbury.....	150 25	
No. 2437—J. G. Woodbury.....	163 10	
No. 2450—J. G. Woodbury.....	213 95	
No. 4699—S. Kaufman.....	30 60	
No. 4700—J. W. Hartley.....	15 00	
No. 5134—Thos. Tunstead.....	137 60	
No. 7736—Thos. Tunstead.....	328 55	
No. 7737—Thos. Tunstead.....	57 08	
No. 7986—Thos. Tunstead.....	117 90	
No. 7987—J. A. Richardson.....	181 85	
No. 10282—Baker & Hamilton.....	21 60	
No. 10283—J. S. Lowe.....	221 28	
No. 10613—Hy. Hall & Co.....	3 50	
No. 10614—Hy. Hall & Co.....	381 00	
No. 11324—J. W. Hartley.....	15 00	
No. 15122—S. Kaufman.....	31 35	
No. 15123—F. P. Callandun.....	104 11	
No. 15124—L. Lagloria.....	102 00	
No. 15125—W. A. Schittgyer.....	30 00	
No. 15126—J. D. Ennis.....	96 11	
No. 15127—G. Jepson.....	86 00	
No. 15263—T. W. O'Neill.....	196 00	
No. 15264—G. Jepson.....	112 00	
No. 15265—Thos. Tunstead.....	139 15	
No. 15266—J. P. Babcock.....	125 95	
No. 15628—J. P. Babcock.....	149 10	
No. 15629—A. Haywood.....	25 00	
No. 15630—Geo. H. Koppitz.....	141 75	
No. 16041—Thos. Tunstead.....	306 25	
No. 16407—S. Kaufman.....	52 70	
No. 18049—J. P. Babcock.....	141 91	
No. 18050—A. Haywood.....	25 00	
No. 18051—F. M. Bacigalupi.....	97 71	
Balance on hand.....	163 64	
Totals.....	\$4,507 95	\$4,507 95
June 30, by balance on hand.....		\$163 64

EXPENSES INCURRED

In the Construction of the Bear Valley Hatchery and Dam at Bear Valley, Marin County, State of California.

B. & J. S. Doe, building material.....	\$221 28
S. Grandi, building material.....	9 73
S. Grandi, building material.....	101 58
A. Howe, building material.....	45 00
S. Grandi, building material.....	109 23
Andrew Howe, constructing building.....	100 00
Andrew Howe, carpenter work.....	281 00
Andrew Howe, setting water tanks and water gates.....	40 00
O. Hardman, labor.....	15 00
J. P. Chambers, cutting dam.....	20 00
Whittier, Fuller & Co., painting troughs.....	5 50
A. Pedrotti, hauling lumber for Bear Valley Hatchery.....	84 00
William Massop, freight on lumber.....	22 65
Total.....	\$1,054 97

AMOUNT RECEIVED FROM LICENSES FOR THE YEAR ENDING
MARCH 31, 1892.

Class.	Received of Controller.	Value of Each.	On Hand March 31, 1892.	Sold during the Year.	Total Value of Licenses Sold.	Commissions Paid for Collecting.	Net Amount Due the State.
A ----	500	\$5 00	135	365	\$1,825 00	\$2 75	\$1,821 25
B ----	50	7 50	20	30	225 00	1 10	223 90
C ----	50	10 00	43	7	70 00	-----	70 00
D ----	50	12 50	16	34	425 00	-----	425 00
E ----	50	-----	49	1	25 00	-----	25 00
Totals	700	-----	263	437	\$2,570 00	\$4 85	\$2,565 15

AMOUNT RECEIVED FROM LICENSES FROM APRIL 1, 1892, TO
SEPTEMBER 1, 1892.

Class.	Received of Controller.	Value of Each.	On Hand September 1, 1892.	Sold during the Year.	Total Value of Licenses Sold.	Net Amount Due the State.
A -----	500	\$5 00	125	375	\$1,875 00	\$1,875 00
B -----	50	7 50	24	26	195 00	195 00
C -----	50	10 00	44	6	60 00	60 00
D -----	50	12 50	19	31	387 50	387 50
E -----	50	-----	49	1	25 00	25 00
Totals -----	700	-----	261	439	\$2,542 50	\$2,542 50

BULLETINS ISSUED BY THE FISH COMMISSION.

OFFICE OF THE BOARD OF FISH COMMISSIONERS, }
 SAN FRANCISCO, October 12, 1891. }

[BULLETIN No. 1.]

A question having been made as to the classification of certain fish found in Eel River, in salt water, during the month of September, specimens were obtained ranging from one third of a pound to a pound, and sent by the Commission to Dr. David S. Jordan, the well-known ichthyologist, now President of the Leland Stanford, Junior, University, for classification. He pronounces them trout—young Steel-heads (*Salmo gairdneri*, Richardson).

Under the law, Section 632 of the Penal Code of the State of California, it is unlawful to catch these fish at any time, except with hook and line.

Issued by order of the Board.

RAMON E. WILSON,
 Secretary.

OFFICE OF THE BOARD OF FISH COMMISSIONERS, }
 SAN FRANCISCO, October 12, 1891. }

[BULLETIN No. 2.]

Dr. David S. Jordan, now President of the Leland Stanford, Junior, University, and Dr. Charles H. Gilbert, Professor of Vertebrate Zoölogy in the same University, both well-known ichthyologists, have very kindly offered to assist the Commission in classifying any fish which may be sent to them.

Specimens of trout taken from Lake Webber have recently been sent to Dr. Jordan, which, he says, belong to the form known as the Tahoe trout (*Salmo henshawi*). He now regards these trout as a variety of the Red-throated trout, and writes its name as *Salmo mykiss henshawi*.

He has substituted the word *mykiss* for *purpuratus*, as it is a much older name than the latter.

The trout found in Webber Lake are said to have been planted many years ago by Dr. Webber, and that he took the original stock from Feather River. They have been commonly known in California as the Feather River, or Cut-throat trout.

Issued by order of the Board.

RAMON E. WILSON,
 Secretary.

OFFICE OF THE BOARD OF FISH COMMISSIONERS, }
 SAN FRANCISCO, October 24, 1891. }

[BULLETIN No. 3.]

In the early part of the month of October, Capt. A. W. Foster, of Sacramento, sent to the Commission specimens of trout caught by him in Klamath River, at Beswick. The specimens thus obtained were sent

to Dr. David S. Jordan for classification. He classifies the fish as Steel-head trout (*Salmo gairdneri*), and says: "They correspond more nearly to the Salmon trout of England than do any other of our American species. The name Salmon trout is promiscuously used for all sorts of large trout or small salmon, but if any fish on this west coast is entitled to that name it is the Steel-head."

Issued by order of the Board.

RAMON E. WILSON,
Secretary.

OFFICE OF THE BOARD OF FISH COMMISSIONERS, }
SAN FRANCISCO, February 15, 1892. }

[BULLETIN No. 4.]

By permission of Dr. David Starr Jordan, President of the Leland Stanford, Junior, University, the Board of Fish Commissioners of the State of California take pleasure in presenting the following able and instructive discourse on the subject of "Salmon and Trout of the Pacific Coast."

Issued by order of the Board.

RAMON E. WILSON,
Secretary.

SALMON AND TROUT OF THE PACIFIC COAST.

By DR. DAVID STARR JORDAN, President Leland Stanford, Junior, University.

Of all the families of fishes, the one most interesting from almost every point of view is that of the *Salmonidæ*, the Salmon family. As now understood, it is not one of the largest families, as it comprises less than a hundred species; but in beauty, activity, gaminess, quality as food, and even in size of individuals, different members of the group stand easily with the first among fishes.

The *Salmonidæ* are found only in the North Temperate and Arctic regions, and within this range they are everywhere almost equally abundant wherever suitable waters occur. Some of the species, especially the larger ones, are marine and anadromous, living and growing in the sea, and ascending fresh waters to spawn. Still others live in running brooks, entering lakes or the sea when occasion serves, but not habitually doing so. Still others are lake fishes, approaching the shore or entering brooks in the spawning season; at other times retiring to waters of considerable depth. Some of them are active, voracious, and gamy, while others are comparatively defenseless and will not take the hook.

All the *Salmonidæ* feed upon fish; the smaller ones upon worms, insects, and small fish; the larger forms on fishes and crustacea—whatever they can find. The eggs of the species are much larger than in fishes generally, and the ovaries are without special duct, the eggs falling into the cavity of the abdomen before they are excluded. The large size of the eggs, the fact that they do not stick together, and the ease with which they may be impregnated, render all the *Salmonidæ* peculiarly adapted for artificial culture.

Naturalists divide the *Salmonidæ* into nine genera: *Coregonus*, the White Fish; *Plecoglossus*, a little annual fish which is found in the

waters of Japan, born in the spring, runs up the rivers in the summer, and dies the following winter, only the young surviving; *Brachymystax*, a large and scarcely known salmon-like fish in the waters of Siberia; *Stenodus*, the Inconnu, a large, weak-tooth salmon found in the Mackenzie River; *Thymallus*, the Grayling; *Hucho*, the Huchen, or Roth-fisch of the River Danube, a large, voracious, pike-like salmon, which seems to be little known either to naturalists or to anglers; *Oncorhynchus*, the Pacific Coast salmon, or Quinnats; *Salmo*, the salmon and trout; and *Salvelinus*, the Charr, or Red-spotted trout.

