California. Dept. of Fish and Game.
Biennial Report 1905-1906.

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REPORT

OF THE

State Board of Fish Commissioners

OF

CALIFORNIA

SACRAMENTO RIVER, OR QUINNAT, SALMON—*Onchorhynchus chouicha.*

1905-1906

SACRAMENTO

W. W. SHANNON, - - - - - - SUPERINTENDENT OF STATE PRINTING

1907

NINETEENTH BIENNIAL REPORT

OF THE

State Board of Fish Commissioners

OF THE

STATE OF CALIFORNIA,

FOR THE YEARS 1905-1906.

COMMISSIONERS:

W. W. VAN ARSDALE, - - - - - - - - - - - - San Francisco
W. E. GERBER, - - - - - - - - - - - - - - Sacramento
JOHN BERMINGHAM, JR., - - - - - - - - - - - Pinole

CHAS. A. VOGELSANG, *Chief Deputy*,
SAN FRANCISCO, CAL.

SACRAMENTO:
W. W. SHANNON, : : : SUPERINTENDENT OF STATE PRINTING.
1907

CONTENTS

APPENDIX

NINETEENTH BIENNIAL REPORT

OF THE

STATE BOARD OF FISH COMMISSIONERS.

To Hon. George C. Pardee,

Governor of the State of California:

Sir: In accordance with law, the State Board of Fish Commissioners submits for your consideration its Nineteenth Biennal Report, the same being a record of its work and expenditures from September 1, 1904, to September 1, 1906.

We also submit for your consideration the recommendations which, in our judgment, and based upon our experience in carrying on this work, would tend to the betterment of existing conditions as they refer to the fish and game interests of our State.

Since the Eighteenth Biennial Report was issued, the personnel of this Board has undergone one change. At a meeting held on March 23, 1905, Mr. John Bermingham, Jr., of Pinole, who had been appointed by you as a member of the Fish Commission, presented his credentials and was thereupon seated as a member of this Board.

Regular meetings of the Board have been held during the first of every month, and at such other times as the interests of the work seemed to require.

We are pleased to report that, in spite of the great disaster which visited San Francisco and destroyed our offices in the Mills Building, together with most of their contents, our Chief Deputy, Mr. Charles A. Vogelsang, saved the minute book, containing the records of every meeting, since June 3, 1898; also the expenditure book, showing the amount of every claim drawn against the funds over which we have control, since July 1, 1905. The fishermen's licenses for the current year, duplicate bills, inventories of State property, deeds, leases, contracts, and book of arrests were also saved. We regret, however, to state that our library and long list of reports from other states, together with a great deal of valuable data on fish cultural work in this State

and elsewhere, were lost; also all of the correspondence. Reports of the work of the previous Boards, as shown by their biennial reports since the Commission was first organized, were also destroyed. With respect to the latter, we are pleased to say that we have succeeded, through the courtesy of the U. S. Bureau of Fisheries and through correspondence with people in this State who had saved such reports, in reëstablishing a fairly good file. In addition, Hon. George M. Bowers, Commissioner of Fisheries, and Dr. T. S. Palmer, in charge Game Preservation, U. S. Biological Survey, at Washington, D. C., have donated to us many valuable publications concerning the work of their respective departments, and also solicited publications from other states in our behalf. We have, therefore, the nucleus of another library.

Owing to the complete interruption of all transportation lines it was impossible to carry away from the building any of our specimens or heavy books. Previous to leaving the office the Chief Deputy filled the vault with the most valuable books, literature, reports, stationery supplies, typewriter, and other essentials, in the hope that they would be safe, but the conflagration and the destruction it wrought are now matters of history. The vaults were not built to withstand such intense heat, and on being opened it was found that the contents had been reduced to ashes.

The loss of important data and manuscripts that had been carefully collected with a view of incorporating them in our Nineteenth Biennial Report is severely felt and has involved additional labor and research in order to make an intelligent and comprehensive report.

Immediately following the fire our office was temporarily established at the private home of the President of the Board, Hon. W. W. Van Arsdale, from which point we directed the movements of the patrol force and got in communication with the different hatchery stations, and the office was continued there until the transportation problem was in a measure solved. Through the courtesy of John P. Irish, Naval Officer of the Port of San Francisco, we were offered temporary quarters in the United States Customs House, and arrangements were being made to accept, when a second offer came to us through the courtesy of Arthur M. Briggs, Secretary of the State Board of Trade, in the Ferry Building. As the latter point possessed many advantages in respect to accessibility from all quarters, as well as convenience for the movements of our patrol force, the offer was accepted, and since May 9, 1906, we have been occupying our present small but comfortable quarters, and will remain here until larger accommodations can be secured.

Public interest in our work has largely increased and the volume of correspondence grown accordingly. We now feel that we have developed sufficiently to justify dividing our office work into departments, to successfully accomplish which we will require at least three rooms—

one to be used as a meeting room for the Board, a separate room for the stenographer, to be used also for files, stationery supplies, etc., and a third for the use of deputies, and to receive those having business with the office. When a change is made from our present quarters we shall endeavor to carry out this plan.

We are pleased to report satisfactory results from the amendments that were introduced at the last session of the Legislature, and which became laws with your approval. The amendment that reduced the bag limit on doves from fifty to twenty-five and placed them on the non-sale list has met with universal approval.

The entire family of shore birds (*Limicolæ*) were added to the non-sale list. This restriction, with the establishment of a close season of eight months (making an open season that runs concurrent with the duck law), is working very satisfactorily; in fact, we see no reason for change in seasons, except as to doves. In many states of the Union the dove is not allowed to be killed at any time, and it is unquestionably a fact that, under the present law, which permits their killing on the 1st of July, thousands of nestlings and breeding birds are cruelly destroyed. There is a strong sentiment, notably in the southern section of the State, that the dove be protected at all times; in other words, added to the list of non-game birds. Undoubtedly the long open season, the excessive bag limit, and sale in the markets were responsible for the large decrease in their numbers. The recommendation we offer now is, that the date of the open season be changed from July 1st to July 15th, and extend to October 15th—making a season of three months. Considering the subject from a humane standpoint, and the fact that the dove is really a friend of the horticulturist, as it lives largely on the seed of noxious weeds, are in our opinion sufficient reasons why a shorter season and greater protection should be given this bird.

With respect to the present deer law, we find that in those sections of the State where the conditions are at all favorable, deer have shown a decided increase. In the southern portion, where forest fires have denuded the mountains and where the increase in population has been extraordinary, deer are very scarce; in fact, almost exterminated. Some urge that a close season for a term of years be established. With that contention we do not agree, as the present restrictions are, in our judgment, ample. It is not reasonable to expect that in the more densely settled counties game can show an increase. Civilization and wild game can not increase in an equal ratio; in fact, the converse is true: the greater the increase in population, in that same ratio will there be shown a decrease of wild game.

In some quarters there is a desire to divide the State into fish and game districts. Other states that have tried the experiment have gone back to a general State law. The Federal Department of Game Preser-

vation has had an opportunity to observe the workings of a State divided into districts. As a result of its observations that department is strong in its opposition to the district plan. While we realize that a general State law does not always work to the entire satisfaction of every section, it does so far as the general interests of game are concerned, and is to its advantage. Much confusion over imaginary lines is avoided in a simple and direct State law.

In our Eighteenth Biennial Report, touching upon the duck law, we recommended that the bag limit be reduced from fifty to twenty-five. In the Legislature two years ago there was an attempt made to place ducks on the non-sale list, but the sentiments of the members, the press, and the public generally, were strongly opposed to such a measure, which was supported by only a few, representing largely the sportsmen's element of the State, and it was defeated. In the present duck law there are serious defects that should be remedied. Evasions are easy, both in the field and in the markets. There has been much criticism of our patrol work, alleging that little if any attention has been paid to the market hunter; also, that we have allowed a single individual or firm to receive hundreds of ducks in a single day when the bag limit permits but fifty. Under the present statutes, transportation companies are exempted from the bag-limit provisions; otherwise embarrassing situations would arise. For example, two men hunting together and each kills the bag limit, and presents it to a transportation company, one man only could ship his bag; the other would have to wait until the following day. The market dealers were not slow to perceive where they could accomplish an evasion legally, and that has been done by incorporating and organizing themselves into transportation companies. As their business is conducted throughout the year and they transport and handle fruit, produce of all kinds, poultry, and game, and it is so set forth in their articles of incorporation, they can with perfect safety handle as many ducks as any regular transportation company. We have successfully prosecuted a good many individuals who were found with more than the legal limit, but when it came to those dealers who were using the transportation scheme, decisions were against us.

Two years ago, we prepared and presented to the Legislature a bill providing a graduated license for all individuals or concerns who bought and sold ducks, in other words, handled them for profit. This bill provided that commission houses and game dealers should keep a record—open to inspection of this Board and its deputies—of all parties from whom they purchased ducks; making it unlawful to accept more than the bag limit of twenty-five birds from any individual in one day; it also placed a license on the market hunter, who had to affix not only his name, but his license number on every bag of ducks he shipped; that any ducks coming to market without such name and license number

be confiscated, and that the same license number under different names meant confiscation of the birds. It was also made an offense for any agent of any transportation company to accept for shipment to market any ducks that were not so tagged with the name and license number. This, in our opinion, is the only way in which the market hunter can be held in check and compelled to comply with the law. Otherwise, it is practically impossible to obtain sufficient evidence to warrant a conviction. In the San Joaquin and Sacramento valleys, which are the great duck-hunting sections of the State, all sorts of schemes and evasions are resorted to. The hunters are on the ground and know every inch of it; they have numerous assistants who ship ducks under their individual names, thereby permitting some families to ship as many as two hundred and fifty ducks in a single day. With a license scheme in operation, each hunter would have to pay the license fee, which would add considerable to our resources and would give us complete control of the market hunters by putting a check on the violations at their source, and relieve this Board of the expense of so many deputies in the cities, where most of the game is handled. It would prevent the so-called sportsmen who shoot for profit and pleasure from shooting and disposing of their game unless regularly licensed. Even with a bag limit of twenty-five, which is three times the amount that any sportsman and his family can consume, there would remain a large number of birds to be disposed of. If a market hunter can ship twenty-five birds in one day, or, if possible, take out two licenses under different names and shoot fifty birds, he would still be under control. Commission houses, hotels, or restaurants which handle ducks for food, have none of the pleasure of the chase; in other words, handle only those which have already been killed. The bag-limit provisions would not apply to them except in this respect: that not more than the legal limit should be received from any one person during one calendar day. We estimated that such a license bill would prove a source of considerable revenue, which would enable us to add more men to our force, better patrol the State, besides reducing, probably fifty per cent, the number of birds killed; it would make a more uniform supply for the market; there would not be the waste that there is under the present system, which responsible dealers tell us amounts to fully one third of the number received, as the market is often glutted and the birds spoiled before they can be sold. For these reasons, we believe that so long as ducks are sold in the markets, such a measure would more nearly meet the approval of our Legislature and the requirements of our people, and be supported by them more than any other measure relating to the protection of ducks that has yet been presented.

In addition to the foregoing, we would recommend that an annual license fee of $1 be imposed on every individual who shoots protected

game birds or animals. Such a license plan is in operation in sixteen of the states of the Union and four provinces of Canada, and is working very satisfactorily, besides producing a large revenue, which enables the commissioners to better patrol their states by a considerable increase in their force of deputies, without a tax on the general fund. Such a law would be of great value in our State, owing to its size. But few of the counties appoint game wardens, and in most cases they are selected merely to pay off some political obligation, and consequently good results do not follow. The office, therefore, falls into disfavor, the people realizing that, for the additional tax imposed upon them to maintain a game warden, who is often incompetent or worse, they are receiving no benefit. Another reason why this measure should commend itself to the Legislature is that this slight tax of $1 would fall only on the men who shoot protected game, and does not apply to the individual who does not hunt or has no interest in sport of that kind.

ARRESTS AND FINES.

We are proud to submit the following record of the arrests made during the past two years and the aggregate amount of fines imposed for violations of the fish and game laws. A close reading of this table will be interesting to those who desire to learn to what extent we have enforced the law, and is our reply to a question frequently asked. It will also indicate something of the great variety of work our patrol force is called upon to perform. This statement is taken from our docket of prosecutions, which shows the cases in detail. The work has been far-reaching and thorough. By far the larger number of arrests have been made by our regular patrolmen; though some have been made by men of the Forest Service, and others interested in this work, who have been empowered by us with authority to make arrests for violation of the fish and game laws. In our opinion, all of the cases made throughout the State are directly traceable to the salutary influence created by some important arrest made by one of our older and more experienced deputies.

In a large number of cases, pleas of "guilty" were entered, which indicates that the evidence had been carefully collected, and was so complete that the defendants were glad to throw themselves upon the mercy of the court. Sometimes, we have regretted that this was done, as it gave the court opportunity to show more leniency than in our opinion was warranted by the gravity of the offense, resulting in a small fine. We have investigated hundreds of complaints not all of which were made in good faith. Some we found grew out of spite work, and there was not sufficient evidence to warrant a prosecution.

We have strongly insisted upon this point: that we regard the arrest of an individual an important matter to him as well as to ourselves, and the evidence in every case should be sufficient to command the respect of the judge and the jury. We have been criticised at times because we have not caused an arrest upon some complaint that was undoubtedly made in good faith, but the investigation did not develop sufficient evidence, in our judgment, to take the case into court. We know that so many pleas of guilty are entered owing to the fact that deputies have used careful judgment before making arrests.

For the two years ending August 31, 1906, our force has to its credit 774 arrests, against 550 for the two preceding years, showing a gain of 224. For violations of the game laws 450 arrests were made, against 325 for the preceding two years. For violations of the fish laws 324 arrests were made, as against 225 for the preceding two years. The total amount of fines imposed for violations of both fish and game laws is $23,154.90. Of this amount $13,600 was imposed for violations of the fish laws, and $9,554.90 for violations of the game laws. The largest amount imposed for transgression of any of the game laws was for violations of those provisions which relate to deer, there being 165 arrests, and fines imposed amounting to $4,330, as against $100 in 1897–98. The next was for violating the law relating to striped bass, for which offenses the aggregate sum of $4,120 was imposed, as against $100 ten years ago.

We believe in following a liberal but progressive policy, forging ahead from year to year, and carrying with us public sentiment, the support of which is absolutely essential to a proper enforcement of these laws.

That our policy has been supported is shown by the larger number of arrests and amounts paid in fines. We recognize the existence of slight inequalities in the law, but we believe it to be the part of wisdom to make haste slowly; to hold to that of which we are sure and which our people are learning to respect more and more every year.

The public, the courts, and the peace officers are becoming more familiar with the fish and game laws, and, with the limited number of changes we will recommend, a large majority of our people will be satisfied that their best interests are fully served.

Our regular deputies have seized thousands of pounds of fish and game in transit; fish that were underweight, or that had been taken in violation of the law; prohibited game offered for sale, or shipped contrary to statutory provisions; also for violation of the bag limit. In many cases, conviction followed the seizure. In others, owing to the use of fictitious names, we were unable to locate the shippers; their punishment was effected by confiscation of the shipment, which penalized them to the extent of getting no returns for the time or labor involved in its capture.

More than 60,000 pounds of dried shrimp and shrimp shells were taken; 19,000 pounds of striped bass; 2,600 pounds of salmon; more than 8,000 pounds of steelhead; more than 300 dozen ducks; 50 dozen quail; besides snipe, plover, deer meat, etc. This evidence was placed in cold storage until the cases were disposed of, after which it was distributed among the various hospitals, orphan asylums, etc., of San Francisco. The Little Sisters of the Poor, the Almshouse, and the Protestant and Hebrew Orphan Asylums were among the beneficiaries. We have received grateful letters of acknowledgment from all of these institutions.

A good many deer hides were also seized, and in nearly every case of violation of the deer law, a few hides were collected, which aggregated quite a number. In the absence of any statute providing for their disposition, they were disposed of to a tannery, in accordance with previous custom, and the proceeds placed to the credit of the Game Preservation Fund.

FISH CASES.

Summary of Arrests made by Deputies of the Fish Commission, and Disposition of Cases for Two Years ending August 31, 1906.

Number of Arrests.	Violation Charged With.	Convicted.	Acquitted.	Dismissed.	Fines.	Number of Days' Imprisonment.
*18	Catching or possession of salmon, closed season	11	2	4	$1,300 00	500
6	Saturday and Sunday fishing for salmon, shad, and striped bass	4		2	800 00	
*99	Possession or selling under-weight striped bass	88	2	8	3,340 00	33
19	Trout in possession, close season	19			385 00	10
10	Excess bag limit trout	8		2	280 00	
6	Buying and selling under-weight trout	4	1	1	60 00	27
1	Spearing trout	1			20 00	
8	Steelhead trout, close season	8			180 00	
*18	Sturgeon in possession	15		2	345 00	
2	Taking black bass other than with hook and line	2			40 00	
5	Black bass, close season	4		1	100 00	
7	Catching or possession of the young of fish	7			175 00	150
16	Using set nets	10	1	5	750 00	100
17	Using small mesh nets	14		3	3,210 00	
2	Nets extended more than ½ across stream		2			
10	Shrimp nets for catching fish	10			200 00	
5	Crawfish, close season	4		1	85 00	
14	Crawfish, illegal size	9	3	2	195 00	
11	Abalones, illegal size	11			310 00	
4	Abalone shells, illegal size	4			125 00	
1	Crabs, close season	1			20 00	
5	Female crabs in possession	4		1	80 00	
5	Offering for shipment dried shrimp or shrimp shells	5			250 00	
5	Absence of screens on ditches	5			100 00	
3	Fishing without license			3		
16	Using explosives	6	2	8	1,000 00	335
*11	Polluting waters of the State	1		9	250 00	
324	Total	255	13	52	$13,600 00	1155

*4 cases pending.

GAME CASES.

Summary of Arrests made by Deputies of the Fish Commission, and Disposition of Cases for Two Years, ending August 31, 1906.

Number of Arrests.	Violation Charged With.	Convicted.	Acquitted.	Dismissed.	Fines.	Number of Days' Imprisonment.
2	Doves, bag limit	2			$50 00	
14	Doves, close season, killing or possession	6		8	155 00	
1	Doves, illegally shipped, concealed package	1			25 00	
13	Ducks, bag limit	10	2	1	475 00	
24	Ducks, close season, killing or possession	18		6	445 00	27
13	Netted ducks (drowned)	10		3	250 00	
25	Night shooting	19	1	5	360 00	10
3	Shooting on enclosed land (trespass)	2		1	50 00	
5	Quail, bag limit	4		1	150 00	
82	Quail, close season, killing or possession	64	4	14	1,750 00	
12	Buying or selling quail	9		3	280 00	
4	Trapping quail without permit	1		3	40 00	
3	Live quail in possession without permit	2		1	50 00	
35	Killing deer, close season	34	1		975 00	
57	Deer meat in possession, close season	50	1	6	1,485 00	
3	Pursuing deer, close season	2		1	65 00	
1	Bag limit, deer	1			25 00	
*3	Sale of deer meat	1		1	25 00	
1	Buying deer meat	1			25 00	
*2	Pursuing deer with dogs, close season	1			25 00	
*42	Killing female deer and fawns	28	6	4	1,100 00	25
7	Possession of female deer hides, spotted fawns	6		1	210 00	
18	Possession of deer hides, evidence of sex removed	11	1	6	395 00	25
3	Sale of deer hides	1		2	25 00	
1	Snipe, bag limit	1			25 00	
1	Snipe, close season, killing or possession			1		
1	Snipe, offering for sale			1		
1	Grouse, close season, killing or possession	1			25 00	
2	Pheasants, killing or possession			2		
5	Plover, close season, killing or possession	5			125 00	
2	Curlew, close season, killing or possession	2			50 00	
9	Tree squirrels, killing or possession	7		2	175 00	
2	Mountain sheep, killing	1	1		25 00	
8	Swans, killing or possession	4		4	100 00	
45	Non-game birds, killing	40	2	3	594 90	50
450	Totals	345	19	80	$9,554 90	137

*6 cases pending.

SEIZURE OF FISH, GAME, ETC., MADE BY DEPUTIES, 1905-1906.

29 set-nets removed from water. Owners unknown. Lines destroyed.
14 small-mesh nets removed from water. Owners unknown. Lines destroyed.
10 salmon nets removed from water. (Saturday and Sunday fishing.) Owners unknown. Lines destroyed.
6 sections sturgeon lines. Owners unknown. Lines destroyed.
34,340 pounds dried shrimps. Returned to owners, by order of the court.
14,440 pounds shrimp shells. Returned to owners, by order of the court.
18,656 pounds striped bass. Donated to hospitals and asylums.
2,605 pounds salmon. Donated to hospitals and asylums.
691 pounds sturgeon. Donated to hospitals and asylums.
175 pounds sturgeon eggs. Donated to hospitals and asylums.
8,740 pounds steelhead. Donated to hospitals and asylums.
605 pounds trout. Donated to hospitals and asylums.
660 pounds crawfish. Donated to hospitals and asylums.
544 pounds black bass. Donated to hospitals and asylums.
309 dozen ducks. Donated to hospitals and asylums.

50 dozen quail. Donated to hospitals and asylums.
10 dozen snipe. Donated to hospitals and asylums.
22 dozen plover. Donated to hospitals and asylums.
4 dozen curlew. Donated to hospitals and asylums.
21 dozen blackbirds. Donated to hospitals and asylums.
12 dozen robins. Donated to hospitals and asylums.
6 dozen sandhill cranes. Donated to hospitals and asylums.
1½ dozen owls. Donated to hospitals and asylums.
4 swans. Donated to hospitals and asylums.
2 song thrush. Donated to hospitals and asylums.
3 great stilt. Donated to hospitals and asylums.
20 dozen small birds. Donated to hospitals and asylums.
2 dozen pheasants. Donated to hospitals and asylums.
1 dozen tree squirrels. Donated to hospitals and asylums.
288 pounds, 4 carcasses, and 4 hams deer meat. Donated to hospitals and asylums.

The following comparative table is interesting, showing the increase in the number of arrests from year to year and the amount of fines imposed during the past ten years:

Biennial Period.	Violation of Deer Law.		Violation of Quail Law.		Violation of Duck Law.		Violation of Salmon Law.		Violation of Striped Bass Law.		Illegally Used Nets Seized and Confiscated.	Total Fines from All Sources.
	No. of Arrests.	Fines.	No. of Arrests.	Fines.	No. of Arrests.	Fines.	No. of Arrests.	Fines.	No. of Arrests.	Fines.		
1897-1898	11	$100	7	$40	14	$220	19	$200	8	$100	30	$3,125 00
1899-1900	37	735	13	350	6	220	18	900	47	805	23	5,779 00
1901-1902	75	1,600	97	1,775	30	545	23	2,400	26	185	28	9,497 00
1903-1904	135	3,035	109	2,344	20	375	15	1,040	69	1,340	47	11,738 00
1905-1906	172	4,355	106	2,270	75	1,530	39	3,350	103	4,120	59	23,154 90

FINANCIAL STATEMENT.

The resources and expenditures of this Commission have been as follows for the fifty-sixth and fifty-seventh fiscal years, ending June 30, 1906:

FIFTY-SIXTH FISCAL YEAR.

	Resources.	Disbursements.
Appropriation for support and maintenance of State hatcheries	$12,500 00	$12,500 00
Appropriation for restoration and preservation of fish	10,000 00	10,000 00
Appropriation for restoration and preservation of game	7,500 00	7,500 00
Steelhead Propagation Fund—		
Balance on hand July 1, 1904	625 33	
Drawn from fund during year		489 62
Balance on hand June 30, 1905		135 71
Game Preservation Fund—		
Balance on hand July 1, 1904	1,916 86	
Receipts from fines during year	4,019 15	
Amounts drawn during year		4,620 55
Balance on hand June 30, 1905		1,315 46
Fish Commission Fund—		
Balance on hand July 1, 1904	7,325 52	
Receipts from licenses and fines	10,026 35	
Amount drawn from fund during year		12,377 57
Balance on hand June 30, 1905		4,974 30
Totals	$53,913 21	$53,913 21

FIFTY-SEVENTH FISCAL YEAR.

	Resources.	Disbursements.
Appropriation for support and maintenance of State hatcheries	$12,500 00	$12,500 00
Appropriation for restoration and preservation of game	12,500 00	12,500 00
Appropriation for restoration and preservation of fish	10,000 00	10,000 00
Steelhead Propagation Fund—		
Balance on hand July 1, 1905	135 71	
Drawn from fund during year		135 71
Game Preservation Fund—		
Balance on hand July 1, 1905	1,315 46	
Receipts from fines during year	5,295 89	
Amount drawn during year		4,888 80
Balance on hand June 30, 1906		1,722 55
Fish Commission Fund—		
Balance on hand July 1, 1905	4,974 30	
Receipts from licenses and fines	10,340 35	
Amount drawn from fund during year		10,255 54
Balance on hand June 30, 1906		5,059 11
Totals	$57,061 71	$57,061 71

SISSON HATCHERY.

In our biennial report covering the years 1903–04 we made extended reference to the record accomplished at this, one of the most important fish cultural stations in the United States. We are pleased to report that the record made two years ago has been surpassed in many respects since that time. The $10,000 appropriation granted for "Improvements of Sisson Hatchery" has been repaid to this State more than tenfold. We knew that we had at that station trained hatchery employés, whose long experience and knowledge of fish culture made them the equal of any men in similar work in this country. Until the above appropriation was granted we were not able to make them comfortable on the grounds, or to compensate them fairly, for the services they were rendering. In the past two years we have installed a complete electric lighting plant, operated by our own water supply, which now furnishes light to the three hatchery buildings, the food-preparing establishment, the residence of the superintendent, and the two cottages on the grounds. The third hatchery we were able to construct and furnish completely without asking a cent of appropriation therefor. It has a capacity somewhat larger than our main hatchery building. The details in reference to these improvements, together with the construction of new fish ponds, will be found in the following report of Superintendent W. H. Shebley, of that station.

On the additional acreage of land which we were able to purchase through the appropriation, we have yet a great deal of space that is available for the construction of new ponds, and which will be utilized as our

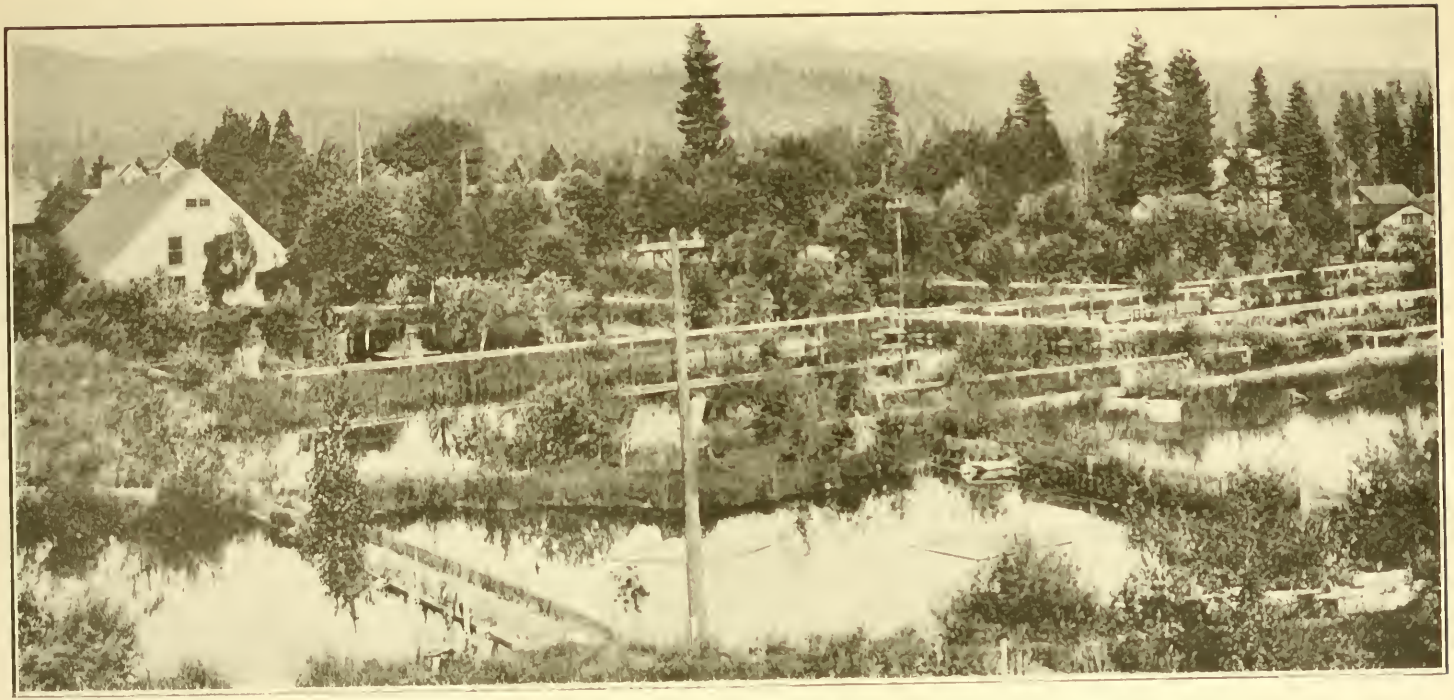
means will permit. All of the improvements made have been of a permanent character. The only expense is the one of maintenance.

