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STATE OF WASHINGTON.
DEPARTMENT OF FISHERIES AND GAME.

TENTH AND ELEVENTH ANNUAL REPORTS

OF THE

STATE FISH COMMISSIONER

AND

GAME WARDEN

TO THE

GOVERNOR OF THE STATE OF WASHINGTON.

A. C. LITTLE,
Commissioner and Warden,
Tacoma.

1899-1900.

OLYMPIA, WASH.
GWIN HICKS, -- STATE PRINTER.
1901.

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STATE OF WASHINGTON *(State)*
Dept. of Fisheries.

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TACOMA, WASH., January 1, 1901.

To His Excellency John R. Rogers, Governor of Washington:

SIR—In compliance with the provisions of the law requiring the same, I have the honor to submit herewith the Tenth and Eleventh Annual Reports of the Department of Fisheries and Game for the years ending December 31, 1899, and December 31, 1900, respectively.

Respectfully submitted,

A. C. LITTLE,

Fish Commizsioner.

GENERAL REVIEW.

There has been a remarkable growth of the fisheries industry of the State of Washington during the past two years. This extraordinary increase in the amount of capital invested, labor employed and the value of the output has interested every portion of the state, it being admitted by all that the fisheries are one of our most important industries. No other state has shown such a remarkable increase and no other like amount of territory on earth, with the exception of Alaska, has the promise of such future growth.

From every quarter we have received encouragement and commendation in our work, and with almost one accord we find the fishermen, cannerymen and all parties engaged in the industry ready to urge and support any reasonable proposition which is for the betterment and preservation of this great industry.

The wise legislation enacted by the Legislatures of 1897 and 1899 for the benefit of the industry, together with the extraordinary progress of the same, is increasing the duties of this office entirely out of proportion to the amount of assistance allowed the Fish Commissioner. It has been impossible for us to do more than the work that under no circumstances could be left undone. For this reason, the enforcement of the law in almost every particular has been sadly neglected. We have done our best to see that the work of artificial propagation of salmon should be carried on to its fullest extent with the funds available. We are, however, compelled to admit that very much necessary work in the line of superintendence of these plants and personal and thorough inspection of the same at frequent intervals has not been done and cannot be done under existing conditions.

In the following pages of this report will be found our suggestions for legislation and requests for more assistance. Our

department has grown from one of the most insignificant in the point of labor required to one of the most important in the state, actually demanding as much assistance in our office and field work as any state department. If the necessary assistance and appropriations are granted, I believe that the next two years will show more remarkable increase in the point of effectiveness of the work done and the benefits resulting from the same than has been shown during the past history of the department.

The present laws for the control of our fisheries are very complete. But few changes or amendments to the same are necessary, and these are minor ones. Our statutes in relation to license fees and the support of our state fish hatcheries are all that are required for the work that is being done at the present, and unless the same are to be considerably enlarged, need not be increased in any particular.

In no state in the Union do the people engaged in the fisheries industry, by special taxation, do twenty-five per cent. as much as is done in our state for the support of their industry. The industry itself in almost every state in the Union is considered of so much importance and of so great value to the citizens in general that it is considered wise to make large appropriations from the general fund of the state for the protection and preservation of the same.

There seems to be an opinion in some quarters on account of the large amount of capital now being employed and the supposed extraordinary returns from the same, that this industry should be compelled to pay the entire expense of the same to the state. No such selfish and narrow ideas will ever be endorsed by any person who takes the time to investigate the importance and great benefit to the state in general derived from this source. Our fishermen, cannerymen and dealers pay a large amount of taxes for the benefit of people engaged in other industries, and furnish a most important portion of the opportunity for employment of labor in very many of the different branches of business in the state; paying millions of dollars for supplies and material used in operating the great canning and preserving establishments and in the taking of the raw product.

There are cities and towns in this state that during the past two years have shown a remarkable growth in their population and advancement in the values of real and personal property,

which result wholly and solely from the increase of the fisheries industry; in fact, no portions of the state show as great an increase in the value of taxable property as is shown in these districts.

To say, then, that the fisheries industry should by special taxation be compelled to pay the entire expense of its preservation and protection is rank folly, and can only emanate, as before stated, from parties who have a very limited knowledge of the true situation. If the same rule is to be applied that every person who receives benefits from the natural resources of the state and protection under its laws should be compelled to pay the entire expense for his particular benefit and the preservation and protection of the same, our people engaged in the fishing industry would offer no complaint. They are now doing much more than is done by any other branch of the state's business, and to ask them to do more is not only uncalled for but unjust. We believe that the importance of the industry is now so well known that any movement in the direction of those indicated above will not find favor, and that this great industry will receive its due proportion of appropriations from the general fund of the state.

Season of 1899.

The season of 1899 was a record breaker in the point of new capital employed and in the value of the season's output. This remarkable increase was confined almost solely to the Puget Sound district; the amount of capital employed, showing an increase of 110 per cent.; the number of employes increasing in the same proportion. In the amount of earnings of employes there was an increase of 300 per cent., the value of the output making the same extraordinary showing.

In the Columbia River district there was no material change in the amount of capital and number of persons employed. The earnings of those engaged in the industry and the value of the output, however, show an increase of fully 20 per cent. On Willapa Harbor the amount of capital employed shows an increase of 25 per cent. In other respects, however, there was no material change in this district. The Grays Harbor district shows a material increase in the amount of capital, number of employes and value of the season's output.

Season of 1900.

The year of 1900 shows a material increase in all points over any previous year with the exception of 1899. Compared with this year, the total value of the output shows a decrease of fully 30 per cent., while the capital increased close to 10 per cent. The amount of labor employed and the earnings from same show no material change. The loss over the previous year is confined wholly to the Puget Sound district, and is due to the decrease in the salmon pack and fresh fish output for this district. This was an off year for the humpback salmon as well as the sockeyes, the humpbacks running every other year.

The Columbia River district shows a slight decrease in the amount of raw material taken, but higher prices prevailing, the total value of the output increased over 10 per cent.; the earnings of labor employed receiving a major portion of this increase. In the Grays Harbor district a cannery that has been idle for some seasons was operated, and the salmon pack shows an increase of some 12,000 cases. To the better prices prevailing is due a considerable amount of the increase in the value of the output. On Willapa Harbor the conditions are very similar to that of 1899, the better prices received making up the loss in the amount of the shell fish output; the total value of the product being somewhat increased. Conditions in the Columbia River, Willapa Harbor and Grays Harbor districts are in what might be termed a settled condition, the run of salmon and other fish not having materially increased or decreased.

The higher prices for the raw and manufactured product generally prevailing will undoubtedly be the cause of more activity in every district in the state in the salmon business for the coming year. A larger run of sockeye salmon than that of 1900 is expected, and we are certain of a fair run of humpbacks, which form a very important portion of the entire pack. All circumstances being taken into consideration, the prospects for 1901 are very good.

Change Date of Filing Report With Governor.

Our experience during the past three years has proven to us that it is impossible, under ordinary circumstances, to get more than a limited number of reports from the cannerymen, fish dealers, etc., before the middle of December, from which we get the data for our report, due to be filed with the Governor on

December 1. The failure to get these reports is due to several causes, the principal one of which is that it entails considerable expense upon a majority of those engaged in the industry to be compelled to compile these reports before they close up their business for the year.

We would, therefore, suggest that a change be made in the law from the first of December to the first of January, for the filing of this report. Certain it is that we shall better obtain the data from which our reports are compiled if this extension of time be given, and it will also be a benefit to a majority of those engaged in the industry.

Reason for Combining in Many Instances the Annual Reports.

On account of shortage in the state printing fund, our report for 1899 was not printed. It has been possible to make our report for 1899 and 1900 much more brief and the expense of printing the same considerably less by combining the reports for the two years in one wherever practicable. This is mainly true in regard to detailed statements in reference to expenditures for the hatcheries and in the general review of the industry and recommendations for the consideration of the Legislature. It will be possible for us at any time to furnish, if necessary, detailed statements for the use of the Legislature or any parties desiring the same.

Deputy Fish Commissioners.

Our department has been seriously handicapped in the past for want of sufficient assistance to properly enforce the law and do the detail work required by the industry. So many different branches require attention that it is impossible for the Commissioner to more than supervise the work to be done. I have attempted to look after the state hatcheries personally, believing that this is the most important branch of our service. It has been impossible for me to give this work anything like the attention it requires and a serious loss to the industry has resulted therefrom.

Under the present law, the Fish Commissioner is provided with three deputies who each work fifty days in the year. This law was passed at the first session of the Legislature in 1890. The industry has grown in a remarkable degree in the last four or five years and this amount of assistance is entirely inadequate.

In order that the work may be reasonably well done it is absolutely necessary that we have two field deputies who shall work the full time during the entire year. If these deputies are provided, it is our intention that one of them shall be assigned to duty on Puget Sound and the other on Columbia River, and we would include in the Columbia River district Willapa Harbor and Grays Harbor. This would not evenly balance the labor required of these two deputies, but as our headquarters are on the Sound we can render material assistance to the Sound deputy from the home office.

It is absolutely necessary, also, that we have a first-class book-keeper in the office. The amount of clerical work necessary to be done in this office is as great as that of any state office, and for the past two years the amount of work really necessary for the proper operation of the department has not been done for want of sufficient assistance. Our office records for the above reason have not been as well kept as they should be, and a considerable amount of fees due from different branches of the industry has not been collected on account of a large amount of clerical work being required. I have employed a stenographer for the last two years, who has performed a considerable amount of the clerical work in the office, as well as doing the required stenographer's work. The correspondence and other work which properly belongs to the stenographer's duties have increased until they require the full time of one person.

With the office force that I have outlined above, it will hardly be possible for us to do the work necessary for the proper conduct of the department.

It is very necessary, also, that our field deputies have a sufficient expense fund. If the Legislature shall make, as requested in another portion of this report, a sufficient appropriation for the purchase and maintenance of a patrol boat on the Columbia River and the Sound, the deputies' expense fund can be cut to \$600 each per year; if no appropriation is made for the boat, and it is expected that from their expense fund they shall pay the cost of whatever patrol boats are necessary in the enforcement of the law, at least \$1,000 per annum for each deputy will be required. It will be impossible, even with this sum, to pay the expense necessary for the proper enforcement of the law.

In order to have a large amount of necessary work done I was

compelled to employ more help than our appropriations provided for during both seasons of 1899 and 1900. In salaries and expenses this overplus amounted to \$785 for 1899 and \$820 for 1900. The major part of this has been paid out of my own pocket, and we respectfully ask the Legislature to reimburse us.

I believe that any reasonable man who will carefully look into the work that we have accomplished and make himself acquainted with the work that could not be left undone will say that we have done right in incurring this extra expense. In order that there will be no deficiency I have paid the money out for this work, and the state has received great benefit therefrom. We have the salary and expense vouchers for every dollar.

The fisheries law passed by the Legislature of 1899 and also the appropriations for fish hatcheries doubled the work of this office many times. I consider that for the amount of work accomplished we have done remarkably well to keep the expenses as low as has been done.

Salary of Commissioner.

In connection with the amount of work required of the fisheries department of this state, we would respectfully call attention to the fact that the salary of the Fish Commissioner of Oregon is \$2,500 per year, while that of the Commissioner of this state is \$2,000. No one aware of the facts in the case will for a moment contend that the fisheries department of the State of Washington is not of more than twice the importance of that of Oregon, and considerably more than double the amount of work is required for the enforcement of the general fishing laws on account of our state having two large districts instead of one, as in Oregon; the industry in the district of Puget Sound in our state being larger than the whole State of Oregon, and demanding more attention.

Also, in respect to the amount of money collected and disbursed, more than three times the labor is required. We also have more than five times the number of fish hatcheries in the state, there again requiring more than five times the amount of supervision and responsibility. We wish to further state that the Legislature of Oregon at the last session provided their Commissioner with twice the amount of deputy service and \$500 a year expense money in excess of that appropriated for the Washington department.

To state the matter briefly, the Fish Commissioner of Washington has more than twice the responsibility than has the same official in Oregon, and certainly three times the amount of labor to perform in order to properly do the work required of his department.

Appropriation for Patrol Boats.

It will always be impossible for this department to do the work necessary for the enforcement of the law, on either the Columbia River or Puget Sound, unless we are provided in both places with a gasoline or steam launch of our own. At the time of year when most of our work should be done, boats that can be leased are very scarce, and many times, even though we have the money to pay for the same, which in the past we have not had, we are unable to procure the proper transportation in order to properly apprehend violators of the law.

Especially is this true on Puget Sound, and the boat required for this district will of necessity be larger and more expensive than that provided for the Columbia River—first, because the work required to be done is several times greater; and second, for the reason that we are compelled to go to portions of the Sound where it is not safe to venture under ordinary circumstances with a small launch. The boat to be used for this district will cost at least \$5,000, and will cost \$75 per month to get a proper man to handle the same, and the running expenses will be at least \$150 more. We will need to operate this boat at least ten months in the year, making a total cost of \$2,250 for running expenses. The deputy doing the patrol work on the Sound will be captain of the launch and his own pilot.

A gasoline launch sufficient for our needs on the Columbia River can be procured for \$2,500. We would require a sufficient amount of expense money for this purpose to procure the necessary amount of gasoline, also for an assistant during ten months of the year. We would be compelled to pay an engineer \$65 per month, and it would cost in the neighborhood of \$75 per month for fuel and other expenses, making a total of about \$1,400 for running expenses. The deputy doing the patrol work on the River will be captain of the launch and his own pilot.

For the above purposes an appropriation would be required of \$7,500 for the boats and \$7,300 for maintenance for two years, making a total appropriation of \$14,800. I am well satisfied

that during the last two years we could have collected a considerable portion of this amount in license fees had we been thus properly equipped with boats in order to thoroughly cover all the territory during the fishing season. The fishermen are well aware of our inability to reach them, and in very many instances escape the payment of their license fees as well as violate the closed season laws. These boats could also be used to materially further our hatchery work in some localities.

The State of California have furnished their Fish Commission a substantial gasoline launch, used on the Sacramento River and San Francisco Harbor, costing \$2,600. This portion of California's fishing industry requires less than one-half the work necessary to be done by our department on the Columbia River, and in amount of output and commercial importance is less than one-half of our district.

In the report of the California State Board of Fish Commissioners for the year 1898 may be found the following statement as to the benefit derived from the use of their launch :

“The presence of this boat among the fishermen has a most beneficial effect in giving weight to the regulations affecting the fisheries, and while our deputies have been enabled by its use to make many arrests, remove set nets, and destroy miles of the prohibited Chinese sturgeon gear, the knowledge that the launch was in commission and liable at any time to visit the fishing grounds, has forcibly impressed upon the fishermen the necessity of a close observance of the regulations.”

Office Furniture and Fixtures.

On assuming the duties of Fish Commissioner, I found very little office equipment. The Legislature of 1897 had materially increased the work of the department and it was found to be at once necessary to better equip the office in order that the required amount of work be done. Our expense funds for the two years, 1897 and 1898, did not warrant much expenditure in this line. Only such furniture and office supplies as were absolutely necessary were purchased.

The Legislature of 1899 again more than doubled up the work of the office, and the equipment with which we had managed to do our work for the two years past was found to be wholly inadequate on account of increased amount of labor.

During our incumbency of the office we have expended in the neighborhood of \$400 for above purposes. This, as a matter of

course, made considerable inroad on our expense funds. For the next two years it will be necessary for us to expend about \$250 for this purpose, which should be provided for in our expense appropriations.

Fine Mesh Seines.

A large number of salmon, as well as herring, smelt and other small fish, are annually destroyed in this state by the use of very fine mesh seines. The use of no seine should be allowed the meshes of which are less than $1\frac{1}{4}$ inches, stretch measure; a mesh of this fineness will not capture herring and smelt that are too small to be saleable. This will stop the catching of a large amount of small fish that are now thrown on the beach and wasted.

Forfeiture of Fishermen's License.

I believe that one of the most effective means of enforcing closed seasons and laws of a like character would be the forfeiture of the fishermen's license when the owner is convicted of any violation of the law, not allowing the issuance of a license to the party during the current year.

Failure to Collect Certain License Fees.

The lack of assistance to properly enforce the law and collect the license fees has resulted in a considerable loss to the state, as may be noted on an examination of our report showing the amount of fees of different kinds collected during the past two years.

During the year 1899 we were able with the expense money at hand to much better enforce the law than in 1900, our fund having been practically exhausted. Certain classes of our license fees cannot be collected without personally visiting the different persons engaged in this particular line of the industry and demanding the fees of them. This can only be done at some considerable expense, and without sufficient help results in a large loss to the state, also being unfair to those who desire to obey the law and pay their fees without trouble.

Recommendations in Regard to Pound Nets.

A matter of considerable importance which needs some definite legislation is to have the term "river" defined. Under the present law, pound nets are not allowed within three miles of the mouth of any of the rivers of the state. Considerable

trouble has arisen from the fact that pound nets have been built near the mouths of some small streams under the contention that these bodies of water are not considered rivers under the language of the statute. The term "river" should be defined so as to avoid this difficulty; and if this cannot be done, the rivers which are supposed to be protected by this statute should be named. To have this matter properly settled will save a good deal of controversy and considerable litigation.

Depth of Water.

Two years ago, in our report, we advised that the manner of measuring the depth of water in which pound nets were allowed to take fish should be changed from low water to high water. This change was not made in the law and has been the source of a large amount of litigation. If it is not deemed wise to change the language of this statute, what is meant by "low water" should be defined by legislative enactment.

Length of Set Nets.

Considerable trouble has arisen in the past among set net fishermen over the length of their nets. As the law now stands, there is no limit to the length of either a set net or a gill net. In my judgment, set nets should be limited to the length of five hundred feet. Very few of those in use are of this length, and where longer nets are used it is usually to interfere with other locations. Five hundred feet of net is ample under all ordinary circumstances; and if a person wishes to cover more territory than can be covered by this length of net, he should be compelled to use two nets and pay for the same.

Prohibiting Fishing Above Tide Water.

I strongly recommend that a general law be passed prohibiting the taking of salmon with any kind of fishing appliance except hook and line, commonly termed angling, in any of the streams of the state above tide water, with the one exception of the Columbia River. This prohibition should apply to fishing with a hook attached to a pole as is practiced in very many of the Sound streams. I have been creditably informed that two men with this sort of fishing appliance have caught over 2,000 salmon on their spawning beds within three days' time. After the salmon have been in the fresh water streams for a short time

they deteriorate considerably and should be allowed to ascend to the spawning beds without hindrance. The class of fish caught are of very poor quality and have a bad effect on the trade.

The Fish Commissioner should also have the power to prohibit fishing in any river at any time on which the hatcheries are located.

Appropriation for the Marking of the Mouths of Rivers and Streams.

The Legislature of 1897 and also of 1899 in enacting the fisheries law for the protection of salmon provided that the Fish Commissioner should mark the mouths of certain rivers and streams in the state. No appropriation was made for this purpose, and for that reason nothing has been done of practical value in this line.

The lack of something to distinctly mark the mouths of these streams is a constant source of trouble for our department, and while we have indicated the mouths of the streams as best we could without anything to properly mark the same, it is hard for us to enforce the law without these guides to the fishermen to give them the information as to when they are within or without the rivers.

It will require quite a considerable appropriation to perform this work, our estimates that to properly complete the work, doing only that which is absolutely necessary, the expenditure of at least \$2,500 will be needed, and even then this amount will leave unmarked a considerable number of important fish streams. It is very important, however, that the work be done, and we sincerely hope that the Legislature will authorize us to do the same.

Logging Dams.

A serious menace to the fishing industry in many localities are the loggers' dams built for the purpose of storing water for splashing or driving their logs down the streams. A large amount of water is accumulated in the ponds and as much of it as possible is turned loose at once, raising the water in the streams some four or five feet, and in this manner carrying the logs and other timber over the shallow places in the river.

The constant use of these dams on certain streams has driven the salmon entirely out of them. The cause of this is the

action of the water in tearing up the spawning beds in some places, and in others covering them to a considerable depth with gravel and sediment. On at least three of the streams on which we now have hatcheries in operation dams have been, or soon will be, built which are certain to be very destructive to the fisheries interests in these localities.

While we understand that the promotion of the logging industry is necessary to the material interests of the state, it is also true that everything should be done to lessen the injury that will be wrought with the appliances as above described. The Legislature should enact a law providing that during the spawning season of the fish, and until the same have been hatched and are able to take care of themselves, these dams should not be used. Especially should the law provide, that on the streams where our hatcheries are in operation these logging dams should not interfere with our work during the season that we are taking the fish for hatchery purposes. Unless this is done on several streams on which we are now operating, the work already done will have been thrown away, and it will be impossible for us to properly handle our station in the future.

Sawdust Thrown in the Sound.

In our last report we called attention to the immense amount of refuse deposited in the Sound by the saw and shingle mills. This evil is increasing year by year and the waste of fish life also constantly increasing. Large beds of clams and the spawning grounds of immense numbers of smelt, herring and other food fish have been destroyed by deposits of sawdust and mill refuse; greatly decreasing the supply of these fish in many localities. A stringent law should be enacted prohibiting this evil as, not only is it an injury to the fishing industry, but to navigation as well. Any person familiar with the conditions on the Sound well knows that large masses of this waste, acres in extent, may be found on the routes of any of the steamboat lines and even causing serious trouble to navigation.

Why More Prosecutions Have Not Been Instituted.