Of these, the various fishes commonly known as salmon and trout belong to the last three genera. The others need not be further mentioned in the present discussion. In order to get a better idea of the proper application of the various vernacular names that are used in America, it is necessary to go back to Europe, the source from which these names have been drawn. First, we have a large fish, common in the salt waters of northern Europe, spending most of its life near the shores in regions where the water is cold and clear, and ascending the rivers in the spring when the high water comes down from the mountains, going through rapids with great force, leaping cataracts, and finally casting its spawn on the gravelly bed of a small stream. This was known to the Latin writers as *Salmo*, the word coming from *salio*, which means "to leap," and in the different languages which are derived from the Latin having as its names some form of the word "salmon." The scientific name of this fish is *Salmo salar*.

Very similar to the salmon in all technical respects, like it having black spots over the surface of the body and rather large silvery scales, is a smaller fish which rarely descends to the sea, and makes its home in the rivers and lakes throughout northern and central Europe. This fish was known by the name of *Fario* to the old Latin writers, the most important of whom, in this regard, was Ansonius, who wrote feelingly and poetically of the fishes of the River Moselle. From the Latin word "fario" comes the German name "forelle." This fish is the trout of all English writers, the trout of Izaak Walton, and its scientific name is *Salmo fario*.

Half way between the salmon and the trout there is a large trout which lives mostly in the estuaries of the rivers, sometimes mistaken for salmon, sometimes for trout, rarely ascending the rivers very far, and seldom venturing far into the sea. This is the *Trutta* of the Latin authors, from which the word "trout" originally comes, although, as it has happened, the word "fario" has become, in its various forms, the name of the trout in all the German* and Scandinavian countries, while derivatives of the word "trutta" have come to mean the same fish in the Latin† countries and with the English. The scientific name of this large fish, half salmon and half trout in appearance, altogether trout in fact, is *Salmo trutta*, and to this fish properly belongs the name of Salmon trout.

There are thus in England, whence our names have come, three species of black-spotted silvery fishes of this family: (1) The Salmon, largest of all and anadromous, that is, running up the rivers to spawn, and living in the sea; (2) the Trout, living in the brooks and the lakes only; (3) the Salmon trout, which stands between the two. All three

* German, Forelle; Danish, Forelse, etc.

† French, Truite; Spanish, Trucha; English, Trout, etc.

belong to the genus *Salmo*, and the only difference of any importance between the salmon and the trout, so far as structure goes, lies in the fact that the salmon shed the teeth on its vomer, that is, the middle part of the roof of its mouth, as it grows older, while in the trout these teeth are preserved throughout the life of the animal. Living in salt water, and feeding on large fishes and crustacea, the salmon is the more vigorous, with coarser and more oily flesh, but this difference becomes of small importance as a matter of distinguishing species.

Besides these three, there is another and a finer fish, found in the coldest and clearest lakes of the Alps and of northern Europe, dark colored and spotted with bright red, the scales so small that they seem as mere impressions in the slimy skin, so that the average fisherman does not recognize their existence. This is a finer and more beautiful fish than any of the trout, and it is very much less abundant. This is known in England as the Charr, and on the Continent it has, in Germany, the name of Saibling or Sälbling (both words from the low Latin name *Salvelinus*, which again is a sort of diminutive of *Salmo*—a little salmon); in France it is called the Ombre Chevalier, which in turn comes from the Latin name *Umbla*, given to the same fish in allusion to its dark colors, and its love of shady places in the lakes and brooks. This charr differs from all the trout in various anatomical respects, the most notable of which is the entirely different form of its vomer, a form which could only be satisfactorily described by a series of comparative drawings. This character of the vomer distinguishes the genus *Salvelinus*, to which the Saibling belongs, its scientific name being *Salvelinus alpinus*.

Armed with these names of Salmon, Trout, Salmon trout, and Charr, our ancestors came to America. The name "charr" was doubtless unfamiliar to most of them, for the charr is scarcely found in England except in the lake district of Cumberland, and for this reason, I suppose, it has never been in common language applied to any American fish.

Our ancestors found running up the rivers of the Atlantic Coast, a large fish precisely like the salmon of Europe; in fact, the very same thing, and so they naturally and correctly enough called it Salmon. In the fresh waters of New England and New York, in all the clear streams throughout the Alleghany region, and in the lakes of Canada and to the northwest, our forefathers found a red-spotted, fine-scaled, dark-colored speckled beauty. Finding no real trout with black spots and large scales in the rivers, and having forgotten the name of "charr," they gave to this fish the name of trout, or Speckled trout, or Brook trout, and in spite of the fact that in reality it is not a trout, but a charr, the name Brook trout is likely to adhere forever to the *Salvelinus fontinalis*.

Real trout there are none on our Atlantic Coast, and Salmon trout is likewise wanting, but the name Salmon trout is often given to the Brook trout, or charr, which has run out into the sea; and it is also often given to another charr, a very large, coarse species, in which the red spots have faded out to a cream color, which is found in all the lakes from Alaska to Maine, across the northern half of our continent. This is the Great Lake trout (*Salvelinus namaycush*), and except for its large size and comparative coarseness, it would never be mistaken either for trout or salmon. The name Salmon trout is wholly inapplicable to it.

In the lakes of Greenland and the eastern part of British America, the European charr (*Salvelinus alpinus*) is as abundant as it is in Europe—a fact which has been only lately made manifest, and even yet there is some question whether some of these which are found in the lakes in New Hampshire have not some time or other been brought over and planted there from Europe.

In the lakes of Maine, and on the north, there is still another charr, smaller and finer than the European one, the Blue-back trout of the Rangle Lakes, known as *Salvelinus oquassa*.

Thus, instead of one of the salmon, salmon trout, trout, and charr, of Europe, we have in the Eastern States the same salmon, the same charr, and three other charrs, but neither the trout nor the salmon trout.

In coming to the Pacific Coast, the settlers of California brought the names with them from the East, but found none of the fishes to which they had been accustomed. Salmon they found, similar in habits and in value as food, but many of them larger, finer, and vastly more abundant than any of the salmon of Europe. California salmon differ from all the rest of the salmon family in the fact that the number of rays in the anal fin is from fourteen to twenty, while in all the salmon and trout on the other side of the Atlantic this fin contains no more than nine or ten rays. The Pacific Coast salmon have also an increased number of branchiostegals, an increased number of gill-rakers, and a much larger number of pyloric cæca, or glands, about the stomach. They are, therefore, in strictness, not salmon at all, but something more intensely salmon than the salmon of Europe itself really is. They have therefore been placed in another genus known as *Oncorhynchus*. For the lack of any other common name they are always spoken of and will always be canned, as long as the canning industry lasts, under the name of Salmon. The Chinook name, *Quinnat*, was early applied to them, and if we feel the need of some other name to distinguish them from real salmon we may call the Pacific Coast salmon Quinnat, or Quinnat Salmon. These species all live in the ocean, ascend the rivers in the spring and summer, spawn in fresh water in the fall, the young, as soon as they are able to swim, floating tail foremost down the river and growing rapidly as soon as they reach the ocean and the peculiar ocean food. There are five species of these Quinnats, which will be described farther on.

Besides the salmon, the settlers of California found in the brooks an abundance of what they called trout. These are black-spotted, silver-scaled, and in every way closely resemble the trout of Europe, and are wholly unlike the charr, or so-called trout of the Eastern States. The name trout by rights belongs to these fishes, and they are placed in the genus *Salmo*. The three species of trout found in the Pacific waters will be mentioned farther on. One of these is so similar to the Salmon trout of Europe that it might fairly be called, as it often is called, by the same name.

A charr is also found in Pacific waters, but as the name "charr" had been wholly forgotten by our ancestors, they could only call this, like the others, a trout. In Oregon the red-spotted trout, or charr, is distinguished by the name of Bull trout. In California it had, for a long time, no distinctive name. A landlady in some hotel in the neighborhood of the United States Fish Hatchery at Baird, on the McCloud

River, at the time of the Dolly Varden craze, noticing the gaudy colors of this California charr, proposed to call it the Dolly Varden trout. This name coming to the ears of Professor Baird, then United States Fish Commissioner, pleased his fancy, and he directed me, who then had the classification of the trout in the Smithsonian Institution in hand, to continue for this species the common name of Dolly Varden trout, and so, in the books at least, Dolly Varden trout it is to this day.

Turning back to the Quinnot salmon, or the salmon of the Pacific Coast, we often find persons puzzled to distinguish its young from the various forms of trout. Any person who can count, and will take the trouble to learn which of the fins is the anal fin—the one on the lower side just behind the vent—can distinguish the young Quinnot salmon from any form of trout. All the so-called salmon of the Pacific Coast, all the species of *Oncorhynchus*, have an increased number of rays in the anal fin, from fourteen to twenty, while all forms of trout in whatever country, all the charrs and the Atlantic Coast salmon, have in this fin but nine or ten rays. This is a matter of some importance, in view of the fact that the fishery laws of this State discriminate between trout and salmon, permitting the catching of the one, when to take the other is forbidden.