The new hatchery (already referred to) enabled us in the past year to handle, in conjunction with hatcheries "A" and "B," the largest number of salmon eggs ever handled under one management in the world. Since these improvements were completed the station has been visited by Mr. L. F. Ayson, Fisheries Commissioner of New Zealand. Mr. Ayson has been actively engaged in fish cultural work for upwards of thirty years. He has visited the principal hatcheries in the United

SISSON HATCHERY, SISSON, CALIFORNIA.
(Mount Shasta in the background.)

States and Canada and those on the Continent of Europe three times. We therefore feel his opinion is entitled to respectful attention. He informs us that the fish cultural work, as he saw it at Sisson, is "head and shoulders" above anything in Europe and "equal to the best he has ever seen." "In my opinion the Sisson Hatchery has the finest location of any I have ever seen, and the high quality of the work is reached by only a few; the standard of the general output is beyond that of any station that has come under my observation."

With reference to the details, we respectfully submit the following report of W. H. Shebley, Superintendent of Sisson Hatchery, whose reputation as a skillful fish culturist is second to none:



HATCHERY "A," SISSON, CALIFORNIA. SECTIONAL VIEW OF GROUNDS AND REARING PONDS.

SISSON, CAL., October 1, 1906.

To the Honorable the Board of Fish Commissioners of the State of California.

GENTLEMEN: I herewith submit a report of the operations of Sisson Hatchery for the years 1905–1906.

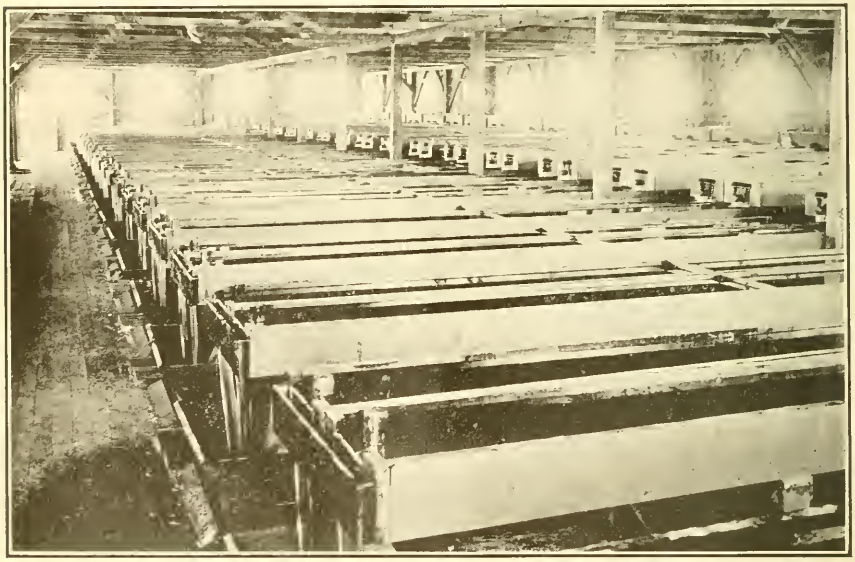
Since my report of two years ago, we have improved the method of handling the spawning fish, increased the capacity of the hatcheries, and enlarged the pond system. The large number of Quinnat salmon eggs collected at the United States egg-collecting stations at Baird, Battle Creek, and Mill Creek, during the fall and winter of 1904–05—brief mention of which is made in the appendix of your biennial report for 1903–1904—compelled us to erect a battery of salmon-hatching troughs. It was built on a sloping piece of ground lying below our main line of ponds. This work was begun in the latter part of November, 1904, and rushed as fast as possible so as to have it in readiness for the large number of salmon eggs that were being collected by Captain Lambson, Superintendent of the Bureau of Fisheries stations, located at Baird on the McCloud River

SUPERINTENDENT'S COTTAGE, SISSON HATCHERY.

and at Battle Creek and Mill Creek. As the time was too short to put up even a temporary building, the battery was put up in the open, and the troughs fitted with wooden covers to keep out the frost and the snow. We made 250 salmon egg-hatching baskets and borrowed 300 from the Bureau of Fisheries; these, with the 750 belonging to this station, enabled us to successfully hatch the 87,000,000 salmon eggs that we received that season. As the hatch of 1903–04 (58,000,000 salmon eggs) at this station was the largest hatch of salmon eggs on record at one station at one time, we again kept our record good, and the 87,000,000 hatched during the season of 1904–05 again placed us at the head of the list. Although the open battery gave us good results so far as hatching the eggs and rearing the fry were concerned, it was very hard on the men, who were exposed both night and day to the inclemency of the weather during the greater part of the time the eggs were hatching. At this altitude (3,500 feet) in mid-winter the climate is rigorous—cold, north wind, sleet, and snow for several days at a time are com-

HATCHERY "C," SISSON, CAL. PARTIAL VIEW OF TROUT-REARING PONDS.

mon—and any work in the water is disagreeable to say the least. Early in the summer of 1905, after consultation with your Chief Deputy, Charles A. Vogelsang, as to ways and means, and being assured by him that, owing to the large amount collected in fines for violations of the fish laws, which he thought would enable us to meet the expense of this new building without waiting for a special appropriation, I recommended to your Honorable Board the construction of a new and permanent hatchery of a slightly greater capacity than the old building. As soon as our pond work would allow, we began the erection of a building 40 by 120 feet, one third pitch roof, 10 foot sides. It was built by our regular crew, and when completed was the most substantial building on the grounds. It was made plain and durable. The troughs were set on long sills running lengthwise with the building, and no joists or flooring used. A gangway or walk was built between each of the sections, thus making a good dry walk or aisle between the sections of troughs. The outlets for the escape of water from the troughs are built so as to keep the volume of water in view until it falls into the waterway that carries it away from the building. This enables the assistants or any one passing through the main aisle of



VIEW SHOWING HATCHING TROUGHS, HATCHERY "C," SISSON, CAL.

the building to see at a glance if the water is running freely through all the troughs. This is quite an improvement over the old system. The building contains 92 troughs, and with those in the other two hatcheries make a total of 230 troughs, which have a capacity of over 1,300 baskets.

Early in the fall of 1905 the great number of salmon in the Sacramento River gave promise of a larger number of eggs than were taken the previous season, showing that the salmon in the Sacramento River were still on the increase. This proved to be true. We received from the Bureau of Fisheries Stations during the fall and winter of 1905-06, 96,550,000 Quinnat salmon eggs, which were successfully hatched with only a small loss, and the fry liberated in the Sacramento River. This we were enabled to do by having the new hatchery completed and the nursery system for rearing the fry improved. The fry were released at a time when they were in the best condition for starting on their journey to the ocean; that is, when their sac of pabulum was absorbed enough to allow them to swim freely. This plan of liberating the fry has proven most successful. If they are fed or held too long at the hatching station, they do not move down the stream as rapidly as they should, and consequently a larger percentage are

left behind in fresh water, where they get stunted and do not make well-developed salmon. This way of handling the fry seems to be the most natural, as the instinct of the spawning salmon is to ascend the fresh-water streams as far from the ocean as possible, and there deposit their eggs, so that when the fry are ready to start on the way to the ocean they may be prepared by a diet of fresh-water food (insect larvæ, both land and aquatic varieties) before entering brackish or salt water, where the food is too coarse for them in their earlier stages, or when they first begin to feed. A second reason for believing that the present system is the most perfect, is that the delicate condition of the young salmon when it first begins to swim will not allow it to enter salt water, and a certain time must elapse before it becomes hardy enough to make the change. This has been demonstrated by actual experiments, and the best reason is the fact that as soon as the present system was adopted the salmon soon made a remarkable increase in the Sacramento River, and will undoubtedly continue to thrive so long as the Bureau of Fisheries and the California Fish Commission work in conjunction, and with the same skill and good management that have been employed in collecting and eyeing the eggs at the Bureau of Fisheries Stations.

The work of hatching the large number of salmon eggs received at this station for the last two years was greatly facilitated by the installation of an electric lighting plant. It furnishes the lights for the three hatcheries, as well as for the dwellings and grounds. The use of the electric lights is of great advantage to the work. The work of handling the eggs at night during the hatching period is now as easy as in the day time, and the night crew keep the eggs and fish in as good condition as the men do who work in the daytime. This way of working the eggs and embryos at night keeps them in good order, and prevents the delicate embryos from getting smothered and injured. This is a great improvement over the old way of hatching salmon eggs, when the work was all done in the daytime and the eggs left without any attention at night. During the last two years we have increased our pond system. Two years ago we had 19 rearing ponds, 3 spawning ponds, and 10 nurseries, a total of 32. At the present date (September 30, 1906) we have 29 rearing ponds, 4 spawning ponds, and 12 nursery ponds, a total of 45. We have several more planned to be built the coming season.

There are 98,050 fish in our ponds, divided as follows:

10,000	Adult Rainbow trout.
4,500	Two-year-old Rainbow trout.
4,000	Yearlings, 6 to 9 inches in length.
20,000	Fry, 2 to 2½ inches in length.
38,500	Total Rainbow trout.
4,500	Eastern Brook trout, adults.
3,000	Two-year-old Eastern Brook trout.
4,000	Yearlings, Eastern Brook trout, 4½ to 8 inches in length.
15,000	Fry Eastern Brook trout, 2 to 2¾ inches in length.
26,500	Total Eastern Brook trout.
500	Adult Loch Leven trout.
4,000	Thirty months old.
3,000	One year old, 4 to 9½ inches.
10,000	Fry.
17,500	Total Loch Leven trout.
500	Three- ear-old Steelhead trout from Eel River.
5,000	Bream or Shiners.
4,000	Sunfish.
200	Golden-Rainbow trout, 3 to 6 inches in length.
700	Red-Rainbow (select stock, a series of experiments).
600	Graylings, two years old.
500	Land-locked Salmon, two years old.
50	Adult Dolly Varden trout.
4,000	Land-locked Salmon fry.
98,050	Total number of all varieties of fish.

The output of fish from Sisson Hatchery for the last two years, from October 1, 1904, to October 1, 1906, is as follows:

1905.

Salmon fry	87,000,000
Cut-throat trout fry	250,000
Steelhead fry	108,000
Sunfish	1,040
Shiners	200
Eastern Brook trout fry, 1½ to 3 inches in length	460,000
Eastern Brook trout fry, two years old	5,200
Eastern Brook trout fry, one year old	9,200
Rainbow trout fry, 1½ to 2½ inches in length	596,000
Loch Leven trout fry	168,000
Total	88,597,640

1906.

Salmon fry	96,550,000
Grayling fry	150,000
Rainbow trout, two years old	1,600
Rainbow trout, one year old	8,000
Rainbow trout fry, 1½ to 2½ inches in length	937,000
Eastern Brook trout, one year old	9,000
Eastern Brook trout fry, 1½ to 3 inches in length	600,000
Loch Leven trout fry, 1½ to 2 inches in length	219,000
Loch Leven trout, one year old	2,000
Loch Leven trout, two years old	1,600
Land-locked salmon fry	6,000
Sunfish	1,000
Total	98,485,200

Making a grand total of 187,082,840.

In June, 1904, we received a shipment of 100,000 Grayling eggs from Bozeman, Montana. They arrived in good order, and in due time hatched out. They were the first Grayling eggs ever brought to California, and we were not prepared to handle them properly. Dr. Henshal, Superintendent of the Bozeman Station, kindly sent me instructions in regard to the best method of hatching and rearing them. They are naturally a very delicate egg and produce a great many weak embryos that are very hard to raise and if placed in the ponds with the others soon fall a prey to the predatory habits of the more precocious ones. This habit seems to change to a great extent as they get older. After they are a few months old they do not appear to be any more predatory than the trout. We placed the young Graylings in a pond where there was a good supply of fresh water, and we succeeded in raising about 7,000 of them until they were about a year and a half old, when they became restless and uneasy and made frantic efforts to escape from the pond. I examined them closely, but could not find anything wrong with them. There were no signs of any sporadic disease. The pond was clean and the water pure. They would work night and day at the screens in their mad efforts to escape. The current of water at the inlet was changed so that they could not get near the screens, and the number of shades or floats increased so that they could keep entirely hidden if they wanted to, but to no avail. Shortly afterwards they quit feeding and in a few weeks began to get diseased and die. We gave them what appeared to be the proper treatment, and did all in our power to arrest the disease, but within two months they all died except 600. Knowing of the failures of others who had tried to raise them in artificial ponds, particularly in some of the Northwestern States, where nearly all attempts to raise them on artificial food had failed, I concluded that they, like the trout, must return to nature until we can get them domesticated. I accordingly built a pond on a piece of swamp land on the lower end of the hatchery grounds, and turned a stream of water into it from the creek. All the grass, rushes, and brush were left in the pond, which covers a half acre of ground. The Graylings were then placed in the pond, shortly after they began to improve from the epidemic, where they became contented, and have been in perfect condition ever since. At this date, October 1st, ten

months since they were put in, they are fat and have nearly doubled their size. From these I expect to get eggs enough this coming season to give us a start, and in a short time I hope to be able to handle them as successfully as trout. For some unknown reason they do not stand the advance of civilization the same as the trout. As soon as the forests are cleared and the land cultivated, and villages, cities and factories are built along the course of their native streams, they begin to disappear. According to well-authenticated accounts, in Michigan and other Northwestern States, where there were thousands of them a few years ago, they are now very scarce. In the mountainous districts of California there are hundreds of lakes and streams that will remain in natural condition where the Grayling can find a wild state in which, I believe, they will thrive as well as they did in their native waters before they were disturbed by the settlement of white men in the country. I would respectfully recommend that your honorable Board arrange to secure other shipments of eggs from

HATCHERY "B," SISSON, CAL.

Bozeman Station, the same as we received this spring, to hatch and plant in the wilder and more remote parts of the country, until such time as we can raise a stock of our own, which I hope to do before long.

During the last two year there has been no serious loss from disease among the trout in our ponds. Several times diseases common to trout have broken out among them, but a little treatment always brought them out all right.

Predatory birds and animals have given us more or less trouble in some of our ponds, but during the last summer we began a systematic work of trapping and hunting them and now we have them thinned out to such an extent that as soon as one shows up we discover it and at once arrange our traps, and in a day or two we have the animal or bird (whatever it happens to be) captured and killed.

Following is a list of animals and birds shot and trapped on the hatchery grounds during the spring and summer of 1906: 10 fish eagles, 8 minks, 2 bitterns, 2 hawks, 3 raccoons, 76 kingfishers, 7 skunks, 3 herons, 4 cats, 6 shrews, 8 merganser or fish ducks, 2 mudhens, 2 divers, 3 sandpipers, 3 ouzels, 2 owls.

All of the animals and birds killed or trapped on the fishery grounds were found to be killing and eating fish, except the skunks. They may do so, but as yet we have found no evidence thereof, although it appeared several times as if they were after the fish in the shallow nurseries.

During the winter of 1904–05 another small cottage was built on the grounds for the pond-keeper and his family. It was built near the meat house, where the fish food is prepared, and where he can always be on hand to look after the screens, regulate the water, etc.

We have been busy this summer repairing the ditches and ponds, and painting the buildings, troughs and baskets, to have everything in readiness for the salmon hatch this fall. We have also been busily engaged in distributing the fish from the ponds and hatcheries. The yearlings were distributed in the spring, but owing to their size the work is very expensive and slow. If there were more funds allowed for this work a greater number of yearling fish could be raised and distributed. The fish make such

POND-KEEPER'S COTTAGE, SISSON HATCHERY.

a rapid growth in this water that the yearlings, running from 4½ to 8 inches in length, are hard to ship, as only a few can be carried in a can. If the Legislature would allow money enough to construct a transportation car, the same as is used in most of the Eastern States and by the United States Fish Commission, a great many more large fish could be handled.

Since the construction of the new hatcheries and nurseries, where we have a great deal more room for our fry, they have grown proportionately larger. The fry that we began shipping at the first of the season averaged from 1½ to 1¾ inches in length, and those shipped during the latter part of the season averaged from 2 to 2½ inches in length. In the last two seasons, since we have had more room for rearing them, we have not shipped any fry less than 1½ inches in length.

In conclusion, I beg to say that I feel a justifiable pride in the record and work done at this station in the last two years, and feel more than grateful to the members of your honorable Board, and to the chief deputy, for the valuable assistance and support that have been given to me and my assistants in conducting the work of the station.

Respectfully submitted.

(Signed) W. H. SHEBLEY,
Superintendent of Sisson Hatchery.

THE SALMON LAW.

Since our last report on the salmon industry, made two years ago, it is gratifying to be able to show still greater results from our system of artificial propagation, supplemented by the important and far-reaching effect of the Saturday and Sunday close season. It is an acknowledged fact that the runs of salmon in the Sacramento and San Joaquin rivers, and their tributaries, are fully restored. This is corroborated by the testimony of all the intelligent salmon fishermen, some of whom have been operating at the same point for upwards of thirty years, and who claim that there are more salmon in our rivers to-day than there were thirty years ago, when the limited demands on our streams were made principally by the Indians and a few wild beasts.

We believe that when the condition of an industry has reached the point where a concession to the people can be safely made, we should be the first to recognize and recommend it. We would therefore respectfully recommend that the beginning of the general close season for taking salmon be changed from the 10th to the 15th of September, and remain closed until the 20th of October, but that no change be made in the existing law referring to the season above tide water.

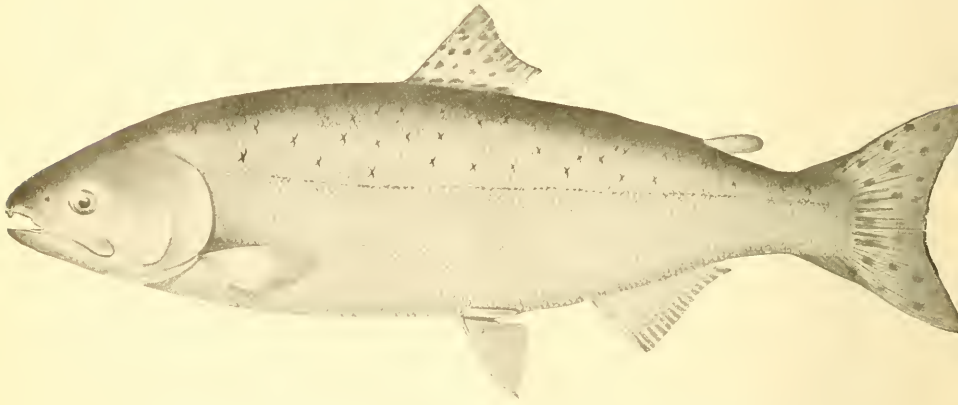
Close observation of the matter for the past four years indicates strongly that the fall run of salmon is appearing later. For the past three years the run has not put in appearance on the rivers until about the 25th of August, leaving but a very short time for the fishermen to operate, when it is considered that the Saturday and Sunday law still further reduces the time. This has had the effect of closing down the canneries and cold-storage plants before the run had reached its height, which accounts for a slight decrease in the pack of salmon during the past two seasons, as the bulk of the fish were passing the fishing grounds protected by the close season.

As the sole purpose of the close season is to permit the fish to reach the egg-collecting stations, in order that a sufficient number of eggs can be taken and hatched to maintain the supply, we believe that the runs have increased to such an extent that we can with perfect safety allow a greater number to be taken for food, and still secure a sufficient number of eggs to fill our hatcheries.

The praise that has been bestowed by the Bureau of Fisheries at Washington on the record made in salmon culture in this State is most gratifying. Dr. David Starr Jordan, of Stanford University, an eminent authority, has pronounced our work in that particular the finest example in the United States. We are also privileged to quote the opinion of Mr. L. F. Ayson, Fisheries Commissioner of New Zealand, who has been engaged in practical fish cultural work for upwards of thirty years, in

the course of which he has visited the principal hatcheries in England, Scotland, and on the continent of Europe, besides having made three trips to the United States and Canada. He unhesitatingly pronounced the Sisson Hatchery one of the best that has come under his observation, and the methods that are followed and quality of work turned out of the first order.

The increase and development of the salmon industry since artificial propagation began can be best shown by quoting a few examples. Up to five years ago, salmon were shipped into this State from Oregon and Washington, because the local supply was not sufficient. For the past four years the tide has been going the other way. Not only are we shipping salmon in carload lots to cities like Portland, Tacoma, and Seattle, but making large consignments to New York, Boston, and Chicago, besides fully meeting the local demands. During the past



SACRAMENTO RIVER, OR QUINNAT, SALMON—*Onchorhynchus chouicha.*

summer, owing to the largely increased runs in Monterey Bay, fresh salmon have been shipped in refrigerator cars from Monterey to New York City on express trains, and there transferred into the refrigerating department of ocean liners and landed in Europe and sold as fresh salmon within two weeks from the time they were taken from the waters of this State.

Another striking example of the efficiency of our methods is shown on Eel River, in Humboldt County. In 1898 a salmon hatchery was established on Price Creek near its junction with Eel River. According to the figures furnished by Mr. M. A. Wilcox, Federal Statistician at Washington, D. C., who has collected these data for nearly twenty years, the average number of pounds of salmon shipped from Eureka was less than 500,000. To be exact, the figures in 1899 were 470,806 pounds net. Taking his figures in 1904, or five years later, which was

six years after the artificial propagation of salmon was undertaken by this Commission in that portion of our State, they show that the shipments from that port reach a grand total of 1,877,000 pounds. These figures are still better appreciated when a comparison is made between the increase of salmon propagated artificially and the steelhead allowed to propagate naturally (in the same streams and during the same period of time), bearing in mind that there was no change whatever in the law as to season, or method of capturing the fish. While the salmon under artificial propagation showed an increase of about one hundred and fifty per cent, the steelhead under natural propagation had decreased fifty-one per cent. Further comment seems unnecessary.

We desire to again call attention to the fact that this work is carried to a successful conclusion through the joint operations of the Bureau of Fisheries at Washington, D. C., under the direction of Captain G. H. Lambson, their courteous and able representative in California, and the State Fish Commission. Captain Lambson operates a salmon egg-collecting station at Baird, on the McCloud River, at which point eggs are taken from both the spring and fall runs; two other stations, one on Battle Creek on the borders of Shasta and Tehama counties, and the other on Mill Creek in Tehama county, are operated, where eggs are taken from the fall run. The expense of capturing the parent fish, and fertilizing and eyeing the eggs, is borne by the Federal Government. After being eyed, the eggs are transported to our hatchery at Sisson, and the one on Eel River in Humboldt County, where they are hatched, the fry reared, and distributed in the headwaters of the upper Sacramento River and in the tributaries of Eel River.

For the season of 1903, the Sisson Hatchery alone handled upwards of 58,000,000 salmon eggs, which was the best record of any station on the Pacific Coast, and of commercial value second to none in the United States. Added to that is the number of eggs (5,500,000) handled at our Eel River station, making a total of 64,000,000 for 1903. For the season of 1904 we handled at Sisson and Eel River upwards of 90,000,000 eggs, and still the limit was not reached, as in 1905 the total number of eggs handled at these two stations aggregated 106,000,000 out of a total of 117,000,000 eggs collected, the remainder being hatched by the Federal hatchery at Baird, shipped to the states north of us, and some to foreign countries.

The present season has shown the largest run of salmon ever known in the Bay of Monterey. In fact, the salmon were so abundant along the coast that for the first time they were taken in large numbers with hook and line by crab fishermen outside the Golden Gate. They also appeared in abundance in Tomales and Bolinas bays, during the months of July and August, and at the present time in every large stream leading to the sea.

Unfortunately, there will be a reduced take of eggs from the summer run of fish at Baird, owing to the carrying away of the racks during the high water that prevailed in the late spring, which permitted the fish to escape and pass up stream. At the same time, the indications are favorable from the present large fall run to collect another record-breaker.

It is also a source of gratification to note that our efforts are generally sustained by every one at all conversant with the salmon industry; in other words, the people living along the Sacramento and San Joaquin rivers, many of whom had felt that the salmon law, which maintained a longer close season above tide water, was discriminating against them, are now realizing the wisdom of that restriction, and there is not an intelligent fisherman along the rivers who is not in full accord with the present law, the only exception being to the date established for the commencement of the close season, to wit: September 10th. It is hard for the law-abiding fishermen who have been waiting patiently for the run of salmon to appear, to find that when the harvest is ripe the close season must put an end to their operations, which means that thousands of fish that would otherwise be captured, sold, and used for food, continue on up stream to perform that last act of their lives,—reproduction of species. When it is recalled, however, that the natural spawning grounds of the rivers in this state are practically wiped out, and that the only possible source for increase of fish is through the medium of hatcheries, it can be readily appreciated that nothing should be done which would tend to reduce the take of eggs to the danger point; yet, as we can collect a larger number of eggs than can be properly handled, we believe the time has arrived when an additional five days of open season will prove of benefit to the people of the State, and not interfere with the output of the young salmon from the hatcheries.

The following table represents the number of cases of Sacramento River salmon packed since 1890, and shows an encouraging increase:

Year.	Cases.	Year.	Cases.	Year.	Cases.
1890	25,065	1896	13,387	1902	48,172
1891	10,353	1897	38,543	1903	64,430
1892	2,281	1898	29,731	1904	54,710
1893	23,336	1899	33,227	1905	51,510
1894	28,463	1900	39,304	1906	53,894
1895	25,185	1901	50,304		

THE TROUT LAW.

We have had two years more in which to observe the effect of the present trout law, which opens the season on April 1st, and desire to reaffirm the recommendation made to you two years ago, that the opening date for the taking of trout be changed from April 1st to May

1st. While it may be true that in two or three of the coastwise counties this law would encounter some opposition, it would meet with the approval of a large majority of our people. In most of the counties in Southern California, the taking of trout has been forbidden by local ordinance until June 1st. It ought to be clear to any person of intelligence, that a fish just through the spawning period is not a fit article of food; in other words, a sufficient time should be given to allow the fish to fully recover from that drain on its vitality. It would also result in larger and stronger fishes, affording better sport to the angler. It would shorten the open season from seven months to six, which in our opinion is an important factor of safety when our rapidly increasing population and ever-increasing number of anglers are considered.

In many of the mountain counties of this State the trout should not be taken before the 1st of June, but as the tourist travel to the mountains does not begin until the 15th of May, and does not reach the higher altitudes before the 1st of June, these sections will not be seriously affected.

During the past summer we have conferred with the honorable Board of Fish Commissioners of the State of Nevada, and are pleased to find that it is strongly in favor of changing the opening day for the taking of trout in that State from the 15th of March to the 1st or 15th of May. We could then have a uniform law in both states, which is of the greatest importance when the fishery interests of Lake Tahoe and the Truckee River are considered; otherwise it is difficult to prevent violations on one side or the other of the line, especially on Lake Tahoe, which is traversed by the State line.

We are pleased to report on the excellent results following the change in the weight of trout that could be legally sold, which was raised at the last session of the Legislature from one-half pound to one pound, and would strongly recommend that the present law be maintained. In many of the states of the Union the sale of all trout is prohibited, but the conditions in those states are unlike those in California.

We have the steelhead trout, a fish of commercial importance, and, as we have recently begun their artificial propagation, we believe the supply of these fishes will not only be maintained but increased, especially as we were able at the last session of the Legislature to secure an amendment to the then existing law (which permitted the capture of steelhead trout with a 7½-inch mesh net under certain conditions), prohibiting their taking other than with hook and line. As we see no reason why the artificial propagation of steelhead trout should be less successful than our salmon work, we feel that we can with safety allow the sale of any trout above a pound in weight, which permits the hotels in the mountains to furnish trout in limited quantities to their guests, adds much to the attractiveness of these resorts, and

encourages travel to such places; in other words, makes for a wider and better distribution of the visitors and wealth from the cities and accrues to the general good of the State.

EASTERN BROOK TROUT.