Inquiry has frequently been made by many persons why we have not instituted more prosecutions for the violations of the fish and game laws. We have been compelled to admit that

these infractions are frequent and well known to this department. From our past experience it has been clearly demonstrated to us that to make an arrest and turn the matter over to the average county authorities, without appearing in person to prosecute the case, seldom results in any good. To prosecute an ordinary violation of the fish laws, as shown by the actual work required in the same, has ordinarily required from six to ten days time and the expenditure of from twenty to thirty-five dollars. It must be readily seen that with the limited amount of deputy assistance and expense money at our disposal and the large amount of work necessary to be done in order that the hatcheries and other work of the department might be accomplished, it was impossible for us to even attempt anything like a systematic prosecution of these violations of the law. We have considered that it was not right for us to dodge out and punish one man for the violation of the law when it was a fact well known to every one that a majority of the cases were to be allowed to pass without notice. It has been my policy to avoid these prosecutions and litigations in every way in my power, knowing full well that the time would soon arrive when we would be compelled to desist on account of the lack of funds and assistance, and the bluff that we have made work fairly well would have ceased to be of any effect. I have considered that the most important work in connection with the fish department was the establishment and proper maintenance of the fish hatcheries. Every year's delay in this respect means a great loss to the fishing industry, and, while the many violations of the law have resulted in considerable injury to the industry, I believe that the policy that has been pursued will be found by test in the future to have been right and proper.

In other portions of this report we have called attention to the lack of assistants and money to enforce the law, and if it is the intention of the Legislature that these laws should be enforced, certainly they should provide sufficient appropriations to pay for the expenses of the same.

Introduction of Fish Not Natives of Waters.

The evil results of the lack of information in regard to the proper kinds of fish that should be introduced into our streams are becoming apparent to all. In many of the eastern states

stringent laws have lately been passed prohibiting the importation into the State of carp and several other varieties of fish. Daily we receive communications from different portions of the State asking that we use our influence to obtain carp for the stocking of private ponds. These fish are as near worthless as a fish can be and are not used for food by any one. They are practically worthless for any purpose, being the poorest fish that swims for the purpose of making fertilizer, the purpose for which the poorer qualities of fish are used. In almost every county in the state may be found private streams and lakes, capable of producing many thousand pounds annually of the choicest food fish, that are now so full of carp that it is nearly impossible for any other class of fish to exist. The grave mistake that has been made in introducing these fish will be better understood a few years hence, as it is practically impossible to get rid of them by any known means and, as they are very prolific, within a few years some of our best trout streams and lakes will be so overrun with them that no class of fish can be therein raised until some plan can be formulated to get rid of the carp. What is true of carp is also true of some other varieties of fish, although to a less degree. In some localities black bass have been introduced in the trout streams and, as everyone knows, in a short time will have practically cleaned out the trout in these localities. If, instead of introducing bass, the best varieties of eastern brook trout had been planted, the results obtained would have been many fold greater, the trout being a vastly better game fish, as well as being of superior quality to the bass.

We advise that a stringent law be passed by the coming Legislature giving the Fish Commissioner the right to prevent the introduction of any fish for the purpose of stocking the waters of this state which, in his judgment, are deemed injurious to the fishing interests. Very many states of the Union have a statute of this character, and the results from the enforcement of the same are very beneficial.

Fisheries Inspection Law.

Numerous complaints come from every part of the state against packers of fish products who put up their output in such a manner that the sale of the same has a very bad influence on the sale of fish products generally. Packers of fish will

put up a package so that the center of the package is of very poor quality, and being sold to the trade for a less sum, work a great injury to the legitimate dealers. Also a considerable number of those engaged in the packing and preserving of fish are not as careful as they should be in the manner of handling the same, a considerable portion of their output being unfit for food. This works to the disadvantage of the legitimate dealer, as this class of products can be sold for less money than a first-class article.

To remedy this evil it has been suggested by a large number of those engaged in the business that a state inspection law be enacted requiring the Fish Commissioner to inspect the products of the different packing and preserving institutions in the state, and that the Commissioner be provided with a stamp which placed on the product insures the quality and quantity of the goods therein contained. Many of the people who recommend this law ask that it be made compulsory. I believe that such a law would be very beneficial to the fishing industry of the state in general, and, in the event that it is not deemed advisable that it shall be compulsory, a large portion of those interested ask that the law be enacted and that the Fish Commissioner, on the payment to him of a reasonable fee, shall put the state stamp of quality and quantity on the goods of any person desiring it. Many of those engaged in the industry believe that this is all that is necessary, for the reason that if any considerable number of those engaged in the industry use the stamp (which it is believed they will), it will compel those now opposed to the proposition to use the state stamp in order to get the full price of their goods on the market. Undoubtedly the putting of considerable quantities of a poor product on the market in both canned and salted goods has resulted in a considerable loss to the industry. Certain is it that legitimate dealers, careful of their output, have suffered from this source. Only those who are putting an inferior product on the market can complain of a compulsory regulation of this character, and even those cannot complain if the law is not made compulsory. It is certain that a law of this character would increase the value of the output of the fishing industry, compelling those who are now putting up an inferior product to handle in a better manner the fish they are packing or preserving.

A fee of one-half cent per case on canned products, two cents per barrel on salted fish, and a proportionate amount on other packages of fish products will more than pay the cost of this inspection; thereby being no expense whatever to the state in general.

Provision of the Law Allowing Departments of the State to Use State Lands.

Frequently we have found it desirable in the prosecution of our work in establishing our hatchery stations to build the same on state lands. We believe it would be wise that there be a provision in the law allowing any of the State departments, when state land can be used to advantage, to enter upon the land and use the same for state purposes.

At the present time we are compelled to go through the formalities of leasing, etc., as any individual must do, and thus come in competition with individuals in the obtaining of leases or in the purchase of lands from the state. This results in larger expense to the department from which the state received no benefit.

Trouble With Indians on Our Hatchery Streams.

The general fisheries law passed by the last Legislature provides that any Indian residing in this state may take salmon or other fish by any means and at any time for the use of himself and family. The Attorney General has advised us that; first, this clause does not apply to Indians who are citizens, and, second, it does not allow the Indians to violate the general fishing laws. However, the Indians have taken this clause to mean that they have a right to do as they please with regard to the taking of salmon, and have built traps entirely across the rivers on which are located some of our hatcheries, and in one instance gave us so much trouble and delayed the run of fish up the stream to the extent that the hatchery located at this point was almost a complete failure for the season.

This provision, instead of being a benefit to the Indians, has resulted in a loss to them, as on account of their attempting to fish in a manner and at times when the law prohibited the same, they have been put to considerable expense and have failed to get as many fish as they have under other circumstances.

This clause in the law should be repealed. It has been the policy of this department to be very lenient with these people,

and no trouble would ever have arisen with them had they not been ill-advised as to their rights under this statute.

Investigation of Conditions Favorable and Unfavorable to Salmon Propagation

One very important matter that heretofore has been entirely overlooked by the Legislature has been the need of close investigation in regard to the habits and life of the young salmon in our waters before they go down to the ocean.

A large number of persons engaged in the fishing industry have very erroneous ideas as to the habits and life of the young salmon. It has been impossible for this department to investigate this except in a very limited way. In connection with our hatchery department we should have some person whose business it is to put in a large portion of his time in close investigation of this particular subject. It is a much disputed question as to whether the salmon stay for a considerable length of time in our streams after we turn them from the hatchery or after they reach a certain age in a natural way in the streams, or whether they at the age of ten or twelve weeks descend the streams to the salt water.

The result of investigations of the California Fish Commission for the last two years are at utter variance with the generally accepted idea that our salmon stay in the streams for a considerable length of time during the earlier periods of their existence.

Again, there is a dispute with regard to the habits of the different varieties of salmon, some claiming that certain classes of them immediately descend to the ocean very soon after they reach the age of three months, while other varieties stay in the streams for a year or more. These questions are of vital importance to our scheme of artificial propagation, and can only be determined by a man competent to do the work with sufficient appropriations to meet the expense.

The lack of knowledge in regard to the habits and growth of young salmon on the part of our department, as well as that of other states, has given rise to the general idea that we are not sufficiently well posted in our business, and not properly attending to the same. We are compelled to plead guilty to the charge of not being sufficiently well informed, but we claim as the reason for this that we have not been provided with sufficient assistance and money to cover the expense of making in-

vestigations so necessary to determine these points and acquire this knowledge.

Very many of the well-accepted theories in regard to salmon have been determined in the last few years to be at utter variance with the facts. We wish to call your attention to a few points in this connection. Only a few years ago it was a generally accepted theory that the Nerka family of salmon, of which the sockeye is the most important variety, would only spawn in lakes, or at least in still water. This has been determined to be utterly false, and that a majority of this class of fish spawn in rapidly running streams as other varieties of salmon do.

Again, in a report made to the United States Commissioners, who were a part of the Joint Commission between the United States and Great Britain, relative to the preservation of fisheries in waters contiguous to the United States and Canada, the statement is made that a considerable run of Nerka or sockeye salmon was found in Lake Washington. This was certainly untrue, as any person acquainted with the facts would be willing to pay at least \$100 apiece for every Nerka salmon found in these waters. These statements were made by men who were paid large salaries for their work and were supposed to understand their business, and arose from a lack of proper investigation of the subject, instead of a lack of proper knowledge to determine the same.

The point that we seek to make in this argument is, that our department should be provided with sufficient funds from some source to make these investigations and determine these very important facts, in order that the work of artificial propagation may produce the results expected from it. While we believe that we are succeeding as well as any other state in the work that we have undertaken, there is no question but that we can do a great deal better in the future than we have done in the past. The knowledge acquired and the experience had in connection with our hatcheries certainly will prove very valuable in the future, but we are still without a great deal of necessary information to manage these plants in such a way as to give the best results.

We should be provided with at least one man who has sufficient scientific knowledge to enable him to properly make these investigations, and we should proceed to the work at once, as on

the proper determination of a few disputed points may rest the main success of our whole proposition.

Fire Insurance of Hatcheries.

One of the most important matters that we have to present for your consideration is the question of fire insurance on our state hatcheries. Very many of them are located in the districts which in the summer months get exceedingly dry and the danger from fire is considerable. It entails a great expense on our department to employ a watchman for this especial purpose for considerable periods of time.

It has been the policy of the state in the past to carry its own insurance, and if this policy is deemed wise and shall be followed in the future, we would respectfully suggest that for the Fisheries Department that they be allowed to set aside from their maintenance funds an amount that would be required for premiums at the lowest rates obtainable, to be placed in what shall be called the fish hatcheries insurance fund. This fund should be under the control of the State Fish Commission and the said commission should be allowed to use the money in the re-erecting of destroyed plants. At present, in case of a fire in any one of our institutions, it will be impossible for us to replace them until the succeeding Legislature has made the necessary appropriation.

No possible loss can come to the state from a plan of this character as the amount set aside for insurance comes from the funds which can only be used for fish hatchery purposes.

Why the Last Three of the Hatcheries Authorized by the Last Legislature Have Not Been Built.

The Legislature of 1899 appropriated \$47,750 for the maintenance of the new hatcheries authorized to be erected in 1899 and 1900. The amount necessary to maintain these hatcheries was simply an estimate on my part, and experience has proved that I was considerably short in the amount required.

It is always more expensive to operate new hatcheries for the first year or two than it is afterwards. I found that the appropriation for maintenance of the new hatcheries would not be sufficient to operate the entire number, and I deemed it wise to allow the building of these plants to go over until an appropria-

tion be made for their maintenance. I was also handicapped for want of funds to make proper investigations in regard to the locations of these institutions.

Baker Lake Hatchery Account.

The Legislature of 1899 passed an act approving of the sale of our Baker Lake salmon hatchery to the national government. The United States Fisheries Department seemed very anxious that this matter should be hurried, and it was thought by myself and every one knowing the facts in the case that the plant would be taken charge of as soon as the act was passed allowing the transfer to be made. For this reason, this act carried an emergency clause.

We found, however, that for some reasons to us unknown, it was impossible for the United States Fisheries Department to take charge of the plant before the first of July. This left the hatchery on our hands to be operated by our department for the three months of April, May and June, 1899. The Legislature, for the reasons given above, had not provided any appropriations for maintenance, but we were compelled to carry on the work on account of having a large number of young fish on hand.

The expense of operation during these three months has been paid by myself. We have vouchers covering all of this expense properly attested to, and the accounts are assigned to me, showing receipts of payments by myself. The total amount of the expense of operation for the three months above mentioned is \$651.45. It was through no fault of mine that this difficulty arose, and I respectfully ask the Legislature to reimburse me.

Native Oyster Land Reserves.

When the state tide lands were surveyed and platted on Puget Sound, a large area of oyster land reserves were established. These reserves were supposed to contain natural oyster beds and were made for the purpose of retaining the title in the state of the source of seed supply for those engaged in the business of oyster culture. This idea was obtained from the practice and the laws of certain eastern states where somewhat similar conditions prevailed. The States of Maryland and Virginia for many years have followed this plan of protecting the small producers in the oyster industry. The scheme has been largely abandoned

in these states on account of its not having attained the result designed, and also for the reason that it entails very large expense.

The tide land commissioners making the reserves on Puget Sound selected in many places land which did not contain and never had contained natural oyster beds. Quite a large area of the amount of oyster land reserves is of this character and is not necessary for the protection of the natural oyster beds, and is of no value to the state unless it can be built up and made to produce oysters. Quite a considerable portion of the reserves did contain natural oyster beds, and at the time the reserves were made were a source of seed supply for those engaged in the industry; but for ten years they have been annually depleted until at the present time only a very small proportion of what were originally valuable natural oyster beds are a source of seed supply.

The natural oyster bed seems to deteriorate in an ever increasing ratio year by year when not properly protected from its natural enemies. Millions of starfish infest these reserves and are annually wiping out large portions of them. In one locality a natural bed of the extent of a hundred acres or more, capable of producing many thousand sacks of oysters annually, at the present time does not yield a sufficient amount to warrant the expense of gathering them. For this reason, no protection is given them by people engaged in the industry, and the Legislature never having provided any appropriations whatever for their protection, the Fish Commissioner has been unable to even make an attempt to properly protect them.

No better illustration could be given of the failure of the present system of handling these oyster beds nor of showing the value of putting these lands into the hands of private investors than the showing made on Oyster Bay. For the reason that the natural beds having been under the control of private parties for many years and having been cultivated by them, practically no portion of the natural oyster beds in this arm of the Sound were reserved by the state. When the law was passed allowing the sale of oyster land to individuals, these parties under a special provision of this act obtained title to the portion of land which they had had under control for past years, and since that time have brought to a high state of cultivation several hundred

acres of these natural beds, producing many thousand sacks of oysters annually, and during the present year in all probability nearly \$100,000 worth of product has been obtained from the lands in this locality.

Other portions of Puget Sound of like extent and also of a like character of lands, capable of producing the same amount of oysters per acre annually, now do not produce, as we stated before, a sufficient number to warrant the expense of gathering the same, having become depleted by the taking, on the part of oystermen, of too many oysters from the beds each year, and more especially having been sadly depleted by the natural enemies of the oyster, starfish and other parasites of that character. If this large area reserved by the state, from which the state now receives no benefit whatever and which each year is deteriorating and decreasing in value, were opened up to sale or lease to private individuals, there is no question but what the amount of oysters annually marketed would largely increase, and within a few years would be producing many times the amount that are now being obtained by the whole amount of land at present owned by private individuals and under cultivation.

Considerable opposition to this scheme has developed, quite a number of parties engaged in the industry being opposed to the proposition. The only argument of any value, however, which they offer against it is that a large company would be liable in some way to get control of the major part of the reserves, and very few individuals would be benefited thereby. To avoid this evil, if it be one, we would suggest that not more than ten acres of any one of these reserves be sold to one individual, and all other restrictions possible should be placed around the sale of these lands, so that the same will pass into the hands of individuals who will at once proceed to bring the lands to a high state of cultivation and production.

It has been suggested by some parties that a scheme of leasing would be the most profitable to the state, a portion of these lands being of that value that parties would be willing to pay \$25 per acre annually for the lease of the same. A very small portion of these reserves, however, is of this character, and, in my judgment, no very material income to the state can be derived from this source. If the lands were brought to a high state of cultivation, the state taxes from the same would give

the state nearly as much revenue as to attempt to collect the same in a lease, and in all probability more extensive improvements would be put upon the land and larger areas brought to a producing state. Certain it is, that the present scheme is a very wasteful one to the state, and is also an injury to the industry.

A larger proportion of spat will be saved in a locality where the whole area is under a good state of cultivation than where the cultivated beds are isolated, and for that reason if certain of these areas lying in vicinities surrounded by productive beds were leased or sold to individuals, it would be to the advantage of all concerned in that particular locality. Oyster spawn will not catch on soft mud, and it requires considerable expense for soft beds to be built up so that the spat can be saved, and, as we stated before, the larger the area in condition to receive and favorable to the life and growth of the spat, the better for all of the beds in that particular vicinity, so that those now engaged in the industry have every reason to demand of the state that these beds now in idleness, and gradually year after year deteriorating until they form a source of destruction to the spawn now floating on them from adjacent beds, shall be put in a good state of cultivation for the protection of those who have invested their money and time in the vicinity.

The conditions on Puget Sound are somewhat different from those existing on Willapa Harbor. On the Sound only a small proportion of those engaged in the industry depend on the natural beds enclosed in the state reserves for their source of seed supply, a large proportion of the Sound oystermen having natural beds upon which are produced the seed.

On Willapa Harbor, however, the opposite is true. Only a very small proportion of the cultivated beds in this district are capable of producing sufficient seed to replant the cultivated beds. From the information at hand on the subject, in our opinion not to exceed five per cent. of the cultivated beds of this district owned by private individuals are capable of producing an amount of oysters that form any source of seed supply. Ninety-five per cent. of the seed, at least, is obtained from the natural oyster beds, the title of which is still in the state. These beds are located in different portions of the bay and formerly contained a very large amount of oysters in their native state. For over thirty years these natural beds have been tonged for

seed, which was planted on the cultivated beds, and year by year the beds have constantly been depleted until at the present time, on many of them where formerly a very large amount of seed was obtained nothing remains except the bare mud flats.

The state law provides that the Fish Commissioner in his discretion can set aside a certain portion of these lands and not allow the taking of oysters from them, the idea being that if allowed to rest for a term of years they would recuperate and again form a source of seed supply. While this sounds well in theory, in practice the opposite is true. If at the present time any considerable portion of the beds on Willapa Harbor were closed to the public, the balance left open from which seed could be obtained would be worked to that extent that within a very short time they would be entirely exhausted. If, then, the proposition was reversed and those recently exhausted closed to the public and the portion which had been worked thrown open to the public, the same result would again soon be obtained.

When a bed has been depleted to any great extent it requires quite a number of years to recuperate. In my judgment, the only way that these beds can again be brought to a high producing state is either by the expenditure on the part of the state of a large sum of money to reseed them and patrol the same, not allowing the public to take oysters therefrom, or to divide them up into small tracts and turn the same over to parties now engaged in the industry. The end to be attained will hardly justify the state in the expenditure of so large a sum of money as would be necessary to bring these beds again to usefulness. If the lands were parceled out among the people engaged in the industry, they would certainly in every way in their power bring their particular portion to a high state of cultivation, and each year would take only such an amount of seed from the beds as could be properly spared and a high state of production retained. In this manner the large area of natural oyster beds on Willapa Harbor might be made to produce many times the amount now obtained from them, and even a larger amount than was ever obtained.

There is, however, a very serious opposition to this plan on the part of a large majority of the people engaged in the industry on Willapa Harbor, and for that reason, while I personally believe that only through such legislation as indicated above can

the natural beds belonging to the state be again made large producers and form a proper source of seed supply, I cannot advise in the face of the above mentioned opposition that the legislation be enacted as, in my judgment, the will of a majority of the people interested in the industry should obtain. I therefore leave this subject to the best judgment of the Legislature, believing that in the course of the next two years public sentiment will demand that the legislation I have specified be enacted. In my judgment, it is certain that the oyster industry on Willapa Harbor will decline each year, unless either the scheme I have proposed is taken up or a large appropriation is made for the reseeded, proper cultivation and patrol of these beds. It would require an appropriation of twenty thousand dollars (\$20,000) for the next two years to properly begin this work, and at least an appropriation of ten thousand dollars (\$10,000) annually thereafter for many years to complete the same.

To more emphatically emphasize the necessity of having something done immediately in regard to changing the system of handling these natural oyster bed reserves, we are pleased to call your attention to Prof. Doane's report on the subject, made after a careful investigation of the conditions on both Puget Sound and Willapa Harbor at our suggestion. No matter what argument may be raised by those engaged in the industry, this report is an unbiased one by a party not interested, and clearly sets forth the serious loss and waste by the present condition of affairs. If the state or the oyster industry ever expect to get any value from these lands they must act at once, as a few years more of the present system will put the lands where it will cost more than they are worth to put them in producing condition.

Dredging Permits.

The Legislature of 1899 authorized the dredging for oysters under such rules and regulations as the Fish Commissioner might prescribe. By the authority thus given we formulated and published the rules that would govern the work under these permits. We exacted a fee of \$2.50 for each dredging permit.

During the year 1899 we received from this source the sum of \$30 from Willapa Harbor and \$2.50 from Puget Sound. The amount received from Willapa Harbor was turned over to the Oyster Land Commissioners for Pacific county, and by them expended in destroying starfish infesting the natural beds.