The existence of large salmon-like fishes in the Pacific has long been known. The different species were recognized about one hundred and forty years ago by that most exact of early observers, Steller, who described and distinguished them with perfect accuracy, under their Russian vernacular names. These Russian names were, in 1792, adopted by Walbaum as specific names, in giving to these animals scientific names. Since Steller's time, writers of all degrees of incompetence, and writers with scanty material or with no material at all, have done their worst to confuse our knowledge of these salmon, until it became evident that no exact knowledge of any of the species remained. In the current system of a few years ago,* the breeding males of the five species known to Steller constituted a separate genus of many species (*Oncorhynchus*, Suckley); the females were placed in the genus *Salmo*, and the young formed still another species of a third genus, called *Fario*, supposed to be a genus of trout. The young breeding males (*grilse*) of one of the species (*Oncorhynchus nerka*) made still a fourth genus, designated as *Hypsifario*. Not one of the writers on these fishes of thirty years ago knew a single species definitely, at sight, or used knowingly in their descriptions a single character by which species are really distinguished. Not less than thirty-five nominal species of *Oncorhynchus* have already been described from the North Pacific, although, so far as is now known, only the five originally noticed by Steller really exist. The descriptive literature of the Pacific salmon is among the very worst extant in science. This is not, however, altogether the fault of the authors, but it is in great part due to the extraordinary variability in appearance of the different species of salmon. These variations are, as will be seen, due to several different causes, notably to differences in surroundings, in sex, and in age, and in conditions connected with the process of reproduction. The writer and his associate, Prof. Charles H. Gilbert, have had, under the auspices of the United States Fish Commission, better opportunities to study the different species of *Oncorhynchus* than had fallen to the lot of any previous ichthyologists. Entirely similar

* See report U. S. Pacific R. R. Explorations, 1858.

conclusions have been independently reached by Dr. Tarleton H. Bean, of the United States Fish Commission, who had several times visited Alaska for the purpose of investigating its salmon fisheries, and whose means of studying the different species has been as extensive as ours. It is very gratifying to see that the results of these different sets of observations agree in all essential respects, and also agree fully with the observations made so long ago by Steller.

All of these authorities recognize the existence of five species of *Oncorhynchus* inhabiting both shores of the North Pacific. There is no evidence of the existence of any more on either the American or the Asiatic side. These species may be called: (1) The Quinнат, or King salmon; (2) the Blue-back salmon, or Red-fish; (3) the Silver salmon; (4) the Dog salmon, and (5) the Humpback salmon; or (1) *Oncorhynchus tshawytscha*; (2) *Oncorhynchus nerka*; (3) *Oncorhynchus kisutch*; (4) *Oncorhynchus keta*, and (5) *Oncorhynchus gorbusha*. All these species are now known to occur in the waters of Kamtschatka as well as in those of Alaska and Oregon. These species, in all their varied conditions, may usually be distinguished by the characters given below. Other differences of form, color, and appearance are absolutely valueless for distinction, unless specimens of the same age, sex, and condition are compared.

The King salmon, or true Quinнат, or Chinook salmon (*Oncorhynchus tshawytscha*), has an average weight of 22 pounds, but individuals weighing 70 to 100 pounds are occasionally taken. It has about 16 anal rays, 15 to 19 branchiostegals, 23 (9+14) gill-rakers on the anterior gill arch, and 140 to 185 pyloric cœca. The scales are comparatively large, there being from 130 to 155 in a longitudinal series. In the spring the body is silvery, the back dorsal fin and caudal fin having more or less of round black spots, and the sides of the head having a peculiar tin-colored metallic luster. In the fall the color is often black or dirty red, and the species can then only be distinguished from the Dog salmon by its technical characters.

The Blue-back salmon (*Oncorhynchus nerka*) usually weighs from 5 to 8 pounds. It has about 14 developed anal rays, 14 branchiostegals, and 75 to 95 pyloric cœca. The gill-rakers are more numerous than in any other salmon, the number being usually about 39 (16+23). The scales are larger, there being 130 to 140 in the lateral line. In the spring the form is plumply rounded, and the color is a clear, bright blue above, silvery below, and everywhere immaculate. Young fishes often show a few round black spots, which disappear when they enter the sea. Fall specimens in the lakes are bright red in color, hook-nosed, and slab-sided, and bear little resemblance to the spring run. Young spawning male grilse are also peculiar in appearance, and were for a time considered as forming a distinct genus, under the name of "*Hypsifario kennerlyi*." This species appears to be sometimes land-locked in mountain lakes, in which case it reaches but a small size. Such specimens, called "Kokos" by the Indians, have been sent us from Lake Whatcom, Washington, by Mr. T. J. Smith, of Whatcom. Similar specimens have been sent in from other mountain lakes.

The Silver salmon (*Oncorhynchus kisutch*) reaches a weight of 3 to 8 pounds. It has developed rays in the anal, 13 branchiostegals, 23 (10+13) gill-rakers, and 45 to 80 pyloric cœca. There are about 127 scales in the lateral line. In color it is silvery in spring, greenish

above, and with a few faint black spots on the upper parts only. In the fall the males are mostly of a dirty red.

The Dog salmon (*Oncorhynchus keta*) reaches an average weight of about 12 pounds. It has about 14 anal rays, 14 branchiostegals, 24 (9+15) gill-rakers, and 140 to 185 pyloric cœca. There are about 150 scales in the lateral line. In spring it is dirty silvery, immaculate, or sprinkled with small black specks, the fins dusky. In the fall the male is brick-red or blackish, and its jaws are greatly distorted.

The Humpback salmon (*Oncorhynchus gorbuscha*) is the smallest of the species, weighing from 3 to 6 pounds. It has usually 15 anal rays, 12 branchiostegals, 28 (13+15) gill-rakers, and about 180 pyloric cœca. Its scales are much smaller than in any other salmon, there being 180 to 240 in the lateral line. In color it is bluish above, silvery below, the posterior and upper parts with many round black spots. The males in the fall are red, and are more extravagantly distorted than in any other in the *Salmonidæ*.

Of these species the Blue-back predominates in Fraser River and in the Yukon River, the Silver salmon in Puget Sound, the Quinnat in the Columbia and the Sacramento, and the Silver salmon in most of the streams along the coast. All the species have been seen by us in the Columbia and in Fraser River; all but the Blue-back in the Sacramento and in waters tributary to Puget Sound. Only the King salmon has been noticed south of San Francisco. Its range has been traced as far as Ventura River. Of these species, the King salmon and Blue-back salmon habitually "run" in the spring, the others in the fall. The usual order of running in the rivers is as follows: *nerka*, *tschawytscha*, *kisutch*, *gorbuscha*, *keta*.

The economic value of the spring-running salmon is far greater than that of the other species, because they can be captured in numbers when at their best, while the others are usually taken only after deterioration. To this fact the worthlessness of *Oncorhynchus keta*, as compared with the other species, is probably wholly due.

The habits of the salmon in the ocean are not easily studied. King salmon and Silver salmon of all sizes are taken with the seine at almost any season in Puget Sound. This would indicate that these species do not go far from the shore. The King salmon takes the hook freely in Monterey Bay, both near the shore and at a distance of six to eight miles out. We have reason to believe that these two species do not necessarily seek great depths, but probably remain not very far from the mouth of the rivers in which they were spawned. The Blue-back and the Dog salmon probably seek deeper water, as the former is seldom or never taken with the seine in the ocean, and the latter is known to enter the Strait of Fuca at the spawning season, therefore coming in from the open sea. The great majority of the King salmon, and nearly all the Blue-back salmon, enter the rivers in the spring. The run of both begins generally at the last of March; it lasts, with various modifications and interruptions, until the actual spawning season in November, the time of running and the proportionate amount in each of the subordinate runs varying with each different river. In general, the runs are slack in the summer and increase with the first high water of autumn. By the last of August only straggling Blue-backs can be found in the lower course of any stream; but both in the Columbia and in the Sacramento the Quinnat runs in considerable numbers, at least till

October. In the Sacramento the run is greatest in the fall, and more run in the summer than in spring. In the Sacramento and the smaller rivers southward, there is a winter run, beginning in December. The spring salmon ascends only those rivers which are fed by the melting snows from the mountains, and which have sufficient volume to send their waters well out to sea. Those salmon which run in the spring are chiefly adults (supposed to be at least three years old). Their milt and spawn are no more developed than at the same time in others of the same species which are not to enter the rivers until fall. It would appear that the contact with cold fresh water, when in the ocean, in some way causes them to run towards it, and to run before there is any special influence to that end exerted by the development of the organs of generation. High water on any of these rivers in the spring is always followed by an increased run of salmon. The salmon canners think, and this is probably true, that salmon which would not have run till later are brought up by the contact with the cold water. The cause of this effect of cold fresh water is not understood. We may call it an instinct of the salmon, which is another way of expressing our ignorance. In general, it seems to be true that in those rivers and during those years when the spring run is greatest, the fall run is least to be depended upon.

As the season advances, smaller and younger salmon of these species (Quinnat and Blue-back) enter the rivers to spawn, and in the fall these young specimens are very numerous. We have thus far failed to notice any gradations in size or appearance of these young fish by which their ages could be ascertained. It is, however, probable that some of both sexes reproduce at the age of one year. In Fraser River, in the fall, Quinnat male grilse of every size, from 8 inches upwards, were running, the milt fully developed, but usually not showing the hooked jaws and dark colors of the older males. Females less than 18 inches in length were rare. All of either sex, large and small, then in the river, had the ovaries or milt developed. Little Blue-backs of every size, down to 6 inches, are also found in the upper Columbia in the fall, with their organs of generation fully developed. Nineteen twentieths of these young fish are males, and some of them have the hooked jaws and red color of the old males.