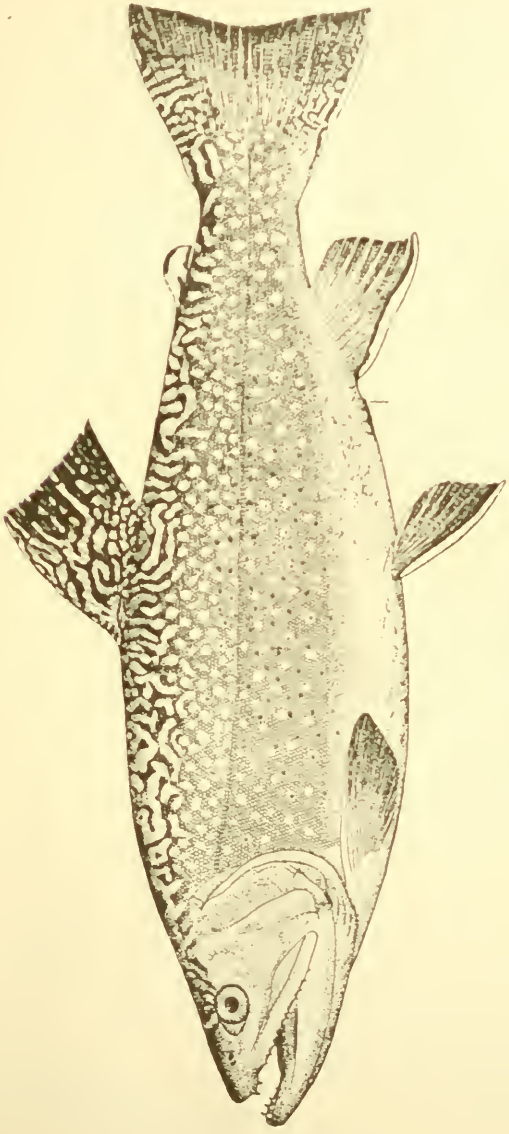
Our efforts with this beautiful and gamy fish are being richly rewarded, as it can now be considered permanently established in all suitable waters where it has been planted, but especially in the small lakes and meadow streams of the higher Sierras. Eastern brook trout have shown some adaptability to the large reservoirs in lower altitudes, but to the Coast Range streams they are not as well adapted. We have made some large plants of fine, healthy fish, but no increase has been apparent. We believe this is due to the fact that these streams are subject to sudden rises in the winter, which interfere with their spawning season, the eggs or alevins being easily destroyed by the torrential floods to which the streams are subject. We therefore would not recommend their planting to any extent in the Coast Range streams, except in reservoirs or such waters as are not subject to much change. We shall, however, continue to stock all the small streams, and those larger ones in the higher elevations where neither the Rainbow nor the Cut-throat trout will remain.

From our stock of breeders at Sisson that are a result of eggs secured in exchange for Rainbow eggs with the Federal Bureau of Fisheries station in Colorado, we have now an ample supply in our rearing ponds. During the season of 1905 we liberated upwards of 600,000. The season just closed we planted about 750,000 fry ranging from 2½ to 4 inches in length, and expect in 1907 to reach 1,000,000, which will be not only ample to maintain the supply in streams and lakes already stocked, but sufficient to stock new waters.

These fish possess a decided advantage over our native trout in respect to their spawning season, which occurs in the latter part of October and November, a period when they can breed in the high elevations unmolested. They also mature a year earlier than any of our native fishes.

During the past two years we have stocked barren waters in the eastern end of Tulare and Fresno counties, in the Giant Forest region, Paradise Valley, and the Sequoia and General Grant National Parks, and also furnished a new supply for the Yosemite region. For stocking the National Parks in Tulare County substantial assistance was received from the Department of the Interior, which set aside a sum of money to bear the expense of transporting the fish long distances by team and pack animals. New lakes in the Glen Alpine region, tributary to the Tahoe basin, have been stocked with these fish, and substantial plants have been made in lakes and streams at an elevation of from 8,000 to

9,000 feet, tributary to the Rubicon and American rivers. Additional plants in Velma lakes, lying in the region between Emerald Bay and the Rubicon River, at an elevation of 8,000 feet, were made through the



EASTERN BROOK TROUT—*Salvelinus fontinalis*

courtesy and assistance of Messrs. Lawrence and Comstock of Tallac and Mr. W. A. Bissell of the Santa Fé Railway. From those lakes, which until two years ago had never contained fish life of any kind, specimens weighing 2¼ pounds were taken. These remarkable results

have created a lively interest in these fish, and demands now come from all the mountain sections of the State; in fact, requests have been made from every quarter, but as experience in the lower altitudes has not been nearly so satisfactory, we have felt it the part of wisdom to confine our efforts to distributing them in regions above 3,000 feet elevation, and furnishing Rainbow and Cut-throat trout to the streams of the lower elevations leading to the sea.

In connection with this subject we take pleasure in reporting that our sister State, Nevada, has again taken up the subject of artificial propagation of trout, and has constructed a new hatchery at Carson City. The Nevada commissioners, Messrs. Mills, Yerrington, and Coryell, have been seriously handicapped in their operations through lack of necessary means. Making known to us their wants, we loaned them the services of an experienced fish culturist, Mr. E. W. Hunt, of the Tahoe stations, who laid out the Carson Hatchery. Mr. Hunt, together with one of our regular hatchery assistants, has been detailed to assist the Nevada commissioners in the collection of Eastern Brook spawn from Marlett Lake, at the close of our stations around Lake Tahoe.

TAHOE AND TALLAC HATCHERIES.

These stations have been operated as usual during the past two years. Our supply of Cut-throat trout eggs was obtained as heretofore through seining operations conducted at the mouth of Taylor Creek, near Tallac. The eggs so collected were eyed at Tallac Hatchery and from there shipped to the station at Tahoe City, to the hatchery located at Wawona, and some also to the Sisson Hatchery. Owing to the unusual snowfall in the spring of 1906, our hatchery force was unable to reach Lake Tahoe for nearly four weeks later than the usual time; we were able, however, to collect a sufficient number of eggs to meet the requirements of the Tahoe and Truckee basin, and the Wawona station, omitting Sisson.

Mr. E. W. Hunt has been in full charge of all fish cultural operations in that region. His report on the work for the past two years is appended. He was assisted in his work by F. F. Anderson, who was placed in charge of the eyed eggs at the Tallac Station. The work on the streams leading into Lake Tahoe was assigned to Wm. Boyle at Tahoe City, and Harry Warr in the Tallac region. Deputy Warr, in addition to taking care of the southern end of the lake, has covered a large portion of El Dorado, Alpine, and Amador counties. He has broken up the practice of the Indians, who heretofore have speared large numbers of spawning fish in the streams tributary to Lake Tahoe and carried them back to Nevada; he has also exercised a careful watch over the campers and tourists.

HATCHERY AND COTTAGE, LAKE TAHOE.

INTERIOR VIEW OF TAHOE HATCHERY.

The following report of Mr. E. W. Hunt gives a brief summary of the work performed at these two stations for the seasons of 1905–06:

TAHOE CITY, CAL., September 30, 1906.

To the Honorable the Board of Fish Commissioners of the State of California.

GENTLEMEN: I herewith submit my detailed report of the work covering the seasons of 1905 and 1906.

Acting under instructions from your Honorable Board, I started for Tahoe on April 2, 1905, to open the stations for the spring and summer work.

On April 3d I met Mr. D L. Bliss, Jr., on his way to Tahoe, and was invited with my party to accompany him to the Lake on special train of the Lake Tahoe Railway and Transportation Company that was in Truckee awaiting his arrival. We arrived in Tahoe at 11:30 A. M., after a very pleasant ride. I inspected the buildings, which had

MOUNT TALLAC AND TAYLOR CREEK, LAKE TAHOE.
SPAWN-COLLECTING STATION.

been in charge of Captain P. Wehrman during the winter months, and found them in very good condition and in readiness for business. I also looked at the new wharf put in by the Captain during the winter. It is a very good piece of work.

On April 4th I started for Taylor Creek, to commence operations with the seine. On April 5th I fixed up quarters for the crew (Messrs. Wehrman, Robinson, and Anderson), and cleaned up the seining ground. Commenced seining same evening, and continued to do so until the night of May 7th. The weather during the time was very pleasant, considering the spring of the year. We caught 2,612 trout (1,712 males and 1,900 females). The males averaged 2 pounds and the females 1½ pounds. Number of females stripped, 1,875, averaging over 1,600 eggs to the fish. The total number of eggs taken was 3,150,000. We shipped 500,000 eyed eggs from this station. Sisson Hatchery received 250,000 and Wawona Hatchery received a like number, leaving about 2,500,000 to be hatched at the Lake Tahoe stations. Tahoe Hatchery received 1,000,000, Tallac Hatchery 1,000,000, Glen Alpine and Camp Agassiz hatcheries, about 500,000.

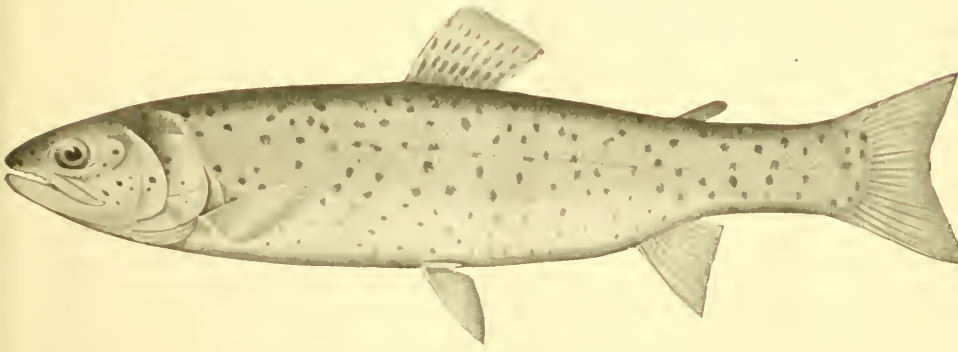
The Glen Alpine people, Mrs. G. W. Pierce & Co., as well as Prof W. W. Price of Camp Agassiz, after consulting Chief Deputy Charles A. Vogelsang with regard to seining trout eggs, decided to build a hatchery at each place. The one at Glen Alpine has a capacity of about 500,000 eggs, and Professor Price's about 100,000.

The stations were operated very successfully during the season, and the fry distributed in the mountain lakes in that vicinity as per distribution report handed in. Commenced distributing the fry at the different stations in July and continued filling the applications until the buildings were emptied.

Received instructions to close the different stations as soon as the distribution was over. Glen Alpine was closed July 20th; Professor Price's, August 15th; Tallac, September 24th, after renewing the interior of the building with a new head box and twelve troughs. The Tahoe Hatchery was closed on October 3d, and I reported in the office at San Francisco, took a vacation, and was ordered to report to Mr. W. H. Shebley, Superintendent of Sisson Hatchery, which I did, arriving there on October 16th, and remained during the winter months.

SEASON OF 1906.

I received instructions from your Honorable Board on April 11th to start from Sisson for Tahoe to open the stations for the season of 1906. Arrived in San Francisco on April 13th with my assistant, S. Montgomery. Was informed by the Lake Tahoe Railway and Transportation Company people that they expected to have the road between



TAHOE TROUT—*Salmo henshawi* Gill and Jordan.

Truckee and Tahoe open in a few days. Was ordered to be in readiness to leave at a moment's notice. Was awaiting the day to start when the terrible earthquake and fire destroyed San Francisco. Had a chance to leave San Francisco as a refugee, so with my assistant started on April 23d and arrived in Truckee the morning of April 24th, where my other assistants, Messrs. Robinson and Anderson, joined me on the 25th, and remained in Truckee until April 30th, on which day the first train was run to Tahoe. Owing to the very heavy winter, it was impossible to get to Tahoe any other way.

April 30th—Arrived in Tahoe, looked over the premises, and found everything in good order, and the hatchery in readiness to be open. Captain Wehrman was in charge of the premises as in previous years, and during the winter added 100 feet of new wharf, which gives us depth enough for all the gasoline launches on Lake Tahoe to land at the hatchery.

May 1st—Started for Taylor Creek to commence seining operations for spawn fish. Put our living quarters in order and worked on mouth of creek to change the course. Found a big run of trout up the creek. Was informed by parties living at Tallac that the run had been on for about a month.

May 2d—Cleaned up seining ground and commenced operations with the seine, and continued until June 2d, with varying success.

The weather was very squally during the month. We caught 606 males and 984 females. The males average about 1¾ pounds, and the females about 1½ pounds. Number of females striped, 937, averaging about 1,650 eggs to the fish. The total number of eggs taken was 1,590,000, of which 250,000 were shipped to the Wawona hatchery on June 19th.

Owing to the very heavy winter the Glen Alpine hatchery was damaged by having the roof cave in from the weight of snow. The station will be rebuilt in the fall and ready for the season of 1907.

Professor Price did not open his hatchery, as he moved from his old site to the head of Fallen Leaf Lake. He may take up the work again next season.

I placed 548,000 eggs in each hatchery (Tahoe and Tallac), which were hatched with a small loss. The Tallac hatchery was closed on September 15th. My assistant from that station helped the Glen Alpine people to reset the troughs, etc., in their building and which is now ready for next season's work.

I will finish up the work at this station on October 5th or 6th and proceed to Carson City, Nevada, and report to the Nevada State Fish Commission as per instructions, to assist in re-establishing their hatchery and collect Eastern Brook eggs from Marlett Lake, received from your Honorable Board.

You will please find reports for the Tahoe and Tallac hatcheries, also inventories for this season, attached.

Respectfully submitted.

(Signed) E. W. HUNT, Superintendent.

WAWONA HATCHERY.

For the past two years the trout hatchery located in the Yosemite National Park at Wawona has been successfully operated during the spring and early summer under the direction of M. L. Cross, one of our experienced and capable hatchery employés. There have been hatched and distributed from this station approximately 700,000 trout fry (Cutthroat, Rainbow, and Eastern) during the past three years. The distribution work has been greatly facilitated through the personal efforts of Major Harry C. Benson, Fourteenth Cavalry, U. S. A., superintendent of the park, who has always been ready with his pack trains and teams to transport fish wherever a plant seemed necessary. The value of this assistance is better appreciated when the vastness of the region is considered and the numerous bodies of suitable trout waters that are accessible only by the aid of pack animals over rough mountainous trails. When not engaged in the distribution of fry from the Wawona Hatchery he has made use of our seines and other necessary appliances to capture and transport adult fish, taking them from streams in which they are abundant, and on pack animals transporting them into barren lakes or streams in the higher altitudes. That the work has been skillfully and intelligently done is shown by the results, there being many streams now teeming with trout in the Yosemite region that could not have been reached by us, and the credit for which is due chiefly to Major Benson and the men of his command.

Messrs. Washburn Brothers, to whom the State is indebted for building and equipping the Wawona Hatchery, have continued to show our employés every courtesy, besides rendering valuable assistance in providing free transportation to and from Yosemite Valley for our employés, for live fish, shipping cans, and all material and supplies that are required, and also for furnishing teams to assist in the distribution of the fry. This can better be appreciated when it is recalled that the hatchery is

operated during their busy season, when practically every man and animal under their direction is in active service.

This hatchery has also furnished fry sufficient to stock the headwaters of the principal trout streams in Madera County, the work of distribution being successfully carried out by the county game warden, assisted by men of the Forest Service.

We are able to report excellent results attending the planting of 60,000 Eastern brook trout in 1905, shipped from Sisson.

The following table is a summary of the distribution from the Wawona Hatchery in 1905–1906:

Year.	Cut-throat Fry.	Rainbow Fry.	Eastern Brook Fry.
1905	250,000	75,000	60,000
1906	350,000		
Totals	600,000	75,000	60,000

VERDI STATION.

This temporary station, located on the Truckee River, in the State of Nevada, was discontinued in 1905; the Truckee River continuing to remain at such a height that the capture of spawning fish was not feasible; at least, the number of eggs we could collect did not justify the expense of operating the station. The hatchery supplies on hand were sent to the stations on Lake Tahoe and at Sisson. The building itself, by contract, reverted to the owner of the land, Mr. George Foulkes; the hatching troughs, and other material too heavy to transport, were donated to the State of Nevada, and have done some excellent service.

Considering, however, that it would be a wise move to establish a station on some stream where a supply of wild Rainbow eggs could be collected at small cost, sufficient to introduce new blood among our pond fish, Superintendent Shebley, of Sisson, was instructed to examine the different streams in Siskiyou County for that purpose. He selected a point on the Shasta River near Edgewood, Siskiyou County; the cost of operating which is light, and besides the eggs can be transported direct from the spawning station to the Sisson Hatchery, avoiding the expense of a double crew of men. We began to operate there in the spring of 1906, but owing to unusual freshets, which swept over our racks, most of the spawning fish were able to pass them, so that we took only about 50,000 eggs; but this we considered sufficient to demonstrate the value of the station. The Federal Bureau of Fisheries, desiring to establish a Rainbow egg-collecting station, have been invited to join with us in the expense of operating this station next

season, and we have granted them the privilege of eyeing their eggs in our Sisson Hatchery. This arrangement will be of mutual benefit to both commissions and insure a continuance of the harmonious relations that exist between us.

STRIPED BASS.

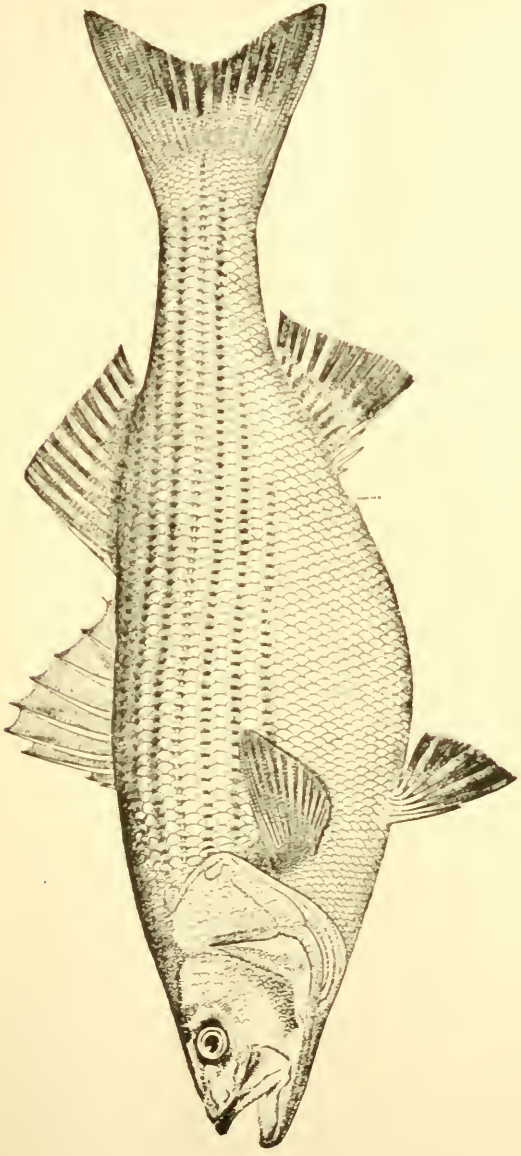
During the past two years we have paid special attention to this valuable food and game fish. Unquestionably the demand has largely increased, and striped bass are being shipped in large quantities to the states of Oregon and Washington, also to states as far eastward as the Missouri River. In the prosperous mining towns that have sprung up in the State of Nevada in the past few years, this variety of fish finds a ready sale at prices sufficient to induce the dealers in this State to make a special effort to meet the demand. The high prices have been an inducement to the fishermen to direct their efforts generally to the capture of these fish.

At the last session of the Legislature a determined effort was made by representatives of the fish dealers to reduce the legal weight at which these fish might be taken and possessed—from three pounds to two pounds—but we were able to convince our legislators that such a move would be extremely unwise, pointing out that the fish must attain the weight of at least three pounds before they are able to reproduce their species. Many of the intelligent market fishermen believe that the weight limit of the fish should be increased from three to six pounds, and there is much merit in the contention. This, however, would not meet with the approval of those who delight in taking the fish for sport.

When striped bass first began to appear in considerable numbers in the waters of this State, there were no restrictions as to the size of mesh that might be used in their capture. It was soon learned, however, that the fishermen would operate on the salmon grounds for them during Saturdays and Sundays, and with smaller mesh nets than can be legally used to take salmon.

In order to protect the salmon, which are by far the more important fish, considered from the commercial viewpoint, the words "shad and striped bass" were, in 1897, on the recommendation of a previous Board, incorporated into Section 634, which had previously referred solely to the methods and time for taking salmon. This statute forbids the netting of salmon during Saturdays and Sundays, or at any time with a net less than 7½-inch mesh. Without this amendment, the fishermen could lay out their nets, presumably to take either shad or striped bass, but in the operation catch large quantities of salmon. They always had a perfect defense when taken into court, that they were operating for striped bass or shad, and accidentally caught the salmon, which are

found in the same waters. It was for this reason that the words "shad and striped bass" were added to the section; but its provisions were not heretofore strictly enforced except in those waters where the operations



STRIPED BASS—*Roccus lineatus.*

were a menace to the salmon industry. This seemed a reasonable course to follow in view of the fact that the shad were in great abundance and there were no restrictions as to size and amount that might be taken, and the only restriction on striped bass was the three-pound

weight limit. That a 7½-inch mesh net would not take a bass of less than six or seven pounds weight gave them some excuse for operating in San Pablo and San Francisco bays with nets of a mesh that would take the legal-sized fish.

Our observations and experiences indicated that the fish needed greater protection to offset the increased demand created by the constantly enlarging market. We therefore felt that it was necessary to enforce strictly all the provisions of the statute as it stands, in exact conformity with the salmon law, irrespective of locality.

Some are of the opinion that a close season should be established. This, in our judgment, is not feasible. The same result can be accomplished by enforcing the Saturday and Sunday law, which means two days close season per week, or, in fifty-two weeks, one hundred and four days, equal to more than three months of close season. This can be done without disturbing the markets and at the same time permit our people to angle for, and have in possession, striped bass the whole year. It reduces the time during which they can be netted from seven to five days per week.

The principal spawning season of striped bass is during the months of April and May, which is also the time during which the spring run of salmon makes it appearance in our rivers. For these fish there is also an ever-increasing market. The fish are sought by the cold-storage concerns of this and other states, and are shipped both East and North in carload lots, the fishermen receiving as high as 12 cents per pound. In this respect California has a more difficult problem than any other state in the Union, it being the only one in which the striped bass and salmon are found in the same waters. If we had no spring run of salmon, it would be a wise and proper move to establish a close season for the striped bass during their breeding period, but it is utterly impossible to catch one fish without catching the other. All the salmon are not needed at that season of the year for spawning purposes, and should rightfully be sold in our markets or shipped to other states. They command a price far beyond that of striped bass at that time, so the fishermen make special efforts to take them, yet in their operations they capture fully as many striped bass, especially in the lower Sacramento and San Joaquin rivers and in Suisun bay. The striped bass that are taken in their nets are dead when brought to the surface, consequently they have no value as spawn producers, and if the fisherman were not allowed to dispose of them it would mean that in a single day tons of a valuable food supply would be thrown away. In view of these facts, it appears to us that no argument can be advanced which would justify the establishment of a close season, other than the one already referred to of strictly enforcing the letter of the law in respect to Saturday and Sunday fishing.

To compensate for the enormous drain that is made on the supply of these fishes, and yet permit the handling of them at all seasons of the year, and encouraged by the remarkable success we have achieved in the work of artificial propagation of salmon and trout, we seriously considered the advisability of establishing a striped bass hatchery. Our funds being insufficient to meet the demand such an establishment would impose on them, the subject was taken up with the authorities of the U. S. Bureau of Fisheries at Washington, D. C., and with such success that instructions were issued to Captain G. H. Lambson, superintendent of the Baird Hatchery, to confer with this Board with a view to locating a suitable site to undertake the work of artificial propagation. The striped bass hatcheries operated by the Federal Bureau of Fisheries at Weldon, North Carolina, show that a three-pound fish has produced 14,000 eggs, while a fifty-pound striped bass has yielded 3,220,000 eggs.

Captain Lambson, in company with our Chief Deputy, made an extended trip through those sections from which the largest number of spawning fish are shipped to market. Several points near the mouth of the San Joaquin and Sacramento rivers were inspected, and Bouldin Island in San Joaquin County has been selected as the best point at which to establish an experiment station. In the month of May the spawning fish are captured there in large numbers. From intelligent fishermen who have been pursuing their vocation in that locality for thirty years and who have seen the salmon industry develop into one of much greater importance than before artificial propagation was begun, and who have also been witnesses to the remarkable development of the striped bass, we learned that fish, ranging in weight from thirty to sixty pounds, can be obtained in almost unlimited numbers ripe for spawning. We confidently believe that it will be a simple matter to collect all the eggs we can handle, provided an increase is made in our fund for the support and maintenance of hatcheries, the money to be expended jointly with the Federal commission in the establishment and operation of an experiment hatchery at that point. The river has not sufficient fall to depend upon a natural flow of water, but by artificial means water can be raised to insure a continuous flow through the hatching troughs. We earnestly hope that you will recommend to the Legislature that the small additional appropriation, sufficient to demonstrate the feasibility of this project, be granted, which, if successful, will prove of vast benefit to our people.

With a close enforcement of the net restrictions, a strict observance of the Saturday and Sunday close season, and the establishment of a hatchery, we believe that the supply of striped bass will not only be maintained in spite of the heavy market demand, but will be largely increased. We therefore do not recommend the establishment of a close season, but, as an additional protection, do recommend that the legal

weight limit at which striped bass can be bought, sold, offered for shipment and sale, be raised from three to five pounds, but none to be taken or possessed less than three pounds in weight. Thousands of our people are enjoying the sport of capturing these fish with hook and line, and it would work a serious hardship on all such if they were deprived of the right to lawfully retain a striped bass taken in that way.

Another plan offered to offset the drain on the striped bass industry of this State is the passage of a non-export law, and there is much to be said in its favor. Our streams do not increase in volume; in fact, from the demands made by irrigating systems, it is possible to conceive that they will be reduced. It may then be the part of wisdom to conserve these valuable fishes for the citizens of our own State. Undoubtedly such a recommendation would meet with fierce opposition from the fish dealers in this city and Sacramento, who ship outside of the State thousands of pounds of striped bass each month. We feel that if these shipments may continue without impairment of the industry, and yet not run the local market value of these fish to a prohibitive figure, it would be an unwise move to prohibit their exportation. When we witness the results that followed the introduction of 100 fingerlings in 1879, and 350 in 1882, planted at Army Point near Benicia, and that the fish still continue to show an increase, and the further fact that they are regularly sold here for much less than in Eastern markets, we believe that the suggested additional restrictions will be sufficient.

It is claimed by some of the sportsmen that the supply is being greatly diminished. In answer to that we submit the figures of W. A. Wilcox, the Statistician of the U. S. Bureau of Fisheries at Washington. Mr. Wilcox is thoroughly familiar with the fishery industry of this State, and has collected the market reports for many years. In 1893 the number of pounds of striped bass received in the San Francisco markets was only 79,738, increasing in three years (1896) to 363,747. In the year 1899, 1,234,320 pounds of striped bass were caught in this State, which had a value to the fishermen of $61,814. Five years later, or in 1904, there were 1,570,404 pounds landed in San Francisco, for which the fishermen received $92,116. These figures show that there has been an increase in the catch since 1899 of about 27 per cent in quantity and 49 per cent in value. Nearly 90 per cent of the catch was marketed at San Francisco. So far as we are able to learn, 40 per cent of the amount taken has been exported.

According to the reports received from Southern California regarding the plants that were made in Orange County two years ago, the fish are showing some increase in those waters. Their natural range north of San Francisco has not been beyond Russian River in Sonoma County, although a small plant was made in Humboldt Bay six years ago. Owing to unusual delays en route, most of the shipment per-

ished and less than a dozen were liberated; but in the past year three or four specimens have been taken in Eel River, ranging as high as twenty pounds in weight, indicating the adaptability of the fish to those waters. We hope to make a larger plant in that county this fall, as we successfully liberated two years ago eighty fish ranging from five to eight inches long, in a brackish lake at Crescent City, Del Norte County. It is yet too early to determine the result of that experiment, but we confidently believe, owing to the favorable conditions, that a good account will be rendered. In the interior rivers striped bass have been taken in the Scramento as far north as Kennett. In the Feather River, east of Oroville, specimens from twelve to fourteen pounds in weight have been captured with hook and line. In the San Joaquin and its tributaries, the Tuolumne, Stanislaus, and Merced, they are continuing to show a decided increase.

THE GRAYLING.