During the season of 1900 there were issued eleven permits for Willapa Harbor and three for Puget Sound. The funds received from these fees are still on hand and will be remitted to the Oyster Land Commissioners of the respective districts, to be used in the destruction of the pests infesting the natural oyster beds.

Considerable opposition to this plan of taking oysters developed, but the regulations are of that character that the oystermen at present feel that no harm is being done and quite an amount of seed is being obtained from water too deep for the oysters to be obtained by tonging or other ordinary methods.

EXPERIMENT OF INTRODUCING EASTERN OYSTERS.

The Legislature of 1899 appropriated the sum of \$7,500 for the purpose of making an experiment of introducing eastern oysters to the waters of our state. After the appropriation had been made and the work was undertaken, I found that we were entering an entirely new field. Any knowledge that could be obtained of former investigations and experiments of this character were of very small value to us. The experiments that had been made in different portions of the country were of a character that even a limited amount of investigation and knowledge of the subject determined that they must have been a failure.

We therefore, during the season of 1899, conducted the experiments that we made in the line of determining what had best be attempted, taking into consideration the difference in conditions on the Atlantic coast and on our own. I had had some correspondence with different parties during the season of 1898 in regard to this matter, and when I had finally concluded what plan had best be followed, I submitted my ideas to Prof. Bryan, of the State Agricultural College, who in turn, turned the matter over to Prof. R. W. Doane, assistant zoologist at this institution. Prof. Doane, with the assistance of Mr. Joseph Gale, of Kamilche, and Mr. Wallace Stuart, of Tokeland, carefully investigated conditions on Puget Sound and Willapa Harbor early in the season of 1899. He finally determined that a loca-

tion near Tokeland on Willapa Harbor would be a desirable one for our preliminary work.

During this season he made extended investigations to determine the best plan of operation before we attempted to build an extensive plant and enter upon the experiment proper. During the fall of the same year he made an extended tour of the Atlantic coast, visiting nearly all of the oyster beds of any prominence, and with the information there gained and the experience and knowledge obtained in his work at Tokeland, a plan of operation was formulated which was followed during the year 1900. These operations were substantially as follows:

It was deemed necessary that we have a pond at least forty acres in extent to be a portion of either Puget Sound or Willapa Harbor, in which we could control the ebb and flow of the tide. Following out this idea, we made a careful investigation to find the best location where conditions would be most favorable and the plant could be constructed for the least possible expense. The location finally determined upon was a small arm of Port Orchard near the entrance of Dog Fish Bay. A landing had been constructed by the citizens of the vicinity during the early spring at this point and given the name of Keyport, and we have given our station the same name. It was found that by building a dam some 150 feet in length, the water of this arm of the Sound could be controlled and that a depth of from five to eight feet over some thirty five acres of tide land could be maintained at any stage of the tide.

Professor Doane in his detailed account of the work in connection with this experiment, which immediately follows this statement, gives an extended and excellent report of the entire operations which were conducted under his supervision.

I made careful estimates of each particular portion of the work and so apportioned our fund. I found, however, that in the construction of the dam our estimates were considerably less than the actual expense turned out to be; the dam costing over \$500 more than our estimates. The other portions of the work and expense had reached that stage that it was impossible for us to cut them down in any particular.

As a result of the above difficulty, we were compelled, that the experiment might be properly carried out, to expend about \$475 more than our appropriation. This deficiency has been practi-

cally all paid by myself, and I sincerely hope that the Legislature will see fit to make an appropriation sufficient to cover this shortage.

We believe that the results of this experiment have been so satisfactory and so valuable that they should be continued for the next two years, feeling certain that at the end of that time we will have demonstrated in a practical and economical manner that eastern oysters can be successfully propagated in our waters, and that a large number of our citizens will be induced to take hold of the cultivation of eastern oysters as a business proposition. If we succeed to the extent that we now feel certain that we shall, undoubtedly a large sum of money will be invested in this business, bringing to the state a large amount of eastern money, as well as employing a considerable amount of home capital.

The expense of continuing these experiments for two years, as outlined by Professor Doane, will be about \$6,500. We wish, however, to take this matter up in connection with some recommendations that we are making in another portion of this report in regard to a permanent scientific experimental station, in connection with our fisheries department, for the purpose of investigating many other problems as well as the question of introduction of eastern oysters.

In the work of my personal investigations in regard to this subject, I have been greatly assisted by a considerable number of persons engaged in the culture of native oysters, and especially have I received valuable assistance from Mr. Joseph A. Gale, of Kamilchie, and Wallace Stuart, of Tokeland. These gentlemen have been untiring in their efforts to give us every assistance in their power.

A detailed account of the disbursements from the appropriation for this purpose will be found in the latter part of this report.

A PRELIMINARY REPORT
RESPECTING THE INVESTIGATIONS RELATIVE TO THE PROP-
AGATION OF THE EASTERN OYSTER IN THE
STATE OF WASHINGTON.

By R. W. DOANE,

*Assistant Professor of Zoology, Washington Agricultural College, and Zoologist of
Experiment Station.*

PULLMAN, WASH., December 6, 1900.

Hon. A. C. Little, State Fish Commissioner, Tacoma, Wash.:

DEAR SIR—I have the honor to submit herewith my report on the investigations relative to the propagation of the eastern oysters in Washington. The work being done under your direction and in connection with the work of the Washington Agricultural College and Experiment Station of Pullman, Wash.

Most respectfully yours,

R. W. DOANE.

The cultivation of our native oyster, *Ostrea lurida*, has for a number of years constituted one of the principal fishery industries of this state. Large areas, both on Puget Sound and Willapa Harbor, are now devoted to the profitable rearing and fattening of this luscious bivalve. The last few years, however, have seen an ever increasing demand for the larger oyster grown along the Atlantic coast and commonly known as the "Eastern Oyster," *Ostrea virginica*. To supply this demand hundreds of barrels and buckets of these oysters are annually shipped into our markets from the east and from San Francisco. As these shipments are nearly all made by express, it is not difficult to understand why it is that those who wish to indulge in this luxury must be willing to pay fancy prices.

For a number of years similar conditions existed in California, but ever since the completion of the overland railroad small "seed oysters" have annually been planted in San Francisco Bay, where they are allowed to remain until they reach a marketable size, when they are taken up and sold. Although this industry is controlled by but a few men, a large amount of capital is invested and thousands of dollars are realized each year from the sale of these oysters all along the Pacific coast.

Several times some of the more progressive oystermen of this state have sent east for a few barrels of these oysters and planted them upon their private beds. In many cases no further care was given them and they were either destroyed or lost sight of, so that the experiments were useless. In other cases the oysters have lain on the beds for years seemingly in good condition. Recently we were shown large oysters from Bruceport said to have been planted there over twenty years ago. In November, 1894, the United States Fish Commissioner planted eighty barrels of eastern oysters in the channel of the Palux River at Bay Center. Unfortunately, however, the place selected for this experiment seems to have been a poor one, for although quite a number of the oysters were found there a year or more after they were planted, the channel began to change and the oysters were soon all buried in the mud. Since then, however, oystermen have taken a renewed interest in this enterprise with the result that we now have planted in Willapa Harbor several car loads of young oysters that are making a phenomenal growth and will within a few years bring a handsome profit to the owners. The most important of these beds are those at Tokeland, belonging to the Willapa Harbor Oyster Company.

For the past four years Prof. F. L. Washburn, of the University of Oregon, has been conducting experiments at Yaquina Bay, Oregon. The eastern oysters planted there have been doing well and he reports having collected a few spat.

These experiments have shown beyond a doubt that these oysters will do well when planted in our waters, but one thing still seems lacking. As yet very few spat, or young oysters, of this species have been collected on the Pacific coast. Various reasons have been assigned for this, the most common of which are that the temperature of the water is too low during the spawning season, or that it is too salt. C. H. Townsend, in his "Report of Observations of the Oyster Resources and Oyster Fishery of the Pacific Coast of the United States," claims that the eastern oyster does propagate in San Francisco Bay, and that while examining the beds there in 1889 he found proof of considerable natural increase due to the spontaneous spawning of the introduced oysters. The companies there, however, make no provision for catching or caring for this natural increase, depending wholly upon their annual shipments of seed from the east to replenish their beds.

Those who are engaged in the eastern oyster industry in this state have been and are depending on this same source for their supply of seed, shipping it from the east. But the freight rates are so high and the risk of shipping young oysters such a long distance is so great, that very few can afford or care to take the risk of making such shipments. If the seed could only be raised in sufficient quantities on this coast to replenish the beds and to supply those wishing to plant new beds, then the whole profit would go to the oysterman instead of his having to give the lion's share to the railroad company, and the price of this commodity would be much reduced.

Realizing the vast importance of this industry to the state, the State Fish Commissioner made a strong plea before the last Legislature for an appropriation to enable him to carry on investigations to find out whether the eastern oyster would propagate in the waters of this state, and if it did, to find some means of collecting and making use of the natural increase. Impressed with the need of such investigations, the Legislature set aside \$7,500 for this work, and the Fish Commissioner was instructed to go on with the investigations. The need for scientific work along this line was apparent. The purpose of the Agricultural College and School of Science, and particularly the experiment station, being the application of scientific investigations to industry, the Fish Commissioner turned quite naturally to it for assistance. The United States Department of Agriculture gave an informal approval of the undertaking. Accordingly a member of the experiment station staff was put in charge of the work. This work coming naturally under the department of zoology, the writer was directed to begin the investigations as soon as possible.

Work During the Summer of 1899.

Early in June, 1899, the work was begun. The first step was the selecting of a favorable place to conduct the experiments. In this we were greatly aided by the advice of Mr. Jos. A. Gale, a veteran oysterman and deputy fish commissioner, who visited with us many of the principal oyster regions of Puget Sound and Willapa Harbor. Tokeland was finally selected upon as being the best suited of any of the places visited for carrying out the work as planned for the summer. Accordingly June 14th found us comfortably quartered at the home of Mr. Kindred with a labora-

tory well supplied with microscopes, thermometers, hydrometers, burrettes, chemicals and all tools and dishes necessary for making temperature and salinity tests and for taking the eggs and rearing, for a short time, the young oysters. In order that more work might be accomplished three of the advanced students of the college were taken as assistants. These were Mr. Stanley Piper, Miss Lora Malone and Mrs. R. W. Doane.

Tokeland is situated on the north side of Willapa Harbor about five miles back from the ocean on a narrow strip of wooded land which extends for some distance out into the bay and furnishes an excellent protection for the little cove that lies behind it. Quite a little fresh water comes down the Cedar River and over the beds on which the Willapa Harbor Oyster Company have their oysters planted. The beds are covered with eight or ten feet of water at high tide, but are entirely exposed at low tide except at certain seasons when the eel grass is quite abundant; this seems to hold more or less water over the beds even during the lowest tides. Protected on one side by the narrow strip of land upon which Tokeland is situated and upon the other side by a densely wooded island is a slough about a mile long and from one hundred to three hundred yards wide; this receives a small stream near its head and, although it contains little or no water at low tide, it is about eight feet deep at high tide. It was along this slough that most of our experiments this first season were conducted.

Life History of the Eastern Oyster.

Before entering into a discussion of the experiments, it will be necessary to give briefly the life history of the eastern oyster, as it differs in many respects from that of our native oyster.

Our native oyster is hermaphroditic and viviparous; that is, both ova and spermatazoa are produced in the same individual, and the eggs are fertilized in the gill and mantle cavities, where they pass through the early stages of development. At spawning season, when these young embryos are set free, they have already reached the swimming stage, and are soon ready to attach themselves to some convenient shell or other collector, where they remain fixed throughout life.

The eastern oyster, on the other hand, is unisexual, the ova and spermatazoa being produced in different individuals. During spawning season the female produces millions of ova, which

are set free in the water, to meet by chance with the spermatazoa from a male. If this union takes place the ova are fertilized and soon lose their original pear shape and become quite round. If they are not fertilized they soon perish. Within two or three hours after fertilization these ova, which are single cells too small to be detected with the unaided eye, begin to divide, and in two hours more we have, instead of single round cells, whole masses of cells, the masses themselves being rounded and about the size of the original cells. A little later, small thread-like projections, or cilia, begin to appear on one side. The embryos have now reached the swimming stage, for by means of these cilia the young oysters are able to move about through the water at will. They remain in this stage for about five or six days, or until the shells have begun to form, when they sink to the bottom, and, if they are fortunate enough to strike some suitable collector, they become attached and begin to take on the character of the adult oyster. From this time on the young oysters are comparatively free from danger, but the number that reach maturity is very small when compared with the number that perish or are destroyed in one way or another.

It has been estimated that an average sized eastern oyster lays about sixteen or twenty million eggs in a single season. The number of spermatazoa that the male produces is almost inconceivable. Yet when we remember that these elements are set free in the water to be swept here and there by the tides and currents it is not surprising to find that only a small portion of the ova are ever fertilized. Especially is this apt to be true if only a few scattered oysters are spawning in a large bay. We have seen that within a few hours after the eggs have been fertilized the young embryos reach the swimming stage. This is a period of great danger, for the first use the little oysters make of their newly acquired locomotive organs is to use them in swimming to the surface of the water. Here they remain in a perfectly defenceless condition for several days, the time depending upon the temperature of the water. While here they are not only exposed to various enemies, but a sudden fall in temperature, a cold wind or a cold rain may destroy millions and millions of the young oysters in a very short time. As soon as they leave the surface and swim at greater depths the danger from these things is greatly diminished. But another great dan-

ger is soon upon them. As the shell grows larger and they sink deeper they must find some firm substance to which they may attach themselves or they will sink in the mud and be smothered. Even after they become attached, a very thin layer of sediment settling over them will smother them just as effectively as if they were buried an inch deep. Then come still other dangers; if the young settle too thickly on any stone, shell or other collector as they grow and develop, some of them must necessarily be crowded out and those remaining are still at all times subject to the attacks of starfish and various other enemies.

Notwithstanding all these dangers that beset the young oyster in every stage of its existence, a considerable number of them survive each year in their native waters. Some years the catch will be so small as to hardly pay the oystermen for the working of the beds; then will come a particularly favorable season and the supply will seem almost unlimited.

In view of all of these facts, it is not surprising that the oysterman who plants a few of the eastern oysters in his beds here in this state expecting them to propagate is doomed to disappointment. Even should the eggs be fertilized, after the young embryos reach the swimming stage they may be carried by the tides or currents for miles from the beds where the parent oysters lay. Not until we have large numbers of these oysters in our waters as they have in some of the waters along the Atlantic coast can we ever hope to obtain more than an occasional oyster in this way.

The Experiments.

With these facts now before us we may now go on with the discussion of the experiments conducted. A better understanding of the work accomplished may be had by grouping the experiments made under separate heads and following each set from beginning to end. They may be grouped as follows:

1. Temperature tests.
2. Salinity tests.
3. Examination of oysters on the beds to determine whether the reproductive elements ripened there, and if they did, whether the oysters spawned naturally.
4. Efforts to artificially fertilize the eggs.
5. Attempts to rear the young.

The Temperature of the Air and the Temperature and Density of the Water.

The summer of 1899 was the coldest experienced on Willapa Harbor for a number of years. During the first six weeks of the experiments we had only nine days when it was clear all day; the rest were more or less cloudy with rain more than two-thirds of the time. The specific gravity test shows that the water is about the same density as would be found in similar places along the Atlantic coast, over the oyster beds there. In making the temperature and salinity tests a number of stations in various localities were established and tests made at various times of the day and at various stages of the tides. The difference between the temperature of the air during the day and during the night was usually very great, often being as much as 20°. The water was found to be warmest shortly after the tide had set in, especially if the sun had been shining for some hours over the extensive flats that are left exposed by the very low tides. In a few places a little water was held over these flats, even at lowest tides, by the eel grass, which is very abundant certain seasons of the year. If the sun was shining at this time the water would become very much warmer than usual; one test showing a temperature of 82°. The water was usually coldest a little while before high tide and was always colder in the channels than over the flats. Little or no difference was found between the temperature of the surface and that of a depth of six or eight feet; below that depth the temperature was usually lower.

The average temperature of the air, of the surface of the water and the average specific gravity of the water is shown in the following table:

	<i>Temp. of air.</i>	<i>Temp. of water at surface.</i>	<i>Specific gravity.</i>
June 15th to 30th.....	60.4	61.8	1.0151
July.....	61.6	68.1	1.0162
August.....	61.8	66.8	.....
September.....	66.3	65.4	.....
Average for 3½ months.....	62.5	65.5	1.0156

Analysis Sea Water.

Three sample of water from over the oyster beds were sent to the chemical laboratory for analysis. Nos. 57 and 59 were from Tokeland and No. 11 from Bay Center. The analyses were made by Mr. W. H. Heileman, assistant chemist.

ANALYSIS FIGURED TO ORIGINAL SAMPLE.

No. of test.....	No. 57	No. 59	No. 11
Total solids (per cent.) ..	2.960	2.530	2.500
Organic solids (per cent.) ..	.305	.120	.131
Mineral solids (per cent.).....	2.655	2.410	2.370
Water (H ² O).....	97.040	97.470	97.500
Fe and Al oxides.....	trace	trace	trace
Ca oxide.....	.057	.058	.056
Mg oxide .....	.169	.155	.145
Na ² O	1.075	1.042	.945
K ² O .....	.035	.021	.023
SO ³.....	.180	.173	.161
P ² O ³	none	none	none
Cl.....	1.500	1.366	1.326
Organic matter .....	.305	.120	.131
Total	100.361	100.405	100.287
O equivalent to Cl.....	.342	.310	.300
Total corrected	100.019	100.095	99.987
NaCl figured from Na ² O (per cent.).....	2.020	1.960	1.780

Examination of the Beds.

The beds on which the eastern oysters, owned by the Willapa Harbor Oyster Company, were planted, were watched carefully. Tests taken on these beds show an average temperature of 64.4°, with a maximum of 82° and a minimum of 58° for the period covered by the tests. Were it not for the single test that reads over 69°, the average of the tests on these beds would be 62.5°, or 7.5° lower than the optimum temperature for spawning. This test was made at low tide when only a little water was held by the eel grass over the beds.

These oysters were mostly one, two and three years old, but a few older ones were to be found among them. The growth they made during the season was phenomenal, and at all times they seemed to be in prime condition. Nothing was found on the beds that would indicate that they were spawning there, but examinations in the laboratory showed that a large per cent. of the three-year-olds and older were filled with the ripened reproductive elements, and the presence of some of these cells in the mantle cavity is very strong evidence, though not absolute proof, that they were spawning spontaneously on the beds.

The first ripened reproductive elements were found June 21, the first day that search was made for them, in some of the

three-year-olds. During the rest of the month of June all the eggs used in the fertilizing experiments were obtained from these oysters. The older oysters were not used much, as the great majority of them proved upon opening to be males. Later, several of the two-year-olds were used and some of the strongest embryos obtained were from these eggs, but the proportion of ripe individuals was not as great among these as among the three-year-olds.

Artificial Fertilization.

Having found that the ova and the spermatazoa developed and ripened while the oysters were on the beds, an attempt was made to artificially fertilize the eggs and if possible rear the young. Many different methods of fertilizing the eggs were tried, but the plan finally adopted was as follows: Having opened the desired number of males and females, the gills and mantles were removed and the reproductive gland was gently stroked in the direction of the opening; meanwhile, an assistant would pour a little sea water over the gland, and the reproductive cells thus washed away were allowed to drop gently into a beaker. After no more could be secured in this way the glands were placed in another dish of water where they were teased and washed thoroughly, thus saving as many of the desired cells as possible. The ova and spermatazoa were then poured together in a large open dish and in a short time a large proportion of the eggs were usually found to be fertilized; within twenty or twenty-four hours these would reach the swimming stage and a little later would be placed in the float or in the pond where attempts were made to rear them. As it is impossible to distinguish the sexes before the oysters are opened, it sometimes happened that many males were opened before a female was found, or vice versa. As a usual thing, however, very little trouble was encountered in this way. At first all the spermatazoa from one specimen were used to fertilize the ova from a single female, but it was found that better results were obtained if we used only one male for every three or four females.

The water used in these experiments was usually just as it was taken from the bay, averaging about 65° or 66°; in a few instances it was warmed to about 80°, when a little larger proportion of the eggs developed and the time it took to reach the swimming stage was reduced from twenty to twenty-four hours

to five or six hours. Several times the temperature of the water in the laboratory ran down as low as 57° while these experiments were going on. This would greatly retard the development of the embryos, especially in the early stages, but in no instance did it seem to seriously affect them after they had reached the swimming stage.

Provisions for Rearing Embryos.

After the young embryos had reached the swimming stage they were transferred either to a float or a pond, where an effort was made to keep them until they had attached themselves to some collector.