The average weight of the Quinnat in the Columbia in the spring is 22 pounds; in the Sacramento, about 16. Individuals weighing from 40 to 60 pounds are frequently found in both rivers, and some as high as 80 or even 100 pounds are recorded. It is questioned whether these large fishes are those which, of the same age, have grown more rapidly; those which are older, but have for some reason failed to spawn, or those which have survived one or more spawning seasons. All these origins may be possible in individual cases; we are, however, of the opinion that the majority of these large fishes are those which have hitherto run in the fall, and thus having spawned not far from the sea, have survived the spawning season of the previous year.

Those fish which enter the rivers in the spring continue their ascent till death or the spawning season overtakes them. Probably none of them ever return to the ocean, and a large proportion fail to spawn. They are known to ascend the Sacramento to its extreme headwaters, about four hundred miles. In the Columbia they ascend as far as the Bitter Root Mountains, and at least to the Spokane Falls, and their

extreme limit is not known. This is a distance of six to eight hundred miles. At these great distances, when the fish have reached the spawning grounds, besides the usual changes of the breeding season, their bodies are covered with bruises, on which patches of white fungus develop. The fins become mutilated, their eyes are often injured or destroyed, parasitic worms gather in their gills, they become extremely emaciated, their flesh becomes white from the loss of oil, and as soon as the spawning act is accomplished, and sometimes before, *all* of them die. The ascent of the Cascades and the Dalles probably causes the injury or death of a great many salmon.

When the salmon enter the river they refuse to take bait, and their stomachs are always found empty and contracted. In the rivers they do not feed, and when they reach the spawning grounds their stomachs, pyloric cœca and all, are said to be no larger than one's finger. They will sometimes take the fly, or a hook baited with salmon roe, in the clear waters of the upper tributaries, but there is no evidence known to us that they feed when there. Only the Quinnat and Blue-back (there called Red-fish) have been found at any great distance from the sea, and these (as adult fishes) only in late summer and fall.

The spawning season is probably about the same for all the species. It varies for each of the different rivers, and for different parts of the same river. It doubtless extends from July to December. The manner of spawning is probably similar for all the species, but we have no data for any except the Quinnat. In this species the fishes pair off; the male, with tail and snout, excavates a broad, shallow "nest" in the gravelly bed of the stream, in rapid water, at a depth of one to four feet; the female deposits her eggs in it, and, after the exclusion of the milt, they cover them with stones and gravel. They then float down the stream tail foremost. As already stated, a great majority of them die. In the headwaters of the large streams, unquestionably all die; in the small streams, and near the sea, an unknown percentage probably survive. The young hatch in about sixty days, and most of them return to the ocean during the high water of the spring.

The salmon of all kinds, in the spring, are silvery, spotted or not, according to the species, and with the mouth about equally symmetrical in both sexes. As the spawning season approaches, the female loses her silvery color, becomes more slimy, the scales on the back partly sink into the skin, and the flesh changes from salmon-red and becomes variously paler from the loss of oil, the degree of paleness varying much with individuals and with inhabitants of different rivers. In the Sacramento the flesh of the Quinnat, in either spring or fall, is rarely pale. In the Columbia a few with pale flesh are sometimes taken in the spring, and a good many in the fall. In Fraser River the fall run of the Quinnat is nearly worthless for canning purposes, because so many are "white-meated." In the spring very few are "white-meated," but the number increases towards fall, when there is every variation, some having red streaks running through them, others being red toward the head and pale toward the tail. The red and pale ones cannot be distinguished externally, and the color is dependent on neither age nor sex. There is said to be no difference in the taste, but there is no market for canned salmon not of the conventional orange color.

As the season advances, the difference between the males and females becomes more and more marked, and keeps pace with the development

of the milt, as is shown by dissection. The males have (1) the premaxillaries and the tip of the lower jaw more and more prolonged, both of the jaws becoming, finally, strongly and often extravagantly hooked, so that either they shut by the side of each other like shears, or else the mouth cannot be closed. (2) The front teeth become very long and canine-like, the growth proceeding very rapidly, until they are often half an inch long. (3) The teeth on the vomer and tongue often disappear. (4) The body grows more compressed and deeper at the shoulders, so that a very distinct hump is formed; this is more developed in *Oncorhynchus gorbuscha*, but is found in all. (5) The scales disappear, especially on the back, by the growth of spongy skin. (6) The color changes from silvery to various shades of black and red, or blotchy, according to the species. The Blue-back turns rosy red, the Dog salmon a dull, blotchy red, and the Quinnat generally blackish. The distorted males are commonly considered worthless, rejected by the canners and salmon salters, but preserved by the Indians. These changes are due solely to influences connected with the growth of the reproductive organs. They are not in any way due to the action of fresh water. They take place at about the same time in the adult males of all species, whether in the ocean or in the rivers. At the time of the spring runs all are symmetrical. In the fall all males, of whatever species, are more or less distorted. Among the Dog salmon, which run only in the fall, the males are hook-jawed and red-blotched when they first enter the Strait of Fuca from the outside. The Humpback, taken in salt water about Seattle, have the same peculiarities. The male is slab-sided, hook-billed, and distorted, and is rejected by the canners. No hook-jawed females of any species have been seen. It is not positively known that any fully hook-jawed old male survives the reproductive act. If any do, the jaws must resume the normal form.

On first entering a stream the salmon swim about as if playing. They always head towards the current, and this appearance of playing may be simply due to facing the moving tide. Afterwards they enter the deepest parts of the stream and swim straight up, with few interruptions. Their rate of travel at Sacramento is estimated by Stone at about two miles per day; on the Columbia at about three miles per day. Those who enter the Columbia in the spring and ascend to the mountain rivers of Idaho, must go at a more rapid rate than this, as they must make an average of nearly four miles per day.

As already stated, the economic value of any species depends in great part on its being a "spring salmon." It is not generally possible to capture salmon of any species in large numbers until they have entered the rivers, and the spring salmon enters the rivers long before the growth of the organs of reproduction has reduced the richness of the flesh. The fall salmon cannot be taken in quantity until their flesh has deteriorated; hence, the Dog salmon is practically almost worthless, except to the Indians, and the Humpback salmon is little better. The Silver salmon, with the same breeding habits as the Dog salmon, is more valuable, as it is found in the inland waters of Puget Sound for a considerable time before the fall rains cause the fall runs, and it may be taken in large numbers with seines before the season for entering the rivers. The Quinnat salmon, from its great size and abundance, is more valuable than all the other fishes on our Pacific Coast taken together. The Blue-back, similar in flesh, but much smaller and less

abundant, is worth much more than the combined value of the three remaining species of salmon.

The fall salmon of all species, but especially of the Dog salmon, ascend streams but a short distance before spawning. They seem to be in great anxiety to find fresh water, and many of them work their way up little brooks only a few inches deep, where they perish miserably, floundering about on the stones. Every stream, of whatever kind, has more or less of these fall salmon.

It is the prevailing impression that the salmon have some special instinct which leads them to return to spawn in the same spawning grounds where they were originally hatched. We fail to find any evidence of this in the case of the Pacific Coast salmon, and we do not believe it to be true. It seems more probable that the young salmon hatched in any river mostly remain in the ocean, within a radius of twenty, thirty, or forty miles of its mouth. These, in their movements about in the ocean, may come into contact with the cold waters of their parent rivers, or, perhaps, of any other river, at a considerable distance from the shore. In the case of the Quinnet and the Blue-back, their "instinct" seems to lead them to ascend these fresh waters, and, in a majority of cases, these waters will be those in which the fishes in question were originally spawned. Later in the season the growth of the reproductive organs leads them to approach the shore and search for fresh waters, and still the chances are that they may find the original stream. But undoubtedly many fall salmon ascend, or try to ascend, streams in which no salmon were ever hatched. In little brooks about Puget Sound, where the water is not three inches deep, are often found dead or dying salmon, which have entered them for the purpose of spawning. It is said of the Russian River and other California rivers, that their mouths, in the time of low water in summer, generally become entirely closed by sand-bars, and that the salmon, in their eagerness to ascend them, frequently fling themselves entirely out of water on the beach. But this does not prove that the salmon are guided by a marvelous geographical instinct, which leads them to their parent river in spite of the fact that the river cannot be found. The waters of Russian River soak through these sand-bars, and the salmon instinct, we think, leads them merely to search for fresh waters. This matter is much in need of further investigation; at present, however, we find no reason to believe that the salmon enter the Rogue River simply because they were spawned there, or that a salmon hatched in the Clackamas River is more likely, on that account, to return to the Clackamas than to go up the Cowlitz or the Des Chûtes. "At the hatchery on Rogue River the fish are stripped, marked, and set free, and every year since the hatchery has been in operation some of the marked fish have been recaptured. The young fry are also marked, but none of them have been recaptured."

In regard to the diminution of the number of salmon on the coast, Dr. Gilbert and myself published in 1880, in the report of the United States Census Bureau, the following observations: "In Puget Sound, Fraser River, and the small streams, there appears to be little or no evidence of diminution. In the Columbia River the evidence appears somewhat conflicting. The catch in 1880 was considerably greater than ever before (nearly five hundred and forty thousand cases of forty-eight pounds each having been packed), although the fishing for three or

four years has been extensive. On the other hand, the high water of that year undoubtedly caused many fish to become spring salmon which would otherwise have run in the fall. Moreover, it is urged that a few years ago, when the number caught was about half as great as in 1880, the amount of netting used was perhaps one eighth as much. With a comparatively small outfit the canners caught half the fish; now, with nets much larger and more numerous, they catch them nearly all, scarcely any escaping during the fishing season (April 1st to August 1st). Whether an actual reduction in the number of fish running can be proved or not, there can be no question that the present rate of destruction of the salmon will deplete the river before many years. A considerable number of Quinnat salmon run in August and September, and some stragglers even later; these are all which now keep up the supply of fish in the river. The non-molestation of this fall run, therefore, does something to atone for the almost total destruction of the spring run. This, however, is insufficient. A well-ordered salmon hatchery is the only means by which the destruction of the salmon fisheries of the Columbia can be prevented."