In the last report, covering the biennial period of 1903 and 1904, mention was made of the grayling (*Thymallus montanus*), the first shipment of eggs having been donated through the courtesy of Hon. George M. Bowers, of the U. S. Bureau of Fisheries, from the Federal hatchery at Bozeman, Montana. Owing to lack of attention en route, the eggs reached our Sisson station in a weakened condition, but from that shipment we were able to raise and liberate some 7,000 fry. Like all new varieties of fishes experience was necessary to determine the best methods to feed and rear them. The eggs in the first place are very small and exceedingly delicate. After the sac was absorbed and the time arrived to furnish food for the young fish, a new problem was presented. After a great deal of experimental work, our superintendent, W. H. Shebley of Sisson Hatchery, finally discovered a method of feeding that has produced excellent results. We found, however, that they flourished best in a wild place, where they could find their own food, consequently in a remote section of our grounds we had constructed an artificial lake, which was fed by water taken from Spring Creek, and which abounds in natural food. We now have specimens of grayling ten inches long.

In 1905 another shipment of grayling eggs was donated to us from the Bozeman station, but apparently they met with no attention at all en route. As a result every egg was dead when the shipment reached Sisson. This, therefore, proved a total loss, but in 1906 Mr. Bowers again had a shipment of 200,000 eggs sent to us, which arrived in very good order. Of the fry resulting therefrom we have made several plants in the Tahoe region, in the high Sierras, and also in suitable waters in Siskiyou County. We are looking hopefully forward to the permanent establishment of these beautiful fishes in this State. They have a wide

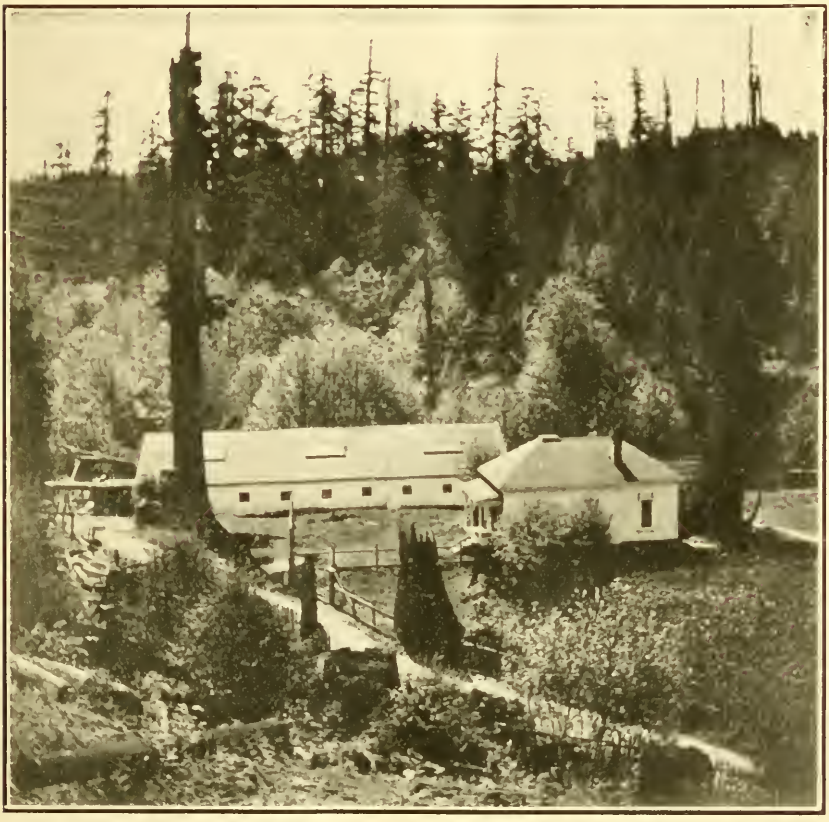
range in their native waters, and are found throughout northern Europe, as far south as the mountains of Hungary. They are also found in England, where it is recorded that graylings weighing five pounds have been taken, although they rarely exceed a foot in length. The American grayling (*Thymallus signifer*) is widely distributed in British America and throughout Alaska.

A gentleman who lived three years in the Yukon Territory writes of these fish that they are quite numerous in the Yukon River and its branches, and are a fine table fish, nearly, if not quite, equal to our Eastern brook trout. He describes them as "resembling the trout in general shape, but the former are longer and more slender in proportion to their weight, with heads more pointed and tails and fins thinner, except the dorsal fins, which are heavy and spinous. These graylings are greenish black on the back, lighter colored, almost gray, on the sides, with some streaks of black and occasional dark spots, while their bellies are white, their bones are about like those of trout, and their meat is very white and solid; in size, they attain twelve to fourteen inches in length, and two pounds or more in weight. While wary in warm weather, they take bait readily, and are very 'gamy,' but do not generally rise to a fly, and they seem to like the clear running waters and rapids, which they traverse in quick, trout-like motions, though mining work and muddy waters drive them away."

LOCH LEVEN TROUT.

We are pleased to report that we have again succeeded in restoring our stock of breeders at Sisson, so that we now have a sufficient number to yield about 350,000 fry for distribution. For the season just closed we have distributed over 300,000. We find that this hardy and gamy fish is a decided acquisition to our trout supply. It is easy to raise and is apparently less liable to disease than any trout we handle. A great many small lakes and a number of the larger streams have been stocked. In the past year Loch Leven trout have made their appearance in the Truckee River, from which some fine specimens were taken. They are probably some of the overflow from Donner Lake, or from a plant made in the upper Truckee near Deer Park. It is claimed by some that they are so destructive that all other forms of trout life must disappear. Our experience does not bear out that opinion. Aside from those taken in the Truckee River, which is unquestionably one of our finest Rainbow trout streams, they are also taken in the same waters with the Rainbow in the upper Sacramento, and in both of these streams the Rainbow show a decided increase. We therefore expect to continue the propagation and planting of these fish, with special reference to stocking the smaller lakes.

At the last session of the Legislature the trout law was so amended that the taking of steelhead with nets at any time was prohibited. This law has created some antagonism among the small element in Humboldt County who follow the vocation of fishing, and we believe they will make a determined effort at the forthcoming session of the Legislature to have it changed so as to again permit the catching of steelhead with nets. When it is shown that the total value of the steelhead that were caught and shipped to market by net fishermen from all parts of



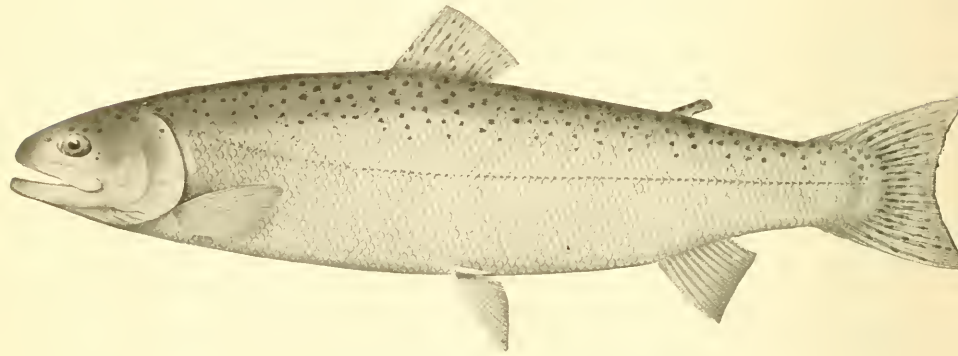
EEL RIVER HATCHERY, HUMBOLDT COUNTY.

the State did not, in the year of 1904, exceed $1,600, and this small amount was distributed among eighty or ninety fishermen, net fishing would seem of insufficient importance compared to the far greater value the steelhead will have in being allowed to ascend all the coastwise streams to their headwaters for the purpose of spawning.

In the spring of 1905, also 1906, these fish have shown a decided increase, especially in Santa Cruz County, where the efficient and skillful conduct of the Brookdale Hatchery, under the management of Mr.

Frank A. Shebley, has produced splendid results. Under the former law there were less than one hundred people benefited by the taking of steelhead with nets. Under the existing law every person who delights in angling—and they number many thousands in this State—are the beneficiaries, to say nothing of the money that is expended by them in the country in payment of steamer, stage, and railroad fares, hotel bills, livery hire, and fishing outfits.

The collection of steelhead eggs at our Eel River station has not been nearly so large as we could wish and easily handle, due entirely to the drain by net fishing, and consequent reduced run of spawn fish. So long as the net fishermen could lawfully operate in tide water, they were stopping absolutely the passage of the fish on their way to spawning grounds and hatching stations. The few that managed to ascend



STEELHEAD TROUT—*Salmo gairdneri.*

had to encounter other dangers and when they did reach spawning beds the very small percentage of fish hatched under natural conditions was not sufficient to offset the drain caused by the nets; besides cutting off our supply of spawn fish at the hatcheries. For the three years we have operated in Humboldt County the largest take in one season, operating simultaneously at three or four different points, had not been over 350,000 eggs, until during the spring of 1906, after the restriction prohibiting netting became effective, when, operating but one small trap on Price Creek (which was at different times flooded), we were able to take the largest number of steelhead eggs ever taken in that county. We therefore urgently recommend that no change be made in the existing law.

The following reports of Superintendent W. O. Fassett, who has had charge of the station for the past two years, are appended. Mr. Fassett has skillfully and successfully handled the important work that was entrusted to him, and maintained his station in an excellent state of repair under great disadvantages:

Report on Salmon Hatch.

GRIZZLY BLUFF, CAL., May 1, 1906.

To the Honorable the Board of Fish Commissioners.

GENTLEMEN: The following is my report of the salmon hatch at this station for the season commencing December 1, 1905, and ending April 6, 1906. The eggs arrived in six shipments, as follows:

December 9, 1905	1,274,000
December 27, 1905	1,671,720
January 1, 1906	1,497,600
January 10, 1906	1,500,000
January 29, 1906	2,000,000
February 13, 1906	2,000,000
Total	9,943,320

The hatch was successful excepting a rather heavy loss on the first two shipments in transit, and a 25 per cent loss in the last shipment, caused by the eggs hatching on the trays before I received them. From this hatch there was planted in Eel River and Price Creek 9,265,920 healthy fry. The following is a summary of the hatch:

Eggs received	9,943,320
Eggs lost	443,900
Loss in rearing	297,500
Fry distributed	9,265,920

Yours respectfully,

W. O. FASSETT.

Report on Steelhead Work, Season of 1905.

GRIZZLY BLUFF, CAL., May 15, 1905.

To the Honorable the Board of Fish Commissioners.

GENTLEMEN: The following is my report on the steelhead work at this station for the season of 1905. This season I made every effort to get fish from the river by means of a seine, but am satisfied that satisfactory results can never be obtained by this plan, owing to the immaturity of the fish, and the uncertainty of weather conditions. In February the seining crew went up the river some twenty-five miles, and brought down the fish they caught in live cars, which I transferred to a pond near the hatchery, in the hopes I could hold them until they ripened. This experiment was a failure, as the fish were so very active that those which did not kill themselves outright in the cars, bruised themselves so that they died shortly after being placed in the pond. I next attempted to hold the fish we caught at a point twenty-five miles up the river, in the hopes that I could spawn them and take the spawn to the hatchery in a row-boat by way of the river, but the same conditions prevailed Most of the fish we caught were at least three to four weeks from their spawning period. While the seining crew were working on the river, I also had the trap at Price Creek in operation, with the following result:

Total number of eggs taken	287,000
Total number of eggs eyed	258,000
Loss in eying	29,000
Loss in hatching and rearing	15,400
Fry distributed	243,000
Number of fish caught—	
Males	50
Females	107
Number of females spawned	69
Average weight of fish—	
Males	3 lbs.
Females	5 lbs.
Highest temperature of water	69°
Lowest temperature of water	48°

The fry were all placed in Price and Howe creeks.

Yours respectfully,

W. O. FASSETT.

Report on Steelhead Work, Season of 1906.

GRIZZLY BLUFF, CAL., June 1, 1906.

To the Honorable the Board of Fish Commissioners.

GENTLEMEN: The following is my report on the steelhead work for the season of 1906. This season the work of catching the fish was confined entirely to trapping them at the dam at Price Creek. The results were very encouraging, and show that the hatching work and a few years of close season for the seines will make this game fish as plentiful on Eel River as it was in former days. The weather conditions this season have been very favorable for the work. The rains lasted late into May, making the water in Price Creek purer and cooler than ordinary. The following is a summary of the season's work:

Total number of eggs taken	411,400
Total number of eggs eyed	370,000
Loss in eying	41,400
Loss in hatching and rearing	18,000
Fry distributed	352,000
Number of fish caught—	
Males	36
Females	113
Number of females spawned	92
Average weight of fish—	
Males	5
Females	7
Highest temperature of water	58°
Lowest temperature of water	39°

All the fry were placed in Price and Howe creeks.

Yours respectfully,

W. O. FASSETT.

GOLDEN TROUT (Salmo roosevelti).

(See Frontispiece.)

These are among the most beautiful fishes known to fish culturists and have attracted the attention of the U. S. Bureau of Fisheries to such an extent that definite steps are now being taken toward their artificial propagation and transplanting into other waters.

In 1893, Dr. David Starr Jordan, of Stanford University, first procured some beautiful specimens from the southern High Sierras, which he named *Salmo mykiss agua-bonita.* In the same year Dr. Charles H. Gilbert, Zoölogist of Stanford University, visited the Kern region and secured some fine examples in Volcano Creek. President Roosevelt, after whom the Volcano Creek fish are named, became greatly interested in their welfare, and brought the matter to the attention of the Hon. George M. Bowers, U. S. Commissioner of Fisheries, who, in compliance with the request of the President, ordered an investigation to be made, with a view of determining the natural geographic distribution of this trout, its abundance, its habits as to food and spawning, its qualities as a food and game fish, and into what waters, if any, it had been transplanted, and finally to determine in what other streams it might be introduced. An investigation party, headed by Barton W. Ever-

GOLDEN TROUT OF SODA CREEK, SALMO WHITEI EVERMANN
(DRAWN FROM LIFE BY CHARLES B. HUDSON FROM THE
TYPE, A SPECIMEN 7¾ INCHES LONG.)

mann, Assistant in Charge of Division of Scientific Inquiry, Bureau of Fisheries, started for Redstone Park, Tulare County, in July, 1904, and made an extended trip through the Mount Whitney region and gathered a great deal of information in reference to them, which has been set forth in a very interesting and beautifully illustrated bulletin issued by the Bureau of Fisheries, May 19, 1906, entitled "Golden Trout of the Southern High Sierras."

Through the courtesy of the officials of the U. S. Bureau of Fisheries, we are able to present two cuts of the Golden trout, and one of the Kern River trout. An expedition was sent out by the U. S. Bureau of Fisheries to collect specimens for the Lewis and Clark Exposition at Portland, Oregon. Upwards of two hundred specimens were secured, which were brought safely out of the mountains, but unfortunately met with a mishap en route to Portland, and all were lost. In March, 1904, this Commission undertook to collect some specimens of the fish for exhibition purposes at the "Forest, Fish and Game Exhibit," held in San Francisco. Mr. R. W. Requa, one of our experienced hatchery men, was detailed to make this collection, and was assisted by Earl L. Morris, of Stanford University. About fifty specimens of the fish, representing both types—*Salmo roosevelti* and *Salmo whitei* (see colored plates)—were secured, most of them taken with hook and line, from Cottonwood Creek, Inyo County, a stream which has its source in Mount Whitney Military Reservation, and flows in an easterly direction into Owens River. The fish were transported a distance of nearly five hundred miles to San Francisco, and were exhibited for two weeks without loss, notwithstanding they were taken from waters of about 38° temperature and transferred to waters the normal temperature of which was about 60°. At the close of the exhibition, the fish were transported three hundred and fifty miles farther to our Sisson Hatchery. It was evident that the abrupt change in temperature had been too much for them. Three fourths of them died on the way to Sisson. Among those that reached Sisson alive were some females that were spawned by our Superintendent W. H. Shebley. There were no ripe males among the survivors. Mr. Shebley fertilized the eggs with the milt of Rainbow males, and has succeeded in raising about three hundred hybrids. They are now a year and a half old, but bear more resemblance to the Golden trout, the markings of that species being more apparent than those of the Rainbow.

During the past summer the U. S. Bureau of Fisheries sent another expedition to Volcano Creek for the purpose of collecting several hundred specimens, which are to be transported in a specially arranged car to Eastern hatcheries. So far as our means permitted we were pleased to assist the United States representatives, and furnished them with pack animal cans and such other paraphernalia as would be useful to them in making the collection. From the catch we hope to get a few

specimens for our Sisson Hatchery, where the fish are to be held as breeders with a view of settling the question as to whether or not these fish will retain their brilliant colors in waters other than those in which they were originally found.

SHRIMPS.

At the last session of the Legislature the shrimp law was amended in a very important particular. It was made unlawful to export dried shrimps or shrimp shells from this State, and at the same time allow our people to have fresh shrimps throughout the year. A great deal of ignorant if not malicious criticism has been directed against this Commission by reason of the passage of this law. In order that the people of this State may fully understand the matter, we feel that a brief review of the shrimp fishery would be timely.

Shrimp fishing has been followed industriously for more than forty years in San Pablo and San Francisco bays. The people engaged in this work have invariably been the Chinese. In 1885–1886 there were upward of fifty boats engaged in this work, and until the present law was enacted fully eighty per cent of the catch, which represented, ready for shipment, dried shrimps, shrimp shells, and small fish, were shipped to China. For years, until 1901, there were no restrictions whatever on the capture of shrimps. The business was profitable to the Chinese, hence they were ever anxious to prevent any legislation looking toward the curtailment of their privileges. The Commission's recommendations had been defeated several times until five years ago, when we were successful in securing a four months close season, which still allowed the shrimp fishermen eight months in which to operate. The four months close season had the effect of reducing the number of boats engaged in the business, which gradually dwindled, until in 1904 there were from 28 to 32 boats engaged in the work. In 1905 this number was further reduced by the non-export law to 21. This year (1906) the number of boats that have paid licenses is 17, but of that number three boats have since gone out of business, and we are advised of four more ready to quit, as their owners claim they can not successfully operate under the present law. We believe that not more than ten boats will find shrimp fishing profitable. There will always be a small amount of shrimps dried in each camp. These represent the culls or smaller ones, for which there is no sale in the fresh shrimp market. The Chinese, however, will utilize and find a market for them locally in the rather large Chinese and Japanese population of this State.

Two years ago we made as strong an argument as possible against any change from the four months' close season, knowing that the Chinese were determined to have it reduced one or two months. In

that we were not disappointed. Through their attorneys they had vigorously attacked the constitutionality of the former law, but were defeated in the State Supreme and Federal courts. Several of the leading Chinese shrimp dealers, previous to the legislative session of 1905, had called at our office and stated that they would spend no more money to contest the law; that they were satisfied it could not be broken, but desired that we should recommend to the Legislature that two months be stricken from the close season, claiming that four months was too long, and produced petitions signed by thousands of our people asking that it be reduced. It was then suggested that we might recommend a twelve months open season, instead of the ten months they asked, but forbid the exportation of dried shrimps and shrimp shells. This, of course, was promptly rejected, as it meant putting out of business about two thirds of the boats, and depriving them entirely of the profits of exportation. Consequently, in our Eighteenth Biennial Report we gave a detailed account of the destructiveness of the shrimp fisheries on small fish, and the disposition made of the catch, in order to draw especial attention to the need of retaining the then existing law, hoping that the opportunity might arise through which we might secure the present greater restrictions, which affect none but aliens. When what was known as the "boodle scandal" became public, Commissioner W. E. Gerber, believing that to be the time in which to secure legislation to further discourage the destruction of small fish, by preventing the exportation of dried shrimps and shrimp shells, suggested the substitution of a bill carrying those provisions. After satisfying ourselves that such a measure would not be unconstitutional, it was substituted for the one already on the files, which embodied all proposed amendments relating to fish, but had recommended no change with regard to the shrimp law. We are pleased to say that this measure quickly passed both legislative branches and encountered no opposition until doubts were raised, as to its constitutionality, by parties working solely in the interests of the Chinese, who hoped by that means to obscure the main issue, which was that they would rather operate under the restriction of a four months close season than to have the profits in exportation of dried shrimps and shrimp shells permanently stopped. Through their attorneys they have since made three test cases or attempts to have the law declared unconstitutional. The matter was carried to the United States District Court, the United States Circuit Court, and the State Supreme Court. They were defeated in every instance. From present indications they will probably attempt to have the law amended at the forthcoming session of the Legislature, so that they may again export shrimps and shrimp shells, with probably a two months close season. We urgently recommend the retention of the non-export law.

Several seizures were made. The principal one involved the capture, by our deputies, of 134 bags or about 50 tons of dried shrimps and shrimp shells, which were offered for shipment as "dried fish" and "fertilizer." The Chinese were arrested, convicted, and fined upwards of $200, besides paying expensive attorneys' fees.

After this bill became a law, the managers of every transportation company were served with a special notice calling attention to it, and each and every one informed us by mail or personally that they would use their best efforts to assist us in securing a strict compliance with the law; and now when "fertilizer" or "dried fish" or "seaweed" is offered for shipment, they require declaration to be made that the packages contain no dried shrimps or shrimp shells. As the shrimps are shipped in large bags much the same in appearance as wool bags, detection is comparatively easy, and since the important seizure was made, which represented many months of catch, we are satisfied none have been either shipped or offered for shipment.

We regret that we have no statutory power to confiscate and destroy the shrimps and shells that are seized for violation of the law. This would in most cases be a heavier penalty than the one imposed by the courts. The 134 sacks already mentioned were, by order of the court, returned to the defendants, after they had plead guilty and paid their fines. We kept track of them and found that the shrimp shells were disposed of to a fertilizing plant in San Francisco, to be mixed with loam and sold as a fertilizer in this State, which is still further evidence that they have given up all hope of exporting them.

While the number of boats have decreased fully one half since this law went into effect, it does not represent all the decrease. Formerly all the boats in the shrimp business used five men each to operate the nets and usually worked a day and night crew, in addition to which there was a gang whose business it was to boil, separate, and dry the catch. Some of the boats now operate but four men, and work but one shift, and only during one tide; in other words, the number of men employed in the shrimp business has been reduced fully three fourths. As the camps remaining are all engaged in the fresh shrimp business, their efforts are directed toward catching the larger shrimps, which are used for fresh market purposes, and are found in the deeper waters, consequently the catching of small fish is reduced to the minimun. Therefore, in our judgment, the present law is successfully carrying out the purpose for which it was framed. It permits our people to have fresh shrimps twelve months in the year without detriment to other fishery interests, and prevents the exportation of dried shrimps and shrimp shells, and has also reduced the number of boats and men to a number which, in our opinion, can work no injury whatever to the larger fishery interests of the State.

STURGEON.

As no positive results have yet followed the artificial propagation of these fish, notwithstanding it has been carried on to some extent in Eastern States, also in Germany and Russia, and as our means do not permit us to assume the expense of such work, we would recommend that no change be made in the present law. Natural propagation is a slow method; but we believe that by continuing the present law in effect for at least two years, these fish may show sufficient increase to justify a short open season. In the past two years we have made a number of arrests and secured convictions for the possession of sturgeon roe as well as of the fish themselves; consequently, there has been no systematic effort made to capture them, but some are taken accidentally by salmon fishermen, who, instead of liberating them, attempt to smuggle them into the markets. The present condition of the sturgeon industry is a striking example of what unrestricted capture means to any fish or game. At one time these fish were so plentiful that the price received would not justify sending them to market; just previous to the establishment of the closed season, they commanded a higher price than either salmon or striped bass. We have had some difficulty in obtaining convictions for the possession of sturgeon roe, one of the minor courts having ruled that sturgeon roe did not fall within the meaning of the statute.

We would recommend that the section referring to these fish include the words "sturgeon roe," making it a misdemeanor to have it in possession.

The principal arrests that have grown out of this law were for the possession of smoked sturgeon, which is considered quite a delicacy and, under various names, is found at certain times of the year in our markets. The dealers apparently will not risk selling the meat fresh, but handle it in their smoke-curing establishments.

SPINY LOBSTER OR CRAWFISH.

Two years ago we suggested that a close season of two years be established on this, one of our most important shell fish, which began to show signs of great depletion, if not extermination. The Legislature, however, considered the proposed restriction too great, but added one month to the close season. We have kept close watch on the fishermen and dealers and have secured a number of convictions for violation of the law, the majority of which were for having undersized fish in possession.

There are practically the same number of camps engaged in the capture of crawfish, but owing to the extreme lightness of the catch of legal-sized fish, the market prices have been unusually high. We have conferred with a number of the more intelligent fishermen who are engaged in

this work, and it is their opinion that there should be established a close season for at least two years.

We find that the greatest damage to the crawfish industry is done by the Japanese fishermen, who take them with a gill net, which is not over three feet in depth, but about one hundred feet in length. These fishermen will put ten or twelve of their nets around a bed of kelp, where the crawfish feed; if the fish are on the inside, they can not get out, and if they attempt to go after food, they are caught, both large and small. When the nets are brought to the surface the fish of legal size are taken into the boats; the smaller ones are usually so badly enmeshed that they can not be removed without maiming or crippling them so badly that they die. The white fishermen use traps made of laths; if the small ones are caught in them, they are not injured in the slightest, and are easily liberated.

In our opinion a close season of two years is at this time absolutely necessary to save these valuable shell fish from extermination.

The number of legal-sized fish now caught hardly justifies the cost of operating traps. We believe that at the end of two years, with a shorter open season of probably three months, and prohibiting their capture by nets, the crawfish industry can be saved to this State.

ABALONES.

The present abalone law is apparently meeting with general approval. A slight change was made at the session of the Legislature in 1905 by reducing the size at which the black abalones (*Haliotis californica*) could be taken, from 15 to 20 inches around the outer edge of the shell. This amendment to the former law has met with universal approval in those counties of the State along whose shores the abalone is found, and the citizens generally are united in favor of retaining the present law. The only suggestion that has come to us is in reference to preventing the use of diving apparatus to effect their capture. The Japanese, it is claimed, are making great inroads on the supply by taking them by that means. As the catch is shipped out of this State and is handled much in the same manner that the Chinese did the shrimps, we believe that an amendment forbidding the use of diving apparatus of any sort would be a wise precaution. The Japanese divers operating beneath the surface can take the meat from the undersized shells, bringing up those only that meet legal requirements. This renders it practically impossible to secure sufficient evidence to sustain a conviction for that offense. A number of arrests were made and convictions secured for the possession of small shells. We would therefore respectfully recommend that the statute be so amended that the use of diving apparatus be prohibited.

BLACK BASS.

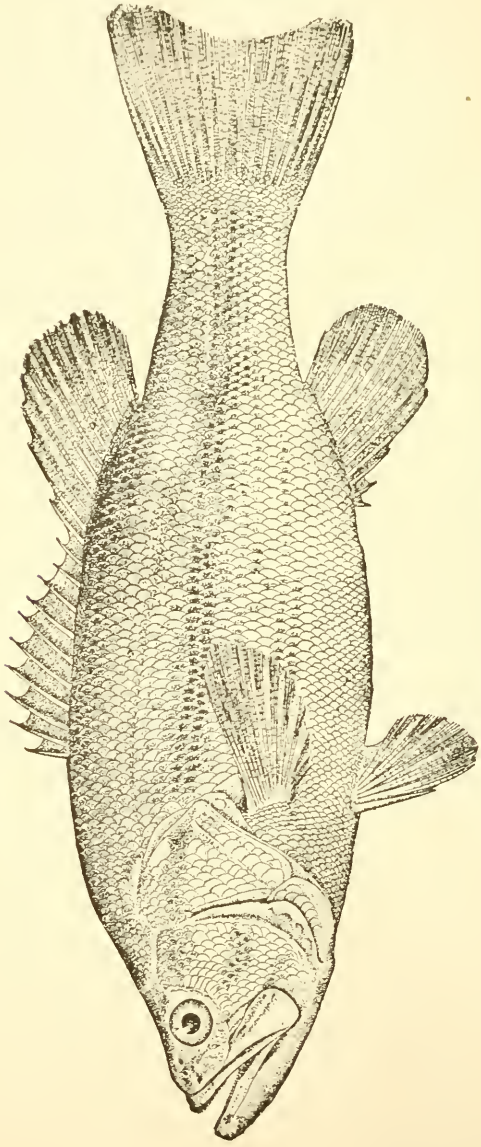
The black bass continue to grow in favor and are found in ever increasing numbers throughout the San Joaquin and Sacramento valleys. It is the opinion of some of the oldest fishermen on the Sacramento and San Joaquin rivers that in a few years these fish will be as plentiful as the carp. While we do not anticipate such a remarkable increase, it may be taken as an indication of their remarkable adaptability to the large bodies of fresh water throughout the two great valleys of the State.