THE FLOAT.—The float used for this purpose was an ordinary "sink float," such as is used by the oystermen for storing oysters that are to be kept for a short time before marketing. It was originally about thirty feet long by twelve feet wide, but partitions were put across dividing it into three sections. The floor, which was made of slats three inches wide laid one-fourth or one-half of an inch apart, was covered with burlap, and then about one and one-half inches of sand was scattered evenly over the bottom. All crevices in the ends and sides were carefully closed, so that the only way for water to get in or out of the float was for it to come in through the burlap and sand. This was deemed a sufficient sifter to prevent any embryos from outside getting in, or any inside from getting out. Several sacks of clean clam shells were strewn over the sand, and several strings with shells tied to them were stretched across so that the shells were held suspended just below the surface of the water. The float was anchored in the channel leading from the big slough just off station one. The water was two or three feet deep here even at the lowest tides. The water in the float was about eight inches deep, always clear, and comparatively free from sediment even when that outside was quite muddy, as it frequently was during very low tides. The temperature of the water was usually several degrees warmer in the float than outside, the difference sometimes being as much as twelve to fifteen degrees. The greatest difference was found, of course, when the sun had been shining for some time. On the other hand, the temperature of the water early in the morning was sometimes two or three degrees colder in the float than that outside of it.

In the first section most of the embryos obtained by artificially fertilizing the eggs were placed, hoping that many of them would collect on the shells. But in this we were disappointed, for although the shells were examined carefully from time to time only one young oyster was found, and this, unfortunately, was crushed later in handling. That the embryos frequently lived for two or three days at least after being placed in the float was conclusively shown by the specimens of the water being examined microscopically a few days after a lot of embryos had been placed in the section; such an examination often showing a number of them still in the swimming stage.

In the second section about two hundred eastern oysters were placed, most of them three-year-olds, but some of them two-year-olds and a few five or six-year-olds. The object of this experiment was to find (*a*) whether they would spawn here and (*b*) if they did spawn whether the eggs would be fertilized and develop. The results of this experiment were very encouraging, for not only were the oysters observed to spawn, but at various times large numbers of swimming embryos were found in specimens of water taken from this section. None of these fixed themselves to the collectors, however. In the third section a few native oysters were placed as we expected to do some work on these also, but our time was so taken up otherwise that very little was done with them.

THE POND.—In order that that some of the experiments might be carried out on a larger scale, a small pond was constructed in a sheltered place near the large slough. This was made by throwing a dam across one of the small sloughs about ten yards from the place where it emptied into the large slough. About thirty yards further up another dam was constructed, and the pond thus made was deepened and widened, so that when finished it was about thirty yards long by ten yards wide and four feet deep. Through the lower dam a flume was constructed with a gate in the inner end so that the pond could be filled at high tide and the water held as long as desired. The entrance to the flume was so arranged that all the water going in or out of the pond could be made to pass through a sieve made by placing a piece of burlap over a wire screen supported by cross pieces. A thin layer of sand was thrown on the burlap at first, but the water passed through so slowly that most of this was

removed later. About three hundred baskets of shells brought from Diamond City were scattered over the bottom of the pond, and a number of bundles or fascines of small twigs were anchored in various places, and other provisions made for collecting any spat that might develop there. Several baskets of the eastern oysters were then placed in the pond. Unfortunately, the water soon began to find its way out under the flume, and in a few days had made such an opening that all the water had to be let out and the leak repaired. Before this was done, however, many specimens of the water were examined and some of those taken in the lower end of the pond were found to contain swimming embryos, thus showing that the oysters had already spawned and the embryos had successfully passed through the earlier stages of development.

While making the repairs much time was lost, and a good deal of sediment settled on the shells. The repairs, too, proved useless, for in a very short time these were washed away and the experiment had to be abandoned for the season.

In order that we might more thoroughly acquaint ourselves with the methods of the cultivation of the eastern oyster in its native waters, most of the month of September was spent in examining the beds along Chesapeake Bay and Long Island Sound. During the past two or three years very few spat have set in these waters and the oystermen were becoming somewhat discouraged, but as soon as work was begun this fall it was found that the "strike" was better than it had been for a number of years before, every shell, stone and stick in suitable places being covered with the young oysters. A number of places where experiments in artificial cultivation were being conducted were visited, and consultations were held with several of the men who have been investigating this same problem in the east, and many valuable points that will be of direct interest to us in our work here were obtained in this way.

EXPERIMENTS MADE DURING THE SEASON OF 1900.

Preparation for the Work.

Encouraged by the result of the previous season's work, we determined to make preparations for more extensive experiments during the spring and summer of 1900. After making an examination of a number of more or less favorable places, both on

Puget Sound and on Willapa Harbor, a small bay or inlet on the east arm of Port Orchard Bay, just below the entrance to Dog Fish Bay, was selected as being the best suited for conducting the experiments as planned for the second year. This bay is at Keyport Landing, about thirty miles from Seattle and two miles from Pearson, the nearest post-office. It covers an area of about thirty-five acres and is shut from the main body of the sound by a long, narrow sand spit, which is just high enough to prevent the highest tides from running over it. The water enters the bay through a channel which was originally about one hundred feet wide and twelve feet deep at high tide. The bottom is comparatively level, so that at high tide the water stands from three to eight feet deep over the greater part of the bay, being shallower of course toward the edges. Although the bottom of the bay is from five to seven feet above the level of the mean low tide, it is never left entirely dry, an area of five or six acres near the center being covered with from six inches to two feet of water even at extreme low tide. The bottom in this part of the bay is composed of sand, gravel, shells and some mud, making ideal oyster land, which formerly produced an abundance of good sized native oysters. A few of these oysters still remain, but the Indians and others have gathered most of them.

In and near the channel the bottom is firmer, being composed principally of gravel and shells. In other parts of the bay the bottom is soft and muddy. In still others it is fine and sandy, covered with an abundance of mussels, clams and barnacles. Quite a stream of water runs into the bay from the low surrounding hills. In order that the water might be kept at a uniform depth of about five feet over the greater part of the bay during the whole spawning season a dam, provided with gates, was built across the entrance to the bay. The gates were so arranged that the bay could be filled or emptied when necessary, and any desired amount of water could be held in it for any length of time. Near the center of the bay a flume four feet wide, five feet deep and about two hundred feet long, was constructed, through which the water was kept in constant circulation by means of a propeller and a small engine, the engine being in a small engine house built out over the flume to accommodate it and the pump which supplied water to the tanks, to be described later. The flume was built in such a way that both ends opened

out over the oyster beds, and the water passing from one end to the other, outside, would pass directly over the beds. Within the flume a number of trays made of galvanized wire netting were placed at various depths, and these, as well as the bottom of the flume, were covered with native oyster shells. Over the beds and in several other places in the bay similar trays were suspended at various depths and covered with shells. A number of fascines were also distributed over the bay at different depths.

On the shore near the edge of the bay a series of six tanks was constructed. These tanks were about eight feet long, six feet wide and six feet deep, and were so constructed that the water which was pumped in at the bottom of the first tank flowed out at the top at the opposite end into a pipe which led to the bottom of the next tank, and so through the series, the water from the last tank flowing back into the bay. Each tank was supplied with six trays made of the wire netting, and so arranged that they could be placed at various depths. These, as well as the floor of the tanks, were covered with the native oyster shells. The insides of the tanks and the wooden frame of the trays were painted with asphalt paint.

Near the tanks, and in the edge of a little grove of fir trees, a story and a half building 24x30 feet was constructed, which served as a laboratory and living rooms for those engaged in the investigations.

A float similar to the one used at Tokeland the previous season, but larger and deeper, being forty feet long, sixteen feet wide and two feet deep, holding about eighteen inches of water when loaded, was made and anchored in a little cove about one-fourth of a mile above the larger bay. At Tokeland another float similar in all respects to the one just described, was built, but it was found impracticable to do any work on the pond constructed there the previous season, as the work at Keyport kept us busy there until too late in the season.

Carload of Eastern Oysters Planted.

Early in February an order was placed with E. E. Ball, of Fair Haven, Conn., for a carload of oysters. These were to come from various points along the coast and the load as made up was as follows: From Chesapeake Bay, 9 barrels, three to four years

old and older; East River, 18 barrels, four and five years old; Princess Bay, 10 barrels, four and five years old; Connecticut, 30 barrels, three years old, 48 barrels four and five years old; Massachusetts, 10 barrels, four and five years old; making 125 barrels in all. An effort was made to get a few barrels from Prince Edward Islands, but they arrived in Fair Haven in such condition that it was thought best not to try to ship them. The oysters were packed in well ventilated barrels and shipped in a refrigerator car which was re-iced once on the route. The car left Fair Haven April 11th and reached Tacoma April 23d. All but fifteen barrels, which were sent to Tokeland, were loaded on a steamer that night and taken to Keyport and by 3 o'clock the next day they were in the water in their new home, where they at once began feeding after a fast of twelve days. The number that perished en route was very small, much less than 1 per cent. The oysters were planted near the center of the bay in that part described above as being covered with water even at the lowest tides, so that they were never left exposed. As the dam was not completed until July 10th, the tides flowed back and forth over them until that time. During this time they were in prime condition, the shells on some of them growing an inch or more. Early in June many of those from Connecticut were observed to be filled with spawn. The spawn in the others ripened soon after, the Chesapeake Bay oysters ripening last.

The Experiments.

As originally planned, the work of conducting the experiments was to have begun early in June, but bad weather and other things delayed the completion of the dam, so that it was impossible to begin any of the experiments until July 10th.

The nature of the work was such that a number of trained assistants were necessary. Those working with us this last season were W. C. Doane, of Stanford University; Miss Florence Snyder, Professor of Biology of Cheney State Normal; and Stanley Piper, Mrs. R. W. Doane and H. E. Burke, of Washington Agricultural College. The laboratory equipment, together with the necessary literature bearing on the subject, was taken from the zoological laboratory of the Washington Agricultural College, and consisted of thermometers, salinometers, microscopes, microtome, dissecting sets, chemical reagents,

dishes, etc., etc. The work done and the experiments undertaken were mainly directed toward answering the following questions :

1. What is the average daily temperature of the air and of the water both inside and outside of the bay; also the average density of the water?

2. Will the eastern oysters spawn on the beds of the bay? If so, can the spat be collected there?

3. Will the swimming embryos obtained by artificial fertilization and placed in the tanks attach themselves to the collectors?

4. Will the oysters spawn in the float? If so, will the young attach themselves to the collectors?

Temperature of the Air.

From July 11th to August 20th the temperature of the air was recorded at 7 A. M., 12 M. and 7 P. M. each day, and at the morning and evening readings the maximum and minimum temperature for the preceding twelve hours was read. The following table shows the average of the temperatures during the periods indicated :

	July 11 to 20.	July 21 to 31.	August 1 to 10.	August 11 to 12.
Maximum	82.	80.	75.	78.
Minimum	48.	51.	46.	48.
Average	64.6	66.3	61.	61.3
Average, 7 A. M.	58.2	59.4	55.3	57.1
Average, 12 M.	68.1	71.1	65.7	66.1
Average, 7 P. M.	67.7	68.5	62.	61.7
Average maximum, 7 P. M. to 7 A. M.	67.2	70.2	64.2	63.7
Average maximum, 7 A. M. to 7 P. M.	73.2	78.7	68.8	70.
Average minimum, 7 P. M. to 7 A. M.	52.6	56.3	51.3	52.2
Average minimum, 7 A. M. to 7 P. M.	59.2	60.	57.2	57.4

The thermometer was hung in the shade of a big fir tree where the sun never reached it. This accounts for the quite low average of 63.2° for the whole season. During the greater part of the season the days were warm and bright, with comparatively little rain.

Temperature and Density of the Water.

For the purpose of determining the temperature and density of the water in different locations, four stations were established. These were numbered as follows: Station One, near the middle of the bay; Station Two, outside of the dam; Stations Three

and Four, in the upper and lower tanks, respectively. The temperature tests were made three times a day at the same time that the temperature of the air was taken. The density was taken at 7 A. M. and 7 P. M. For this purpose we were provided with a set of specific gravity spindles, the same as those used by the United States Fish Commission. All readings have been reduced to a standard temperature of 60° Fahr. As the readings for Stations Three and Four were so near those for Station One, they have been omitted from the following table. The table shows the average temperature and density of the water for the time indicated.

STATION NO. 1.

	<i>July 11 to 20.</i>	<i>July 21 to 31.</i>	<i>August 1 to 10.</i>	<i>August 11 to 20.</i>
Maximum.....	77.	78.8	78.4	78.4
Minimum.....	62.6	64.4	64.4	64.4
Average.....	70.5	71.6	69.8	68.1
Average, 7 A. M.....	67.5	69.6	67.8	66.3
Average, 12 M.....	70.8	73.	70.9	69.1
Average, 7 P. M.....	73.3	73.4	70.8	69.
Maximum density.....	1.0192	1.0201	1.0201	1.0201
Minimum density.....	1.0136	1.0126	1.0162	1.0171
Average density.....	1.0180	1.0189	1.0187	1.0187

STATION NO. 2.

	<i>July 11 to 20.</i>	<i>July 21 to 31.</i>	<i>August 1 to 10.</i>	<i>August 11 to 20.</i>
Maximum.....	71.6	75.2	73.4	71.6
Minimum.....	59.	62.6	62.6	59.
Average.....	64.5	64.1	66.4	63.7
Average, 7 A. M.....	62.7	62.6	62.6	62.2
Average, 12 M.....	67.1	.....	70.1	65.8
Average, 7 P. M.....	64.	67.7	66.7	63.2
Maximum density.....	1.0206	1.0205	1.0204	1.0204
Minimum density.....	1.0184	1.0196	1.0123	1.0126
Average density.....	1.0196	1.0200	1.0197	1.0193

Average temperature of the water July 11th to August 20th at Station No. 1, 70 degrees; average density, 1.0185. Station No. 2, temperature, 64.6 degrees; average density, 1.0196.

From a study of the above table we see that as far as temperature and density is concerned the conditions were nearly ideal for the oyster spawning inside the bay. Outside the total average is somewhat lower, but the maximum temperature shows that at many times the water was sufficiently warm to start the oysters spawning. The density records show that there can be no trouble from this source.

Will the Oysters Spawn on the Beds?

When the oysters arrived in April a number of them were carefully examined, but in none was there found any ripened ova or spawn. Early in June it was found that many of those from Connecticut, Massachusetts, Princess Bay and East River contained ripe reproductive elements and a number of swimming embryos were obtained at this time by artificially fertilizing the eggs. Examinations made July 4th showed that the majority of these were filled with the ova and spawn and that only a slight pressure on the reproductive gland was needed to free these elements. A few were found with the glands partially empty and it was supposed that these had already cast some of their spawn; later observations confirmed this supposition. Many of the Virginia oysters examined at this time showed the reproductive elements just ripening, thus they ripened some three weeks later than the others. This was as might be expected, however, since as they came from warmer waters they would not spawn until the water had reached a higher temperature here than that required for those from the colder waters farther north. From this time on the reproductive glands of all except the Virginia oysters decreased in size and fullness until by July 25th over half of those examined showed the glands to be practically empty, and the oysters poor, thin and watery, a condition exactly corresponding to what is found after the oyster has spawned in its native waters. About August 1st these began to fatten up and in two or three weeks more they were in prime condition again. The Virginia oysters seemed to be in the best condition between July 25th and August 10th, the number filled with spawn decreasing very rapidly after August 15th.

While examining some of the shells on the beds July 24th a few young spat were found attached to oyster and clam shells. Further search at a later date showed that here and there others had attached both in the beds and in the channel leading toward the dam and a very few were found on the shells in the bottom of the flume and on some of the trays. None were found on the fascines.

The Experiment With the Tanks.

The experiments with the tanks were less successful. After they were filled just enough water was pumped into them to keep up a slow circulation. It was thought that the young oys-

ters swimming at the surface of the water in the upper tank would be carried by the slow current to the bottom of the next and as they again rose to the surface they would be brought in contact with the under surface of the shells, which would be free from sediment, and thus abundant opportunity would be offered for attachment before they had passed throughout the whole series of tanks. An average of about twenty-five oysters were opened each day and the young embryos obtained by artificially fertilizing the ova thus obtained, were poured into the upper tank when they were about twenty-four hours old, or after the majority of them had reached the swimming stage. After the tanks had been filled for about a month they were emptied and the shells, trays and the sides of the tanks were found to be covered with slime and silt; in most places so thick that it would have been impossible for an embryo to attach. This of course was sufficient explanation as to why no spat was found. This condition was believed to have been due to two causes, both of which might have been avoided had we foreseen the results in time: *First*, The supply pipe took the water from too near the bottom of the bay and thus carried too much sediment into the tanks. *Second*, Several baskets of the eastern oysters were taken from the beds early in the season and placed in the upper tank in order that they might be convenient for use. It was soon found that under the influence of the direct rays of the sun and the warm water, a kind of slimy moss, found on some of the shells, grew so rapidly that the three upper tanks were soon badly infested with it, and some was found even in the lower tanks. This of course helped to form the slime over the shells. August 4th the lower tank was emptied and thoroughly cleaned and after being refilled only enough water to make up for the evaporation and leakage was allowed to enter. In a few days, however, the shells began to get slimy as the water had to be taken from the upper tanks, and as it was too late in the season to clear out and start them all anew, the experiments had to be abandoned for the season.

The Float.

The float was divided into three sections as during the previous season. In the first section several baskets of eastern oysters were placed, in the second swimming embryos obtained by artificial fertilization, and in the third a number of

native oysters. The bottom of each section was well shelled and later a few trays of shells were placed in the second section. Microscopic examinations from time to time, of the water from section one, usually showed a number of swimming embryos, showing that the oysters had spawned and that the young embryos had safely reached this stage. On July 27th the first young spat were found in this section and several others were found at later dates. In the second section the first spat were found August 4th. These were then about one-fourth of an inch in length. Later several others were found, some larger and some smaller. In the third section no spat was found. This was due to the fact that the native oyster were nearly through spawning when placed in the float so that few or no embryos were thrown off.

Experiments at Tokeland.

July 20th Mr. Stanley Piper left Keyport and went to Tokeland to continue the work there under our direction. An attempt had been made to put the pond built the previous season into proper condition, but it was decided that the season was too far advanced to make it profitable to complete this. Mr. Piper accordingly bent all his energies toward making the experiments with the float as successful as possible, with very encouraging results. A large float had been constructed on the same plan as the one used the previous season and divided into two sections. In one section eastern oysters were placed; in the other a number of swimming embryos, obtained by artificial fertilization, were placed each day. An examination of the shells on August 30th showed that quite a large number of these young oysters had attached themselves and a further examination on September 18th showed them to be in prime condition and growing very rapidly. September 20th all the shells were taken from the float and placed on the beds, where they seem to be doing well. Mr. Stewart, who so kindly assisted in so many ways during our first season's experiments, rendered us much valuable assistance again this last season.

The following table is of interest as showing the average temperature of the air and of the water, both inside and outside the float, during the time the experiments were being conducted. Tests were taken at various times of the day and at various stages of the tide:

	July 28 Aug. 8.	August 9 to 18.	August 19 to 23.
Average temperature of air.....	65.6	63.3	64.4
Average temperature, water.....	65.9	63.6	65.6
Average temperature, water in float ...	69.7	66.2	65.8

Summary.

The increasing demand on this coast for the eastern oyster has led to attempts to grow this species in our western waters. The experiments at San Francisco have shown that this oyster can be successfully grown there, but no attempt is made to catch the spat said to be produced there. A few experiments have already been made in the waters of the State of Washington.

These may be divided into three groups: *First*, Those made by private parties where only a few oysters were introduced. When these were properly cared for they have lived and are usually found to be in prime condition. *Second*, The experiments made by the United States Fish Commissioner by placing eighty-four barrels in the channel of the Palux River at Bay Center. These were destroyed by the river changing its channel and covering them up. *Third*, The experiments now being conducted by the Willapa Harbor Oyster Company. They have several carloads of young oysters on their beds that are in prime condition and making a fine growth each season. The Legislature of the State of Washington in 1899 appropriated \$7,500 for the investigation of the eastern oyster problem in this state, and the State Fish Commissioner asked the Agricultural Experiment Station at Pullman to help him conduct experiments to find whether the eastern oyster would propagate in our waters and if not, why not.

In 1899 experiments were conducted at Tokeland, Washington, where the average temperature of the air for the season was 62.5°. The average temperature of the water for the same season was 65.5° or 4.5° cooler than the temperature assumed to be the optimum for spawning. It is known, however, that the temperature may go somewhat lower than 70° and the oysters still spawn. The salinity tests showed that many places might be selected having the proper density and salinity.

No oysters were found spawning on the beds, but when opened they were found to contain ripened reproductive elements and

there is reason to believe that they spawned while on the beds. Millions of embryos were obtained by artificial fertilization and reared until they reached the swimming stage, when they were placed in the float or pond especially prepared for them. The attempt to rear these in the float was unsuccessful. The failure was probably due to the water being too shallow and thus too subject to the great change of temperature between day and night. The cold rains which prevailed during the season doubtless destroyed many of the embryos that were swimming at or near the surface. The eastern oysters placed in one section of the float spawned and the eggs were fertilized, the embryos reaching the swimming stage, but no spat was found on the collectors.

The experiments with the artificial pond which were begun late were interrupted by the dam giving way, but it was shown that the oysters spawned there and that the embryos reached the swimming stage.

Encouraged by the results of the previous season's work, more extensive experiments were made at Keyport Landing, on Puget Sound, in 1900. A dam was constructed across the entrance to a small bay so that the water could be held in at a uniform depth. The water was kept in circulation by a propeller in a flume in the middle of the bay. Tanks were constructed through which the water was kept in circulation by means of a pump. A building to be used as a laboratory and dwelling was built for the accommodation of those conducting the investigations. A large float was constructed and anchored in a cove near by. A carload of oysters was planted in the bay in April, less than 1 per cent. having perished in transit. The temperature records show an average of 63.2° as the temperature of the air at that station during the season. The average temperature of the water inside of the bay was 70° , outside 64.6° . The average specific gravity inside the bay was 1.0185, outside 1.0196. The oysters were found to be spawning on the beds in the bay and a few spat were found. The collectors in the tanks became covered with slime and silt so that no spat were collected on them. The oysters in the float spawned and a few spat were collected both in the section containing the eastern oysters and in the one where the swimming embryos were placed. At Tokeland the experiments were continued with more promise of suc-

cess, as a number of the young oysters were found attached to the collectors.