Since this was written the over-fishing has gone on steadily, the number of nets used is two or three times as great as it was in 1880, while the catch has steadily fallen off. Seines are now used freely in the Columbia, and other appliances by which great numbers of young salmon, too small for use in the canneries, are destroyed, and the utter disappearance of the salmon fishery of the Columbia is only a question of a few years unless some vigorous means is taken to prevent over-fishing, to prevent the destruction of young fish, and to replenish the losses from all these causes. The same story of the destruction of the rich fisheries of the Columbia will be told again in the Fraser River and in the Yukon, and in every other stream where unlimited fishing is allowed, and where no adequate effort is made to keep up the supply. Just as the forests are wantonly and thoughtlessly destroyed by early settlers and by lumbermen, just so the fisheries of this coast will go under the hands of the canner.

Of the American trout, the one which most nearly approaches the European *Salmo fario*, is the Rainbow trout of California, *Salmo irideus*, as it was named some forty years ago by Dr. W. P. Gibbons, of Alameda. The name Rainbow trout is simply a translation of the Latin name *irideus* given by Dr. Gibbons, and in default of any better common name this name is likely to last. The distinctive characters of this trout lie mainly in the large scales (about 135) in a lengthwise series, in the comparatively small mouth and plump body. The color is bluish, the sides silvery, usually with a red lateral band, and marked with reddish and dusky blotches. The young, as in all trout, are crossed by dark bands, which are, in every case, a mark of immaturity. In the Rainbow trout the head, back, and upper fins are sprinkled with round black spots, which are very variable in number. In specimens taken in the sea, this species, like most other trout in similar conditions, is bright silvery, and sometimes immaculate. This species is especially characteristic of the waters of California. It abounds in every clear brook from the Mexican line northward to Mount Shasta, and perhaps farther. No specimens have been anywhere obtained to the eastward of the Cascade Range or of the Sierra Nevada. It varies much in size, specimens from Northern California often reaching a weight of 6 pounds,

while in the Rio San Luis Rey, the southernmost locality from which I have obtained trout, they seldom exceed a length of 6 inches. Although not an anadromous species, the Rainbow trout frequently moves about in the rivers, and it often enters the sea. All of the small trout which I have seen from the streams of the Coast Range belong to this species, and there is no authentic record of its occurrence outside of California.

Another California trout is the so-called Steel-head, more usually known in California as Salmon trout, a fish sufficiently like the Salmon trout of Europe, but the name Steel-head seems to me preferable because it is given to no other fish. The Steel-head, so called from the color of its head and the hardness of the bones of its skull as compared with the bones of the Quinnat salmon, is found very abundantly in the mouth of the Columbia and other rivers at the time of the salmon run. Its usual weight in the Columbia is about 12 pounds, but it occasionally reaches 20 or 25 pounds. The fishes seen in the river mouth at the time of the early salmon runs are evidently spent fishes. They are lean and lank, the flesh is pale and poor, and the bones are hard, for all of which reasons it is, or ought to be, rejected by the canners, although there is no doubt that the Steel-head, when taken at its best, may be one of the finest of all trout. It certainly reaches a larger average size than any other real trout in any country. Its scientific name is *Salmo gairdneri*, named for Dr. Gairdner, of Astoria, who first discovered the species and sent it to John Richardson. The fact that these fishes are spent in the spring would indicate a spawning time later than that of the salmon—probably midwinter—and they are probably found in the rivers at this time, because they are returning toward the sea. Steel-heads are most abundant in the Columbia, but they are not infrequently taken in the Sacramento, and several young specimens have been sent to me by Mr. Ramon E. Wilson, of the State Fish Commission, from the Eel River and the Klamath River. It is not unlikely that the most of the trout in the coastwise streams of northwestern California belong to this species.

Comparing the Steel-heads with the Rainbow trout, we find no differences, other than the former is of much larger size, and has a larger mouth, and its caudal fin is truncate instead of forked. But the tail becomes more truncate and the mouth larger with age in all species of salmon and trout. If a Rainbow trout were to reach the size of the Steel-head, it ought to acquire characters similar to those of the latter species. It is not at all unlikely that the Steel-head is simply a Rainbow trout which has descended into the sea, and which has grown larger and coarser and acquired somewhat different form and habits, on account of its food and its surroundings. If this be true, the very young Steel-heads would not be distinguishable from the young Rainbow trout, and I do not know a single structural character of any kind by which the two may be separated. In every other case there is some mark, some difference in the number of scales or bones, by which we can tell the species of trout, the one from the other; but in the case of the Steel-head there is absolutely no such difference. The Rainbow trout is a small, plump fish, found in the fresh-water streams, and having certain peculiarities of form and coloration. In every internal respect, in every bone and every part of its structure, the Steel-head and the Rainbow trout agree, and so it is one of the unsettled problems connected with the fisheries of California whether the Steel-head is a distinct kind of

trout, or whether any Rainbow trout, placed in the ocean or the river mouth, and allowed to feed on the rich food which the salmon gets, would not, in time, develop into a Steel-head regardless of the form of its parents. The evidence, so far as it is in, is conflicting. There are some things which go to show that the two are distinct fishes. Other evidence would show that they are simply forms of the same thing, and a thorough study of the coastwise streams of this State is necessary before this point can be settled. If the two are the same, then the name *Salmo irideus* must drop from our lists, because the Steel-head was first introduced to science, and the name of *Salmo gairdneri* is the oldest.

The remaining trout of this coast is the species known as the Cut-throat trout, or *Salmo mykiss*. This is the longest known of the American trout, having been discovered first by Steller, who gave it the Russian name of *mykiss*, which science has preserved. It is the most widely distributed of all our trout, being found throughout Alaska, Kamtschatka, in all the streams of Washington and Oregon, in the northwestern part of this State, throughout the rivers of the Great Basin of Utah, in all the streams on both sides of the Rocky Mountains until we come to the desert lands, where the washes of sand make the streams uninhabitable to any trout, and thence extending its range southward in the mountains as far as the springs in Chihuahua, the southernmost point reached by any trout in any country. Throughout this vast area the *Salmo mykiss* is found. It is subject to very great variations according to the character of the water, according to the food which it receives, and according to various other less known circumstances. It is, however, in all this region, substantially the same fish. In some places it reaches a weight of 25 or 30 pounds. In the southernmost limit of its range it never becomes more than a fingerling, but everywhere in this whole great region every specimen retains more or less distinct traces of the same mark—a deep crimson or scarlet blotch on the half-concealed membrane between the two branches of the lower jaw—the mark which has suggested the name of Cut-throat trout. It has much smaller scales than the Rainbow trout or the Steel-head. In fact it has smaller scales than any other of the known species of trout, although much larger than the scales of any of the charrs. In a longitudinal series along the side the usual number is about 175. Excepting the red blotch and the presence of black spots somewhere, all other details of coloration are extremely variable. As we go eastward the spots tend to bunch themselves more and more on the tail, so that in eastern Colorado, on the Rio Grande and the Platte, most specimens that are taken are spotted almost entirely on the tail. In Washington and Oregon the spots are usually evenly divided over the back, and in the trout of Lake Tahoe they commonly cover the belly also. In California it has been positively found only in Lake Tahoe, in the Feather River, and in some streams of the northwestern part of the State. It will probably be found to be the common trout of Lassen and Modoc Counties, and perhaps along the east slope of the entire Sierra Nevada. The largest known specimens have been taken in Lake Tahoe and in the salt water about Puget Sound. Here it is a very common fish. As in the case of all trout entering salt water, these sea-run individuals are more silvery and less spotted than those found in the mountain streams and the lakes. The presence of salt water in all fishes destroys the black spots and markings which are found in fresh water, replacing

them by a uniform silvery hue. The same effect is noticeable when trout enter alkaline lakes. Thus, the trout of Utah Lake are more silvery than those which inhabit any of the surrounding streams, the waters of Utah Lake, in the summer at least, being milky with alkali.

The remaining fish of this family to which I need refer, is the Dolly Varden trout, or charr, which is the finest of the trout-like fishes on this coast. It is found in the upper Sacramento, and thence along the line of the Cascade Range as far as Kamtschatka. It often enters the sea, where it loses its spots and becomes plain silvery gray. I have myself obtained a specimen, weighing 11 pounds, near Seattle, in Puget Sound. but in the mountain streams specimens weighing even a single pound are comparatively rare. It is true of all the trout that their size depends upon the conditions. They all grow large in the sea, and in the little mountain brooks their size corresponds to their advantages; every trout, large or small, is perfect so far as he goes. The Dolly Varden trout is scarcely different from the Eastern Brook trout, the slight difference being, on the whole, to his advantage. It is rather plumper in body than the Brook trout of the East. The red spots are found on the back as well as on the sides, and the back and upper fins do not show the dark green marblings which are characteristic of *Salvelinus fontinalis*. In food, in body, and in gaminess, the Dolly Varden, or *Salvelinus malma* (this, too, a Russian name, first given it by Steller), is not inferior to its Eastern cousin.