During the past two years the work of transplanting these fish has been carried on conscientiously and intelligently. Whenever a new reservoir has been created for power purposes in localities not suitable for trout, we have planted black bass. We are constantly in receipt of letters from those in charge of reservoirs and artificial lakes testifying to the notable increase of this excellent game and food fish. In several instances where bass have been planted when trout had been requested, we have been gratified to have our judgment vindicated by the applicant.

Our chief source of supply is found in the sloughs and overflowed lands around Sacramento, and from that locality thousands of bass have been collected in the past two years and distributed from Siskiyou County on the north to Orange, Los Angeles and Riverside counties on the south. We are specially indebted to Mr. George Neale, the very efficient game warden of Sacramento County, for valuable services in this particular. In that respect Mr. Neale has done the State a great service. He has kept track of the principal bodies of water adjacent to Sacramento where black bass are found, and when, in his judgment, the expense attending their capture would be reduced to the minimum, he has notified us, and assisted by Deputy M. L. Cross has made these collections and distributed them. Together these deputies have handled thousands of bass two and three years old, and distributed them with no loss whatever. Most of the work has been done with seines, although some are taken with the Wilson spoon. It might be well at this time to call attention to the fact that there is apparently no permanent injury inflicted on the bass by taking them with a hook, as our deputies have never lost a single fish in transportation that was taken that way, notwithstanding they have been transported in some cases more than six hundred miles in 20-gallon shipping cans.

Along the Sacramento River in Butte and Colusa counties the bass have increased so that a good many fishermen are earning a livelihood by taking them with hook and line. They have not been found in such abundance in the San Joaquin River, but they are continuing to show up there in greater numbers and are furnishing sport to hundreds of anglers.

In the larger waters, near the mouths of the Sacramento and San Joaquin rivers, the salmon fishermen inform us that, in their opinion, in two or three years they will be as plentiful as the carp, which, on the



LARGE-MOUTH BLACK BASS—*Micropterus salmoides.*

other hand, are not nearly so numerous as they were five years ago. This information seems hardly credible, but it indicates the remarkable development of bass. In Cache and Miner sloughs, in Solano County,

these fish are found in countless numbers, and anglers who have fished for them in Eastern States claim that never in their experience have they found them so plentiful elsewhere.

In our report two years ago we mentioned that a plant of 300 black bass had been placed in Crane Valley Lake, Madera County. The fish were one and two years old. We have recently received a communication from the president of this water company, stating that while he had been opposed to having black bass planted in that body of water in the first instance, as he believed we should have given him trout, he was now convinced that he had been in error; that "everybody was catching large strings of fish, and most people considered them quite as gamy and equally as good a table fish as the trout."

On the other hand, we decline a good many applications for black bass when they are made for waters containing trout or better adapted to trout life than black bass. Our further experience with both varieties of fish bears out our judgment that these two high-grade sporting fishes are not adapted to the same waters. They are antagonistic and therefore expend much of their energy in fighting one another, rather than in increasing and multiplying.

An important plant is to be made this fall in Antelope Valley reservoir, located in Mono County, a body of water formerly known as Alkali Lake, which has been enlarged by draining the waters of the south fork of Walker River into it, which gives a surface area of more than six square miles. Carp have obtained quite a foothold in this lake, and as our experience shows that black bass will flourish wherever carp exist, we intend to make a liberal plant in those waters, and believe that in two or three years there will have been added another to the considerable list of bass lakes in this State.

Mention was made in our Eighteenth Biennial Report of shipments made into the State of Nevada, from which we take the following extracts: "We confidently believe that in two years the people of Nevada will find that they have an additional food supply in the shape of a fish that can not be excelled for table or gamy qualities." Quoting Mr. D. C. Wheeler, a prominent citizen of that State, in whose 80-acre lake about 200 fish ranging from 3 to 8 inches in length were planted, he says there are now "millions of them," and specimens weighing 3½ pounds have been taken.

We believe it would be wisdom on the part of the Legislature to amend the black bass law so as to make it a misdemeanor for any one to take, ship, offer for sale, buy, sell, or possess more than fifty black bass during one calendar day.

CARP.

The State Fish Commission has often been criticised and held responsible for introducing carp into the waters of this State. As a matter of fact, these fish were distributed very generally throughout the United States something over twenty years ago, in the hope that they could be successfully raised in ponds and small inland waters unsuited for other fishes.

In the year 1875 about 700 carp were brought to California by Spencer F. Baird, at that time the U. S. Fish Commissioner, who thereby expended a portion of an appropriation made by the Federal Government for that purpose. The species were secured from different rivers of Europe; the upper Rhine, the Po, and the Danube each contributed a portion. It was not the intention of the Federal Fish Commission to introduce these fish into public waters that were already stocked with good native species, but it was believed they could be extensively and profitably raised in many sections of the country not favorable to the growth of better fish. According to reports of the U. S. Fish Commission, the demand became so great that in 1882 more than 7,000 applications were filed and more than 5,700 applicants were supplied with from fifteen to twenty carp each; in the following year 9,870 applicants secured fish, and the distribution continued large until about 1890, when it began to diminish, but was not discontinued until 1897.

In spite of the prejudice that exists toward the carp, which we believe in most cases is based upon imperfect knowledge of the habits and uses of these fish, we are of the opinion that their introduction has been a benefit rather than a detriment to our waters—not as a general food supply for our poople, but because of their value as a food supply to better fishes; indeed, we believe it is due to their presence that black bass, striped bass, and even shad have become so abundant.

Carp are found in the larger markets at every season of the year, but the purchasers are principally Chinese. In the Eastern markets they find a ready sale at prices ranging, wholesale, from 3 to 7 cents per pound.

From a report of the U. S. Bureau of Fisheries, in 1904, we make an extract from an article entitled "The German carp in the United States," by Leon J. Cole, which throws considerable light on the introduction of carp in California. It is as follows:

> The circumstances attending the successful introduction of the scale carp into California, in 1872, by J. A. Poppe, of Sonoma, are better known. Mr. Poppe left California for Germany in the spring of 1872. At a place called Reinfeld, in Holstein, he procured 83 carp of various ages and sizes, the three largest of which were two feet or more in length, the smallest "the length of an ordinary steel pen." The fish were placed in 22-gallon tanks arranged one above the other, so that the water flowed down from the highest to the lowest, when it was dipped back to the top. These were put aboard a steamer for New York. Many of the carp died on the way, the larger ones

going first, and only 8 reached New York alive. They were taken across the continent to San Francisco in safety, but three more were lost before reaching Sonoma, where Mr. Poppe arrived on the 5th of August, 1872, with only five of the smallest of the 83 fish with which he started. Ponds had already been prepared, and the surviving carp were placed in them at once. They did well from the first, and, according to Mr. Poppe in the report mentioned above, they spawned the next spring, by which time they had reached a length of 16 inches. It was estimated that in May (1873) there were in the ponds over 3,000 young carp. The young fish were sold to farmers throughout California and adjacent states, and some were shipped even to Honolulu and Central America. The report gives a list of persons in Sonoma County who undertook the culture of the fish, and states that at that time (presumably 1878) Los Angeles, San Bernardino, and the adjacent counties in the southern part of the State were well supplied with the fish, and reports were coming in from all quarters that they were doing remarkably well.

There seems to be some question, also, as to whether the fish introduced by Mr. Poppe were a pure strain, for Professor Baird, who examined some specimens that were sent to him, says: "These are scale carp, apparently somewhat hybridized; at least, they do not present the characteristics of the pure breed brought by Mr. Hessel."

PERMITS FOR LIVE GAME.

At the last session of the Legislature, with the hearty coöperation of the Audubon Society, Section 637*a* of the Penal Code was amended to include within its provisions the protection of all non-game birds, except those that are considered destructive: bluejay, English sparrow, sharp shinned hawk, Cooper's hawk, duck hawk, great horned owl, and California linnet. For violations of this law quite a number of convictions have been secured and fines paid. We find that the law is meeting with universal approval, as it gives the farmer or tenant the right to kill, on his own premises, any of the non-game birds when found destroying berries, fruits, or crops. Our experience indicates that the farmers are appreciating the true value of the birds, and rarely, if ever kill them. The offenses are committed almost exclusively by the foreign element, most of whom are not citizens.

This statute also provides for the issuance of permits to collect birds, their nests and eggs, for scientific purposes. Immediately after it became a law, we were besieged with applications for such permits. The urgent necessity for the law was quickly apparent. Nests had been robbed indiscriminately and parent birds even killed by thousands, under the pretext of scientific study. Many young people seemed simply possessed with a desire to amass a collection — a larger number of birds or their eggs than their neighbors. We soon found it necessary to make a rule that no application would be considered until the applicant was indorsed by the head of the zoölogical department of either of the universities, the Academy of Sciences, or some other educational institution. This had the effect of reducing the number of collectors about seventy-five per cent, which practically restricts the use of permits to those who are connected with some educational or

scientific institution and are carrying out a legitimate line of scientific study or research.

We have issued limited, though broad, permits to the University of California at Berkeley and the Leland Stanford Junior University at Palo Alto. Both institutions are anxious to obtain complete series of all fauna peculiar to California for their zoölogical departments.

With respect to the issuance of permits to take game birds and animals, we are adhering to the rule established two years ago, allowing them to be taken only during the open season, after being satisfied that some good would be accomplished. The only exceptions to this rule have been when some large institution, free to the public, made application, and in such cases we have issued permits liberal in form, believing it to be within the spirit of the law. As careful supervision is given to all requests for permits, abuse of them is exceedingly rare and entirely out of proportion to the good that is accomplished. A number of arrests have been made for having trapped birds in possession, the necessary written authority not having first been procured.

In general, we note a great improvement in the sentiment of our people touching bird life. By far the larger number of applications are made for purposes of propagation, and in innumerable instances we have learned that where a permit had been issued to take three or four pairs of quail a considerable increase has resulted and they have been liberated, in most cases, on the land adjoining the owner's home, where the birds receive protection, which they quickly appreciate, with the result that there are many more quail than before.

Some criticism is yet heard because permits are issued to transport live birds from the State. In reply to that, we have to say, that the number of quail and ducks shipped outside of this State has not exceeded three hundred birds each year, and we were in every case satisfied that the birds were intended for propagating or scientific purposes. Sometimes they have been offered by us in exchange for bobwhite or other Eastern game birds. The criticisms, therefore, are not well founded. As the birds can neither be trapped, nor transported after being trapped, without written permission from this office, a positive record is kept of each individual who secures a permit to either trap, ship, or possess.

We are pleased also at this time to call attention to the assistance given this Commission by the Wells-Fargo Express Company with reference to the shipping of live game. In many cases the requests for permits come from this company's agents, showing that they are kept informed on the law, and exercise a wholesome influence in their respective communities. We therefore see no need for any change in the present law. We believe it should be interpreted liberally, giving all people who desire to trap birds for legitimate purposes an opportunity

to do so, as experience has shown that as the people come closer in touch with wild birds or animals, they are less anxious to destroy them and their efforts are turned more in the direction of protection and preservation.

Many requests have come from those living in the mountain counties asking for permission to retain in possession a fawn that had been picked up helpless, and would have died but for the attention given it. We discourage the taking of live deer, but generally grant a request to retain a fawn taken in that way, believing it means another deer saved. After a fawn (if it be a male) gets to be a year old, the party holding it is generally glad enough to release it, as the animal is then able to take care of himself. The female fawns seem to become quickly domesticated and will not leave a place where they are kindly treated.

When permits to trap wild game are issued, we have, in the past two years, established a time limit during which the permit can be used. This was done as an additional safeguard. Some of our earlier permits were not restricted in that way, the only limit being the number of birds or animals that could be taken. Under the present law, we issue permits to trap to those who write for permission to destroy protected game, claiming it does them damage.

As the provisions of the non-game law do not apply to protected game, we meet the situation by issuing a permit to the complainant, permitting him to take a limited number. In San Diego County, for example, from which section the most vigorous complaints come, we have granted permission to land owners who thought they were being damaged. For the service we paid $2.50 per dozen, crated and delivered at the nearest express office. The birds were then transported at our expense to other portions of the State where they are scarce and where it was believed new blood would be an advantage to the old stock. This rule has worked very satisfactorily, as after the farmer finds he can get a money value for trapping them, besides having them shipped away, he is glad enough to take advantage of it; but in every instance we have found that the number of birds that were reported doing damage was grossly exaggerated. For the year 1906 we have had practically no complaints of that kind. In 1905 we had issued permits for the trapping of two hundred dozen, which were to be captured in those sections where the greatest damage was reported. The number of birds taken on these permits was less than fifty dozen.

In certain quarters there has been some bitter criticism regarding our interpretation of the law with reference to permits. Under the statutory provisions authorizing this Commission to issue permits for scientific purposes and for purposes of propagation, we have construed it to mean that everything which makes for the restoration and preservation of game should be granted freely.

A great many of our people are raising pheasants and some quail. Pheasants are also landed here from foreign countries under permits from the Federal authorities at Washington, and while the letter of the law forbids the sale of pheasants or quail, it is our contention that the spirit of the law is to prevent the sale of any dead birds for market purposes, but that permits should be freely issued for transferring the birds from one party to another who desires to propagate them. It is not reasonable to suppose that one would go to the expense of buying birds in a foreign country, pay transportation charges across the sea, and then give them away. In the past two years dozens of pheasants have come in that have been disposed of by the dealers who imported them, and many have been sold by people who raised them. In each case to make a transfer, a permit was issued by this Board entitling the party to hold the birds "for purposes of propagation, together with their increase." We have followed the same plan with reference to permits for trapping quail, but have granted no permits to dealers to sell quail or pheasants.

We have not the means nor the men to engage in the trapping of quail, but when proper applications came to us from Eastern States for a limited number (which has not been more than fifty birds, or four dozen) we have issued a permit allowing them to be trapped, shipped to San Francisco, and then properly crated and shipped East. In no case have we issued a permit until first satisfied that the birds were to be used solely for propagating or scientific purposes, and in that respect we have issued permits for both quail and pheasants.

IMPORTATION OF GAME BIRDS.

Our means have not permitted us at any time to take up seriously the introduction of new species, although special efforts were made to secure some Hungarian partridges, a fine game bird which we believe is adaptable to the conditions in this State. We corresponded with bird dealers in England and on the Continent, all of whom were willing enough to promise us birds (at what seemed extravagant prices), but they were not able to deliver them. We then took up the matter with game importers in this country, and placed an order with Mr. C. Lincoln Free, of Easton, Pa. Mr. Free is a member of the American Museum of Natural History, and one of the most successful importers of wild birds and animals, but he was unable to procure them. Finally Commissioner W. E. Gerber, while on an extended European trip, took up the matter in person at Vienna, and after much correspondence and trips to various points, even invoking the aid of the royal gamekeepers, he succeeded in getting together a shipment of fifty-four birds and directed them to be sent to Sacramento. Owing to the fact that the

birds were not properly crated, due to the failure of the shipper to carry out Mr. Gerber's express instructions, fifty per cent of the birds died en route. All the expenses attending their purchase, crating, and express charges from Austria to Sacramento, were borne by Mr. Gerber, who was determined that at least one personal effort should be made to introduce these most desirable game birds into California. He has now about two dozen in his large aviary (known familiarly as "The Roost") at Sacramento, where he hopes to breed them during the coming spring, and from the increase liberate some in those sections that seem best adapted to their needs.

In the years 1904 and 1905, we again secured permission, through Dr. T. S. Palmer, in charge of Game Preservation, Biological Survey, Washington, D. C., to have transported from Alaska to this State a sufficient number of ptarmigan to properly demonstrate whether or not they would find a congenial habitat in the Shasta and Tahoe regions. Permits were secured for three different individuals, in the hope that one of them might be able to bring back a few pairs. We contracted to pay from $8 to $10 per pair, but regret to say that not a single bird was received.

We are glad to report that the practice of bringing Chinese quail into this State for market purposes has been discontinued, through the assistance of the authorities at Washington. A good many have been brought in at different times that were intended for purposes of propagation, yet none seemed to survive, no matter where liberated or what protection had been given them. The Chinese have a theory that the quail come from frogs, and it is noteworthy that even Chinese merchants, who, on other things, seem to be as well balanced as any European, adhere to this belief. Some ten dozen that had been seized from a Chinese restaurant, where they were to be used in conflict with the law, were liberated in Mendocino County on a large tract of land, where every protection is accorded wild game. It was confidently believed that the birds would thrive there if in any place in the State. They were noticed near the spot of liberation for a few weeks only. Shortly afterwards they entirely disappeared.

About fifty dozen bobwhite quail have been brought into this State in the last two years. Two shipments came from H. A. Boies, Hudson, Michigan; one from Massachusetts; another consignment from Alabama, and the fourth came from Texas. In exchange were given both valley and mountain quail. Of the latter less than five dozen were obtainable. The bobwhite have been liberated over a wide range; that is, a dozen birds in widely separated sections of the State. They seem to have shown a marked development in one section only—Sacramento County, on the Del Paso Rancho, near the city of Sacramento, where

twenty dozen were turned out and where special efforts had been made to protect them by killing off the ground varmint and establishing a close season on all shooting for a term of years. Our experience would seem to indicate that as these birds roost upon the ground they fall easy prey to the varmint, but where the latter have been exterminated an increase is noted.

In February, 1905, another effort was made to secure quail from Mexico, and deputy H. T. Payne was sent there for that purpose, but owing to continuous storms and otherwise unfavorable conditions that prevailed in the country at that time, and also a serious illness contracted by Mr. Payne while there, he returned empty handed, which was a great disappointment to us. From the specimens brought by him on a previous trip the year before, no special success followed.

With respect to pheasants, we are pleased to report continued interest in their propagation in captivity by people in all sections of the State. The increase is yet small and is generally disposed of to friends and neighbors. Our means have not permitted us to procure additional birds from Oregon, and the prices in Asiatic countries, added to the transportation charged, preclude their importation.

FISH AND GAME PROTECTIVE ASSOCIATIONS.

During the past two years quite a number of new fish and game protective associations have been organized in different portions of the State, chiefly in the high Sierras. They have accomplished much toward building up a better sentiment in their respective communities in favor of the observance and enforcement of the fish and game laws. On the recommendation of the officers of these associations we have appointed several members in each one as deputies of this Board, which gives them full authority to make arrests for violations of the fish and game laws. We are pleased to say that excellent results have followed these appointments, which is the more commendable in view of the fact that in the higher elevations the fish and game breed much later than in the valleys, and the general State law does not fit to the entire satisfaction of the permanent residents in those regions.

These clubs are in the main composed of representative and intelligent citizens, who realize the importance of having a bountiful supply of fish and game in order to attract the summer tourists, who bring in a considerable amount of money each year, which would not be the case if the fish and game were scarce. We have always found the associations ready and willing to do their full share of the work, also in meeting the expense attached to the hauling and planting of fish, and in some sections where prosecutions for violation of the fish and game laws had never before been even considered, there have been a sufficient

number of convictions to call attention of violators to the fact that the State laws apply there as well as elsewhere.

In the great interior valleys these clubs have shown commendable activity in reporting violations of the law to this office, and in that way have been instrumental in causing many arrests and securing convictions for infractions that would not have come to our attention but for the notification we received from them.

We hope to keep one of our regular deputies in the field, so far as our means will permit, to visit with the different associations, instruct their officers in the matter of arrests, and explain the work and purposes of this Commission, and also to assist in the organization of new associations.

HUNTING LICENSES.

It appears to us that the time has arrived when we should recommend, for the consideration of yourself and the Legislature of this State, a plan to provide for an increase of revenue without taxing the General Fund; in other words, to make those who hunt for protected game pay for the privilege. We appreciate that the General Fund of this State is already taxed to its full limit, and we believe that no legitimate sportsman or other person who hunts, either for pleasure or profit, would object to such a measure.

Quoting from Bulletin No. 19 of the U. S. Department of Agriculture, which was prepared by Dr. T. S. Palmer, in charge of Game Preservation, U. S. Biological Survey, we make the following extracts:

> Two of the most important problems of practical game protection are how to enforce the laws and how to secure the funds necessary for the purpose. Without funds it is manifestly impossible to either provide or maintain the service required to carry the laws into effect, and if no serious effort is made to secure compliance with the law, public interest in game protection flags until it becomes difficult to secure either appropriations or such legislation as will yield revenue for warden service. The most successful method of raising funds thus far devised is a system of licenses, which in effect amounts to a direct tax on those who hunt. Several states depend almost entirely on some system of this kind for maintaining their warden service, and others receive from it important additions to their game protection funds.

There are three systems or classes of licenses: resident, non-resident, and alien.

The total amount collected in 1905 from the 36 states of the Union and 4 provinces of Canada, in which *non*-resident licenses are requested, was $153,429, the largest sum being collected by the State of Maine, and aggregating more than $31,000. Next in the list of states is Wisconsin, with a collection of $11,225; North Carolina, $10,111; Florida and Wyoming, each upward of $7,000. The data for 1905, collected by the Bureau of Biological Survey, U. S. Department of Agriculture, show that nearly 10,000 licenses were issued to non-residents, or people hunt-

ing outside of their own states; that in 16 states of the Union and 4 provinces of Canada 511,905 licenses were issued to residents; and that, so far as figures are obtainable, the total number of licensed hunters in the United States and Canada was more than half a million and the amount paid for licenses more than $600,000.

The first non-resident license law was enacted in 1895, but is now in force in 36 of the states of the Union and throughout Canada. A resident license is required in 16 states of the Union and in 4 provinces of Canada.

With this record before us, it seems that California can very properly demand a license scheme of some kind to provide revenue for the support of the Game Preservation Fund; the moneys so collected to be applied to the payment of claims approved by the Board of Fish Commissioners for the expense of protecting, restoring, and introducing game into the State and to the payment of costs and expenses incurred in the prosecution of offenders against any of the provisions of the game laws.

When it is recalled that in 1905 Wisconsin collected in $1 resident license fees $88,000, Illinois $127,988, Missouri $48,721, Kansas $42,300, Montana $32,662, Oregon more than $21,000 (the first year in which the license law had been in effect), and Washington $26,271, it can readily be seen what an advantage it would be to the game interests of our State, that have been struggling along for the past eight years on an appropriation varying from $3,750 to $12,500 per annum (all taken from the General Fund), to adopt a similar plan to raise revenue.

We find also that the states of Pennsylvania, Louisiana, Utah, and Wyoming have recently adopted another plan worthy of our consideration, which provides that all hunters who are not naturalized residents of the State must secure the same license obtained for non-residents. It is known as the "alien license law." In this State, where we have a large foreign population, composed of Italians, Hungarians, and Japanese, a considerable revenue could be collected if these people were required to take out such a license. Reference to our record of arrests shows that more than two thirds of the violations are committed by the foreign element. The State of New York meets the situation in a different way. On the statute books of that State is a law making it a misdemeanor for any alien to carry firearms in public places. This would give the foreigner who owns property the right to have firearms on his premises for his own protection, but would not permit him to use them afield. We believe either or both of the above plans would be of the greatest benefit to the game interest of this State, and shall recommend at the forthcoming session of the Legislature (after careful study of the license schemes in effect) that one which, in our judgment, is best adapted to the conditions in California.

The following, taken from the U. S. Bulletin, for 1905, on Hunting Licenses, issued by Dr. T. S. Palmer, in charge of Game Preservation, U. S. Biological Survey, Washington, D. C., is worthy of the careful consideration of our legislators and others who may be interested in the restoration and preservation of the game of California:

EXPERIMENTS IN LICENSE LEGISLATION.

Since the adoption of license laws, a number of experiments have been tried, some of which have proved successful and others unsatisfactory. The possibility of making the protection of game self-sustaining and of maintaining a warden service from the income derived from license fees has been successfully demonstrated. In 1905 warden service was maintained without appropriation from the State treasury in nine of the thirty-six states which have State commissioners or game wardens in charge of the work: Idaho, Illinois, Michigan, Missouri, Montana, North Carolina, North Dakota, Washington, and Wisconsin.

The right of a State to impose heavier fees on non-residents than on residents, which has often been questioned, has been upheld in every instance in which test cases have been carried to the higher courts. Such decisions have been rendered by the Supreme Courts of Illinois (*Cummings* vs. *People*, 71 N. E. 1031) and New Jersey (*Allen* vs. *Wyckoff*, 2 Atl. 659), and by the U. S. Circuit Court in Illinois (*In re Eberle*, 98 Fed. 295). The Supreme Court of Arkansas, however, has held that a law prohibiting non-residents from hunting in the State is unconstitutional in so far as it prevents them from hunting on their own property (*State* vs. *Mallory*, 83 S. W. 955).

In the effort to devise some means of identifying the holder, one or two states have required a photograph in addition to a description on the license; but this requirement has not come into general use. Nine states—Arizona, Colorado, Maine, Michigan, Minnesota, New Hampshire, Vermont, Wisconsin, Wyoming—and the provinces of Ontario and Quebec have adopted the coupon license, which furnishes a record of the game offered for shipment, but not of the game killed. The latter information is secured by Manitoba by requiring each holder of a permit to return the permit to the department of agriculture, with an affidavit showing the number of animals killed or taken. Failure to make such returns within thirty days after the close of the season subjects the holder to a fine and may be ground for refusal of a permit another year. In the British colonies of Africa such returns of game killed under license are commonly required and furnish valuable statistics of the quantity of game killed each year. Only by the adoption of some such system as this can the full statistical benefits of the license system be obtained—namely, a record of the persons hunting, a record of game shipments, and a record of the game killed.

About one third of the states which issue licenses either allow no export or make no provision for carrying home game. Among these are Florida, Mississippi, New Jersey, New York, North Dakota, and West Virginia. Other states allow licenses to take home certain kinds of game, but not others. Withholding such privileges is naturally regarded as a hardship, and a slight change in policy, so as to allow the licensee to take with him a reasonable amount of game, would eliminate much criticism of the game laws.

In the attempt to issue licenses in the most economical manner, several expedients have been tried which were promising at first, but proved to be unsatisfactory. Few states have been able to handle the immense amount of work involved in issuing resident licenses without the assistance of county clerks or similar local officers, but when this work is delegated to such officers adequate provision should be made for securing reports of the number of licenses issued and the amounts collected. Exemption of persons hunting in the county of residence has proved unsatisfactory and probably reduces the income to about twenty-five per cent of what it should be.

Several states, including Maryland, Minnesota, Nebraska and South Dakota, have gone so far in attempting to enforce the license laws as to authorize the confiscation of guns or other hunting paraphernalia. The wisdom, if not the constitutionality, of such provisions is open to question, as considerable opposition and litigation are sure to be

aroused. In Minnesota the legislature has recently repealed such a provision and in Nebraska the Supreme Court has held a similar one unconstitutional (*McConnell* vs. *McKillip*, 99 N. W. 595).

Some of the experiments are given in the following table:

Unsuccessful.

1. A license system without supervision of special State officer.
2. Proceeds from licenses devoted to purposes other than game protection.
3. Licenses good only in county of issue.
4. Variable fees, *i. e.*, same as required of non-resident in State of applicant.
5. Excessive fees required from non-residents—more than $15 for birds, or more than $25 for big game, comprising deer only.
6. Denial to non-resident licensees of the privilege of carrying home game.
7. Exemption of non-resident landowners without stipulating amount of property owned in the State or limiting hunting to their own lands.
8. Exemption of residents hunting in their own county.
9. Exemption of guests of landowners, *i. e.*, substitution of invitations for licenses.
10. Attempt to punish hunting without license by confiscation of guns.

Successful.

1. License system under supervision of State game warden, and if licenses are issued by other officers license blanks furnished by him and the number issued returnable to him.
2. Proceeds devoted to game protection fund (unless prevented by constitutional provision).
3. Licenses, both resident and non-resident, good anywhere in the State.
4. Definite fees uniform with those of adjoining states.
5. Moderate fees—usually $10 or $15 from non-residents for birds and $25 for big game, and $1 from residents.
6. Privilege of carrying home a reasonable amount of game if tagged with license coupon and carried or shipped open to view.
7. Exemption limited to persons paying taxes of $100 or more on property in the State or hunting on their own lands.
8. Exemption limited to persons hunting on their own premises.
9. Guests' licenses issued at nominal rate, say $1 per day.
10. Penalty for hunting without license, a fine at least double the amount of license or imprisonment not exceeding sixty days.

GAME WARDENS.