Discussion.

After a series of experiments extending over two seasons, the question "will the eastern oysters spawn in the Pacific waters?" can be answered in the affirmative. Furthermore it has been shown that the young embryos will attach themselves to the collectors and form spat if proper provision is made. Why is it then some will ask that we have been unable to raise young oysters on this coast? The answer is simply that we have made no provision for it. As we have seen, Mr. Townsend in his report says that he found some eastern oysters that had undoubtedly been raised in San Francisco Bay, where the conditions are more favorable than elsewhere on this coast because they have more eastern oysters there than we have any place else. Let us look at the conditions on Puget Sound or Willapa Harbor. Only a few oysters have ever been planted in any one place in either of these waters and these always in places where the tides swept back and forth over them four times daily. It has been shown that the oysters spawn under these conditions, but the chances that the eggs will come in contact with the spermatazoa and thus be fertilized are exceedingly small, because the limited number of these elements that can be produced by a small number of oysters have to be, or are, distributed through such a large body of water. But let us grant that by good fortune a number of the eggs are fertilized. In a few hours they reach the swimming stage and from three to six days they are at or near the surface of the water and are being carried for miles to and fro by the tides until by the time the young embryo has formed a shell and is ready to attach it may be miles from the beds where the parent oysters lay, and as it sinks to the bottom it is usually buried in the mud or silt and perishes. Or if by another rare bit of good fortune it should fall upon some proper collector it may attach itself and go on with its development and perhaps be found later by some oysterman and exhibited as a curiosity. Just such a case as this occurred on Willapa Harbor a few years ago. While tonging on the Nema beds, a young eastern oyster was found whose parents were undoubtedly lying on some of the small beds miles away, where they had been planted a few years before.

The young oysters in Chesapeake Bay, Long Island Sound and in other waters are subject to the same dangers that they are here, but there the adult oysters are so abundant in so many different localities that the number of young produced is inconceivably great, so that if only one in thousands attaches itself the numbers are still large enough to keep up the supply.

The principal aim of the experiments we have been conducting during the past two seasons was to protect the young oyster during the most dangerous period of its life and offer it every opportunity to attach itself to some collector. Thus the object of damming in the bay at Keyport was to hold the water over the beds during the spawning season so that the eggs and embryos would not be swept into the main body of the Sound. The bay was large enough so that there was sufficient aeration, enough fresh water flowed in to keep the water the proper density and the propeller in the flume provided for some circulation. It is believed that had everything been ready at the beginning of the season a large number of spat would have been caught, but as it was the number caught was comparatively small. The principle involved in using the sink floats was much the same. The construction allowed for a sufficient change of water to keep it in proper condition, yet no young oysters could escape through the sand through which the water had to filter. So here again we had a number of oysters in a limited area where provision was made that none of these productive elements or young embryos should escape, and conditions were so favorable that many young oysters were collected in this way, both at Tokeland and Keyport. By artificially fertilizing the eggs and caring for the young in the laboratory until they had reached the swimming stage, we were able to obtain many more of the young embryos than if we had left the eggs to be fertilized by chance.

Now what practical application can be made of the knowledge obtained in conducting these experiments? Let us say in the first place that we are not yet ready to advise anyone to undertake the raising of eastern oysters here as a commercial enterprise. While the oysters can undoubtedly be raised if the proper methods are pursued, there are yet a number of important experiments to be made in order that the most economical methods may be devised. The closing of a bay, such as was used in last season's experiments, is expensive, and there is yet

some question whether enough oysters can be obtained in this way to warrant the investment of the necessary capital. Further experiments will have to be conducted before this question can be answered. The floats are comparatively inexpensive, and considering the success that we have already had with them, it would seem that some modification of this system is most promising. But this, too, is a problem that needs further study and experimenting, and as they are matters that are of interest and importance to the whole commonwealth, it would seem that the wisest thing would be for the state to continue these experiments along the same lines until enough had been determined so that the individual oysterman could be told how to go about raising his own eastern oyster seed. This much is due to this young industry which promises to be, in the near future, of so much importance to the whole state.

Recommendations.

Should it be deemed advisable to continue these experiments we would recommend that they be carried on along much the same lines as last season. If possible, the bay in which the experiments are being conducted should be thoroughly drained and kept dry for a period of six or eight weeks in order that all the seaweeds, mussels, clams, barnacles, native oysters, etc., should be killed. These were a serious hindrance to our work last season and should be gotten rid of if possible. The bottom could then be thoroughly cleaned, gravel could be scattered over the soft places and ample provision could be made for catching the spat by covering the bottom with clean shells and arranging the trays, fascines and pieces of broken tile in such ways that every opportunity possible would be offered for the young embryos to attach themselves. Better provisions for circulating the water should be made by putting in a larger propeller and lengthening the flume. This work should be finished not later than May 1st, in order that the eastern oysters could again be placed on the beds at least one month before spawning time. While the work could be carried on with the oysters that are now on the beds, much more could be accomplished if another carload could be added to them. Another small tank should be built near the others and provided with a filter in order that all water entering the tanks could be filtered. The

inside of the tanks should be covered with cement or some other similar substance to keep the wood from tainting the water. The take-in pipe should be raised and placed in a better location. Two or three more sink floats like the one now in use should be built in order that this promising method could be more thoroughly tested. It is desirable that the laboratory be provided with small salt water aquaria and a few other improvements made about the building.

Above all we would recommend that whatever work is done be finished at least two or three weeks before June 1st in order that everything may be in readiness as soon as the oysters begin to spawn.

THE NATIVE OR PACIFIC COAST OYSTER.

(*Ostrea lurida*.)

While investigating the eastern oyster problem some little opportunity was offered for the study of our native Pacific coast oyster. While we are not yet ready to make anything like a report on this work we give here a few notes, as there has been an ever increasing demand for information regarding this species.

Notwithstanding the importance of the native oyster industry on this coast, very little has been done in the way of studying this oyster. Observations made by Prof. R. C. Scheidt, Prof. F. L. Washburn and others show that this oyster is hermaphroditic, that is, both ova and spermatazoa are produced in the same individual. In making an examination of the generative glands during the spawning season, however, some will be found to be filled with sperm while others are filled with ova. Very rarely, at this time at least, do we find both ova and sperm in the same individual. Several questions now present themselves. Do the ova and sperm ripen at the same time in an individual? If so, are the ova fertilized by this sperm and does fertilization take place within the generative gland or after the eggs have passed into the mantle cavity? Or, do the ova and sperm ripen at different times or different seasons in an individual and thus provide against self-fertilization? These and a number of similar and important questions have never, so far as we can learn, been closely enough studied so that anything like satisfactory answers can be given.

Last season Mr. W. C. Doane spent a considerable part of his time while at the biological station studying these problems

and although his work is yet far from complete, we feel that something has been accomplished toward their solution.

After the eggs are fertilized they remain within the gill and mantle cavities of the parent until they reach the swimming stage and the shell begins to develop. What happens to the young embryos after they leave the parent is not definitely known. It is supposed, however, that they behave much in the same manner as do the swimming embryos of the eastern oyster. A few observations made last season seem to confirm this supposition. After a short time the young embryos sink to the bottom and attach themselves to some rock, shell or other suitable collector and develop a much firmer, permanent shell.

During the warm summer months the young oysters grow very rapidly, those that attach early in the summer attaining a considerable size before winter sets in. There is not much increase in the size of the shell during winter, but the oyster usually becomes more plump and fills out the shell better. The rate of growth depends largely upon the conditions under which the oysters are placed; moderately warm water, an abundance of food and plenty of room are the conditions most favorable. Observations made during the season of 1899 show that the food of the native oyster is essentially that of the eastern oyster, *i. e.*, diatoms and other minute plants and animal organisms. These are more abundant on or near the bottom in warm water, as conditions for their development are more favorable there. Anything that will tend to bring about these conditions will help develop the oyster. The oyster is usually marketed when it is from four to six years old.

Until a few years ago it was not thought necessary to exercise any care in taking the oysters from the beds. The supply seemed almost unlimited, and it was supposed it would always remain so. The deplorable condition of these beds to-day shows the fallacy of this notion. Many natural beds on Puget Sound that in former years yielded an abundant supply of fine marketable oysters are now wholly useless, or yield only a few sacks yearly. This was the inevitable result of the system, or rather lack of system, of working these beds. Anyone who wanted oysters for himself, or for the market, could go to the beds and gather all he wanted, gathering them in whatever way was easiest. In a short time the number of oysters was so reduced

that not enough were left to restock the beds, and year after year the numbers grew less until the once prolific beds had to be abandoned because oysters were no longer found there.

A few of these natural beds fell into the hands of private owners, who, realizing the need of properly caring for them, have kept them in their old time vigor, and in many instances increased the yield many fold. The principle underlying their method of cultivation is simply this: *Leave enough oysters on the bed so that they will be restocked each season by the young oysters being produced on the beds and collected on the shells or other collectors provided for them.* We cannot go into a detailed description of the handling of these beds, for almost every bed has to be handled in its own peculiar way in order to get the best results. This fundamental principle must be observed, however, for no bed can last for any length of time unless an abundant supply of oysters be left on the beds for brooders. In some cases the catch is abundantly increased by scattering clean shells and other suitable collectors over the beds just at the beginning of the spawning season. Any clean, firm surface will serve for a collector. In one instance a lot of scrap tin was scattered over the beds with excellent results. Many times we find beds that are excellent for collecting spat but do not seem to develop first-class oysters. In such cases the young oysters are moved to other beds which are more suitable for preparing the oysters for market. In a few instances different systems of "parking" have been resorted to, usually with very gratifying results. These parks are modeled after the French system of parking, and are simply enclosed tracts so arranged that water can be held at any desired depth over the beds. By means of the parks an abundant supply of seed oysters may often be obtained where otherwise few or none would be taken. Since the depletion of the natural beds the most serious question that confronts the oysterman is, "How shall we obtain our seed?" We believe that those who eventually succeed will be those who, either by some system of parking or by some other means, make ample provision for rearing and saving their own seed.

On Willapa Harbor conditions are very different from those on Puget Sound, and we find accordingly very different methods used in handling the oysters there. The natural beds are, as a rule, still in much better condition than those on Puget Sound.

A number of the best beds have been worked so close, however, that they can hardly be depended on any longer as sources of supply for seed.

The extensive tide flats left bare by the receding tides makes large areas available upon which the seed oysters may be planted and cared for until they are ready for market. Hundreds of acres in different parts of the harbor are thus under cultivation, the planters depending entirely upon the natural beds for their supply of seed. This demand has increased year by year with the increased area put under cultivation. Just as surely and much more rapidly has the supply been diminished because the natural beds have been worked so close that not enough oysters are left to restock them. At present the planters depend almost entirely upon a single large bed which heretofore has withstood in a remarkable manner the demands made upon it. But gradually, and of late quite rapidly, it has been losing in the unequal struggle, and each year the oystermen find it more difficult to get anything like a plentiful supply of good seed. The seed when gathered is carried to the private beds where it is sowed broadcast from the boat and cared for for from three to six years, or until the oysters have attained a marketable size.

The Willapa Harbor oyster will average considerably larger than the Puget Sound oyster, and is considered by many to be superior to the latter in flavor, not possessing that peculiar "coppery flavor," but it does not open as well, and will not bring as high a price in the market.

For the last two or three years there has been a big demand for oyster land. So great has this demand been that almost every tide flat on Puget Sound that looks at all as if it could be used for this purpose has been taken. Of course a great deal of this land is absolutely valueless as far as ever making good oyster land is concerned, other tracts can, with a little labor, be put in excellent condition, and a few need only to be properly seeded to make them paying beds. Much of this land has been bought from the state merely as a matter of speculation, but many have bought with the intention of going into the oyster business more or less extensively. Many of these buyers, it is true, know absolutely nothing about the methods of caring for an oyster bed, and their chances of making a success at this business are even less than the chance of a man making a success of farming or

any other business he knows nothing about. This shows, in a measure, the great amount of interest that is being taken in this industry, and the ever increasing demand for information shows that many are desirous of going into the business intelligently. In order that this information may be given, it is very desirable that much more time be given to the study of this oyster. Many points in its early life history need to be more clearly understood, and the best methods of taking and caring for the seed need careful investigation. If we are to make any advance in this industry, if we ever hope to hold it where it is, the time has come when we must go about the work intelligently.

The question of legislation in regard to the oyster problem is a difficult and serious one and cannot be discussed here. Suffice to say that if the state intends to retain the natural beds as state property, the laws now governing them need to be rigidly enforced. If it is found impracticable to enforce these laws, some other protection must be given. A few more years of such treatment as they have been receiving during the past few years will put them in such a depleted condition that we can hardly hope to restore them, at least not without very great expense. If the taking of oysters from these beds could be restricted for a few years, and large quantities of clean shells and other collectors could be scattered over them during the spawning season they might be restored to their old-time vigor. In 1899 we sowed a boat load of shells taken from the beach at Diamond City over a small area of the Noma beds, and late in the season found them thickly covered with young spat. This shows that with proper care these beds could be made to yield enormously. If the state can make provision for caring for these beds, well and good. If not, the sooner they can be put into the hands of private individuals who will care for them the better it will be for the oyster industry of the state.

Cross Fertilization Experiments.

During the past season a few experiments were made looking toward getting a cross between the eastern oyster and our native species. Both theoretically and practically there are many difficulties to overcome, but the results obtained from these few experiments were extremely interesting, and seem to indicate that the proposition is not altogether impossible. The oyster resulting from such a cross would, if produced, be one of

considerable scientific interest, and probably might prove to be of economic importance. It is hoped that these experiments may be followed up.

Greening of Oysters.

A few of the eastern oysters shipped for our experimental work were found upon opening to possess a peculiar green color. Some of our local oystermen on seeing these were somewhat alarmed, fearing that these were diseased, and that the disease might be introduced among our native oysters. They were assured, however, that they had nothing to fear from this. Under certain favorable conditions any oyster may take on this green color. We have seen it in the native oyster in several different localities, and in eastern oysters that had been in these waters for several years. The green color is due to the oysters feeding upon certain of the lower plants from which is derived a harmless blue-green substance known as phycocyanin. The green matter is soluble in the digestive juices of the oyster, and passes into the tissues affecting principally the blood corpuscles. The first indications of greening are usually seen in the gills, palps and mantle; later it may effect nearly the whole oyster. Such oysters are usually, though not always, fat and well fed, showing that they have had an abundance of nutritious food.

In France a great deal of care is taken to impart this green color to the oyster as the connoisseur finds in them a peculiar and exquisite flavor not found in other oysters. In America, however, such oysters are often regarded as unfit for food, or even poisonous, although almost every recent writer on the subject has insisted on the harmlessness of the green coloration. The oysters may be freed from this green color by placing them in water where the green food is lacking or is less abundant. It should be clearly understood, however, that the green color is not caused by disease, a parasite or any poisonous substance, but is usually an evidence that the oyster has been on good feeding grounds. It is thought that the peculiar "coppery" flavor of our Puget Sound oyster is due to some such similar cause. The subject needs investigation.

Japanese Oysters.

The success attending the introduction of the eastern oyster into the waters of the Pacific coast has suggested the possibility

of introducing other species also. Considerable interest has been aroused over the proposed introduction of one of the Japanese oysters. During the past two years we have had some correspondence with Hon. Chas. B. Harris, United States Consul at Nagasaki and with Prof. K. Mitsukuri, of the Imperial University of Tokyo, in regard to the question. The following is a quotation from one of Prof. Mitsukuri's letters: "It has been suggested that the oysters from the great beds in Akkeshi, Hokkaido, our northern island, would be most adapted for transportation to America. There the climate is very rigorous and the oysters must naturally be adapted to survive such a cold as would be met in your state. * * * I do not see why transportation cannot be successful with proper precaution."

These oysters are of large size and might, if introduced into our waters, become an important article of food and of considerable economic importance. It is a matter worthy of further investigation.

LOBSTERS.

In our last report we called attention to the desirability of making some experiments in lobster culture in this state. During the past two years quite extensive investigations have been made on the part of our department for the purpose of a better understanding of the conditions necessary for the successful introduction of this valuable shell fish. From the knowledge obtained we are well satisfied that many portions of Puget Sound and probably Willapa Harbor present excellent conditions for the growth and reproduction of these fish.

As stated in another portion of this report, at large expense the state has constructed an experimental station for eastern oysters. In connection with the same, lobster culture might be carried on, and with every probability of success. During the past two years quite a number of persons engaged in the industry in Canada and the New England states have visited Puget Sound, and with one accord agree that conditions are very favorable for the introduction of these fish. Experiments that have been made in the past in this line have been very feeble attempts, and no one well acquainted with the conditions could

more than hope for a successful result. In connection with our oyster experimental station this work could be carried on in a practical and scientific manner.

We have at this station artificial conditions which do not exist in any other portion of the Sound and which would be very material in the successful termination of the experiment. The lobsters planted in the Sound in the attempts already made were turned loose in the different localities and no attention whatever given to them, and have been without result. At our station, with but little extra expense, we could do this work in connection with our eastern oyster experiments, giving the lobsters the proper attention and studying well the conditions, and if not proper to their growth and welfare, in all probability they might be changed. At least we could determine the reason for the failure if we did not obtain satisfactory results. My judgment is, however, that we would be practically certain of success if the matter was handled at the station under scientific control in connection with our oyster experiments.

The cost of this experiment would be almost wholly confined to the shipping of a car of these fish from the eastern waters. Several schemes have been suggested for the better transportation of the lobsters, and while we should want to ship a considerable number of adults, our main hope for success would be in the shipping of a large number of fry in the state of artificial propagation. The cost of this experiment can be brought within \$2,500, and we respectfully urge that this appropriation be made, and a proper experiment made for the introduction of these valuable food fish. For the purpose of calling attention to the value of this industry, if lobsters could be successfully introduced into our waters, we call your attention to a portion of our report for the years 1897-98, which gives the statistics of this industry for several years in Canada and the eastern states.

JAPANESE OYSTERS.

We have had considerable correspondence with the head of the fisheries department in Japan, and from the information at hand believe that it would be wise to attempt the experiment of introducing Japanese oysters into our waters. This can be accomplished at a small expense. The cost of a sufficient number of oysters to properly conduct this experiment, including freight and all other charges, will not exceed \$500, and we would recom-

mend that an appropriation of this amount be made for such purpose.

These oysters, coming from a climate considerably colder than our own, are quite likely to do well in our waters; they are also of very fine quality and good size. In connection with our work at the present oyster station the only extra expense will be the small one of obtaining a sufficient quantity of these fish to make the proper experiments.

CRAWFISH.

One of the most popular shell fish found in any of the waters of the Pacific coast is the crawfish. Large numbers of them are caught annually in tributaries of the Willamette River. They are also found in some other streams emptying into the Columbia. These fish are practically unknown on Puget Sound, Grays Harbor, or Willapa Harbor. Undoubtedly they would thrive well in the rivers tributary to and discharging their waters into Puget Sound, Grays Harbor and Willapa Harbor.

I believe that a small appropriation for the purpose of introducing these excellent and popular fish would produce very satisfactory results. An appropriation of \$200 for the introduction of these fish to Puget Sound, and \$100 each for Grays Harbor and Willapa Harbor would be sufficient for the experiment. Fishermen, well informed as to the habits of these fish and the conditions they require for their growth and propagation, inform me that there is no question but that they would do as well in the above-named rivers and streams as they do in the Willamette river and tributaries.

The trade in these fish in Portland alone amounts to several thousand dollars annually. Quite an amount of them are shipped from Portland to our Sound cities. Certainly everything should be done that can be done to fill our waters with good varieties of any class of fish that might do well here, and we earnestly recommend the above appropriation.

SEA LIONS AND SEALS.

It is a well known fact that the sea lions and seals which infest our waters, especially in the Columbia River district, destroy many thousands of fish each year. Often a fisherman in taking in his net will find that a majority of them have been badly torn by seals or sea lions.

The Fish Commissions of California and Oregon have earnestly recommended to the Legislature that a bounty be placed upon these sea animals. In my judgment it would be wise legislation to follow their example. If the Legislature of Oregon should pass a law giving a bounty for the destruction of these pests on the Columbia River, justice to our sister state would demand that we enact the same legislation. That eminent authority on fish and fish culture, David Starr Jordan of Stanford University, has strongly recommended this legislation to the Legislature of California. It is an undisputed fact that if we could destroy the parasites on salmon life, such as sea lions and certain classes of voracious fish, we would do as much for the increase of these fish as it is possible to do in any manner.

Space forbids an exhaustive argument in favor of this legislation, but we are in hearty sympathy with the movement, and recommend it to our Legislature.

PERMANENT SCIENTIFIC AND EXPERIMENTAL STATION.