Everywhere on the Pacific Coast, in the clear streams of the Cascade, the Sierra Nevadas, and even the Coast Range of mountains, some species of trout abounds. This region should be the paradise of anglers. In the East, according to the words of the veteran angler, Rev. Myron W. Reed, the day of the trout is passed:

“This is the last generation of trout fishers. The children will not be able to find any. Already there are well-trodden paths by every stream in Maine, in New York, and in Michigan. I know of but one river in North America by the side of which you will find no paper collar or other evidence of civilization. It is the Nameless River. Not that trout will cease to be. They will be hatched by machinery, and raised in ponds, and fattened on chopped liver, and grow flabby and lose their spots. The trout of the restaurant will not cease to be. He is no more like the trout of the wild river than the fat and songless reedbird is like the bobolink. Gross feeding and easy pond life enervate and deprave him. The trout that the children will know only by legend is the gold-sprinkled living arrow of the white water; able to zigzag up the cataract; able to loiter in the rapids; whose dainty meat is the glancing butterfly.”

OFFICE OF THE BOARD OF FISH COMMISSIONERS, }
SAN FRANCISCO, March 15, 1892. }

[BULLETIN No. 5.]

To game dealers, hotel and restaurant keepers, and all persons engaged in the business of dealing in or selling ducks or English snipe:

Your attention is especially called to the following ordinance, adopted by the Board of Supervisors of the City and County of San Francisco, July 22, 1890:

ORDER No. 2,249.

PROHIBITING ANY PERSON FROM HUNTING, PURSUING, SELLING, KILLING, OR OFFERING FOR SALE, ETC., ANY MALLARD DUCK, WIDGEON, ETC., BETWEEN THE FIRST DAY OF MARCH AND THE FIRST DAY OF SEPTEMBER, OF EACH YEAR.

The People of the City and County of San Francisco do Ordain as follows:

SECTION 1. It shall be unlawful for any person, between the first day of March and the first day of September, of each year, in the City and County of San Francisco, to hunt, pursue, kill, or destroy, or to buy, sell, barter, exchange, offer or expose for sale, transport, or have in his possession, any mallard duck, widgeon, teal, redhead, pintail, gadwall, wood duck, or Jack Wilson snipe, commonly known as English snipe.

SEC. 2. Any person violating the provisions of this order shall be deemed guilty of a misdemeanor, and upon conviction thereof shall be punishable by a fine of not less than fifty dollars, nor more than five hundred dollars, or by imprisonment in the county jail for not more than six months.

JOHN A. RUSSELL, Clerk.

Approved: San Francisco, July 22, 1890.

E. B. POND,

Mayor, and ex officio President Board of Supervisors.

It is the intention of the State Board of Fish Commissioners to enforce the above ordinance by prosecuting every person who, between the first day of March and the first day of next September, shall sell, offer or expose for sale, or have in his possession, any of the ducks mentioned in the above ordinance, or any Jack, or English snipe, whether the same be held in cold storage or otherwise.

Issued by order of the Board.

RAMON E. WILSON,
Secretary.

OFFICE OF THE BOARD OF FISH COMMISSIONERS, }
SAN FRANCISCO, July 12, 1892. }

[BULLETIN No. 6.]

Three specimens of trout caught in Mount Whitney Creek, on Mount Whitney, by Mr. Harvey, of Lone Pine, Inyo County, California, and by him given to Hon. George S. Mills, Fish Commissioner of Nevada, who in turn sent them to Mr. William H. Shockley, were sent to Dr. David S. Jordan, President of Leland Stanford, Junior, University, with request that he classify them. The following is what Dr. Jordan has to say of them:

They are the famous Golden trout of Mount Whitney and the upper Kern River, which has attracted the attention of anglers for some little time, but which has not yet, so far as I know, received any adequate notice in print.

The trout were first brought to my notice by Lieutenant Wheeler's geological survey, which brought me specimens in 1877. These were not in very good condition. I regarded them as of the same kind as the trout in the headwaters of the Colorado, at the same time calling attention to the remarkable distribution of species on both sides of the desert and the mountains. Later on I received other small specimens, but still in such poor condition that I could do nothing more with them. The three received were in perfect condition, and I have had a colored painting made of them. The fish is really a distinct species of trout, entirely different from any found elsewhere, either in the Rocky Mountains or Sierra Nevadas. The very small size of its scales, the lack of teeth on the hyoid bones, and the peculiar color markings, are all distinctive of this trout, which will in time receive a name of its own.

It seems evident, so far as one can judge of such matter, that this trout is descended from the trout of western Colorado, which abound in the tributaries of Clear River, the Green River, and the Grand River, and in the Gunnison district. But in being separated from these trout it has undergone a considerable change, and one would think this separation must have occurred before the Sierra Nevadas were elevated. It has already been claimed by geologists that the Kern Valley, although on the California side of the Sierras, is geologically a part of the Great Basin. Its trout, at any rate, are wholly different from the Rainbow trout of California.

Issued by order of the Board.

RAMON E. WILSON,
Secretary.

DESCRIPTION OF A NEW SPECIES OF TROUT (SALMO
KAMLOOPS).

FROM THE LAKES OF BRITISH COLUMBIA.

By DAVID STARR JORDAN.

Salmo Kamloops. Species nova.

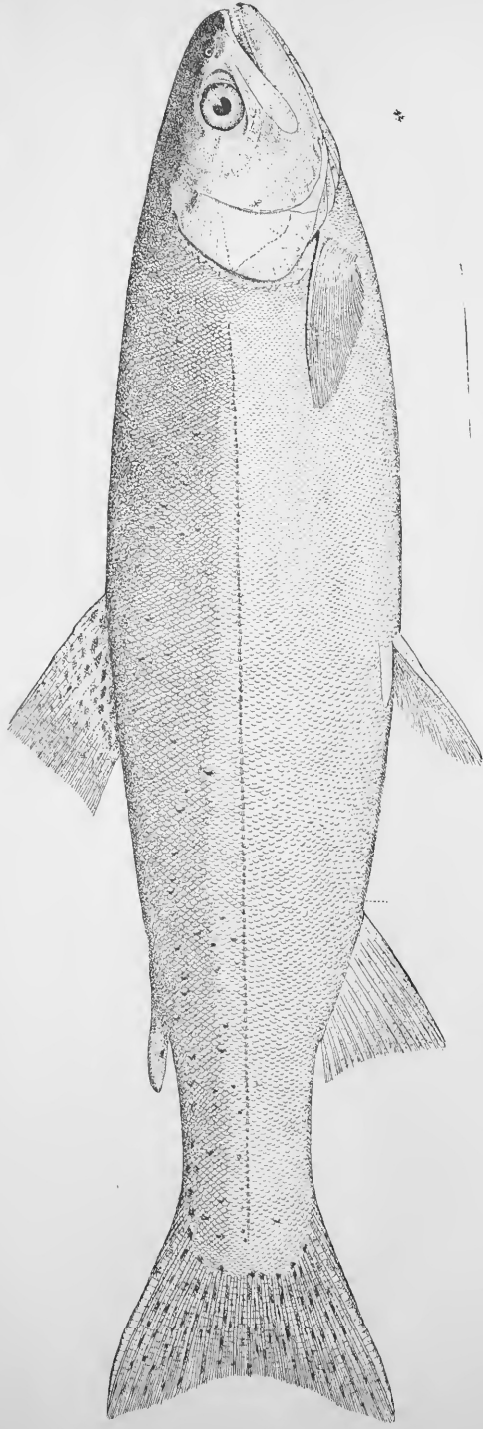
Head $4\frac{1}{2}$ in length to base of caudal; depth, $4\frac{1}{3}$; dorsal rays, 11, not counting the rudiments; anal rays, 11 in one specimen, 12 in the other, besides 3 rudiments; scales, 30-145-26 (in second specimen 135 scales); about 120 pores; length of body, largest specimen, $16\frac{1}{4}$ inches; smallest specimen, $15\frac{3}{4}$.

Body moderately elongated, somewhat compressed, the general form resembling that of a Silver salmon (*Oncorhynchus kisutch*); jaws in the typical specimens not prolonged, the maxillary extending beyond the eye, its length not quite half the head; snout slightly rounded in profile, the profile regularly ascending; eye large, about as long as snout, $4\frac{1}{2}$ times in head; teeth moderate, some of those in the outer row in each jaw moderately enlarged; teeth on tongue and vomer, as usual in *Salmo gairdneri*; opercles striate, not much produced backward; branchiostegal rays, 11 on each side; dorsal fin rather low, its longest ray slightly greater than the base of the fin, $1\frac{2}{3}$ in head; anal fin lower and smaller than usual in *Oncorhynchus*, but larger than usual in the trouts, its outline slightly concave, its longest ray greater than the base of the fin and a little more than half-head; adipose fin moderate; caudal fin rather broad, distinctly forked, its outer rays about twice inner; pectoral fins rather long, $1\frac{1}{3}$ in head; ventrals moderate, $1\frac{2}{3}$ in head; gill-rakers comparatively short and few in number, about 6+12, or 11.