We desire again to recommend that the statute governing the appointment of game wardens be amended so that the compensation could be increased, believing that it would act as an inducement for a better grade of men to seek the office. We believe that the right should be given to the boards of supervisors to appoint a warden at any time and for as long a period, not to exceed two years, as in their judgment good services could be rendered. It is a remarkable fact that in the counties having the greatest amount of fish and game there has been the least attention paid to the subject. It is only in those counties where fish and game are comparatively scarce, due to being more densely populated, that the people have been aroused to a proper appreciation of its value. In our opinion every county in the State should have a game warden to serve at least a portion of the year,

especially in all the mountain counties during the summer months when the tourists and campers visit those sections. Most of these people are law-abiding citizens at home, but are inclined to treat the fish and game laws lightly when in the remote mountains, thereby setting a bad example to the natives, who resent the idea of having their fish and game taken without stint by the summer visitors. An efficient and properly paid game warden can do good work during that time of the year at least. Wherever the fitness of the individual has been given first consideration, in such counties do we find the laws observed. We have made it a rule to issue credentials to the county wardens, as it increases the scope of their authority and gives them full power to make arrests outside of their own county lines. In this way we have been able to pay something for such additional service, and it has also had the effect of causing two or three good men to remain in office. Experience has shown it is best in the long run to make the compensation sufficient to be an inducement for a good man to seek it.

RECOMMENDATIONS.

Realizing the urgent need for economy, we are making but one request with reference to increased appropriations, and this deals with a great industry, one of such far-reaching importance that we feel that it is not only warranted, but absolutely imperative in order to maintain the present efficiency of our hatchery department. It is generally recognized that our fish cultural work, especially in regard to salmon, stands in the front rank in the United States. We have accomplished this on the very modest appropriation of $12,500 per year, and it appears to us that the great State of California can well afford to increase this amount $5,000 per annum, or $10,000 for two years. This would still leave our appropriation for the support and maintenance of hatcheries less than $20,000 per year. As the hatchery work has broadened, and the experience of our skillful hatchery force correspondingly enriched, they are in demand by other states, which are anxious to improve in their methods of artificial propagation of fishes. We feel that these men belong to the State of California, and that it can not afford to lose their services at this time. It must be remembered that fish culturists are scarce. For years our men have struggled along, enduring all kinds of privations, and endangering sometimes their lives as well as their general health, by exposure to the climatic extremes that are found in this State. They are worthy of more pay. The small increase asked for would enable us to more nearly compensate them to the full value of their services and also permit us to make the necessary repairs and smaller improvements that are essential to keep pace with the growing demands of the work. We believe that every

taxpayer of this State who has visited any one of our hatcheries will heartily approve of this recommendation, also every individual who is in any way connected with the fishery interests of this State, whether it be the men who delight in angling in the mountain streams, or those who are engaged in the commercial fisheries—all would be beneficiaries from whatever improvement is made in our hatchery department.

We would also recommend that, in accordance with the practice of such states as New York, Minnesota, Colorado, Washington, Idaho, Maine, Illinois, Indiana, Michigan, and New Jersey, the same right be granted to our deputies and assistants to make search, without warrants, of any hunting outfit or place of business where game is handled. In many cases it is impossible to secure the evidence without having authority to act on the instant. Many justices of the peace and police judges hesitate about issuing search warrants, fearing it might interfere with their chances at election time. In the meantime, the offender disposes of the illegal game. In some of the states authority has been given to the game wardens to seize fish and game improperly shipped, and to sell it.

We would respectfully recommend that a law be enacted that will prohibit the use of any live blinds.

We would also recommend that a close season be declared for the taking or killing of grouse, for a period of three years.

We would recommend the abolishment of the law of protecting all fish-eating birds except sea gulls, and the blue and white crane or heron.

We would recommend the following modifications of the existing game laws:

Amend section 626*a*, relating to doves, making the open season from July 15th to October 15th.

Amend and modify section 626*g*, relating to tree squirrels, by granting an open season for their killing between September 1st and January 1st; placing a bag limit of six for the season, but prohibiting sale at any time.

Amend section 626*j* so as to prohibit the use of hounds at any time to run, track, or trail any deer.

Amend section 637*a* by adding the word "robin" after "meadowlark."

With reference to the bag limit on ducks, we recommended two years ago a reduction from fifty to twenty-five. The recommendation failed of passage. It was our intention to renew this recommendation, but at a large meeting composed of representative sportsmen from different sections of the State, as well as representatives selected by the boards of supervisors from many of the counties, after an earnest discussion of this question in all its phases, it was agreed to recommend a bag limit

of thirty-five; as this seemed to be a fair expression of the general sentiment, we would respectfully suggest that it be given careful consideration.

We would respectfully recommend the following amendments to the fish laws:

Amend section 628*b* by making it a misdemeanor to take, catch and kill, or have in possession, buy or sell, or offer for sale, more than fifty black bass during one calendar day.

Amend section 632 by making the open season for the taking of trout from May 1st to November 15th.

Amend section 634 by extending the open season for the taking of salmon from the 10th day of September to the 17th day of September, and extending the close season from the 16th day of October to the 23d day of October.

We recommend that no close season be made for striped bass, but that, in lieu thereof, the weight limit at which striped bass shall be sold or offered for shipment or sale shall be increased, and, if necessary, their shipment from the State prohibited.

We recommend that there be a close season declared on Sacramento perch for four years.

We recommend that the tide-water clause on steelhead trout be stricken out of section 632 of the Penal Code.

We recommend that the shipping or carrying of trout outside of the State for sale be prohibited, and also the catching of white fish be prohibited during the close season on trout.

We recommend that there be a close season declared on crawfish for a period of at least two years.

ACKNOWLEDGMENTS.

We desire to extend to you officially and personally our sincere appreciation of the confidence you have shown in us and the encouraging interest you have taken in our work. All of our requests and recommendations have met with courteous and prompt recognition, for which we thank you.

To Hon. George M. Bowers, Commissioner of the U. S. Bureau of Fisheries and to his able assistants in Washington, Dr. H. M. Smith and John W. Titcomb, we are under many obligations for their support and assistance; also to Captain G. H. Lambson, superintendent of the summer egg-collecting stations in California.

To the Southern Pacific Company, the California Northwestern and North Shore Railway Company, the Santa Fé Railroad Company, the Lake Tahoe Railroad Company, the Butte County Railroad Company, and the Boca and Loyalton Railroad Company, our thanks are

extended for most generous treatment in the free transportation of our employés and supplies, and the distribution of fish and eggs, without which our efforts would have been so restricted as to have been of little value to the State.

We are especially indebted to A. Christeson, General Manager of Wells, Fargo & Co., and all of the superintendents, agents, and other employés of their company, for many privileges and most courteous treatment. No reasonable request has failed to receive consideration, and in many instances voluntary assistance has been rendered that proved of great value to our work.

To the Pacific Coast Steamship Company we are indebted for the free transportation of salmon eggs and live fish between San Francisco and Eureka.

Thanks are due to all the employés of the Southern Pacific Company, officials or subordinates, with whom our deputies have come in contact, for assistance rendered our fish distributors when transporting fish, eggs, or other material necessary to our work.

We have also to thank Mr. D. L. Bliss, Jr., superintendent of the Lake Tahoe Railway and Transportation Company, for most courteous and liberal treatment with respect to transportation of our men and distribution of fish on the lines over which he has control in the Tahoe region.

To Messrs. Lawrence and Comstock at Tallac we are under obligations for many privileges and also for the free use of teams in hauling fish, eggs and supplies; without these substantial concessions our operations would have been seriously handicapped.

Our thanks are also due to the U. S. Army officers stationed in the Yosemite National Park; especially to Major Harry C. Benson, Superintendent of the Park.

In submitting this record of the work accomplished during the past two years, we are confident that it will meet with the approval of yourself and all fair-minded citizens, and trust that the recommendations made by us, which represent our best judgment, based on our experience and observation of the various subjects, will be enacted into laws, to still better enable us to carry out the important reasons for which this Commission was created.

Yours respectfully,

W. W. VAN ARSDALE,
W. E. GERBER,
JOHN BERMINGHAM, Jr.,
Fish Commissioners.

San Francisco, Cal., September, 1906.

APPENDIX

TO THE

NINETEENTH BIENNIAL REPORT

OF THE

BOARD OF FISH COMMISSIONERS.

1905–1906.

CONTENTS.

THE TROUT AND SALMON OF THE PACIFIC COAST

By DAVID STARR JORDAN.

With drawings from nature by Sekko Shimada.

TROUT.

It is now just a hundred years ago that Meriwether Lewis and William Clark, encouraged by Thomas Jefferson, the Roosevelt of those days, crossed the great divide and explored the waters which we now call Columbia.

It was in the headwaters of the Columbia that these explorers first met with the true trout in America. William Clark, who was a judge of fine fishes, found it good, and thirty years later, when Sir John Richardson published his noble work on the animals of the North, "Fauna-Boreali-Americana," he named this Columbia River trout *Salmo clarkii*.

His specimens came from Astoria, where they were collected by the enthusiastic surgeon-naturalist, Dr. Gairdner, then an employé of the great fur company, a man worthy of remembrance in the annals of the good men who knew fish.

The word trout is of French origin, *truite* in modern French, and still earlier from the late Latin word *trutta,* which becomes *trucha* in Spanish-speaking countries. In Europe, the name trout in all its forms is used for black-spotted fishes only, those with red spots, as we shall see later, being called by other names.

All the true trout have come to America from Asia, and none have naturally crossed the great plains. For in the Great Lake region, the Alleghanies and the valley proper of the Mississippi the true trout are unknown.

But in northern Europe, Siberia, southern Alaska, and throughout the Rocky Mountain region and the waters to the westward, trout are everywhere. Their original parentage, no doubt, was from some sort of land-locked salmon; their original birthplace being perhaps not a thousand miles from the Baltic Sea. Since that time of their birthday, very long ago, trout have traveled up and down the rivers, down into the sea and up another river, until they have reached from Scotland

to Chihuahua, from Montana to the Pyrenees, and whoever seeks them honestly anywhere in all this range shall find exceeding great reward. Whether he catches trout or not, it does not matter; he will be a better man for the breath of the forests and the wash of the mountain streams in which the trout makes its home.

CUT-THROAT TROUT.

Most primitive of the American species, no doubt, is the one named for William Clark. It was born in Alaska, and has worked its way southward and eastward; southward as far as Eel River in California, eastward across the divide into Montana; no great task, for on the swampy flat of Two Ocean Pass the head-streams of the Yellowstone interlock with those of the Snake. It runs southward throughout the

CUT-THROAT TROUT—*Salmo clarkii* Richardson.

great basin of Utah, once tributary to the Snake, and, more or less changed, its descendants have peopled the Platte, the Arkansas, the Rio Grande and the Colorado.

The Clark trout is usually known as the Cut-throat trout, from the half-hidden gash of deep scarlet which is always found just below the base of the lower jaw. This gash of red is the sign manual of the Sioux Indian, the Cut-throat among the fierce aborigines.

This is the best mark of the Cut-throat trout, though it disappears in alcohol, and it is sometimes faintly shown in other trout, especially in the large Rainbow trout of the Shasta region. Other marks are the rather long head, which forms nearly a fourth of the length of the body from the snout to the base of the caudal fin. Almost always there is a narrow line of very slender teeth along the middle line of the base of the tongue, besides the larger teeth which surround the edge of the tongue in all trout. The body is usually well spotted, and the spots are small, there being none on the belly. But no one can know a trout

by its spots, because the spots vary interminably. They depend mostly on the character of the water. In the lakes they grow faint, and in the sea they vanish altogether, giving place to a uniform silvery sheen. This is true of all trout alike—American, Asiatic, and European. The color of the flesh varies equally. It seems to depend partly on age, partly on the food. A diet of shrimps turns the flesh red, it is said, but the statement needs proving. The size of trout varies as much as the color. A species which is mature and spawns at six inches in the mountain brooks, may reach a weight of ten or even twenty pounds when taken in the sea. Whatever food the fishes can get, they will turn into trout, and the trout which cannot get much are just as perfect as the others.

The best mark of the Cut-throat trout is found in the small scales. In a row from head to tail you will count from one hundred and fifty to one hundred and eighty.

The Cut-throat trout spawns in the spring. Those in the streams run up the smaller brooks, while those in the sea or the lakes seek shallower waters, either a stream or a sandbar in the lake. No trout ever spawns in the sea. The Cut-throat trout is hardy and vigorous, but its degree of energy depends on the character of the streams. A trout in warm water anywhere usually shows little fight. In the lakes, the Cut-throat rises to the spoon or the phantom minnow. In the brooks, a fly, a grasshopper, or a bunch of salmon eggs will usually engage its attention. This species is the most widely distributed of the trout. It is one of the handsomest and finest, yet it has rarely been transplanted to waters other than those to which it is native.

TAHOE TROUT.

One of the most direct descendants of the Cut-throat trout is the Tahoe trout, which is confined to the streams and lakes of the desert of Nevada, the basin of the former Lake Lahontan.

It is found in Lake Tahoe, where it was discovered by Dr. Henry W. Henshaw, in 1877. It descends in the Truckee to Pyramid Lake, whence it comes in large numbers to the markets of San Francisco. It was found also in Donner, Webber, and Independence lakes. It is found again in the Carson and the Humboldt—both once tributaries of the vanished glacial lake called Lahontan. From the Truckee it has been introduced into the Feather, the Stanislaus, and the Mokelumne, on the western slope of the Sierras.

The Tahoe trout is plainly a Cut-throat, having the same red dashes under the throat, the same long head, small scales and teeth on the base of the tongue. It is, however, browner or yellower in color, and the spots are always larger, covering the belly as well as the back of the fish.

The Tahoe trout usually weighs, when mature, two or three pounds, but in the depths of Lake Tahoe huge specimens weighing from seven to twenty-eight pounds have been sometimes taken.

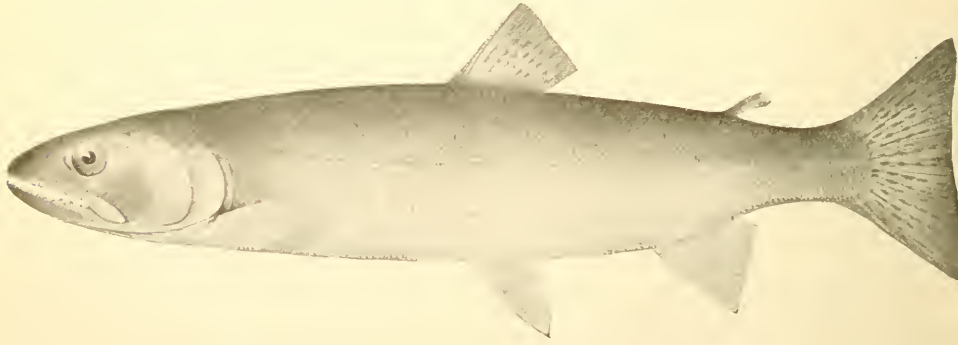
Those large trout called the Silver trout of Lake Tahoe (*Salmo tahoensis*) are supposed to spawn in the lake, and thus to form a sub-

TAHOE TROUT—*Salmo henshawi* Gill and Jordan.

species more or less distinct from those which spawn in the brooks. As a food or as a game fish, the Tahoe trout is scarcely different from the ordinary Cut-throat of the Columbia.

CRESCENT TROUT.

Of the many long-headed trout more or less allied to *Salmo clarkii*, two are especially interesting to the angler, the Crescent trout and the Beardslee trout. Both are found only in the deep glacial lake in Clallam County, Washington, known as Crescent Lake. The Crescent



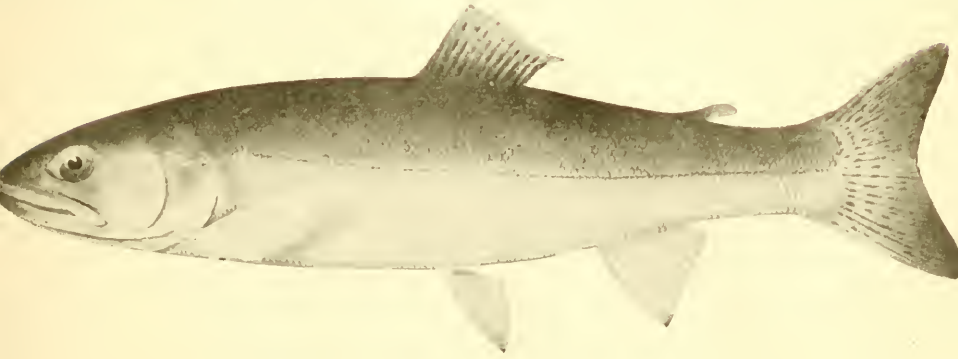
CRESCENT TROUT—*Salmo crescentis*.

trout is a fine game fish, reaching a weight of eight to ten pounds. It is very deep steel-blue in color, with fine specks and without red at the throat. The scales are as small as those of the Steelhead, but the head is not short.

BEARDSLEE TROUT.

In Crescent Lake, Admiral Beardslee also discovered the Beardslee trout, to which his name has been given. It is found in deeper water than the Crescent trout, and it is larger, some specimens weighing from ten to fourteen pounds. Its color is deep blue, dotted with small black spots. The scales are as large as in the Rainbow trout, about one hundred and thirty in a lengthwise series, and the head is long, making more than one fourth the total length to the base of the caudal. This is one of the finest trout known in any country, and it should be planted in other deep lakes before it is exterminated by the trout-hog, who is already encamped on the shores of Lake Crescent.

Another trout has been described from Lake Crescent as *Salmo bathaecetor* (Meek). It is certainly much like the Crescent trout, of which it would seem to be a deep-water variation. Near to Lake



BEARDSLEE TROUT—*Salmo beardsleii* Jordan and Seale.

Crescent, but wholly separated from it, is another mountain lake called Lake Southerland. In this lake two other species or forms of trout are found, the one called *Salmo jordani* being close to *Salmo clarkii*, the other *Salmo declivifrons*, resembling *Salmo crescentis*. Doubtless other mountain lakes of the Olympic range will yield still other species of trout isolated from the body of their kind and at least on the road to becoming separate species. The origin of each of the different species of trout is clearly to be traced to the condition of isolation.

STEELHEAD TROUT.

In the coastwise streams from Skagway, in Alaska, to Santa Barbara, California, is found a fine, large trout, known as the Steelhead, its scientific name being *Salmo rivularis*. This name was given by Dr. W. O. Ayres to a specimen taken in the Sacramento River, at Martinez. The species was long known as *Salmo gairdneri*, but the specimen originally named by Dr. Richardson for Dr. Gairdner was a young

Blueback salmon, and not a trout. The Steelhead is sometimes called Salmon trout, and this name is not inappropriate. The Salmon trout of England is, however, merely a sea-run example of the European brook trout, or brown trout, *Salmo eriox*, a species which is also called in the books *Salmo fario* and *Salmo trutta*.

YOUNG STEELHEAD TROUT.

From the other trout, the Steelhead is best known by its short head, the length of the head along the side being contained four and one half to five times in the length of the body from the tip of the snout to the base of the caudal fin. The scales in the Steelhead are rather small, averaging about one hundred and fifty in a lengthwise series from head to tail. The dorsal fin is low, and it has usually but three or four rows

ADULT STEELHEAD TROUT—*Salmo rivularis* Ayres.

of dark spots. There are no teeth on the base of the tongue, the usual series lying around the outer edge.

The Steelhead trout does not go very far from the sea, except in the large rivers, its habits in this regard being more like the salmon than those usual among trout. The old fishes do not, however, die after spawning. When in salt water, the Steelhead is very silvery, but in fresh water the spots appear, and in the small streams it is

almost as much spotted as the Rainbow trout. It reaches a weight of sixteen to twenty pounds. From the market point of view, the Steelhead is the most important of American trout, being, usually, the largest and one of those most easily reared artificially. It is a fine game fish, taking the hook freely and vigorously. The large trout of Fraser River, known as Stitse, or Kamloops trout, is a Steelhead. It probably resides in the large lakes of Washington and British Columbia, never descending to the sea.

There has been much discussion as to whether the Steelhead is a species really distinct from the Rainbow trout, and on this question the writer has at different times held different opinions.

Very careful comparison of specimens leaves no doubt that the two are distinct. The Steelhead usually is slenderer than the Rainbow trout, less spotted, has less red on the side, and reaches a larger size. But these distinctions are all deceptive. The best characteristic of all is the short head, shorter in proportion than in any other trout. The head, as in fishes generally, is proportionately shorter in the adult than in the young.

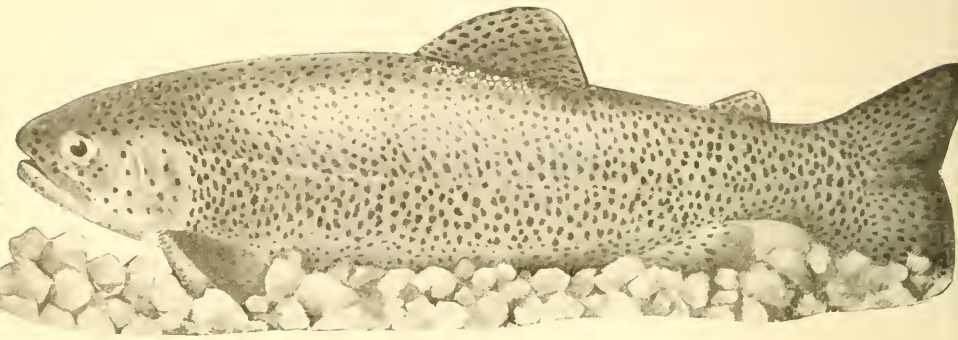
The dorsal fin of the Steelhead is never, in my experience, as large or as much spotted as in the Rainbow trout, or even as in the Cut-throat trout. The scales are always larger than in the Rainbow, and smaller than in the Cut-throat. By these marks even young fish, like the one represented in our figure, can be readily distinguished. The Steelhead finds its center of distribution in the Columbia. The Kamchatka trout, *Salmo mykiss*, which we once wrongly supposed to be the same as the Cut-throat trout, is more like the Steelhead.

RAINBOW TROUT.

The trout *par excellence* of California, found in almost every permanent brook, is the one to which I gave, in 1878, the name of Rainbow trout, this name being a translation of *Salmo iridia*, given it in 1854 by Dr. W. P. Gibbons, of Alameda. Gibbons wrote the name "*iridia*," and perhaps that form of the word ought to stand, but *irideus*, as it is usually spelled, is better Latin. Gibbons's specimens came from San Leandro Creek, near Alameda.

The Rainbow trout has larger scales than the others, usually one hundred and twenty-five to one hundred and thirty, in a lengthwise row. The dorsal fin is high, having usually seven to ten rows of black spots. The old males show a good deal of bright red along the side. There are no teeth on the middle line of the tongue. The head is larger than in any other of these trout, its length being contained from three and one half to four times in the length of the body, measured along the side from the tip of the snout to the base of the

caudal fin. There is usually no red behind the lower jaw, although in large fishes of the upper Sierras this shade sometimes appears. In little streams the Rainbow is mature at six inches, but in larger streams and in the estuaries it reaches a weight of six to eight pounds.



RAINBOW TROUT.
Specimen showing river coloration; from McCloud River, California.

Brook specimens are usually most profusely spotted, but in the sea these spots are more or less obscured by a silvery sheen. In coastwise streams it runs up the streams in March to spawn, like a salmon, being able to leap over small waterfalls.

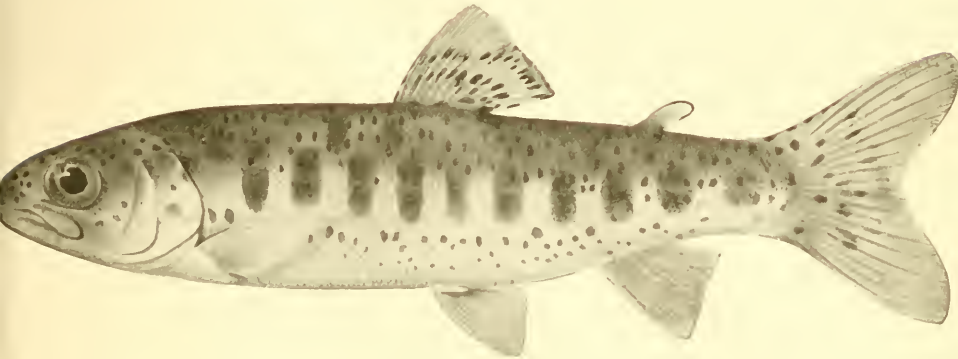
RAINBOW TROUT—*Salmo iridia* Gibbons.
Sea-run specimen from San Francisquito Creek.

The Rainbow on the whole is probably the gamiest of the trout, taking a fly eagerly and responding also to the lure of a grasshopper or a salmon egg. The range of the Rainbow trout extends southward to San Luis Rey River in Southern California and even across the Mexican line into Lower California. Perhaps even more than any other trout this species varies with its surroundings.

OREGON BROOK TROUT.

In Oregon and Washington there is a trout which is scarcely distinguishable from the Rainbow trout. It reaches, however, so far as we know, only a small size. We have seen none weighing a pound. The mouth is smaller than any other of our trout, and the dorsal fin is less spotted than in the true Rainbow.

This dainty and gamy little trout was first taken in the Cathlapootl River by General George B. McClellan. Dr. Suckley named it *Salmo masoni*.



OREGON BROOK TROUT—*Salmo masoni* Suckley.

KERN RIVER TROUT.

In the Kern, Kings, Merced and other rivers of the southern portion of the Sierra Nevadas the Rainbow trout have much smaller scales than in the coastwise streams. About one hundred and sixty-five scales form lengthwise series. Unlike the true Rainbow trout, this form, named for its discoverer, Dr. Charles H. Gilbert, has always a white tip to the dorsal fin, and there is generally some orange under the lower jaw. In the lakes as Kern Lake, this species reaches a weight of eight to ten pounds. In the mountain brooks it is very much smaller, but everywhere it is active, vigorous and gamy.

GOLDEN TROUT OF MOUNT WHITNEY.

The most beautiful of all our trout is the dainty little fish called Golden trout, found in Volcano Creek, on the flanks of Mount Whitney, the highest peak in the United States. This clear little stream flows shallow and open, over rocks of orange-colored granite, or quartzite, and the trout which are separated from the main body of Kern River by a high waterfall called Aqua Bonita, have taken on the color of the rocks on which they lie.

With the general characteristics of the Kern River trout, *Salmo gilberti*, from which these dainty fishes are plainly descended, the Golden trout has the body largely golden-yellow, with a scarlet stripe along the middle of the side, while the lower fins are bright orange. There is a white dash on the front of the dorsal fin, as in *Salmo gilberti*. The scales are equally small, one hundred and sixty to one hundred and eighty in a lengthwise series, and they are so little developed that they scarcely overlap.

The Golden trout rarely reach a foot in length. They are extremely gamy, taking the fly or the bait with the greatest readiness. They are hence in imminent danger of utter extermination, because the trout-hog, the most vulgar of all beasts of prey, has already invaded the Kern Valley, and boasts of his great catches of this unsuspecting and defenseless little trout. Only yesterday I heard of one assemblage of cads from San Francisco who caught six hundred in one afternoon, leaving four hundred and fifty lying on the bank. Two other idiots at the same time caught two hundred in an afternoon.

The interest attached to this wonderful trout, interesting alike to the angler, the artist and the man of science, led President Roosevelt to arrange for a complete exploration of its haunts. In 1904, B. W. Evermann, of the Bureau of Fisheries, Professors O. P. Jenkins and R. L. Green, of Stanford University, and Professor Juday, of the University of Chauncy, Colorado, with volunteer and other assistants, made a complete survey of the waters inhabited by the Golden trout. The report of this work is not yet published, but it is understood that besides the original species of Golden trout, two others equally beautiful were found, each isolated in a particular stream at the head of Kern River, each being shut off from the main body of Kern River trout by a waterfall.

How these fishes came to be above the waterfall no one knows. For in the Sierras, as in the mountains generally, there are no fish above the falls until some man helps them up. Indians do not often do this. Volcanic or earthquake disturbances create dams and change currents. They may make in time a cataract out of a rapid. Anyhow, these exquisite trout are found above the falls, and while there they have changed their color to match the bottom over which they live.