As we stated in another portion of this report, we deem it a matter of great importance that the experiment undertaken to introduce and propagate eastern oysters in Washington waters be continued. We consider it wise as a matter of economy and material benefit that a permanent experimental station be established in connection with our fisheries department to handle the work of the introduction of eastern oysters, lobsters and other shell fish; also to determine other problems that are very material in the furtherance of our work in the line of artificial propagation of fish, and the investigations of conditions pertaining to the fisheries of the state.

It is impossible for the Fish Commissioner personally to do any amount of scientific investigation. The duties of the office outside of this line of work require all the time that any person can give to them; moreover, to make a proper investigation it would be necessary to turn over the duties of the office to subordinates at many times when it would not be advisable to do so.

Many of the eastern states have established scientific stations of the character that we recommend, and the results from the same have been so satisfactory that each year large appropriations are made for their maintenance. In these old established

states they have the result of many years' experience and investigation which are entirely lacking in a young state like our own. If with the vast amount of accumulated knowledge and experience they deem it wise to establish stations of this character, certainly it is evidence of the need of the same in our young and growing state.

In our report of 1897-98, we strongly advised the establishment of this station. Two years of experience since that time in meeting the many questions presented that require scientific investigation have emphasized all that we had to say at that time, and we now again strongly urge this point.

After careful investigation of the subject, we have arrived at the conclusion that in order to conduct the work of this station properly, it would require the services of a superintendent who is especially fitted for a place of this kind and who has a large scientific knowledge of the subjects and problems which will be presented to him. A man of this character cannot be obtained for a salary of less than \$2,000 per annum. Unless we have a person who is skilled in this line no great results can be obtained. With the proper man as superintendent of this station, we are sure that no money ever appropriated by the State of Washington for any purpose will give such large returns; and unless a sufficient appropriation can be had to pay a salary of this amount, we would not advise the establishment of the station at this time.

We submit the following estimates as being absolutely necessary for the establishment and operation of this station for two years:

Salary of superintendent, at \$2,000 per annum.....	\$4,000 00
Salary of assistant, at \$750 per year.....	1,500 00
General expenses, at \$1,000 per year.....	2,000 00
Buildings and water supply.....	2,500 00
Total for station.....	\$10,000 00

To continue the eastern oyster experiment in connection with above station, the following amounts will be necessary:

Car of eastern oysters.....	\$1,200 00
Cleaning pond and constructing flume to empty same.....	1,100 00
Machinery, floats, etc.....	1,500 00
Total.....	\$3,800 00

Appropriations necessary for the introduction of Japanese oysters	\$500 00
Appropriation necessary for the experiment of introducing lobsters	\$1,200 00

If the appropriation is made for the permanent station, the above sums for experiments are ample. If the station is not built, in addition to the sum for eastern oysters, an appropriation of \$2,000 for expenses for two years will be necessary.

No state in the Union has such great natural resources in its fisheries as has our state. We are, however, laboring under great difficulties, as in the past very meagre appropriations have been made for the fisheries department, and largely for the reason that we have neither the knowledge or experience necessary for the proper conduct of this department. Reasonable appropriations at this time will save many times the amount in years to come if our fisheries are to be properly preserved and protected. We hope sincerely that the legislature will take due consideration of the needs of this department and especially in this particular, and make the appropriations that we have recommended necessary for its proper operation in the future.

TABULATED REPORT OF FISHING INDUSTRY, COLUMBIA
RIVER DISTRICT, YEAR ENDING DECEMBER 31, 1899.
(STATE OF WASHINGTON SIDE.)

CANNERIES AND FISHING APPLIANCES OPERATED.

	No.	Value.
Canneries (four not operated)	9	\$142,000 00
Pound nets fished	380	276,000 00
Pound net locations	56	2,800 00
Wheels	33	36,200 00
Gill nets	380	58,400 00
Set nets	157	7,130 00
Seines, drag	38	19,000 00
Boats	670	40,200 00
Steamers	8	2,300 00
Launches	12	1,900 00
Scows, all kinds, and pile drivers	112	26,400 00
All other appliances		12,500 00
Capital used in operating canneries		150,000 00
Total		\$774,830 00

NOTE.—The term "canneries" includes shore property, machinery, etc.

NUMBER OF MEN EMPLOYED IN FISHING INDUSTRY.

HOW EMPLOYED.	No.	Average annual earnings.	Total.
In canneries, white labor	40	\$250 00	\$10,000 00
In canneries, Chinese and others	235	240 00	56,400 00
Operating and constructing pound nets	365	270 00	98,550 00
Operating wheels	57	230 00	13,110 00
Operating gill nets	620	350 00	217,000 00
Operating set nets	52	215 00	11,180 00
Operating seines, drag	190	240 00	45,600 00
Operating steamers	16	400 00	6,400 00
Operating launches	24	385 00	9,240 00
Scows and pile drivers	45	375 00	16,875 00
Fresh fish dealers	38	315 00	11,970 00
Totals	1,682		\$496,325 00

SALMON PACKED.

	No. of cases.	Value.
Chinook	86,300	.....
Blue back	9,620	.....
Steel heads	6,470	.....
Silvers and Comax	17,210	.....
Totals	119,600	\$598,730 00

FRESH, SALT AND SMOKED FISH SHIPPED AND CONSUMED LOCALLY.

	No. of pounds.	Value.
Salmon, fresh	2,643,000	.....
Salmon, salted and smoked.....	435,000	.....
Smelt, fresh and salted.....	280,420	.....
Trout, all kinds	18,600	.....
Sturgeon.....	37,400	.....
Shad.....	136,200	.....
Cod, all kinds.....	29,300	.....
Catfish	7,200	.....
All other kinds.....	21,400	.....
Totals	3,608,520	\$213,179 10

SHELL FISH OUTPUT.

	Output.	Value.
Clams	1,900 sacks	\$2,280 00

VALUE OF OUTPUT FOR 1899.

Salmon packed.....	\$598,730 00
Fresh, salt and smoked fish	213,179 10
Shell fish	2,280 00
Total value.....	\$814,189 10

TABULATED REPORT OF FISHING INDUSTRY, PUGET SOUND DISTRICT, YEAR ENDING DECEMBER 31, 1899.

CANNERIES AND FISHING APPLIANCES OPERATED.

	No.	Value.
Canneries (two not operated).....	19	\$384,650 00
Pound nets fished.....	159	1,590,000 00
Pound net locations.....	165	49,500 00
Gill nets.....	325	48,750 00
Set nets.....	330	13,200 00
Seines, drag.....	125	18,750 00
Seines, purse.....	72	46,700 00
Fishing boats and dories.....	820	32,800 00
Steamboats.....	31	248,000 00
Launches.....	17	34,000 00
Scows.....	187	37,400 00
Pile drivers.....	26	90,500 00
All other appliances.....	.....	19,850 00
Capital used in operation canneries.....	.....	530,000 00
Total.....	.....	\$3,144,100 00

NOTE.—The term "canneries" includes shore property, machinery, etc.

NUMBER OF MEN EMPLOYED IN FISHING INDUSTRY.

HOW EMPLOYED.	No.	Average annual earnings.	Total.
In canneries, white labor.....	480	\$230 00	\$110,400 00
In canneries, Chinese and Japanese.....	1,560	220 00	343,200 00
Construction and operating pound nets.....	730	260 00	189,800 00
Operating gill nets.....	610	350 00	213,500 00
Operating set nets.....	130	180 00	23,400 00
Operating drag seines.....	385	235 00	90,175 00
Operating purse seines.....	375	245 00	91,875 00
Operating steamboats.....	112	480 00	53,760 00
Operating launches.....	88	375 00	14,250 00
Operating pile drivers.....	154	420 00	64,680 00
Operating other appliances.....	217	310 00	67,270 00
Oyster industry.....	210	260 00	54,600 00
Clams and mussels fishing.....	180	210 00	37,800 00
Crab and shrimp fishing.....	52	300 00	15,600 00
Fresh fish business.....	125	550 00	68,750 00
Totals.....	5,378	.....	\$1,439,360 00

SALMON PACKED.

SALMON.	No. of cases.	Value.
Sockeye.....	512,500	.....
Spring.....	24,500	.....
Humpbacks.....	254,000	.....
Silvers.....	102,500	.....
Comax.....	34,000	.....
Totals.....	927,500	\$4,405,525 00

FRESH, SALT AND SMOKED FISH SHIPPED AND CONSUMED LOCALLY.

VARIETY.	No. of pounds.	Value.
Salmon, fresh.....	12,637,000	.....
Salmon, salt.....	4,110,200	.....
Salmon, smoked.....	822,300	.....
Sturgeon, fresh.....	19,300	.....
Smelt, fresh.....	857,000	.....
Smelt, salt.....	227,200	.....
Halibut, fresh.....	3,130,400	.....
Halibut, salt and smoked.....	87,230	.....
Cod, salt and fresh.....	238,000	.....
Soles, etc.....	19,000	.....
Flounders, tom cod, etc.....	28,000	.....
Mackerel.....	12,300	.....
Trout, all kinds.....	34,200	.....
Herring, salt, smoked and fresh.....	281,000	.....
Shad.....	14,200	.....
Catfish.....	7,200	.....
All other kinds.....	21,400	.....
Totals.....	22,495,930	\$713,127 30

SHELL FISH OUTPUT.

VARIETY.	Output.	Value.
Oysters from natural beds.....	2,230 sacks	.....
Oysters from cultivated beds.....	24,800 sacks	.....
Clams.....	18,300 sacks	.....
Mussels.....	720 sacks	.....
Crabs.....	17,360 dozen	.....
Shrimps.....	57,200 pounds	.....
Total.....		\$130,960 00

TOTAL VALUE OF OUTPUT FOR 1899.

Salmon, packed.....	\$4,405,525 00
Fresh, salt and smoked fish.....	713,127 30
Shell fish.....	130,960 00
Total value.....	\$5,249,612 30

TABULATED REPORT OF FISHING INDUSTRY, WILLAPA HARBOR DISTRICT, YEAR ENDING DECEMBER 31, 1899:

CANNERIES AND FISHING APPLIANCES OPERATED.

	No.	Value.
Canneries.....	3	\$23,000 00
Pound nets fished.....	43	23,100 00
Gill nets.....	30	4,100 00
Set nets.....	60	1,800 00
Boats.....	125	7,250 00
Steamers.....	2	5,000 00
Launches.....	3	4,500 00
Scows, all kinds, and pile drivers.....	60	2,500 00
All other appliances.....		1,500 00
Capital used in operating canneries.....		25,000 00
Total.....		\$97,750 00

Note.—The term "canneries" includes shore property, machinery, etc.

NUMBER OF MEN EMPLOYED IN FISHING INDUSTRY.

HOW EMPLOYED.	No.	Average annual earnings.	Total.
In canneries, white labor.....	18	\$200 00	\$3,600 00
In canneries, Chinese and others.....	72	160 00	11,520 00
Operating and constructing pound nets.....	40	235 00	9,400 00
Operating gill nets.....	40	325 00	13,000 00
Operating set nets.....	30	170 00	5,100 00
Operating steamers.....	8	325 00	2,600 00
Operating launches.....	6	250 00	1,500 00
Oyster industry.....	225	235 00	47,885 00
Clams and crabs.....	12	180 00	2,160 00
Fresh fish dealers.....	8	250 00	2,000 00
Totals.....	459		\$98,765 00

SALMON PACKED.

SALMON.	No. of cases.	Value.
Fall Chinook.....	6,320	.....
Silvers	10,210	.....
Comax.....	6,700	.....
Totals.....	23,230	\$91,820 00

FRESH, SALT AND SMOKED FISH SHIPPED AND CONSUMED LOCALLY.

VARIETY.	No. of pounds.	Value.
Salmon, fresh.....	321,200	.....
Salmon, salt and smoked.....	37,800	.....
Sturgeon.....	11,200	.....
All other kinds.....	14,900	.....
Totals.....	384,600	\$10,902 00

SHELL FISH OUTPUT.

	Output.	Value.
Oysters.....	37,000 sacks.	.....
Clams.....	2,300 sacks.	.....
Crabs.....	680 boxes.	.....
Total.....		\$93,372 00

TOTAL VALUE OF OUTPUT FOR 1899.

Salmon packed.....	\$91,820 00
Fresh, salt and smoked fish	10,902 00
Shell fish	93,372 00
Total.....	\$196,094 00

TABULATED REPORT OF FISHING INDUSTRY, GRAYS HARBOR DISTRICT, YEAR ENDING DECEMBER 31, 1899.

CANNERY AND FISHING APPLIANCES OPERATED.

	No.	Value.
Canneries (one operated)	2	\$19,000 00
Pound nets fished	12	9,600 00
Pound nets, locations	32	960 00
Gill nets	63	8,450 00
Set nets	82	3,280 00
Seines, drag	6	1,400 00
Boats	118	7,080 00
Steamers	2	5,000 00
Launches	2	3,500 00
Scows and pile drivers	25	3,500 00
All other appliances		800 00
Capital operating canneries and dealers		20,000 00
Total		\$88,570 00

NOTE.—The term "canneries" includes shore property, machinery, etc.

NUMBER OF MEN EMPLOYED IN FISHING INDUSTRY.

HOW EMPLOYED.	No.	Average annual earnings.	Total.
In canneries, white labor	8	\$205 00	\$1,640 00
In canneries, Chinese and Japanese labor	40	160 00	6,400 00
Operating and constructing pound nets	16	250 00	4,000 00
Operating gill nets	110	355 00	39,050 00
Operating set nets	40	220 00	8,800 00
Operating drag seines	16	240 00	3,840 00
Operating steamers	5	285 00	2,425 00
Operating launches	4	255 00	1,020 00
Clam and crab fishing	8	180 00	1,440 00
Fresh fish dealers	10	325 00	3,250 00
Totals	257		\$71,865 00

SALMON PACKED.

SALMON.	No. of cases.	Value.
Fall Chinook	5,500	.....
Silvers	7,300	.....
Comax	5,400	.....
Totals	18,200	\$71,800 00

FRESH, SALT AND SMOKED FISH SHIPPED AND CONSUMED LOCALLY.

VARIETY.	No. of pounds.	Value.
Salmon, fresh	1,696,300	.....
Salmon, salt and smoked.....	162,100	.....
Sturgeon.....	5,200	.....
All other kinds.....	14,600	.....
Totals	1,878,200	\$52,621 50

SHELL FISH OUTPUT.

	Output.	Value.
Clams.....	2,840 sacks.	.....
Crabs.....	670 boxes.	.....
Total.....		\$5,325 50

TOTAL VALUE OF OUTPUT FOR 1899.

Salmon packed.....	\$71,300 00
Fresh, salt and smoked fish.....	52,621 50
Shell fish.....	5,325 50
Total value	\$129,247 00

GENERAL SUMMARY OF THE FISHERIES INDUSTRY OF THE STATE OF WASHINGTON FOR THE YEAR 1899—CAPITAL AND LABOR EMPLOYED, EARNINGS OF LABOR EMPLOYED—VALUE OF OUTPUT.

CAPITAL EMPLOYED.

Columbia River district.....	\$744,830 00
Puget Sound district.....	3,144,100 00
Willapa Harbor district.....	97,750 00
Grays Harbor district.....	83,570 00
Total.....	\$4,070,250 00

NUMBER OF PERSONS EMPLOYED.

Columbia River district.....	1,682
Puget Sound district.....	5,378
Willapa Harbor district.....	459
Grays Harbor district.....	257
Total.....	7,776

EARNINGS OF LABOR EMPLOYED.

Columbia River district.....	\$496,325 00
Puget Sound district.....	1,439,360 00
Willapa Harbor district.....	98,765 00
Grays Harbor district.....	71,865 00
Total.....	\$2,106,315 00

VALUE OF OUTPUT.

Columbia River district.....	\$814,189 00
Puget Sound district.....	5,249,612 30
Willapa Harbor district.....	196,094 00
Grays Harbor district.....	129,247 00
Total.....	\$6,389,142 30

LICENSES NOT REPORTED IN 1898, FROM DECEMBER 10TH
TO 31ST.

4 Pound nets, Puget Sound, at \$25 each.....	\$100 00	
1 Gill net, Puget Sound, at \$2.50.....	2 50	
1 Gill net, Grays Harbor, at \$2.50.....	2 50	
6 Set nets, Columbia River, at \$1 each.....	6 00	
22 Set nets, Puget Sound, at \$1 each.....	22 00	
11 Set nets, Grays Harbor, at \$1 each.....	11 00	
2 Set nets, Willapa Harbor, at \$1 each.....	2 00	
		\$146 00

LICENSES ISSUED UNDER LAW 1897, JANUARY,
FEBRUARY, MARCH 13, 1899.

24 Pound nets, Columbia River, at \$15 each.....	\$360 00	
94 Pound nets, Puget Sound, at \$25 each.....	2,350 00	
5 First class, wheels, Columbia River, at \$25 each.....	100 00	
1 Gill net, Puget Sound, at \$2.50.....	2 50	
5 Gill nets, Grays Harbor, at \$2.50 each.....	12 50	
20 Set nets, Columbia River, at \$1 each.....	20 00	
41 Set nets, Puget Sound, at \$1 each.....	41 00	
35 Set nets, Grays Harbor, at \$1 each.....	35 00	
1 Set net, Willapa Harbor, at \$1.....	1 00	
1 Seine, Columbia River, at \$2.50.....	2 50	
2 Seines, Columbia River, at \$15 each.....	30 00	
3 Seines, Puget Sound, at \$2.50 each.....	7 50	
14 Purse seines, Puget Sound, at \$25 each.....	350 00	
		\$3,312 00
Total amount of licenses collected under law of 1897.....		\$3,458 00

LICENSES ISSUED FROM MARCH 13, 1899, TO DECEMBER 31, 1899.

COLUMBIA RIVER POUND NETS.

66	Pound nets, Columbia River, at \$20 each.....	\$1,320 00	
13	Pound nets, Columbia River, at \$40 each.....	520 00	
333	Pound nets, Columbia River, at \$10 each.....	3,330 00	
			\$5,170 00

PUGET SOUND POUND NETS.

228	Pound nets, Puget Sound, at \$50 each.....	\$11,400 00	
2	Pound nets, Puget Sound, at \$100 each.....	200 00	
			11,600 00

WILLAPA HARBOR POUND NETS.

44	Pound nets, Willapa Harbor, at \$10 each.....	\$440 00	
			440 00

GRAYS HARBOR POUND NETS.

44	Pound nets, Grays Harbor, at \$10 each.....	\$440 00	
			440 00

Total for pound nets.....			\$17,650 00
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COLUMBIA RIVER FISH WHEELS.

3	First-class stationary wheels, at \$25 each.....	\$75 00	
7	Second class stationary wheels, at \$10 each.....	70 00	
18	Scow wheels, at \$15 each.....	270 00	
			\$415 00

GILL NETS.

399	Gill nets, Columbia River, at \$2.50 each.....	\$997 50	
325	Gill nets, Puget Sound, at \$2.50 each.....	812 50	
40	Gill nets, Willapa Harbor, at \$2.50 each.....	100 00	
5	Gill nets, Grays Harbor, at \$2.50 each.....	12 50	
			1,922 50

SET NETS.

137	Set nets, Columbia River, at \$2.50 each.....	\$342 50	
289	Set nets, Puget Sound, at \$2.50 each.....	722 50	
77	Set nets, Willapa Harbor, at \$2.50 each.....	192 50	
50	Set nets, Grays Harbor, at \$2.50 each.....	125 00	
			1,382 50

COLUMBIA RIVER SEINES.

8	Seines, Columbia River, at \$2.50 each.....	\$20 00	
6	Seines, Columbia River, at \$5 each.....	30 00	
10	Seines, Columbia River, at \$10 each.....	100 00	
10	Seines, Columbia River, at \$15 each.....	150 00	
2	Seines, Columbia River, at \$20 each.....	40 00	
2	Seines, Columbia River, at \$25 each.....	50 00	
			390 00

PUGET SOUND SEINES.

57	Seines, Puget Sound, at \$2.50 each.....	\$145 50	
45	Seines, Puget Sound, at \$5 each.....	225 00	
16	Seines, Puget Sound, at \$10 each.....	160 00	
3	Seines, Puget Sound, at \$15 each.....	45 00	
1	Seine, Puget Sound, at \$20.....	20 00	
55	Purse seines, Puget Sound, at \$25 each.....	1,370 00	
3	Purse seines, Puget Sound, at \$50 each.....	150 00	
			2,115 50

GRAYS HARBOR SEINES.

2	Seines, Grays Harbor, at \$2.50 each.....	\$5 00	
3	Seines, Grays Harbor, at \$5 each.....	15 00	
1	Seine, Grays Harbor, at \$15 each.....	15 00	
			85 00
	Total fishing gear licenses.....		<u>\$27,368 50</u>

INDIVIDUAL LICENSES.

834	Individual licenses, Columbia River, at \$1 each.....	\$884 00	
1193	Individual licenses, Puget Sound, at \$1 each.....	1,193 00	
36	Individual licenses, Willapa Harbor, at \$1 each.....	36 00	
77	Individual licenses, Grays Harbor, at \$1 each.....	77 00	
			<u>\$2,140 00</u>

CANNERY LICENSES.