Coloration dark olive above, bright silvery below, the silvery color extending for some distance below the lateral line, where it ends abruptly; when fresh the middle of the sides in both specimens was occupied by a broad band of bright light rose-pink, covering about one third of the total depth of the fish; back above with small black spots, about the size of pin-heads, irregularly scattered, and somewhat more numerous posteriorly; a very few faint spots on upper part of head; dorsal and caudal fins rather closely covered with small black spots similar to those on the back, but more distinct; a few spots on the adipose fin, which is edged with blackish; lower fins plain; the upper border of the pectoral dusky; a vague dusky blotch on the upper middle rays of the anal; ventrals entirely plain.

The intestines had been removed, and so no account can be given of the pyloric cœca.

The existence of this fish was first known to me from conversation with Mr. A. C. Bassett, of Menlo Park, California, a very enthusiastic angler, who had taken the fish in the Kamloops Lake in British Columbia. I was unable to identify the fish from the account given by Mr. Bassett. In going for a summer outing in July, 1892, Mr. Bassett went



THE KAMLOOPS TROUT. (*Salmo Kamloops.*)



to Kamloops Lake and secured the two type specimens, which were carefully placed in alcohol and sent to me. The following statement of their habitat was furnished me by Mr. Bassett:

These specimens were taken at the outlet of Kamloops Lake into the South Thompson; the North Thompson River flows into the upper end of the same lake. These waters connect with the Shuswap Lakes, and this fish we find in all the tributaries of the last named lakes, also in Okanagan Lake, the waters of which flow towards the Columbia (the other lakes being tributary to the Fraser River). Reliable information gives the weight of the largest specimen ever caught in Okanagan Lake as 17½ pounds. The Shuswap Indian name for this salmon is *Stit-tse*. They have been taken fifty miles below the Kamloops Lake in the Thompson River, but not in large numbers.

Mr. Bassett has since informed me that the species is found also in Kootenay Lake, and that it is locally known as Silver trout.

This seems to be a species of trout distinct from those hitherto authentically recorded from the waters of the Pacific Coast. There is not much doubt, from the account of Mr. Bassett, as well as from the appearance of the fish, that it is a "land-locked" species. Its nearest relationships seem to be with the Steel-head trout, or Salmon trout (*Salmo gairdneri*), from which it differs somewhat in coloration, and especially in the longer pectoral fin and in the form of the preopercle. It is, however, not unlikely that it is descended from *Salmo gairdneri*. This species is really intermediate between the ordinary trout and the Pacific salmon, composing the genus *Oncorhynchus*, and its characters indicate the necessity of replacing all in the genus *Salmo*.

I have given the species the name of the lake from which it was first taken. One of the two type specimens has been sent to the United States National Museum, and the other is in the museum of the Leland Stanford, Junior, University. With these two specimens was a small fish about 5 inches long, of the kind on which these salmon were feeding. This little fish was without spots, and has some 18 rays in the anal fin. Apparently it is the young of the Quinnat salmon; certainly it is not the young of the species in question.

PALO ALTO, September 12, 1892.

DESCRIPTION OF THE GOLDEN TROUT OF KERN RIVER.

SALMON MYKISS AGUA BONITA.

By DAVID STARR JORDAN.

I have lately received from Mr. W. H. Shockley, of San Francisco, three specimens, each about 7 inches in length, of the Golden trout of Kern River. These specimens were taken by Mr. Harvey, of Lone Pine, California, in a stream called by him Whitney Creek, on the west side of the Sierra Nevada, near Mount Whitney. The specimens were sent in ice to Mr. George T. Mills, Fish Commissioner of the State of Nevada, who forwarded them to Mr. Shockley. The following is a detailed description:

Salmo Mykiss Agua Bonita. New sub-species.

Head, $3\frac{3}{4}$ in length; depth, $4\frac{1}{3}$. D. 2, 12; A. 1, 10. Scales, 130 to 200 rows; 121 to 124 pores. Length, 7 inches.

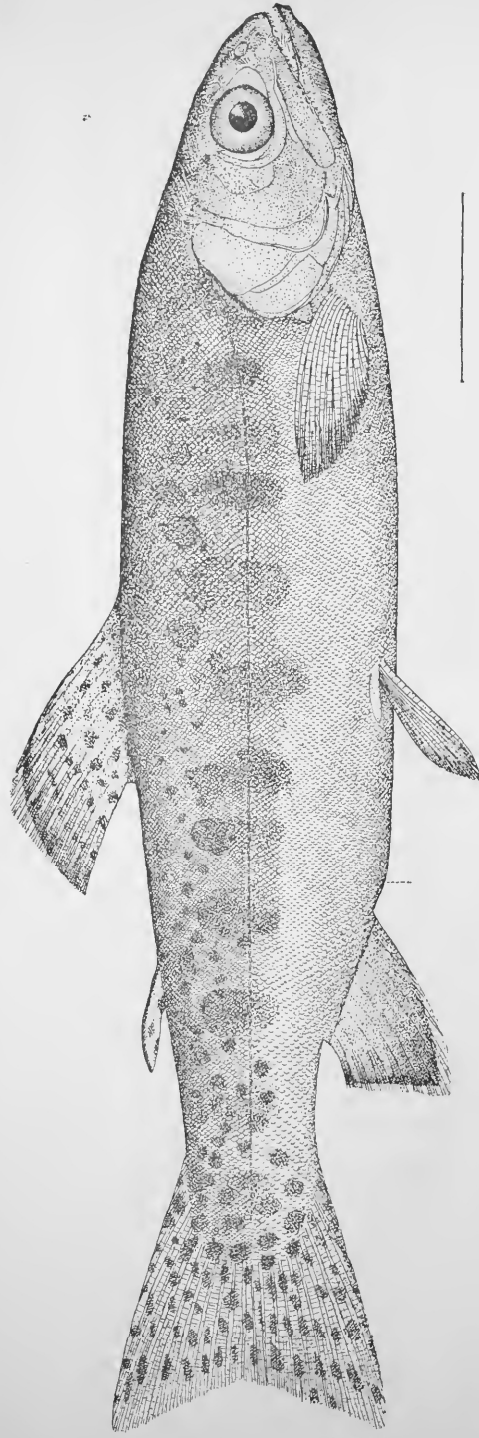
Body formed about the same as usual in *Salmo mykiss* and its varieties. Head rather long, bluntish at tip; mouth moderate, the maxillary extending a little beyond the eye, $1\frac{1}{3}$ in head. Hyoid teeth not evident; opercle moderate. Its greatest length $4\frac{1}{2}$ in head; its posterior margin moderately convex. Eye, $4\frac{2}{3}$ in head; snout, $4\frac{1}{2}$; gill-rakers not very short, x+11 or 12 in number.

Scales extremely small, smaller than in any other species of *Salmo*. Fins moderate; the anal high, the caudal moderately emarginate; pectoral, $1\frac{1}{2}$ in head; ventral, 2; caudal, $1\frac{2}{5}$.

Olive above; sides and belly light golden; about twelve dark cross-bars on middle of sides; these the usual parr-marks; middle of sides along lateral line with a deep scarlet lateral stripe, broadest under the dorsal, where it is about as wide as eye; thence narrowing to either end, and not reaching either head or caudal; middle line of belly with a broad scarlet band, extending from chin to anal fin, equally bright all the way; a fainter shade along lower side from anal fin to tip of caudal; no crimson dash at throat between branches of lower jaw; the whole region uniform bright orange; opercle largely orange.

Dark spots chiefly posterior, as in *spilurus* and *pleuriticus*, large and well marked, some as large as pupil on tail and posterior part of body; smaller and well marked on dorsal; a few small ones scattered along forward to the head in two specimens; none on body before adipose fin in the other.

Upper anterior angle of dorsal abruptly yellowish white; this color edged by a dark oblique streak, made by coalescent spots; the rest of the fin light olive with four or five rows of small black spots; pectorals light orange; ventrals deep orange, with a faint blackish tip; the anterior edge of the fin conspicuously and abruptly whitish, as in *Salvelinus fontinalis*; anal dusky orange, the tips of the last rays blackish, the outer anterior corner abruptly white, the white stripe wider than the pupil, and separated from the color of the fin by a dusky shade.



THE GOLDEN TROUT. (*Salmo gairdneri*.)



Caudal olive, tinged with orange on its lower edge, and profusely spotted with black. Inside of mouth pink; of gill cavity light orange.

Of the three typical specimens, two have been sent to the United States National Museum, and one remains in the museum of the Leland Stanford, Junior, University.

This trout is evidently an off-shoot or descendant of the widely-distributed Cut-throat trout, or *Salmo mykiss*, which is found in all the rivers suitable for trout between the Sierra Nevada and the Rocky Mountains. It, however, differs from any known specimens of any of the many varieties of *Salmo mykiss* in its pattern of coloration and the absence of the deep red patch between the branches of the lower jaw, from which *Salmo mykiss* receives its common name—Cut-throat trout—and in the small size of its scales, which are more numerous than in any of the forms of *Salmo mykiss*. Matters of less importance, which are, however, comparatively distinct, are the presence of white and black edges to the fins, and in the absence of teeth on the hyoid bone. The name *Agua bonita*, suggested for the species, is that of the falls in Volcano Creek.

The earliest record of this trout, is that of Jordan and Henshaw in Appendix NN of the annual report of the Chief of Engineers for 1878, p. 195.