How do they do this? We know of only one way, and that is not yet proved. We suppose that the scarlet, orange and golden colors of the rocks below were transferred to the trout by natural selection. These tributaries of the Kern at timber line are shallow, open and exposed to the attacks of kingfishers, fishhawks, fishducks and the like birds which are fond of little fishes, and which know how to capture them. Any trout brought into exposed water turns pale as compared with his colors in a dark pool. This is not a real change in color, but

a change in the tension at which the fish holds his scales. All trout show some reddish shades on body or fins. Those which show most red on a red ground were most likely to escape from the birds. Those darkest in shade, most brown or green, were the ones likely to be taken first. They are of the usual trout color, the color the birds perhaps expect, and they are most easily seen against the background of the red rocks. This explanation of the Golden trout and of the reasons why three parallel species of this type have arisen under parallel conditions may or may not be satisfactory, but it is the only one yet suggested. We can not think of any other explanation. It is certain that in some fashion in California, or anywhere else, a red bottom produces red fish. And the rocks and the fish do not use the same chemicals in producing this result.

All these species, the Cut-throat trout, the Steelhead trout, and the Rainbow trout, with their several allies and descendants, are true trout, belonging to the genus *Salmo*, and all of them are dwarfed representatives of the salmon of the Atlantic. All of them have silvery scales; all are black spotted; all have the anal fin short, with but ten, eleven or twelve developed rays. All are likely to run down into the sea if they can, and into little streams to spawn, their eggs ripening in the spring or summer. There is not much difference between males and females. The old males have the jaws lengthened a little, but never hooked, as in the Pacific salmon. The same fish may spawn a number of times, while with the Pacific salmon a fish spawns but once, dying in a week or so after casting the eggs or the milt.

In Europe the name trout is given only to the black-spotted forms, which, together with the Atlantic salmon, *Salmo salar*, constitute the genus *Salmo*.

To the very fine-scaled, red-spotted forms of the cold streams and alpine lakes, constituting the genus *Salvelinus*, the people of England have always given the name of char. The char of Europe, known in Germany as "Saibling," and in France as "Ombre Chevalier," is in science *Salvelinus alpinus*.

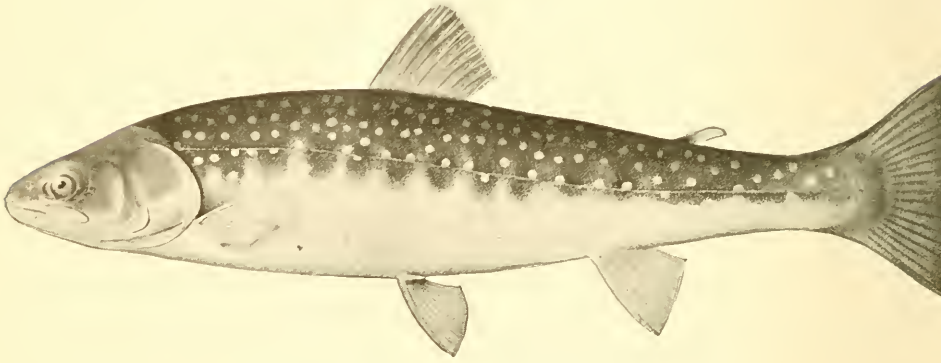
Closely related to this char of Europe are two or three species found in Canada and the Northeast. The Eastern "brook trout," or "speckled trout," the trout of our fathers and grandfathers, is a char, *Salvelinus fontinalis*. There is no higher praise to be given to any trout-like fish than to say that it is a char. In strict truth, there is no trout to be found in the United States or Canada, east of the great plains, except where the Rainbow trout or the brown trout of Europe, or some other of their kind, has been planted.

DOLLY VARDEN TROUT, OR MALMA.

The Pacific slope has one char, the *Malma*, or Dolly Varden, known in science as *Salvelinus malma*. In 1878, when the present writer first

tried to classify these Western trout, a specimen of this *malma* was sent in from the Upper Soda Springs, on the Sacramento River, near the foot of Mount Shasta. The landlady at the Soda Springs said of it: "Why, that is a regular Dolly Varden!" So Professor Baird said to me: "Why not call it Dolly Varden trout?" And Dolly Varden trout it has remained to this day.

As it appears in the rivers, the Dolly Varden is one of the most beautiful of all trout. Dark steel-blue above, with round spots of crimson on its sides and over its back, while its fins are trimmed in front, as in chars generally, with crimson and white. The Dolly Varden is found in the McCloud and other tributaries of the Upper Sacramento. It is more plentiful in the Upper Columbia, always in cold, clear waters. It is still more abundant in all the shorewise streams of Alaska and across the Aleutian Islands to the coast of Kamchatka,



DOLLY VARDEN TROUT—*Salvelinus malma* Walbaum.

and it is equally plentiful in northern Japan. From Puget Sound northward it runs down to the sea, where it loses its spots and becomes nearly plain silver-gray. In Alaska it is called Salmon trout; in Washington, Bull trout, but the name Dolly Varden can be used anywhere.

Its size depends on its food. It may weigh, when mature, anywhere from six ounces to twelve pounds. The little ones are brightest in color. In the little brook which falls into Captain's Harbor at Unalaska are multitudes of bright little Dolly Vardens, mature at six inches. In the harbor below the falls are plenty of sea-run fishes of the same sort weighing ten pounds. In Kadiak the Dolly Varden is caught in the seine by the ton and thrown away by the salmon fishermen.

The Dolly Varden is much more voracious than the true trout. In the Alaska streams they devour millions of salmon eggs, as well as young salmon. It is the greatest enemy the salmon breeder finds. It

is gamy and vigorous, takes the hook freely, with a fly, an insect, a salmon egg or a scarlet petal from some mountain flower.

It is a good food fish. All trout are that; some perhaps better, but I cannot see much choice. In Kamchatka the Dolly Varden is baked in pies, "deep pies," like those sold in English eating houses, and in that form they are surely good. To the trout-hog the Dolly Varden can be strongly commended, for it swarms in millions in every Alaska stream (the Yukon and its tributaries excepted). It will take the hook cheerfully, even dutifully. I once saw two Dolly Vardens caught with a pin-hook, which a little girl let down through a knot hole into the gutter on a street in Skagway. And of the thousands there is not one that would ever be missed, for each one which is killed saves the lives of a dozen salmon.

The trout of the Yukon is the Mackinaw, or Great Lake trout (*Christivomer namaycush*), another kind of char, which reaches a great size, and is known by its cream-color spots. These are never red as in the true char. This char is found also in various lakes of British Columbia, but it does not enter the United States to the westward of Lake Superior and Lake Michigan. And so it does not belong in the list of trout of our Pacific Coast.

But with all the rest we may commend it to the true angler. And the true angler is not the one who loves to fish, or who catches fish, or catches many fish, or many large fish. The true angler is one who loves fish well enough to know one kind from another. "It is good luck to any man," so Izaak Walton tells us, "to be on the good side of the man that knows fish." And to that man this little sketch, with its pictures from the deft hand of the Japanese artist, Sekko Shimada, is dedicated.

SALMON.

The name salmon is given in England and all Eastern States to a large, trout-like fish which lives in the sea, chiefly about the mouths of rivers, and which enters the streams to spawn, running for a considerable distance up the stream and returning to the sea after the act of spawning is accomplished. The old males become somewhat distorted, especially through the lengthening of the jaws, but the changes with age and season are not much greater than in any large trout. The true salmon, like the true trout, is black spotted. It is called in science *Salmo salar*, and along with the true trout it belongs to the genus *Salmo*. There is but one species of Atlantic salmon; it is found on both sides of the ocean, and on both sides it becomes, sometimes, land-locked and dwarfish when it is shut up in a lake and when it can not or does not go to the sea.

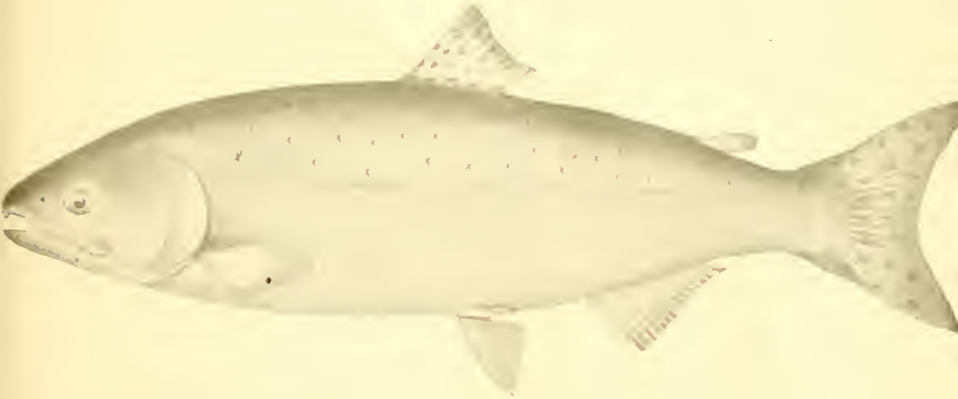
In the North Pacific, on both coasts, there are five different species of fishes called salmon. They do not belong to the genus *Salmo*, but to a peculiar group called *Oncorhynchus*, or hook-snout. In all the species of *Oncorhynchus*, every individual, large or small, old or young, male or female, dies after the act of spawning is completed. All the tissues of the body become degenerate, the muscle is as dead as a dead corn-stalk, and when the eggs, or the milt, are deposited, all life processes are at a standstill. This in itself distinguishes *Oncorhynchus* from *Salmo*. Other characteristics are the great elongation of the jaws in the old males, which are hooked over at the tip, and on which the front teeth become greatly enlarged. The spawning fish change greatly in color and looks, the scales sink into the spongy skin, and so different are these spawning fishes from the same fishes in the spring that no one would suspect them of belonging to the same species. Technically, all the species of *Oncorhynchus* may be known by the presence of more than twelve developed rays in the anal fin, and more than twelve branchiostegal rays on each side underneath the gill covers. They all spawn in cooling water, in the fall. The young descend the next spring to the sea. They feed only in salt water, and after about four years (sometimes three, or two) they re-enter the river to cast their spawn and die. The old salmon never feed in fresh water. The different species have different habits. It is clear that the habit of running is a very old one. I have received from Dr. John C. Merriam, of the University of California, fragments of spawning salmon jaws embedded in rock about the Postpliocene lakes of Idaho.

The largest and finest salmon is the Chinook, Quinnat, or King Salmon, known in science as *Oncorhynchus tschawytscha*. This salmon is the common salmon of the Sacramento and Columbia rivers. As a food fish it is the best of all its tribe, and in size, when full grown, it ranges from fifteen to one hundred pounds.

It spawns in the fall, in snow-fed rivers, and as it ascends very far, it leaves the sea early, at the time of spring freshets. Up the Yukon it runs as far as Caribou Crossing, 2,250 miles; up the Columbia and Sacramento to their very headwaters. This species is the chief stay of the canning industry south of Puget Sound. Its value, commercially, far exceeds that of any other fish of the Pacific, the red salmon excepted.

The Blueback salmon, Alaska red salmon, or Sukkegh ("Sock-eye"), *Oncorhynchus nerka*, is even more valuable in the aggregate, for it runs in countless millions in Alaska. But it is a smaller fish, the average being six to ten pounds. Its flesh is drier, redder and coarser. In the sea, and in the early runs, its body is bright metallic blue in color, with white belly, unspotted. Later, the body turns crimson red, while the head takes a shade of olive green. The names Blueback and Red

salmon are both appropriate, according to the season. The Red salmon spawns only in streams which flow into lakes. A stream without a lake never has Red salmon. Hence there are none in the Sacramento or Rogue rivers. In the lake-fed Fraser River, in the Karluk River, and in the rivers about Bristol Bay, Red salmon run in numbers literally fabulous. There are many in the Columbia. They run with the Chinook salmon, but sometimes when a stream forks each salmon goes its way, the Chinook to the snow-fed branches, the Red salmon to the head of the lakes. The distance from the sea is immaterial. At Boca de Quadra, in Alaska, the river from the lake to the sea is not ten rods long, yet it is crowded with Red salmon. In the Yukon, the Red salmon range up the river to Lake Labarge, the first lake, about eighteen hundred miles.



CHINOOK, QUINNAT, OR KING SALMON—*Oncorhynchus chouicha* Walbaum.

The Silver salmon (*Oncorhynchus milktschitch*) is of about the same size as the Red salmon, and of much the same grade as food. It is faintly spotted, the top of the dorsal fin is blackish. Its scales are less fine than in the Red salmon and more lustrous, and it does not turn red in the summer.

This species abounds all along the shore, especially northward. It runs but a short distance to spawn—rarely over a mile. For this reason it can not easily be taken in large numbers. Its flesh is much paler than in the King salmon, or the Red salmon, hence, notwithstanding its excellence, it brings a lower price when canned. It is then sold as Coho, or as medium Red.

The Dog salmon or Calico salmon (*Oncorhynchus keta*) has much the same habits, and it is common along shore from San Francisco northward. It is the principal salmon of Japan, being salted in great numbers and sold under the name of *Sake*. Its flesh is very pale and mushy, almost worthless when canned, but better when salted. Many

are frozen and sent to the Eastern markets. The Dog salmon, as the season goes on, becomes irregularly cross-barred with blackish streaks, by which marks it can be generally told from the others.

The Humpback salmon (*Oncorhynchus gorbuscha*) has much smaller scales than the others. It reaches a smaller size (three to six pounds), and it may be known by the large black spots on its back and tail. It is rarely seen in California, but from Puget Sound northward it is found in unnumbered myriads about the mouth of every stream. It spawns near the sea and in any kind of fresh water. Its flesh is wholesome, but without fine flavor, and it is of a faded brownish color, instead of salmon red. It is largely canned under the name of Pink salmon. It sells for about half the price of the Red salmon, and is worth still less. Its value, at the best, is little more than the cost of canning, though, as already stated, as food it is quite wholesome, and doubtless as nourishing as the species which taste better and look better. Salted salmon bellies, as prepared in Alaska, are mostly from the Humpback salmon, the body of the fish being thrown away. In actual food value, the five species stand in this order: Chinook, Silver, Red, Humpback, Dog. In economic importance: Red, Chinook, Humpback, Silver, Dog. In the United States, outside of Alaska, the Chinook far outvalues all the rest. But in Alaska and British Columbia, the Red salmon greatly predominates. In Japan, only the Dog salmon and Silver salmon are commonly seen, the first far in excess of the second.

As a food fish, the Chinook salmon is finer and larger than the salmon of Europe. The latter, however, ranks with our Steelhead trout, as superior to the Red salmon and perhaps to the Silver salmon also.

All the salmon take the hook in the sea, and are fairly gamy. In the rivers, they will sometimes snap at a hook, baited or not, but never for the purpose of feeding. They strike at it as though it were an annoyance, but they could not swallow it, as after the spawning season the stomach shrinks away till it is little larger than a cherry.

With the Chinook salmon is seen the greatest triumph of fish hatching. Now that the spawning grounds of the species in the Sacramento have been nearly all destroyed, the fish hatcheries turn millions of young fish into the rivers, after having led them past the period of greatest destruction from their enemies. But more salmon run in the Sacramento now than in the days when there was no fishing and no mining.

With the same treatment, the over-fishing of the Columbia, the Fraser and the streams of Alaska, could be met, and one of the best forms of food would continue to be one of the cheapest.

DO QUINNAT SALMON RETURN TO THEIR NATIVE STREAMS?

(Extracts from "Report on Investigations in the Sacramento River, 1896-1901," by Cloudsley Rutter, late Naturalist, U. S. Fish Commissioner steamer "Albatross.")

There is a widespread belief that when a salmon returns to fresh water to breed it seeks the stream in which it was hatched, though there is very little evidence that such is true. Various fishermen claim that they can distinguish the salmon of particular streams by their general appearance, which is incredible. The employés of the Alaska Packers' Association state that the red salmon taken at Uganuk are always smaller than those taken at Karluk, both places on the north coast of Kadiak Island, Alaska; that 13 of the former are required to make a case of canned salmon, while only 11 of the latter are necessary. This seems to indicate that the salmon of the two localities are distinct, but the larger salmon may go to Karluk, not because they have been hatched in Karluk Lake, but because they are larger.

In 1897, 855,000 Quinnat salmon fry were released in Paper-mill Creek and its tributaries draining into Tomales Bay, California, and 2,000,000 alevins were released in the same streams in 1898. (See "Observations on alevins artificially reared.") In 1900 a few salmon were seen in Paper-mill Creek, and in 1901 they were abundant. In one haul of the seine in the tide-water portion of Paper-mill Creek, covering a section about 150 feet long, 7 Quinnat salmon were taken November 16, 1901. It is well known that Quinnat salmon did not breed in Paper-mill Creek or its tributaries previous to 1897, for which reason these streams were selected for the experiment. Mr. Thomas Irwin reports that he saw two large salmon in Paper-mill Creek about 1890, but with these exceptions he never saw any fishes in the stream that might be taken for Quinnats until 1900. He lives on the banks of the creek and knows the stream thoroughly. His statement agrees with that of other persons.

Paper-mill Creek is not suitable for Quinnat salmon, being entirely too small, but it is frequented by Dog salmon and Steelheads.

But there is no conclusive evidence that the fishes which were found in Paper-mill Creek in 1900 and 1901 were the same individuals released there three or four years previously. They may have been merely stray fishes, and their being found there at that time only a coincidence; or their coming into Tomales Bay may have been caused by there being an extra large number of salmon in the ocean, which might very well be, owing to the large output of young from the hatcheries; or those found in Paper-mill Creek in 1900 and 1901 may have been some of those released there, in which case it is very probable that they had never reached the ocean at all, but remained in Tomales Bay. Paper-mill Creek would then be their only stream.

It is incredible that the salmon remember their native stream during their two or three years of ocean life and that they consciously seek it when they desire to return to fresh water. Probably most of them do return to the stream from which they entered the ocean, not because it is their native stream, but because they do not get far away from its mouth, and when ready to return to fresh water it is the first to attract them.

THE TWO RUNS OF SALMON.

Adult salmon may be found in the Sacramento River at almost any time of the year. There are, however, two more or less distinct runs, the first of which passes up the river during April, May, and June, and the latter during August, September, and October. The former is known as the spring run, the latter as the fall run.

The salmon of the spring run ascend the river to the headwaters, such as the Upper Sacramento, McCloud River, and Hat Creek, and some of the earlier ones even pass Pit River Falls and ascend Fall River to its source. They are not found in Pit River above the mouth of Fall River. By the time they reach this portion of the stream, the Upper Pit River is very low and the water impure, and the salmon all turn into Fall River. The salmon of this, the spring run, spawn mainly in August.

The fall salmon do not ascend the river as far as the spring run, but turn into the lower tributaries or spawn in the main river. They reach their spawning grounds during the latter half of October, November, and the first half of December, and spawn soon after. The main river is very low at that time of the year, and the portion between Tehama and Redding is an important spawning ground.

As a matter of fact there is no definite distinction between the spring and fall runs; that is, there is no time during the summer when there are no salmon running. First there are a few very early salmon that begin running up the river in February, and the number increases until May, when it decreases till July; then it increases till the 1st of

September, when it again decreases, there being a very few each month, until the next spring run.

The spawning seasons merge in the same way. The earliest salmon go farthest upstream, and as the season advances they stop at lower points. The localities and dates of the spawning of the earlier salmon have not been determined except that Superintendent Lambson, of Baird, reports having seen a pair of spawning salmon in the McCloud at the hatchery on the 20th of April, 1902, which is the earliest record known. By the 1st of October, spawning fishes are found as far downstream as Redding, and as far as Tehama by the 1st of November.

There is no way of tracing the passage of the salmon through the bays, but from records made at Vallejo, Benicia, and Collinsville it seems to require about a week to reach the mouth of the river after they enter the Golden Gate.

The spring run passes upstream quite rapidly, reaching their spawning grounds on the McCloud River in about six weeks after entering the river at Collinsville.

The fall run moves more slowly. They are about two months reaching their spawning grounds, which are not so far upstream. The flood and ebb tides are more nearly equal, owing to the smaller amount of water coming from the rivers, making the passage of the salmon through the bay a little longer. The nets of the fishermen also offer a greater obstruction during the low water and in this way hold the salmon back. In 1900 salmon were taken in abundance in Suisun Bay and in the river as far up as Rio Vista by the middle of August, but were not taken at Sacramento until after the 1st of September. The low water doubtless made the movement slow, and the taking of from 2,000 to 10,000 daily out of a slow run would account for their non-appearance at Sacramento.

Upon reaching the shoals in the middle portion of the river they cease their migration, having already found good spawning grounds. In 1898, 1899, and 1900 the water was normally low and a large proportion of the salmon found spawning places in the main river. The early high water and frequent fall rains in 1897 sent them into the tributaries.

The latter part of September, 1901, 150 salmon were weighed and branded with serial numbers and released in the river near Rio Vista. Three of these were taken at the hatcheries the latter part of November, just at the close of the season. The following is a particular account of these three specimens:

No. 8, a female, was branded September 20, when it weighed 13,930 grams. It was taken again at Mill Creek fishery November 23, when it weighed 10,180 grams, having been 64 days on the road and having lost 26 per cent of its weight.

No. 91, also a female, was branded September 24, when it weighed 8,470 grams. It was taken at Mill Creek November 20, when it weighed 7,160 grams, its time in passing up the river being 56 days and its loss

in weight being 15 per cent. This specimen was returned to the creek after being weighed November 20. It was found dead on the racks 8 days later, when it had spawned all but 20 of its ova. Its weight had decreased 1,860 grams.

No. 43, a male, was branded September 20, when it weighed 10,080 grams. It was taken at Battle Creek, November 25, when it weighed 6,275 grams, making its time from Rio Vista 66 days and its loss in weight 25 per cent.

This important experiment proves that the fall salmon travel very slowly, at a rate of four or five miles a day, and require about two months to reach the spawning grounds from the mouth of the river.

The salmon of the spring run arrive at their spawning grounds from two to six weeks or even longer before they are ready to spawn. This time they spend lying quietly in the pools. The fall salmon are more nearly ripe when they reach their spawning grounds. Indeed, it is probable that many of them cease to ascend the streams only when they are ready to spawn.

One important point to be considered in this study of the loss in weight during migration is the deterioration in the value of the flesh as a food. The loss of 12 or 16 or 25 per cent is entirely in nutriment. If even a very fat beef were starved two months, or until it had lost 16 per cent of its total weight, no one would care to eat of its flesh. But such is the condition of the fall salmon upon their arrival at the upper portion of the river. They have eaten nothing for over two months, and nutriment to the extent of about 16 per cent of their weight has been absorbed almost wholly from the flesh.

It is evident, therefore, that the fall salmon taken at the upstream points have but little value as food, and their capture should be prohibited.

NATURAL PROPAGATION.

Spawning Habits.—Salmon in spawning usually take a position at the upper end of a riffle where the current is strong and where there are gravel and cobblestones among which the eggs may lodge. The male immediately takes her exact position, or perhaps a point 1 or 2 feet downstream from it, and extrudes a small quantity of milt. In about five minutes the process is repeated, the female always taking the position first occupied. This they continue day and night for over a week, usually nearly two weeks. I have observed salmon spawning at night, but have never been able to watch one pair until spawning was completed. Branded salmon No. 91, previously referred to, was only eight days in spawning, although some eggs had been extruded before it was taken. Two weeks is the spawning time usually assigned by persons living in the vicinity of salmon streams, which is probably about right.

On account of the difficulty in seeing eggs under water, it has been impossible to determine the rate at which ova are deposited. The motions of the fish show just when ova are being extruded, but observation at a distance of 5 feet, with the aid of a field glass, has failed to disclose the eggs.

The female at irregular intervals turns over on her side and digs her tail into the gravel. If the gravel is fine there is often a considerable hillock thrown up, leaving a hole 6 or 8 inches deep and 2 feet across. This digging is probably not for the purpose of covering the eggs, nor to make a space for them to lie in, but by the violent exercise to loosen the eggs from the ovaries. If the purpose were to cover the eggs it would be repeated every time any were deposited. Gravel does not drift as far as the eggs, and if such were the purpose it would not be accomplished. Besides, it is almost impossible to cover eggs with gravel; the eggs, being almost as light as the water, slide away from the gravel. More than that, a covering of over an inch of even fine gravel kills them. The hillock, by forming an eddy at the bottom of the stream, prevents many eggs from floating away and being devoured by other fishes, but such are liable to be covered too deeply and killed in that way. Some of the fine sediment, however, may settle on the eggs and tend to make them invisible to egg-eating fishes. The "nest" can hardly be made as a place for the eggs to lie in, for the current always carries them below it.

The presence of the other sex is not necessary to excite either to spawning efforts. I have seen the female spawning alone at Battle Creek fishery, and other persons have reported similar observations from other places. In September, 1900, I saw a male spawning alone near Sims, the female having been killed by a sportsman in order to get trout bait. Like observations have been reported by other persons.

Percentage of Fertilization.—As one pair of salmon deposits an average of 6,000 eggs the increase would be enormous unless there was great loss at some period. It is usually supposed that the greater part of this loss is due to a lack of fertilization of the ova. The great care necessary to secure perfect fertilization artificially has led fish-culturists to suppose that the percentage of fertilization under natural conditions must necessarily be very low. In artificial fertilization the ova and milt are mixed together in a vessel, insuring a coating of milt or spermatized water over each ovum. In natural spawning the ova are caught in the eddies among the rocks, either near the nest or within a few yards below it. A few seconds after the ova are spawned a small quantity of milt is disseminated in the current to be carried against them. It seems very unlikely that a large percentage could be fertilized under such conditions.

THE GOLDEN TROUT OF THE SOUTHERN HIGH SIERRAS

By BARTON WARREN EVERMANN,
Assistant in Charge of Division of Scientific Inquiry, Bureau of Fisheries.

In 1893 Dr. David Starr Jordan described from the southern High Sierras a species of Golden trout which he named *Salmo mykiss aguabonita*. The description was based on three specimens received by him from Mr. W. H. Shockley, of San Francisco, to whom they had been sent by Mr. George T. Mills, Fish Commissioner of Nevada. At the time the description was written it was supposed that the specimens came from Volcano (then called Whitney) Creek, but it was subsequently learned that they really came from Cottonwood Creek, into which it was said the species had been transplanted from Volcano Creek. In 1893 Dr. Charles H. Gilbert visited the upper Kern River region and secured color notes on examples of Golden trout which he caught in Volcano Creek, and upon others which he obtained from the South Fork of the Kern.

Although it was apparent from the original description and Dr. Gilbert's notes that the trout described by Dr. Jordan was a fish of unusual beauty, and that the species found in Volcano Creek was even more beautiful, little was added to our knowledge of the trout of the Kern River region until recently. From time to time reports had come to the Bureau of Fisheries regarding the beauty, gameness, and delicious flavor of the Golden trout of Volcano Creek, and then the fear began to be expressed that, owing to its extremely restricted habitat and the ease with which it may be captured, the species was in danger of extermination.

Stewart Edward White visited the region in 1903 and, impressed with the ease with which the extinction of the species could be compassed, called the attention of the President to the matter, and the President in turn brought it to the attention of Hon. George M. Bowers, Commissioner of Fisheries. Complying with the request of the President, the Commissioner ordered an investigation to be made for the purpose of determining (*a*) the natural geographic distribution of this trout, (*b*) its abundance, (*c*) its habits as to food and spawning time and its qualities as a food and game fish, (*d*) into what waters,

if any, it has been transplanted, (*e*) into what other streams it may be introduced, (*f*) whether its artificial propagation can be undertaken by the Bureau, and, finally, (*g*) what measures or regulations, if any, are necessary for the adequate protection of the species. An investigating party, under the writer's direction,* outfitted at Redstone Park, Tulare County, Cal., with saddle horses, pack animals, and camping equipment, and on July 13, 1904, started for Volcano Creek.

STREAMS AND LAKES EXAMINED.

That portion of the southern High Sierras drained by the Kings, Kaweah and Kern and, on its eastern slope, by numerous small streams tributary to Owens Lake, is marvelously rich in mountain streams and small mountain lakes. Practically all of them are naturally well suited to trout. The waters are usually clear and cold and free from injurious contamination. The supply of fish food is ample; entomastraca and other small crustaceans, as well as aquatic insects and insect larvæ, abound. Yet many of these lakes as well as many of the streams in their upper courses are entirely without fish of any kind. All the larger streams were originally well supplied with trout and, in their lower warmer portions, with suckers and minnows, and these fishes, especially the trout, naturally pushed their way up the main streams and also into the tributaries until they came to waterfalls which proved impassable barriers. Many of these streams have such barriers somewhere in their course.