2	Cannery licenses, Columbia River, at \$100 each.....	\$200 00	
1	Cannery license, Columbia River, at \$150.....	150 00	
1	Cannery license, Columbia River, at \$200.....	200 00	
1	Cannery license, Columbia River, at \$250.....	250 00	
			\$800 00
2	Cannery licenses, Puget Sound, at \$100 each.....	\$200 00	
3	Cannery licenses, Puget Sound, at \$150 each.....	450 00	
5	Cannery licenses, Puget Sound, at \$200 each.....	1,000 00	
3	Cannery licenses, Puget Sound, at \$250 each.....	750 00	
1	Cannery license, Puget Sound, at \$300.....	300 00	
2	Cannery licenses, Puget Sound, at \$400 each.....	800 00	
2	Cannery licenses, Puget Sound, at \$600 each.....	1,200 00	
			4,700 00
2	Cannery licenses, Willapa Harbor, at \$100 each.....	\$200 00	
1	Cannery license, Willapa Harbor, at \$200.....	200 00	
			400 00
1	Cannery license, Grays Harbor, at \$100.....	\$100 00	
			100 00
	Total cannery licenses.....		<u>\$6,000 00</u>

FISH TAKEN IN POUND NETS AND WHEELS.

(At \$1 per thousand fish.)

Columbia River district.....	\$133 42	
Puget Sound district.....	8,118 85	
		\$8,252 27

FISH DEALERS' LICENSE.

7	Columbia River district, at \$2.50 each.....	\$17 50	
37	Puget Sound district, at \$2.50 each.....	92 50	
1	Willapa Harbor district, at \$2.50 each.....	2 50	
1	Grays Harbor district, at \$2.50.....	2 50	
			115 00

FRESH FISH DEALERS' REPORT.

(At 30c. per ton in the round.)

Columbia River district.....	\$120 16	
Puget Sound district.....	236 71	
Willapa Harbor district.....	3 90	
Grays Harbor district.....	8 40	
		369 17
Total all other licenses.....		<u>\$16,876 44</u>

RECAPITULATION BY DISTRICTS.

Total Columbia River licenses.....	\$9,738 58
Total Puget Sound licenses.....	32,446 06
Total Willapa Harbor licenses.....	1,177 90
Total Grays Harbor licenses.....	861 40
Grand total.....	\$44,244 94

LICENSE PERMITS FOR DREDGING OYSTERS.

1 Puget Sound district, at \$2.50.....	\$2 50
12 Willapa Harbor district, at \$2.50 each.....	30 00
	\$32 50

TABULATED REPORT OF FISHING INDUSTRY, COLUMBIA RIVER DISTRICT, YEAR ENDING DECEMBER 31, 1900. (STATE OF WASHINGTON SIDE.)

CANNERIES AND FISHING APPLIANCES OPERATED.

	No.	Value.
Canneries (four not operated).....	9	\$139,000 00
Pound nets fished.....	378	274,000 00
Pound net locations.....	15	750 00
Wheels.....	33	36,200 00
Gill nets.....	340	53,400 00
Set nets.....	133	6,650 00
Seines, drag.....	48	27,500 00
Boats.....	652	39,120 00
Steamers.....	5	1,500 00
Launches.....	15	23,250 00
Scows and pile drivers.....	109	23,900 00
All other appliances.....		11,000 00
Capital used in operating canneries.....		150,000 00
Total.....		\$786,270 00

NOTE.—The term "canneries" includes shore property, machinery, etc.

NUMBER OF MEN EMPLOYED IN FISHING INDUSTRY.

HOW EMPLOYED.	No.	Average annual earnings.	Total.
In canneries, white labor.....	45	\$250 00	\$11,250 00
In canneries, Chinese and others.....	245	240 00	58,800 00
Operating and constructing pound nets.....	330	275 00	90,750 00
Operating wheels.....	57	230 00	13,110 00
Operating gill nets.....	580	370 00	214,600 00
Operating set nets.....	60	225 00	13,500 00
Operating seines, drag.....	240	240 00	57,600 00
Operating steamers.....	16	400 00	6,400 00
Operating launches.....	30	385 00	11,550 00
Scows and pile drivers.....	50	375 00	18,750 00
Fresh fish dealers.....	40	325 00	14,000 00
Totals.....	1,693		\$510,310 00

SALMON PACKED.

	No. of cases.	Value.
Chinook.....	91,560	.....
Blue back.....	7,730	.....
Steel heads.....	8,880	.....
Silvers and Comax.....	19,460	.....
Totals.....	127,130	\$672,780 00

FRESH, SALT AND SMOKED FISH SHIPPED AND CONSUMED LOCALLY.

	No. of pounds.	Value.
Salmon, fresh.....	2,786,200	.....
Salmon, salted and smoked.....	386,300	.....
Smelt, fresh and salted.....	227,400	.....
Trout, all kinds.....	21,300	.....
Sturgeon.....	34,600	.....
Shad.....	166,100	.....
Cod, all kinds.....	27,200	.....
Cat fish.....	6,700	.....
All other kinds.....	28,500	.....
Totals.....	3,684,300	\$216,214 00

SHELL FISH OUTPUT.

	Output.	Value.
Clams.....	2,100	\$2,520 00

VALUE OF OUTPUT FOR 1900.

Salmon packed.....	\$672,780 00
Fresh, salt and smoked fish.....	216,214 00
Shell fish.....	2,520 00
Total value.....	\$891,514 00

TABULATED REPORT OF FISHING INDUSTRY, PUGET SOUND
DISTRICT, YEAR ENDING DECEMBER 31, 1900.

CANNERIES AND FISHING APPLIANCES OPERATED.

	No.	Value.
Canneries (two not operated).....	21	\$424,750 00
Pound nets fished.....	170	1,700,000 00
Pound nets, locations.....	284	85,200 00
Gill nets.....	380	57,000 00
Set nets.....	330	13,200 00
Seines, drag.....	114	17,100 00
Seines, purse.....	67	43,200 00
Boats and dories.....	830	33,750 00
Steamboats.....	33	253,000 00
Launches.....	18	35,000 00
Scows, all kinds.....	194	38,600 00
Piledrivers.....	27	92,500 00
All other appliances.....		21,600 00
Capital used in operation.....		565,000 00
Total.....		\$3,379,900 00

NOTE.—The term "canneries" includes shore property, machinery, etc.

NUMBER OF MEN EMPLOYED IN FISHING INDUSTRY.

HOW EMPLOYED.	No.	Average annual earnings.	Total.
In canneries, white labor.....	450	\$220 00	\$99,000 00
In canneries, Chinese and Japanese labor.....	1,410	200 00	282,000 00
Operating and constructing pound nets.....	820	270 00	221,400 00
Operating gill nets.....	650	350 00	227,500 00
Operating set nets.....	135	180 00	21,300 00
Operating drag seines.....	360	235 00	84,600 00
Operating purse seines.....	370	235 00	86,950 00
Operating steamboats.....	120	480 00	57,600 00
Operating launches.....	42	375 00	15,750 00
Operating piledrivers.....	170	420 00	71,400 00
Operating other appliances.....	220	310 00	68,200 00
Oyster industry.....	220	270 00	59,400 00
Clams and mussels fishing.....	180	210 00	37,800 00
Crab and shrimp fishing.....	57	300 00	17,100 00
Fresh fish.....	115	550 00	63,250 00
Totals.....	5,319		\$1,416,250 00

SALMON PACKED.

SALMON.	No. of cases.	Value.
Sockeye.....	229,800	.....
Spring.....	22,350	.....
Silver.....	128,200	.....
Comax.....	89,100	.....
Totals.....	469,450	\$2,347,280 00

FRESH, SALT AND SMOKED FISH SHIPPED AND CONSUMED LOCALLY.

VARIETY.	No. of pounds.	Value.
Salmon, fresh.....	6,722,000	.....
Salmon, salt.....	2,620,000	.....
Salmon, smoked.....	720,000	.....
Sturgeon.....	16,500	.....
Smelt, fresh.....	1,637,000	.....
Smelt, salt.....	218,000	.....
Halibut, fresh.....	3,722,000	.....
Halibut, salt and smoked.....	43,200	.....
Cod, salt and fresh.....	246,000	.....
Soles, etc.....	21,200	.....
Flounders, tom cod, etc.....	29,600	.....
Mackerel.....	14,200	.....
Trout, all kinds.....	36,300	.....
Herring, salt, smoked and fresh.....	293,700	.....
Shad.....	16,300	.....
Catfish.....	8,300	.....
All other kinds.....	23,600	.....
Totals.....	16,387,900	\$598,059 00

SHELL FISH OUTPUT.

VARIETY.	Output.	Value.
Oysters from natural beds.....	1,820 sacks.	.....
Oysters from cultivated beds.....	29,900 sacks.	.....
Clams.....	23,200 sacks.	.....
Mussels.....	430 sacks.	.....
Crabs.....	19,600 dozen.	.....
Shrimps.....	63,400 pounds.	.....
Total.....		\$159,882 00

TOTAL VALUE OF OUTPUT FOR 1900.

Salmon packed.....	\$2,347,280 00
Fresh, salt and smoked fish.....	598,059 00
Shell fish.....	159,882 00
Total value.....	\$3,105,221 00

TABULATED REPORT OF FISHING INDUSTRY, WILLAPA
HARBOR DISTRICT, YEAR ENDING DECEMBER 31, 1900.

CANNERIES AND FISHING APPLIANCES OPERATED.

	No.	Value.
Canneries.....	3	\$23,000 00
Pound nets fished.....	45	25,000 00
Pound net locations.....	23	690 00
Gill nets.....	30	4,100 00
Set nets.....	60	1,800 00
Seines, drag.....	4	750 00
Boats.....	125	7,250 00
Steamers.....	2	5,000 00
Launches.....	3	4,500 00
Scows, all kinds, and pile drivers.....	60	2,500 00
All other appliances.....		1,500 00
Capital used in operating canneries.....		25,000 00
Total.....		\$101,090 00

NOTE.—The term "canneries" includes shore property, machinery, etc.

NUMBER OF MEN EMPLOYED IN FISHING INDUSTRY.

HOW EMPLOYED.	No.	Average annual earnings.	Total.
In canneries, white labor.....	18	\$200 00	\$3,600 00
In canneries, Chinese and others.....	72	150 00	11,520 00
Operating and constructing pound nets.....	45	230 00	10,350 00
Operating gill nets.....	48	325 00	15,600 00
Operating set nets.....	35	170 00	5,950 00
Operating steamers.....	9	325 00	2,925 00
Operating launches.....	6	250 00	1,500 00
Oyster industry.....	225	235 00	47,885 00
Clams and crabs.....	12	180 00	2,160 00
Fresh fish dealers.....	10	225 00	2,250 00
Totals.....	480		\$103,740 00

SALMON PACKED.

SALMON.	No. of cases.	Value.
Fall Chinook.....	6,700	
Silvers.....	12,400	
Comax.....	7,200	
Totals.....	26,300	\$101,200 00

FRESH, SALT AND SMOKED FISH SHIPPED AND CONSUMED LOCALLY.

VARIETY.	No. of pounds.	Value.
Salmon, fresh.....	267,100	.....
Salmon, salt and smoked.....	32,600	.....
Sturgeon.....	14,200	.....
All other kinds.....	16,300	.....
Totals.....	330,200	\$9,092 10

SHELL FISH OUTPUT.

	Output.	Value.
Oysters.....	33,600 sacks.	.....
Clams.....	2,520 sacks.	.....
Crabs.....	560 boxes.	.....
Total.....		\$92,078 00

TOTAL VALUE OF OUTPUT FOR 1900.

Salmon packed.....	\$101,200 00
Fresh, salt and smoked fish.....	9,092 10
Shell fish.....	92,078 00
Total value.....	\$202,370 10

TABULATED REPORT OF FISHING INDUSTRY, GRAYS HARBOR DISTRICT, YEAR ENDING DECEMBER 31, 1900.

CANNERIES AND FISHING APPLIANCES OPERATED.

	No.	Value.
Canneries.....	2	\$19,000 00
Pound nets fished.....	18	10,300 00
Pound net locations.....	31	930 00
Gill nets.....	72	9,800 00
Set nets.....	93	3,720 00
Selnes, drag.....	5	1,100 00
Boats.....	122	7,460 00
Steamers.....	2	5,000 00
Launches.....	2	3,300 00
Scows and piledrivers.....	25	3,500 00
All other appliances.....		900 00
Capital used in operating canneries.....		30,000 00
Total.....		\$95,210 00

NOTE.—The term "canneries" includes shore property, machinery, etc.

NUMBER OF MEN EMPLOYED IN FISHING INDUSTRY.

HOW EMPLOYED.	No.	Average annual earnings.	Total.
In canneries, white labor	12	\$245 00	\$2,940 00
In canneries, Chinese and others.....	66	280 00	15,180 00
Operating and constructing pound nets.....	20	270 00	5,400 00
Operating gill nets.....	120	385 00	46,200 00
Operating set nets.....	38	260 00	9,880 00
Operating drag seines.....	12	290 00	3,480 00
Operating steamers.....	6	325 00	1,950 00
Operating launches.....	4	285 00	1,140 00
Clams and crabs.....	8	180 00	1,440 00
Fresh fish dealers.....	11	325 00	3,575 00
Totals.....	297		\$91,185 00

SALMON PACKED.

SALMON.	No. of cases.	Value.
Fall Chinook	6,700	.....
Silvers	12,900	.....
Comax.....	11,200	.....
Totals.....	30,800	\$119,200 00

FRESH, SALT AND SMOKED FISH SHIPPED AND CONSUMED LOCALLY.

	No. of pounds.	Value.
Salmon, fresh	1,022,000	.....
Salmon, salt and smoked.....	136,300	.....
Sturgeon.....	4,210	.....
All other kinds.....	16,700	.....
Totals.....	1,179,210	\$84,272 50

SHELL FISH OUTPUT.

	Output.	Value.
Clams.....	3,110 sacks.	.....
Crabs.....	460 boxes.	.....
Total.....		\$5,175 50

TOTAL VALUE OF OUTPUT FOR 1900.

Salmon packed.....	\$119,200 00
Fresh, salt and smoked fish.....	34,272 50
Shell fish	5,175 50
Total value.....	\$158,648 00

GENERAL SUMMARY OF THE FISHERIES INDUSTRY OF
THE STATE OF WASHINGTON FOR THE YEAR 1900—
CAPITAL AND LABOR EMPLOYED, EARNINGS OF LABOR
EMPLOYED, AND VALUE OF OUTPUT.

CAPITAL EMPLOYED.

Columbia River district.....	\$786,270 00
Puget Sound district.....	3,379,900 00
Willapa Harbor district.....	101,090 00
Grays Harbor district.....	95,210 00
Total	\$4,362,470 00

NUMBER OF PERSONS EMPLOYED.

Columbia River district.....	1,698
Puget Sound district.....	5,319
Willapa Harbor district.....	480
Grays Harbor district.....	297
Total.....	7,789

EARNINGS OF LABOR EMPLOYED.

Columbia River district.....	\$510,310 00
Puget Sound district.....	1,416,250 00
Willapa Harbor district.....	108,740 00
Grays Harbor district.....	91,185 00
Total.....	\$2,121,485 00

VALUE OF OUTPUT.

Columbia River district.....	\$891,514 00
Puget Sound district.....	3,105,221 00
Willapa Harbor district.....	202,370 00
Grays Harbor district.....	158,648 00
Total.....	\$4,357,753 00

NUMBER OF LICENSES ISSUED DURING YEAR ENDING
DECEMBER 31, 1900.

COLUMBIA RIVER POUND NETS.

5 Pound nets, first class, two pots, at \$40 each.....	\$200 00	
12 Pound nets, first class, at \$20 each	240 00	
321 Pound nets, second class, at \$10 each.....	3,210 00	
55 Pound nets, second class, two pots, at \$20 each.....	1,100 00	
		\$4,750 00

PUGET SOUND NETS.

449 Pound nets, at \$50 each.....	\$22,450 00	
5 Pound nets, two pots, at \$100 each.....	500 00	
		22,950 00

WILLAPA HARBOR POUND NETS.

93 Pound nets, at \$10 each	\$930 00	
		930 00

GRAYS HARBOR POUND NETS.

49 Pound nets, at \$10 each.....	\$490 00	
		490 00

Total pound nets \$29,120 00

COLUMBIA RIVER FISH WHEELS.

5 Wheels, first class, stationary, at \$25 each.....	\$125 00	
11 Wheels, second class, stationary, at \$10 each.....	110 00	
17 Scow wheels, at \$15 each.....	255 00	
		\$490 00

GILL NETS.

360 Gill nets, Columbia River, at \$2.50 each.....	\$900 00	
441 Gill nets, Puget Sound, at \$2.50 each.....	1,102 50	
11 Gill nets, Willapa Harbor, at \$2.50 each.....	27 50	
63 Gill nets, Grays Harbor, at \$2.50 each.....	157 50	
		2,187 50

SET NETS.

133 Set nets, Columbia River, at \$2.50 each.....	\$332 50	
344 Set nets, Puget Sound, at \$2.50 each.....	860 00	
71 Set nets, Willapa Harbor, at \$2.50 each	177 50	
93 Set nets, Grays Harbor, at \$2.50 each	232 50	
		1,602 50

COLUMBIA RIVER SEINES.

4 Seines, Columbia River, at \$2.50 each	\$10 00	
9 Seines, Columbia River, at \$5 each	45 00	
8 Seines, Columbia River, at \$10 each.....	80 00	
24 Seines, Columbia River, at \$15 each	360 00	
1 Seine, Columbia River, at \$20.....	20 00	
2 Seines, Columbia River, at \$25 each	50 00	
		565 00

PUGET SOUND SEINES.

53 Seines, Puget Sound, at \$2.50 each.....	\$132 50	
31 Seines, Puget Sound, at \$5 each	155 00	
23 Seines, Puget Sound, at \$10 each	280 00	
2 Seines, Puget Sound, at \$15 each	30 00	
1 Seine, Puget Sound, at \$20.....	20 00	
4 Seines, Puget Sound, at \$30 each.....	120 00	
6 Purse seines, Puget Sound, at \$50 each	300 00	
61 Purse seines, Puget Sound, at \$25 each	1,525 00	
		2,562 50

WILLAPA HARBOR SEINES.

1 Seine, Willapa Harbor, at \$5.....	\$5 00	
2 Seines, Willapa Harbor, at \$10 each.....	20 00	
1 Seine, Willapa Harbor, at \$15.....	15 00	
		\$40 00

GRAYS HARBOR SEINES.

5 Seines, Grays Harbor, at \$10 each.....	\$50 00	
		50 00
Total fishing gear license		\$36,617 50

INDIVIDUAL LICENSES.

657 Columbia River district, at \$1 each.....	\$657 00	
896 Puget Sound district, at \$1 each.....	896 00	
32 Willapa Harbor district, at \$1 each.....	32 00	
50 Grays Harbor district, at \$1 each.....	50 00	
		\$1,635 00

CANNERY LICENSES.

2 Columbia River district, at \$150 each.....	\$300 00	
3 Columbia River district, at \$200 each.....	600 00	
		900 00
1 Puget Sound district, at \$150.....	\$150 00	
3 Puget Sound district, at \$200 each.....	600 00	
5 Puget Sound district, at \$250 each.....	1,250 00	
2 Puget Sound district, at \$400 each.....	800 00	
4 Puget Sound district, at \$500 each.....	2,000 00	
1 Puget Sound district, at \$600.....	600 00	
1 Puget Sound district, at \$750.....	750 00	
2 Puget Sound district, at \$1,000 each.....	2,000 00	
		8,150 00
2 Willapa Harbor district, at \$100 each.....	\$200 00	
		200 00

REPORT OF FISH TAKEN IN POUND NETS AND WHEELS.

(At \$1 per thousand fish.)

Columbia River district, pound nets.....	\$49 95	
Columbia River district, wheels.....	30 82	
Puget Sound district, pound nets.....	1,783 66	
Willapa Harbor district, pound nets.....	9 24	
Grays Harbor district, pound nets.....	7 31	
		1,880 98

FRESH FISH DEALERS' LICENSES.

34 Puget Sound district, at \$2.50 each.....	\$85 00	
		85 00

FRESH FISH DEALERS' REPORT.

(At 30c. per ton in the round.)

Columbia River district.....	\$14 70	
Puget Sound district.....	194 66	
Willapa Harbor district.....	1 25	
Grays Harbor district.....	15 50	
		226 11

Total of all other licenses.....	\$18,077 09
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RECAPITULATION BY DISTRICTS.

Columbia River district.....	\$8,689 97
Puget Sound district.....	38,584 32
Willapa Harbor district.....	1,417 49
Grays Harbor district.....	1,002 81
Grand total, year 1900.....	\$49,694 59
Total fees for two years, all sources.....	\$93,939 53
Received from United States government, Baker Lake hatchery.....	6,100 00
Total.....	\$100,039 53

LICENSE PERMITS FOR DREDGING OYSTERS.

3 Puget Sound district, at \$2.50 each	\$7 50	
11 Willapa Harbor district, at \$2.50 each.....	27 50	
		\$35 00

APPROPRIATIONS FOR FISHERIES DEPARTMENT FOR TWO YEARS ENDING APRIL 1, 1901.

GENERAL FUND.

Fish Commissioner's salary	\$4,000 00
Deputies' salaries.....	1,500 00
Traveling and incidental expenses	1,500 00
Office rent.....	500 00
Traveling and incidental expenses of deputies.....	1,000 00
Deficiency expense of fish commission.....	500 00
Propagation of eastern oysters.....	7,500 00
Total.....	\$16,500 00

FISH HATCHERY FUND.