The specimen collected by Mr. H. W. Henshaw, in 1875, from the South Fork of the Kern River, and No. 17,107 in the National Museum collection, is here referred to, *Salmo pleuriticus*, Cope. With this reference is the remark, that "the extension of its range west of the Sierra Nevada is rather unexpected. The prevalent theory that most of the species of trout have a narrow local range is hardly supported by a study of our western forms." This trout, Mr. Henshaw says, was "abundant in the South Fork of the Kern River, beyond which statement nothing can be said of its distribution on the western coast, or of its abundance as compared with *S. irideus*, the distinctness of the forms not having been recognized at the time of collection."

On page 195 of the same paper is a reference by Mr. Henshaw to the "Golden trout," which apparently belongs to the species here described, although Mr. Henshaw identifies his specimens taken from near Mount Whitney with the *Salmo irideus*. Mr. Henshaw says:

This is the common Brook trout of the small mountain streams of the Pacific Slope, and up to an altitude of 9,000 feet it is the rare exception to find a suitable stream that is not well stocked with it. Upon many of them, as the tributaries of the South Fork of the Kern River, these trout are found in very great abundance, each pool and rapid numbering its finny denizens by the score. They may be taken in any sort of weather, at any hour of the day, by almost any kind of bait. During the heat of the day they frequent almost entirely the deeper pools, lying under overshadowing rocks or in the shade of some convenient log; in early morning or late afternoon they come out and run more into the shallows and rapids, under which circumstances they bite best and furnish the finest sport. Like the average Brook trout, the species rarely attains any considerable size, ranging from 4 to 8 or more inches in length. Their colors are usually very bright, and for beauty this species takes rank among the foremost of its kind, and has been well called the "Golden trout." In this respect, however, it is subject to the usual variations obtaining in the family, the change of color not only accompanying a difference in locality, but being plainly discernible in individuals taken in different parts of the same stream not far distant. In fact, as a specific character, color in this family seems to be at its lowest value. The character of the bottom and water itself has much to do with this, and I remember to have fished in a small rivulet on one of the sub-alpine meadows not far from Mount Whitney, whose sluggish waters flowed over a bottom of dark mud, in which the color of the trout simulated very closely its hue; they had lost nearly all the flashing iridescent tints characterizing the same species caught but a few hours before in another stream, and had become dull and somber-hued. Accompanying this change of color was a correspondingly noticeable difference in habits and motions, and

the several dozen trout caught that evening for supper were taken out with the hook with the display of very little more gaminess than would be noticed in so many Horned Pout. On the contrary, in the clear, rapid current of the mountain stream, a flash of sunlight is scarcely quicker than the gleam of gold and silver seen for a single instant as the whirling waters are cut by one of these trout, as he makes a rush from his lurking place for some chance morsel which is being borne past him. The western trout are rarely as shy as their relatives of Eastern waters, and because of their numbers and the consequent scarcity of food, are apt to be less fastidious; yet even when most abundant, due caution must be used if one would be successful, and not every one can catch trout, even in the West. With the proper care in concealing one's self, a pool may be almost decimated ere the alarm will be taken, and I have seen fifteen fair-sized trout taken from a single small pool in quick succession.

During the present year other specimens have been sent to the museum of the Leland Stanford, Junior, University, but in such very bad condition that nothing could be made of them, except that they were evidently small scaled trout of the *mykiss* type, and nearest to the sub-species *pleuriticus* of the Colorado River, and not in any way related to the Rainbow trout, which inhabits most of the streams of the basin of California.

In a pamphlet entitled "Whitney Photo-Campers," written by Mr. W. E. Houghton, of Bakersfield, California, and bearing the following title: "Whitney Photo-Campers, Bakersfield to Mt. Whitney and Return, July 30 to August 23, 1889: An Abstract of General Results, with some Details of the Beauties and Marvels of Kern River," I find the following references to the Golden trout, and the streams in which it occurs:

Camp Beautiful was made that day on Whitney Creek, near the Natural Bridges, at 2 P. M. The whole current of Whitney Creek foams under those bridges of lava. It is from here, and for only a distance of three hundred yards in length, namely, from Agua Bonita Falls to the Chute, that the only Golden trout in the United States can be caught. The deeper the pool the darker the fish in color, but all, as drawn from the water, have a genuine golden sheen. Whoever makes the journey below these falls deserves a prize, for it is a most difficult undertaking; but while he will be fully repaid with one Golden trout, a loaded basket will be his reward.

This whole country is distinctly volcanic. At the Divide there is a small mountain, whose surface is as red as ordinary brick. From this Red Mountain—as locally named—a stream of lava at some time flowed directly in the course of Whitney Creek as far as Kern River. At different points the trail passes over this irregular bed, while there are large piles of it on either side. In places the stream and the elements have washed the earth away, leaving perpendicular masses of lava, just as when it was in a molten state. Occasionally there will be a cave. Natural Bridge Creek forms from seven springs, all within a radius of one hundred yards, and not more than two hundred yards above the bridges. At the point where the waters all join just above the bridges, they form a good-sized trout stream, which precipitates itself over the rocks and down its steep bed, a mass of foam until it reaches Whitney Creek. One bridge is about fifteen feet wide, the other at least thirty. From the surface of the water, is on the upper side about ten and on the lower side forty feet. In every direction from the bridges are views of grandeur and beauty. Looking east is a beautiful little meadow with springs of water flowing into it from almost every direction. To the left, almost touching the trail, one spring sends a volume of water out of the side of a bare mountain, which equals the flow of the largest artesian well in the valley. To the south rises a timbered slope covered with pines, manzanitas, and cedars. Northward is the stream of lava, just across Whitney Creek, and back of it a perpendicular cliff towering at least a thousand feet above the spectator. But the grandest view of all is toward the west. Whitney Creek takes a leap into space. It must be at least 2,000 feet above Kern River, which the creek rushes down to meet in less than a mile. One looks down and down to fathom the end of the headlong career, to see boiling foam with occasional lines of soft, hazy blue between cliffs of enormous proportions. And at the end, across the cañon of Kern River, there rises a snow-capped giant 14,000 feet in height, which bars the rushing waters and baffles the vision. Besides numerous cascades, there are in this short distance three waterfalls, the largest perhaps 125 feet in height.

A graphic story of Golden trout is told by the Captain of the Pilgrims: "You can only get below this fall at one point, and that by an extremely hazardous route, only possible by aid of the firmly-rooted and stout bushes. Down this cliff I went with many a choky feeling, for if a bush was to give way, then good-bye all. Once at the bottom, right amid the spray of the falls, I lost all interest in the scenery and bother about brush, and fell to hook and line as quickly as possible. Down in the beautiful deep pool below me in an instant I hooked a ten-inch Golden trout, to be followed by another and another, and as many as I wanted, in rapid succession. The stream of ages has





worn into the lava mountain, until away above my head it was a huge overhanging cliff, threatening in appearance to fall at any time, and bury me mountains deep. Once out from under, I drew a long breath and reasoned. Certainly that cavern and cliff has stood just as it is for 3,000 years, anyhow; it ought reasonably to last a few days longer; and besides, those dearly beloved Golden trout. So back under the beetling precipice again; back to the sport I had come so far to seek. The waters roared, the spray ascended, the mighty rocks continued their rest of ages, and the golden beauties rose with all the fervor of the tallest kind of true love to the cast of my glittering fly."

As far up the cliffs as the spray can reach the rocks are mantled with lichens, ferns, flowers, shrubs, beautiful grasses and mosses, and in the niches, fashioned by water in perfect regularity and symmetry, vegetable growth attains rare luxuriance; while above the reach of the water, the rocky battlements have the barrenness of desolation. The lava is porous and light, but tough and enduring, and with its different strata or layers, presents a bewildering variety of colors. The broken debris at the mountain's feet is tenanted by a world of ground-hogs, whose piercing whistles are ever-sounding notes of alarm and orders for prompt disappearance.

In a recent letter from Mr. Houghton, to whom I am indebted for a copy of the above-named pamphlet, he writes:

In the first place, "Whitney Creek" is not the proper name of the stream in which they are caught, although it is almost universally so called. The proper name is undoubtedly "Volcano Creek," so called because it runs through a bed of lava and lava formation for about ten miles from its confluence with Kern River. "Whitney Creek" proper heads in a little lake directly at the base of "New Mount Whitney," at the point where Professor Langley had his camp when making atmospherical experiments, and flows into Kern River twelve or fifteen miles north of the mouth of Volcano Creek. The latter creek does not receive any of the water shed off either old or new Mount Whitney, consequently I claim that it has no right to the name of Whitney Creek.

As the book states, the Golden trout are only to be found between Agua Bonita Falls and the Chute.

The first time I was there was in 1879. At that time the meat of every fish caught was a deep golden yellow. I was again there in 1887, and noticed that we occasionally caught one with white meat. In 1889 more than —? of our catch were of white meat. This demonstrates very plainly that they are crossing with trout from above Agua Bonita Falls, which are the ordinary species of Brook trout. Fish cannot get up the Chute from Kern River, nor can they get up Agua Bonita Falls.

Now, from the very peculiar form of the fish, I am more than inclined to think they are an entirely different species from any on the coast. You will observe this in the direct rise of the meat from the head to the back, giving them an almost hump-backed appearance; the same spread on the sides is something unusual. I have never seen any other trout with this peculiarity.

The question of the relation of this trout to others in Kern River must be settled by further investigations, as also the question whether the *Salmo Agua Bonita* itself is confined to the space in Volcano Creek between the two waterfalls mentioned, or whether in that part of the stream is found a variety different from the ordinary form.