In nature, fishes are found only in those streams and lakes which they have been able to reach from some other stream or lake. Usually the invasion of any stream is from below; and falls that fishes can not surmount prove a final obstruction; no fish will be found in that stream or any of its connecting waters above that point. Occasionally by eating back into the watershed one stream may steal a portion of the headwaters of another on the other side of the divide, and fishes sometimes enter a water course in that way. This, however, happens but rarely. In the region under consideration the streams are typical mountain streams, all more or less turbulent, containing many rapids, cascades, and waterfalls, and with long, relatively quiet reaches where the waters flow through mountain meadows. The larger streams flow through deep cañons, often with sheer walls several hundred feet high, extending back from the top of which is the relatively level high plateau, traversed by many smaller streams. Many, perhaps most, of these tributary streams leave the plateau in a series

*The other members of the party were Prof. Oliver P. Jenkins and Prof. Rufus L. Green, of Stanford University; Prof. Chancey Juday, of the University of Colorado; Mr. Charles B. Hudson, of Detroit, Mich., artist of the expedition, and necessary assistants, packers, and cook.

of cascades and falls, the latter sometimes many feet in a sheer drop, and all picturesque and beautiful. These falls, in nearly all the streams tributary to Kern River above the mouth of the Little Kern and in those in the upper courses of the Kaweahs and Kings, have proved impassable barriers, and the streams above the falls are wholly without trout or any other fish. Some of these barren waters, however, have been stocked by private individuals, fish and game clubs, or by the State and Federal governments.

THE FISHES OF THE KERN RIVER REGION.

There are not many species of fishes in the Kern River region. Two species of suckers, three of minnows (*Cyprinidae*), and two of trout seem to be all that have been recorded. But the streams and lakes have not been carefully investigated and it is quite probable that other species will be found when more thorough collections are made. Of the two suckers only one was obtained by us. Specimens of the three minnows were secured. As regards the trout, our collection contains more species than have hitherto been recorded from the region, there being at least six represented. They are all save one regarded as belonging to the Rainbow trout series and are as follows: (1) the Kern River trout (*Salmo gilberti*), occurring only in Kern River; (2) *Salmo agua-bonita*, native only to the South Fork of the Kern and its tributaries, but introduced from it into Cottonwood Creek; (3) the Golden trout of Volcano Creek, which does not occur in any other stream; (4) the Soda Creek trout, found throughout the basin of the Little Kern and in Coyote Creek and introduced from Soda Creek into the headwaters of the South Fork of the Kaweah; (5) the common Rainbow trout (*Salmo shasta*), widely introduced by the State Fish Commission into the waters of the State and found by us in the headwaters of the Middle Tule, the lower course of the South Fork of the Kaweah, the Middle Fork of the Kaweah, and in Marble Fork; and (6) the common Cut-throat (*Salmo clarkii*), introduced into at least some streams of the region and found by us in Marble Fork of the Kaweah.

The Coyote Creek trout are somewhat anomalous in that some of them show considerable red on the throat. It may become necessary to separate these red-throated trout as a distinct species, but for the present the question of their distinctness is held in abeyance.

THE TROUT OF THE KERN RIVER REGION.

The native trout of the Kern River region represent at least four well-marked species or subspecies, all belonging apparently to the Rainbow trout series. They are as follows: (1) The Kern River

trout (*Salmo gilberti*), occurring only in Kern River and possibly in the lower portions of some of its larger tributaries. The type locality is Kern River at Soda Springs. This is the species from which it is believed all the other native trout of the Kern basin have descended. (2) The Soda Creek trout, native to Soda Creek, Wet Meadow Creek, Little Kern River, Coyote Creek, and possibly other small western tributaries of Kern River, and introduced from Soda Creek into the headwaters of the South Fork of the Kaweah at South Fork Meadows, and elsewhere. (3) The South Fork of Kern Golden trout (*Salmo agua-bonita*), described originally from Cottonwood Creek, into which it had been introduced, but native only to the South Fork of the Kern and its tributaries. (4) The Golden trout of Volcano Creek. This is the real "Golden trout" and is native only to the one stream—Volcano Creek.

Comparing the trout from these various streams the following statements appear to be justified:

(1) The Kern River trout is profusely and closely spotted over the entire body, head, and on all the fins, and the belly is not richly colored.

(2) The Soda Creek trout has numerous black spots on head, back, and entire length of side both above and below lateral line, but the pectorals, ventrals, and anal are without spots, and the belly is rich orange in color.

(3) The South Fork of Kern Golden trout is sparsely spotted on caudal peduncle, along side only above lateral line, and on top of head. There are no spots below the lateral line. The belly is rich orange.

(4) The Golden trout of Volcano Creek is entirely without spots, except on the caudal peduncle and occasionally a few above the lateral line posterior to the dorsal fin. The belly is a very rich cadmium.

The different species may be described in detail as follows:

Salmo gilberti (Jordan). *Kern River Trout; Gilbert Trout.*

Head 4 in length to base of caudal; depth 3.6; eye 5 in head; snout 4.3; maxillary 1.16; mandible 1.3; preorbital 20; scales small, about 165 in lateral line; dorsal fin with 14 rays; anal 12. Body stout, moderately compressed, deepest slightly in front of dorsal; head long, conic, snout pointed; mouth large, maxillary long and narrow, reaching more than an eye's diameter beyond the eye; mandible slightly curved; teeth on lower jaw rather strong, wide-set, in a single series, those on maxillary strongest; caudal peduncle stout, its least depth equal to snout and eye. Fins all well developed; origin

of dorsal midway between tip of snout and base of tail, the longest ray nearly two in head, base of fin slightly greater than height; caudal broad, truncate, the lobes equal, exceeding height of dorsal; base of anal equaling height of fin, also height of dorsal; origin of ventrals somewhat posterior to that of dorsal and much nearer base of caudal than tip of snout, longest ventral ray equal to longest dorsal ray; longest pectoral ray exceeding by one fourth the height of dorsal.

Color in life, head, body, and fins everywhere profusely and rather uniformly covered with small black spots, those on body stellate, those on fins oblong, those on head roundish and more sparse; inner half of ventral and pectoral less spotted; anterior rays of dorsal scarcely tipped with lighter; anal and ventrals with the anterior rays white at tip; adipose dorsal olivaceous with three or four black spots; side broadly rich rosy red, broadest and brightest near middle, least distinct on caudal peduncle; lower half of side slightly pink and pale bluish; belly with slight irregular wash of old gold on dirty-white ground color; back and upper part of side olivaceous with fine yellow, orange, or lemon specks; cheek and opercles rich rosy; little or no red on throat, no red dash on membrane between rami of lower jaw; few spots on side of head; top of head olive green, well covered with round black spots.

The above description and the accompanying colored plate are from an example (a male) 18.25 inches long and weighing 3.5 pounds caught by me July 19 in Kern River about one-half mile above Kern Lake.

Another example, weighing 2 pounds, taken the same day at the lower end of Kern Lake, was described as follows: Color on back and upper third of side very dark olivaceous; middle of side with a broad pale rosy band from cheek to caudal fin; lower side dirty silvery; belly white with dirty wash; back and entire side closely covered with small roundish black spots, scarcely less numerous on middle and lower part of side to level of ventral than on back; spots covering top of head, 2 rows below eye, one spot on opercle, 6 on maxillary, and about 10 on tip of lower jaw; cheek and opercles rosy; lower part of head faint rosy, with dusky wash; vertical fins all thickly spotted; upper half of pectoral and ventral spotted; anal and ventral tipped anteriorly with white; dorsal and adipose dorsal slightly white-tipped; throat with slight yellowish wash; inside of mouth white.

Another example (a male 18 inches long), caught by one of our party in Kern River above the lake, had top of head, back, and entire side closely covered with small roundish black spots, similar spots covering vertical fins and some on pectorals and ventrals; cheek and opercles dark rosy, with a few black spots; general color dark olivaceous; side with moderately distinct rosy band.

KERN RIVER TROUT, SALMO GILBERTI (JORDAN)
(DRAWN FROM LIFE BY CHARLES B. HUDSON FROM THE TYPE, A SPECIMEN 18¾ INCHES LONG.)

This species is abundant in Kern Lake and in the river for several miles above the lake. It is probably common in the river for some miles below the lake, but of this I have no personal knowledge, as we did no collecting below the lake. As a rule, the fish taken from the river are more deeply and brightly colored and decidedly more game than those from the lake. During the spawning season early in the spring the fish are found chiefly in the river, but after the spawning has been completed they tend to run down into the lake, where they become less active and less highly colored. The large examples which we took in the lake were, as a rule, more slender than those from the river, probably on account of the fact that those from the lake were all spent fish.

This species is said by Jordan and Evermann to reach a weight of 8 pounds, but I do not recall the authority upon which the statement was based. The largest example seen by us was the one upon which the above description is based. It was 18.25 inches long and weighed 3.5 pounds. Several other examples 14 to 19.25 inches long were caught by us. The largest individual of which I have a definite record was caught in 1900 in the river above the lake by Mr. E. D. Cox and weighed by Mr. D. J. Cruice, both of Bakersfield, Cal. This fish was 27.5 inches long and weighed 5 pounds 14 ounces.

The Kern River trout is a beautiful fish, well built and symmetrical, and very rich in coloration when in prime condition. As a game fish it will stand easily among the best, but, as already stated, in the river it greatly excels those of its kind in the lake. It usually takes the fly quite freely, and will, of course, take all sorts of live or cut bait. Members of our party took these trout with the artificial fly, with grasshoppers (which they greatly preferred), and with pieces of fish or other meat. The large example painted was first tried with a gray hackle, to which he rose once and then paid no more attention to it. A larger, plain hook and a good-sized grasshopper were substituted, with better results. Scarcely had the lure touched the water when he rose and struck most viciously, only to miss it, then turn and strike again more viciously than before. This time the hook caught inside the mouth just under the middle of the maxillary, and then began a fight that would delight a better angler than I. He first circled about in a wide curve, then jumped twice, clearing the water beautifully each time; circled again, went to the bottom in water 10 feet deep, came to the surface and jumped again, after which no more leaps were made, but he continued dashing about until finally brought to net.

Another good-sized example (2 pounds) was taken July 19 at the drift in the lower end of the lake. This fish was seen swimming slowly down the lake at a depth of about 3 feet. A cast brought a rise at

once. Missing, he turned and came again, not with a rush, but deliberately, and took the lure. He pulled and tugged vigorously, rushed a bit, jumped once, shaking his head savagely, ran inshore, then out again. Then I reeled him in, but three times he dashed away before I could use the landing net. This was the gamest fish caught in the lake, and was not much inferior to those taken in the river. Another large example caught in the lake July 20 broke water six times before coming to net, and was really very game.

Trout appear to be quite abundant in Kern River, but it is doubtful whether they will long remain so. During the few days we were at Kern Lake, six or seven other parties were camped at or near the lake, each party consisting of from two to ten people. One party of two, excellent anglers and true sportsmen, had been there for more than two months. They fished more or less every day, always with the fly, and usually threw back all they caught, especially the smaller ones. Another party of two were observed to go out upon the lake every day, tie their dugout to a snag, and devote the entire day to jerking out the trout. They kept it up day after day, and none was too small for their creel. On one occasion they were noticed to have at least thirty fish 6 to 12 inches long. And most of the other parties were doing about the same.

At this rate the trout can not long continue abundant in this stream. All fishing in the lake should be prohibited, the daily catch from the river should be limited to ten fish per rod, and 8 inches should be the minimum legal size.

This species was named for Dr. Charles H. Gilbert, Professor of Zoölogy in Stanford University, who collected the type July 13, 1893, from Kern River at Soda Springs.

Salmo whitei (Evermann), new species *Golden Trout of Soda Creek.*

(See colored plate, page —.)

Head 3.22 in length; depth 3.68; eye 4.54 in head; snout 3.33; maxillary 1.72; mandible 1.66; interorbital 3.57; longest dorsal ray 2.08; longest anal ray 2.17; pectoral 1.66; ventral 2.17; caudal lobes 1.61. Body rather stout, moderately compressed; head conic; mouth large, oblique, jaws subequal; maxillary long and slender, reaching much beyond the eye; teeth on jaws, tongue and palatines well developed; caudal peduncle deep, its least depth about equal to distance from tip of snout to middle of eye. Fins well developed; origin of dorsal somewhat nearer tip of snout than base of caudal fin; insertion of ventral about under middle of dorsal fin. Scales small, but noticeably larger than in the Volcano Creek trout.

Color in life, back and upper part of side light olive; side and back profusely covered with small roundish black spots, these extending on

top of head, vertical fins, and on side below lateral line; side with 10 large roundish parr-marks and a broadish median band of light-brick or terra-cotta red; lower part of side light lemon-yellow with a number of bluish-black blotches, chiefly anteriorly, somewhat larger than similar ones on back; belly from tip of lower jaw to anal fin rich orange-red or cadmium, richest between pectoral and ventral fins, this band the full width of the belly; no red dash on throat; suborbital pale rosy or purplish; cheek brassy, with a large dark blotch; opercle rosy orange, olivaceous above; dorsal fin with about five rows of small round black spots and a black border except anteriorly, where the rays are tipped with a light-rosy border; pectoral light yellowish; ventral and anal reddish, with broad white edge; caudal profusely spotted with black like the dorsal fin.

In spirits all the bright colors have faded, but the black spots remain distinct. These spots are largest on the caudal peduncle, over which they are evenly distributed. They are also pretty evenly distributed over the entire side and top of head; the space along the lateral line, however, has fewer spots. Those below the lateral line extend more than halfway to the belly and are somewhat smaller than those above. About fourteen spots show on side of head.

There is not much variation in color, as shown by examination of many examples. In all, the black spots completely cover the caudal peduncle and the entire length of side from median line of back to some distance below the lateral line; the top and sides of the head are always spotted. The middle line of the side and the belly are always richly colored, the parr-marks always present, and the dorsal, anal, and ventral fins bright-edged. No conspicuous red dash was observed on the lower jaw in any of the specimens from South Fork of Kaweah, Soda Creek, or Wet Meadow Creek, but among those from Coyote Creek were some showing considerable color.

A cotype was described as follows: Back and top of head light brown with numerous small black spots extending on dorsal and caudal fins and on side distinctly to lateral line and below it less plainly, those on caudal peduncle largest and blackest; black spots also on top of head and halfway down sides on opercles and cheek; middle of side with a broad red or orange-red band extending from just behind base of pectoral to about middle of anal, broadest in middle portion; a large blotch of same color on opercle and some on cheek; thirteen distinct parr-marks on side, a row of smaller similar spots below; lower part of side light brown; a broad reddish or orange band along ventral line from throat to vent, the anterior part yellowish; dorsal fin covered with small black spots except anterior upper margin, which is light pink, whole distal edge, except the pink, margined with black, not quite continuous; pectoral olivaceous, with pink tinge, over-

laid with dusky; ventrals same color as pectorals, but the pink more pronounced and the exterior distal edge white; anal same as ventral, bordered with white; caudal spotted like the dorsal, but no pink edge; adipose same as back, margin black, one spot on base.

In alcohol all of the specimens from South Fork Meadows are profusely covered with small, round, well-defined black spots on caudal peduncle, side, both above and below lateral line, and on top of head. The dorsal, anal, and ventral are light-edged in all. These specimens all seem to differ from South Fork of Kern specimens in the greater number of spots, and particularly in the presence of spots below the lateral line. They differ from the six specimens obtained in South Fork of Kaweah near Three Rivers in having more spots below the lateral line and having the spots much more nearly round; besides, those from Three Rivers in life were decidedly different in color, as shown by the life-color notes.

The collection contains 10 specimens from the South Fork of the Kaweah River at South Fork Meadows and 3 from Soda Creek at Quinns Horse Camp, about 5 miles distant. Besides these specimens, we examined perhaps 25 others from those two places. They range in length from 5.5 to 7.75 inches and are quite uniform in size. They show little or no variation in color from that indicated by the preceding descriptions.

The collection also contains five specimens from Wet Meadow Creek, which are in some respects the finest that were obtained. They range in length from 7 to 9.75 inches and show some variation in spotting. The smallest two of these are more sparsely spotted than any of the others; nevertheless they show spots the full length of the side and some spots below the lateral line. The largest specimen (cotype No. 53398, U. S. N. M., 9.75 inches long) is rather more completely spotted than the type. The two other Wet Meadow Creek specimens (cotypes), although larger than the type, are spotted very much like it.

A large number of examples were examined from Little Kern, taken chiefly in the vicinity of Broder's cabin; of these, three were saved. They agree in all respects with those from South Fork Meadows.

Forty-four excellent specimens were obtained from Coyote Creek. These were taken at various places between the headwaters and the mouth of the stream. This creek has several falls which doubtless at present are barriers to the ascent of fish; nevertheless trout are found throughout the entire length of the stream, and are abundant immediately below and above each of the falls. Evidently the peopling of the entire stream was accomplished before the falls were formed or became impassable barriers. An examination of the large series of specimens shows them to be a very perplexing lot; the amount of variation among them is very great, and it is not without hesitation that

I refer them all provisionally to *Salmo whitei*. In general they all agree essentially in being well spotted, although occasionally a specimen is seen with fewer spots below the lateral line. The spots, however, vary considerably in size; in some they are larger than in the South Fork Meadows fish, in others they are smaller; in many the spotting is more complete. In life some examples were quite dark in general coloration, and several showed red or yellow between the rami of the lower jaw. An effort was made to see whether these differences could be correlated in any way with different particular parts of the stream, and there is considerable evidence that such correlation can be made. It is believed that all the specimens taken between any two falls agree better among themselves than they do with those from any other portion of the stream, and it seems that we have here a number of differentiations now in progress which promise to become of taxonomic value. For the present these trout are all considered to be conspecific with those from South Fork Meadows and Soda Creek.

As stated elsewhere in this report, the headwaters of the South Fork of the Kaweah were originally without trout and were stocked with fish from Soda Creek at Quinns Horse Camp, and this species may therefore very properly be called the Soda Creek trout. It is known to reach a length of about 10 inches, takes the fly readily, and is a good fighter. Though less brilliantly colored than the Golden trout of Volcano Creek, it is in every respect a beautiful and attractive fish.

I am pleased to name this beautiful trout for Stewart Edward White, author of The Blazed Trail.

SALMO ROOSEVELTI (Evermann), new species. *Golden Trout of Volcano Creek; Roosevelt Trout.*

(See frontispiece.)

Head 3.5 in length to base of caudal fin; depth 4; eye 5.6 in head; snout 3.4; maxillary 1.8; mandible 1.5; interorbital 3.79; D. 11; A. 11; longest dorsal ray 1.8; longest anal ray 1.9; pectoral 1.8; ventral 2.1; caudal lobes 1.8; base of dorsal 1.9; base of anal 2.6; least depth of caudal peduncle 2.6. Body stout, moderately compressed; head conic, rather long; snout long; jaws subequal, mouth large, somewhat oblique; maxillary long and narrow but slightly curved, extending much beyond orbit; teeth well developed on mandible, maxillary, palatines, front of vomer, and on front of tongue, the latter in two rows; caudal peduncle very stout. Fins all strong and well developed; origin of dorsal midway between tip of snout and base of caudal peduncle; base of ventrals under middle of dorsal; caudal broad, strong, little notched when fully spread; anal with its free edge somewhat falcate. Scales exceedingly small, smaller than in any

other known species of trout, noninbricated, and scarcely showing unless dry; there are about 50 in an oblique series from front of dorsal downward and backward to lateral line, and 40 from the lateral line downward and backward to the base of the ventrals; there are about 200 scales in the lateral line, 140 to 150 of them having pores.

Color in life, back, top of head, and upper part of side very light yellowish olive; middle of the side from gill-opening to adipose fin with a broad bright rosy band, the greatest width of which is about equal to greatest diameter of orbit; side below lateral line bright golden yellow, fading below into yellowish white; belly with a broad cadmium or deep orange-red band from throat to anal fin, the color deepest between pectoral and ventral; some red on belly between origin of anal and base of caudal; about 10 roundish or vertically oblong parr-marks on middle of side, upon which apparently the rosy lateral band is superimposed; 3 of these parr-marks are on the caudal peduncle, posterior to the adipose fin, 2 between the adipose and dorsal fins, 2 under the dorsal, and 3 anterior to it; between the first and second large parr-marks and somewhat below them is a small round spot of the same color, and there is a similar one between the fifth and sixth spots; cheek and opercles bright rosy, edged posteriorly and below with yellowish, an olivaceous blotch on upper part of cheek and a small black spot on upper part of opercle; region about eye olivaceous yellow, especially below; lower jaw rosy, with some yellowish, membrane between rami of lower jaw whitish, without rosy wash, tip of lower jaw olivaceous; mouth on sides and below tongue orange, whitish elsewhere; side of caudal peduncle with about 30 small roundish black spots, these most numerous on posterior half, there being only 3 anterior to the adipose dorsal fin; rest of body entirely without spots; dorsal fin with about 6 irregular series of small roundish black spots, those toward the distal portion largest and blackest; general color of dorsal fin light olivaceous yellow, the tips of the anterior rays with a broad margin of whitish orange; adipose dorsal olivaceous, narrowly bordered with black, and with 2 small round black spots; caudal fin profusely spotted with black, the spots arranged irregularly in about 8 or 10 vertical rows; those at the base blackest and roundest, those on the distal edge somewhat linear, those on the outer edges of the lobes extending forward onto the dorsal and ventral lines of the caudal peduncle; general color of caudal fin yellowish and olivaceous, the lower lobe somewhat rosy; pectoral red, somewhat lighter than lateral band; ventral reddish, the anterior rays edged with white; anal reddish with a little orange, the anterior half or two thirds broadly edged with white.

There is not much variation in color, except such as is probably due to difference in age; the rosy lateral band, the parr-marks, and the

broad rich cadmium band on the belly are characteristic. The variation in the black spots is inconsiderable. In the 29 specimens which I have examined critically 15 do not show any spots whatever anterior to the adipose fin, and only 2 of the remaining 14 show any spots anterior to the dorsal fin, and these are obscure and few in number. In one large specimen there are but 12 to 14 spots on the caudal peduncle; in another somewhat smaller example there are but 6 spots. The dorsal, anal, and ventral fins are invariably edged with brighter color. The head in the males is longer and more pointed; the maxillary is also longer than in the females. When well spread the caudal fin is usually slightly lunate or slightly notched, but in some examples it is almost truncate or square. In alcohol all of the bright colors soon fade, the parr-marks, black spots, and pale edges to the dorsal, anal, and ventral fins persisting. The general color of the body then becomes a dirty yellowish white or in some specimens brownish. In some cases the parr-marks almost wholly disappear.

The type specimen of this species is No. 53064, Z. S. Nat. Mus. Cotypes are No. 53400, U. S. Nat. Mus., No. 1251, Bureau of Fisheries, and No. 9255, Stanford University. It gives me great pleasure to name this superb trout for Theodore Roosevelt, in recognition of his active interest in fish and game protection.

This is the most beautiful of all the trouts; the brilliancy and richness of its coloration are not equaled in any other known species; the delicate golden olive of the head, back, and upper part of the side, the clear golden yellow along and below the lateral line, and the marvelously rich cadmium of the under parts fully entitle this species to be known above all others as *the* Golden trout. In form it is no less beautiful; its lines are perfect, the fins large and well proportioned, and the caudal peduncle strong; all fitting it admirably for life in the turbulent waters in which it dwells. It is a small fish, however. The largest example collected by us was 11¼ inches in total length and the heaviest one weighed 10 ounces. It is probable that it never attains a greater length than 14 inches or a weight of more than a pound in Volcano Creek.

The Golden trout is a native of Volcano Creek alone, and occurs throughout the entire length of that stream. We caught specimens at various places from above the tunnel to below the lowermost of the series of falls near the mouth, and it was seen in all suitable places from the tunnel to the headwaters above Volcano Meadows, where the elevation is more than 10,000 feet. Although the fish runs down Volcano Creek even to below the lowest falls, it apparently does not venture out into Kern River; no examples were seen there. It is a creek fish and appears to keep within the peculiar environment of the small stream. Although we obtained a specimen at the foot of

the first falls, it is doubtful whether many individuals venture so far down.

Trout are abundant in Volcano Creek; every pool at the foot of a fall or below a cascade or rapid was sure to contain a number of them, and others were seen on the riffles and under the protecting banks. They were most numerous above the tunnel, probably because fewer tourists visit that portion of the stream. The fish there, however, were usually small. The largest, finest examples were seen between the natural bridge and the lower falls.

As a game fish the Golden trout is one of the best. It will rise to any kind of lure, including the artificial fly, and at any time of day. A No. 10 fly is large enough, perhaps too large; No. 12 or even smaller is much better. In the morning and again in the evening it would take the fly with a rush and make a good fight, jumping frequently when permitted to do so; during the middle of the day it rose more deliberately and could sometimes be tempted only with grasshoppers. It is a fish that does not give up soon but continues the fight. Its unusual breadth of fins and strength of caudal peduncle, together with the turbulent water in which it dwells, enable it to make a fight equaling that offered by many a larger trout.

Although now abundant the Golden trout can not long remain so unless afforded some protection. The attractiveness of the Kern River region because of its scenic beauty is sure to appeal more and more to tourists every year. Practically the entire length of Volcano Creek is easily accessible from the trail from Kern River to Mount Whitney, and that portion above the tunnel is covered by the trail from the east side of the divide. As a matter of fact one can in one day travel the entire length of the creek and have time to stop frequently to drop a fly into the pools which he passes. The trout are readily found and are easily captured, as they are so voracious and rise to the lure so readily. Two years ago the members of the Sierra Club and others accompanying them on their annual outing to Mount Whitney are said to have taken 600 or 700 trout from Volcano Creek in one day. During the time our party was on Volcano Creek three to five other parties were camping at different places along its course. Each of these parties contained two to ten persons, and they all depended chiefly on the creek for their meat. How many trout were taken daily there is no means of knowing, but the number must have been very large. One party of three acknowledged that they ate sixty-five one day for supper.

RECOMMENDATIONS FOR THE PROTECTION OF THE GOLDEN TROUT.

Provisions for the protection and preservation of the Golden trout should proceed along two lines, viz: through fish-cultural operations, and by imposing restrictions on its capture.

In May, 1905, the United States Bureau of Fisheries attempted to establish a temporary station on Volcano Creek for the purpose of taking the eggs of the Golden trout. It was found that the spawning season was practically over before the station could be installed, and the matter was postponed temporarily. A number of fish (264) were captured, however, and carried practically without loss on pack animals to Lone Pine, whence they were shipped in care of a special messenger to the Lewis and Clark Exposition at Portland. Through a mishap, however, the entire lot was lost en route.

Although the efforts thus far made have not proved successful, it is not believed that any real difficulties exist to prevent the carrying of trout from Volcano Creek to one or more of the trout hatcheries of the Bureau, and it is hoped that another effort may soon be made. If a number of fish can once be gotten to one of the hatcheries it will be easy to propagate the species artificially.

There are many small mountain streams in the Western States where this fish would certainly thrive. It should also be tried in certain streams in the East. A small, clear stream, with low temperature and fine gravelly bottom, preferably of granite, is recommended. It would be extremely interesting to try the species in several streams and note the effects of the new environment. The possibility of adding such an attractive fish to the streams of other states is well worth a serious effort. It is also desirable to establish a temporary hatchery on Volcano Creek where eggs may be taken and eyed for shipment.

Another thing that should be taken up at once, preferably by the California Fish Commission, is the stocking of barren waters in the Kern River region. As stated elsewhere in this report, there are many small streams and lakes of the southern High Sierras that are entirely without fish of any kind, although certainly well suited to trout. Among these may be mentioned Rock Creek, Guyot Creek, Whitney Creek and the lakes at its head, and many others. To stock these waters by transplanting from Volcano Creek would be a very easy matter.

Protection.—As already stated, it is only a question of time, a very few years at most, when the Golden trout of Volcano Creek will become practically exterminated unless it receives some protection.

In order that adequate protection be secured, it is recommended that the limits of the Mount Whitney Military Reservation be extended so as to include the whole of Volcano Creek. This can be done by extending the eastern boundary from the present southern boundary along the meridian of 118° 10′ to its intersection with the parallel of 36° 20′, thence west on that parallel to Kern River, which should be made the western boundary.

The northern boundary should be extended westward to the main fork of Kern River. This would include all of Volcano Creek, the headwaters of Cottonwood Creek, and South Fork of the Kern, as well as all of Rock Creek and Whitney Creek. When the boundaries have been thus extended, fishing within the limits of the reservation should be absolutely prohibited for three years, after which it might be permitted under certain restrictions. These restrictions should provide a minimum size, limit the number that may be caught, and prohibit all fishing during the spawning season.

With such regulations as these, together with the fish-cultural operations suggested, it is believed the Golden trout will continue an abundant fish and remain one of the great attractions of this interesting region.