	Mainten- ance.	Construc- tion.	Improve- ments.
Deficiency February 1, 1899	\$2,000 00		
Kalama hatchery.....	6,000 00		\$1,500 00
Chinook hatchery.....	4,000 00		500 00
Chehalis hatchery.....	5,000 00		
Fish hatcheries, two years.....	47,750 00		
Wenatchee hatchery.....		\$3,000 00	2,000 00
Nooksack hatchery.....		3,000 00	2,000 00
Skokomish hatchery.....		3,000 00	2,000 00
Willapa hatchery.....		2,500 00	1,500 00
Wind River hatchery.....		1,500 00	1,000 00
Samish hatchery		1,500 00	
Little Spokane hatchery.....		2,000 00	
Snohomish hatchery		2,000 00	1,000 00
White River hatchery.....		2,000 00	
Methow hatchery.....		2,000 00	
Nesqually hatchery		2,000 00	
Colville hatchery.....		2,000 00	
Klickitat hatchery.....		2,000 00	
Stillaguamish hatchery.....		2,000 00	
Dungeness hatchery.....		2,000 00	
Skagit hatchery.....		2,000 00	
Totals.....	\$64,750 00	\$33,500 00	\$11,500 00

TOTAL APPROPRIATIONS FROM FISH HATCHERY FUND.

Maintenance.....	\$64,750 00
Construction.....	33,500 00
Improvements.....	11,500 00
Skokomish River fishway.....	400 00
Total.....	\$110,150 00

EXPENDITURES OF FISHERIES DEPARTMENT.

SALARY AND EXPENSES, FISH COMMISSIONER AND DEPUTIES, FOR TWO YEARS ENDING JANUARY 1, 1901.

NAME.	Office.	Salary.	Expenses.
A. C. Little	Fish commissioner	\$4,000 00	\$1,793 55
A. D. Boardman	Deputy commissioner	900 00	595 51
Stephen Butts	Deputy commissioner	400 00	183 43
E. C. McReavy	Deputy commissioner	200 00	266 50
J. A. Gale	Deputy commissioner	75 00	.....
Totals .....	.....	\$5,575 00	\$2,838 99
Office rent, two years ending January 1, 1901			\$560 00
Salary and expenses paid deputies by Commissioner, 1899			785 00
Salary and expenses paid deputies by Commissioner, 1900			820 00
Salaries of Commissioner and deputies, regular appropriation			5,575 00
Expenses of Commissioner and deputies, regular appropriation			2,838 99
Total expense commissioner's office			\$10,578 99

EXPENDITURES FROM EASTERN OYSTER EXPERIMENT FUND.

Prof. R. W. Doane and assistants, expenses	\$1,069 61
Labor	2,779 65
Lumber	682 63
Machinery	128 75
Pipe and fixtures	23 80
Steamer and boat service	108 00
Piling and driving same	224 13
Hardware	182 99
Furniture and fixtures	192 87
Expenses	1,009 15
Incidentals	16 45
Oysters	1,428 30
Freight	131 70
Total	\$7,978 03
Paid by Fish Commissioner of above	\$478 03

AMOUNT EXPENDED FOR CONSTRUCTION AND IMPROVEMENT OF
HATCHERIES—FROM APRIL 1, 1899, TO JANUARY 1, 1901.

	Construction fund.	Improvement fund.	*Maintenance fund.
Kalama hatchery		\$1,500 00	\$894 00
Chinook hatchery		500 00	
Chehalis hatchery			722 00
Wenatchee hatchery	\$3,000 00	1,999 51	1,727 00
Nooksack hatchery	3,000 00	1,988 29	1,136 00
Skokomish hatchery	3,000 00	2,000 00	283 40
Willapa hatchery	2,492 41	1,066 31	
Wind River hatchery	1,499 75	845 81	517 60
Samish hatchery	1,489 12		612 30
Little Spokane hatchery	2,000 00		314 10
Snohomish hatchery	1,991 44	1,000 00	803 20
White River hatchery	2,000 00		
Nesqually hatchery	2,000 00		
Methow hatchery	1,955 10		
Colville hatchery	1,659 44		
Klickitat hatchery	958 93		
Totals	\$27,046 19	\$10,899 92	\$7,009 60

Total expenditure from construction fund.....	\$27,046 19
Total expenditure from improvement fund.....	10,899 92
Total expenditure from maintenance fund.....	7,009 60
Total.....	\$44,955 71

AMOUNT EXPENDED FOR MAINTENANCE OF HATCHERIES—FROM DE-
CEMBER 20, 1898, TO JANUARY 1, 1901.

HATCHERIES.	From ap- propriation 1898-99.	From ap- propriation 1899.
Baker Lake.....	\$673 55	
Kalama.....	862 42	\$5,101 17
Chinook.....	431 05	3,672 01
Chehalis.....	426 88	4,251 90
Wenatchee.....		7,288 26
Nooksack.....		6,325 75
Skokomish.....		5,585 65
Willapa.....		3,095 64
Wind River.....		4,421 30
Samish.....		3,961 19
Little Spokane.....		2,090 31
Snohomish.....		3,230 09
White River.....		826 52
Nesqually.....		559 02
Methow.....		623 68
Totals.....	\$2,398 90	\$50,982 49

Total expenditure from hatchery fund for maintenance.....	\$53,376 39
Baker Lake, from April 1, 1899, to July 1, 1899, paid by commissioner.....	651 45
Total.....	\$54,027 84

UNEXPENDED BALANCES IN APPROPRIATIONS.

Fish Commissioner's salary fund.....	\$500 00
Fish Commissioner's traveling and incidental fund.....	95 00
Deputies' expense fund.....	27 46
Total general fund.....	\$623 40

BALANCE IN FISH HATCHERY FUNDS.

Maintenance hatcheries constructed 1899-1900.....	\$4,399 99
" Chehalis hatchery.....	26 10
" Chinook hatchery.....	327 99
" Kalama hatchery.....	4 83
Total maintenance.....	\$4,758 91
Construction Willapa hatchery.....	\$7 59
" Wind River hatchery.....	25
" Samish hatchery.....	10 88
" Snohomish hatchery.....	8 56
" Methow hatchery.....	44 90
" Colville hatchery.....	320 56
" Klickitat hatchery.....	1,041 07
" Stillaguamish hatchery.....	2,000 00
" Dungeness hatchery.....	2,000 00
" Skagit hatchery.....	2,000 00
Total construction.....	\$7,433 81
Improvements Wenatchee hatchery.....	49
" Nooksack hatchery.....	11 71
" Willapa hatchery.....	433 69
" Wind River hatchery.....	154 19
Total improvements.....	\$600 08

VALUATION OF PROPERTY CONTROLLED BY STATE
FISHERIES DEPARTMENT.

Kalama hatchery.....	\$5,000 00	.....
Kalama eyeing station.....	2,394 00	.....
Chinook hatchery.....	4,500 00	.....
Chehalis hatchery.....	5,500 00	.....
Wenatchee hatchery.....	6,700 00	.....
Nooksack hatchery.....	6,200 00	.....
Skokomish hatchery.....	5,500 00	.....
Skokomish eyeing station.....	350 00	.....
Willapa hatchery.....	3,500 00	.....
Wind River hatchery.....	3,000 00	.....
Samish hatchery.....	2,100 00	.....
Little Spokane hatchery.....	2,250 00	.....
Snohomish hatchery.....	4,000 00	.....
White River hatchery.....	2,000 00	.....
Nesqually hatchery.....	2,000 00	.....
Methow hatchery.....	2,000 00	.....
Colville hatchery.....	1,660 00	.....
Klickitat hatchery.....	960 00	.....
Total.....		\$59,614 00
Eastern oyster experiment station.....		4,525 00
Office furniture and fixtures.....		885 00
Total valuation.....		\$64,524 00

TABULATED STATEMENT OF OUTPUT OF WASHINGTON
STATE FISH HATCHERIES—FRY AND SPAWN ON HAND
AND FRY TURNED OUT—SEASON OF 1899-1900.

COLUMBIA RIVER DISTRICT.

Kalama River hatchery.....	5,512,000
Chinook River hatchery.....	1,415,000
Wenatchee River hatchery.....	7,810,000
Wind River hatchery.....	2,780,000
Little Spokane River hatchery (800,000 from Wenatchee).....	860,000
Total.....	17,827,000

PUGET SOUND DISTRICT.

Nooksack River hatchery.....	10,368,000
Skokomish River hatchery.....	8,082,000
Samish River hatchery.....	2,564,000
Total.....	20,964,000

GRAYS HARBOR DISTRICT.

Chehalis River hatchery (150,000 from Kalama).....	2,617,000
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WILLAPA HARBOR DISTRICT.

Willapa River hatchery (150,000 from Kalama).....	1,190,000
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TOTAL OUTPUT.

Columbia River district.....	17,827,000
Puget Sound district.....	20,964,000
Grays Harbor district.....	2,617,000
Willapa Harbor district.....	1,190,000
Total output.....	42,598,000

TABULATED STATEMENT OF OUTPUT OF WASHINGTON
STATE FISH HATCHERIES—FRY AND SPAWN ON HAND
AND FRY TURNED OUT—SEASON 1900-1901.

COLUMBIA RIVER DISTRICT.

Kalama River hatchery.....	5,890,000
Chinook River hatchery.....	1,715,000
Wenatchee River hatchery.....	6,025,000
Wind River hatchery.....	2,810,000
Little Spokane River hatchery.....	43,000
Methow River hatchery.....	152,500
Total.....	16,635,500

PUGET SOUND DISTRICT.

Nooksack River hatchery.....	12,501,000
Skokomish River hatchery.....	12,716,000
Samish River hatchery.....	3,164,000
Snohomish River hatchery.....	5,253,000
White River hatchery.....	1,712,000
Nesqually River hatchery.....	2,327,000
Total.....	37,673,000

GRAYS HARBOR DISTRICT.

Chehalis River hatchery.....	2,122,000
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WILLAPA HARBOR DISTRICT.

Willapa River hatchery.....	726,000
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TOTAL OUTPUT.

Columbia River district.....	16,635,500
Puget Sound district.....	37,673,000
Grays Harbor district.....	2,122,000
Willapa Harbor district.....	726,000
Total.....	57,156,500

TOTAL OUTPUT FOR TWO YEARS.

Season 1899-1900.....	42,598,000
Season 1900-1901.....	57,156,500
Total.....	99,754,500

FISH HATCHERY FUND BALANCES.

Unappropriated balance in fish hatchery fund January 1, 1901, 1899 appropriations for Dungeness and Skagit River hatcheries not being deducted..... \$6,887 56
 Estimated unappropriated balance fish hatchery fund April 1, 1901..... 16,500 00

ESTIMATE OF NECESSARY APPROPRIATIONS FOR MAINTENANCE AND IMPROVEMENTS OF STATE SALMON HATCHERIES—FROM APRIL 1, 1901, TO APRIL 1, 1903.

Kalama Hatchery—		
Maintenance, two years.....	\$6,000 00	
Improvements, two years.....		\$1,500 00
Chinook Hatchery—		
Maintenance, two years.....	4,000 00	
Improvements, two years.....		500 00
Chehalis Hatchery—		
Maintenance, two years.....	5,000 00	
Improvements, two years (eyeing station).....		1,500 00
Wenatchee Hatchery—		
Maintenance, two years.....	6,500 00	
Improvements, two years.....		1,000 00
Nooksack Hatchery—		
Maintenance, two years.....	6,500 00	
Improvements, two years.....		1,000 00
Skokomish Hatchery—		
Maintenance, two years.....	6,500 00	
Improvements, two years.....		1,000 00
Willapa Hatchery—		
Maintenance, two years.....	5,000 00	
Improvements, two years (eyeing station).....		1,500 00
Wind River Hatchery—		
Maintenance, two years.....	4,500 00	
Improvements, two years.....		1,000 00
Samish Hatchery—		
Maintenance, two years.....	3,000 00	
Improvements, two years.....		500 00
Little Spokane Hatchery—		
Maintenance, two years.....	2,500 00	
Snohomish Hatchery—		
Maintenance, two years.....	6,000 00	
Improvements, two years.....		750 00
White River Hatchery—		
Maintenance, two years.....	4,000 00	
Improvements, two years.....		1,000 00
Methow Hatchery—		
Maintenance, two years.....	4,000 00	
Improvements, two years.....		500 00
Nesqually Hatchery—		
Maintenance, two years.....	4,500 00	
Improvements, two years.....		1,000 00
Colville Hatchery—		
Maintenance, two years.....	2,500 00	
Klickitat Hatchery—		
Maintenance, two years.....	2,500 00	
Stillaguamish Hatchery—		
Maintenance, two years.....	4,000 00	
Totals.....	\$77,000 00	\$12,750 00
Total for maintenance and improvements.....		\$89,750 00

ARTIFICIAL PROPAGATION.

Rearing Ponds.

Among the many improvements and additions for our hatcheries, asked for in this report, the most important, in my estimation, is that means be provided for the construction of nurseries or rearing ponds at each of our stations. There has always been quite a diversity of opinion as to the propriety of keeping the young salmon beyond the period that they may be retained in our hatcheries without the expense of feeding, the rule having been to turn them out as soon as it was necessary to provide food for them.

In our report of 1898 we urged very strongly that means be provided for these ponds. The appropriation made for the different hatcheries has not been sufficient for their ordinary maintenance and leave a balance that could be used for the construction of these nurseries. The experiments of the past two seasons have more firmly grounded our belief of the necessity and benefit of these additions. At some of our stations we have, in a limited way, attempted to carry out these ideas and have found that the rearing of young salmon is a very simple matter provided that a sufficient amount of the right kind of food could be cheaply obtained. Some new experiments in this line have shown that the food for the young fish may be obtained at a cost that justifies the feeding of a large number of these young fish, and undoubtedly the results from our hatcheries will be much more satisfactory. In our statement of appropriations for new work, improvements and maintenance we have, in connection with each hatchery, asked that we be provided with a sufficient sum to build these ponds.

Under the head of the need of a permanent, scientific experimental station in connection with our fisheries department, may be found a number of reasons why the work of rearing the young salmon has not heretofore been carried on to a greater extent. It is a fact that at the present time it is not well known what would be the best food for the young fry, that is obtainable at a price

that warrants the feeding of a very large number of them. The work of this station would soon give us much desired information and without doubt furnish us with facts necessary to be known in order to obtain a desirable food that would be economical. The young fish kept in rearing ponds for two years have made a remarkable growth and are proof that the fish may be kept to advantage for a year after the time they are usually turned into the streams.

The Necessity of the Building of Fish Hatcheries by the States of Oregon and Washington on the Head Waters of the Snake River in Idaho.

It is a fact well demonstrated by our experience during the past three years that a very large proportion of the best Columbia River salmon, known as the royal chinook, running during the months of May and June, ascend to the head waters of the tributaries of the Snake River to deposit their spawn. Careful investigation of the rivers and streams tributary to the Columbia in both Washington and Oregon does not disclose a first-class location for the artificial propagation of this particular variety of salmon. More of these fish may be found spawning in the tributaries of the Clearwater and Salmon Rivers than may be found in all the rivers and streams tributary to the Columbia River in Washington and Oregon.

Again, a large portion of the fish ascending the Columbia above the Snake, spawn in the tributaries of the great river in British Columbia. Thousands of them passed over Kettle Falls during the past season. In very many of the streams tributary to the Columbia River below Kettle Falls very few fish were found during the past year.

In my judgment at least two hatcheries should be built on tributaries of the Snake River in Idaho—one each on the Clearwater and Salmon Rivers. Undoubtedly, hatcheries located on these streams would be very successful and would be able to propagate large numbers of the choicest of the Columbia River fish.

I have had considerable correspondence with the Oregon Fish Commissioner on this subject, and he heartily agrees with me that these hatcheries are necessary that the best results may be obtained from artificial propagation in the Columbia River district. We respectfully request special attention of the Legisla-

ture to this subject, believing that it is vital to the interests of the Columbia River fisheries.

Need of Hatcheries for the Propagation of Sockeye Salmon on the Frazer River.

As we stated in our report of 1898, a very large proportion of the best varieties of salmon obtained in the waters of Puget Sound are on their way to their natural spawning beds in the Frazer River. These breeding grounds are entirely in Canadian territory. From the best information at hand I am of the opinion that there is no stream tributary to the Frazer heading in American territory in which any considerable number of the sockeyes spawn. This being the case it is necessary that any work attempted in the line of the propagation of these valuable fish must be done in British Columbian territory.

Three years ago we entered into correspondence with the Inspector of Fisheries of British Columbia in regard to this matter and requested him to take the matter up with the Minister of Marine and Fisheries in Canada, with a view of getting concessions that would allow the United States government, or the State of Washington, to erect hatcheries in their territory to be operated by funds furnished either by the United States government or by our state. After a number of communications had passed between us, the Inspector informed me that at that time nothing could be accomplished. A short time afterwards we took the matter up with the Association of Cannerymen on the Frazer, requesting them that they obtain the concession necessary for the construction and operation of these plants, agreeing on our part to devise some means of furnishing the funds for the work. A number of the cannerymen and fishermen of our state signified their willingness by private subscription to aid in the enterprise. At one time it looked as though our scheme would materialize and we formulated a plan and submitted it to several of the leading cannerymen and fishermen for the raising of the funds necessary to make a start in the enterprise. Before anything material had been accomplished we were again informed by the Canadian people that at the present time it would be impossible to carry out their part of the agreement.

In connection with the above attempts to assist in the building of hatcheries for the restocking of the Frazer, it was neces-

sary for my department to investigate to a considerable degree different locations and conditions surrounding the same at many points on the Frazer River. There is no question but what excellent sites may be secured for a number of these hatcheries at a very small cost and that a very large number of these fish, at a comparatively small cost, may be annually turned into the Frazer River. That something should be done in this line is apparent to all engaged in the fishing industry on the lower Sound. Just how the work may be accomplished and the desired results obtained, at present writing we are unable to state, the matter being one which can only be handled through the different departments at Washington. In our judgement the United States government can better handle the proposition than can the state. However, if a small appropriation was made for the expense of properly investigating the matter and assisting the United States and Canadian authorities in the enterprise, I believe that much good could be accomplished. Certain it is that something should be done at once towards keeping up the supply of these excellent fish in American waters.

GENERAL REVIEW OF THE OPERATION AND OUTPUT OF THE
STATE FISH HATCHERIES FOR TWO YEARS
ENDING DECEMBER 31, 1900.

Kalama River Hatchery.

This hatchery, built six years ago, is situated about four miles north of Kalama on the Kalama River. The hatchery plant consists of a two-story building forty feet wide and one hundred feet long, the lower floor of which is used as the hatchery and the upper floor for the sleeping apartments of the employes and general storage purposes. The water supply is obtained from a small stream and is carried to the hatchery in a flume, which is about fifteen hundred feet long.

The Legislature of 1899 made an appropriation of \$1,500 for the purpose of making improvements at this station. It had been our intention to make some extensive repairs on the building and put in a new water system. After carefully considering the matter, I concluded that it would be a much better plan for this money to be used in the building of an eyeing station some

two and one-half miles further down the river. This was necessary on account of the spawning of a majority of the salmon at or near the location of our eyeing station. During several seasons when the run of salmon was short, only a limited number of spawn could be obtained, the hatchery being too far above the spawning grounds.

When the plan of building the eyeing station was decided upon, it was supposed that we should be able to put in a water wheel or some cheap appliance for elevating the water necessary to run the plant. After the building had been erected and a large amount of the expense incurred, and also after further investigation, it was deemed impracticable to use the water system at first designed. I was certain that the eyeing station would be the plant where a greater part of the work would be done on this stream, and therefore expended a larger sum in the erection of the same than our appropriations allowed. We were compelled to buy a steam pump, boiler and fixtures at a cost of some \$600 when in position to be operated. This extra expense and also a larger expense on the building cut into our maintenance funds to the extent that we are now out of money for the operation of this plant. If we had expended the \$1,500 appropriated for improvements in repairing the old building and putting in a new water system, it would have been impossible for us to obtain anything like the amount of spawn that has been obtained during the past two seasons.

During the season of 1899 the spawn taken at the eyeing station was shipped to the upper hatchery and there handled during the winter. When the time came for the spawn to be shipped to the upper plant during the season of 1900, my superintendent informed me that the underpinning of the building and the flume would need to be practically rebuilt in order that it might be safe to handle the large amount of spawn taken during the season. I finally concluded that the best plan to follow would be to attempt to handle our spawn at the eyeing station and ask the Legislature for an appropriation for improvements for the season of 1901. For this reason the upper plant has not been operated during the season of 1900. Quite a quantity of the supplies and internal apparatus was needed at the lower station, and these were removed to be used during the season.

In order that the eyeing station may be completed in a proper manner and fitted to do the work intended, improvements amounting to about \$500 are necessary. To put the upper building in shape for use it will require an entirely new water system and the building will need to be newly underpinned. This will cost about \$750. We also need about \$250 to build the rearing ponds at this station, and are compelled to ask the Legislature for an appropriation to continue the operation of the hatchery and pay some few bills already incurred, which will amount to a total of about \$1,000.

The output of the hatchery has been very satisfactory for the last two years, the present year being exceptionally large. The run of salmon of the character obtained at this station was not nearly as large during the season of 1900 as in many former years on the Columbia River in general. In the Kalama River, however, the run was the best ever known; and if we had been properly supplied with money to operate the plant to its fullest capacity, would in all probability have turned out nearly double the amount ever turned out of the hatchery before. There is no doubt but what this large run of fish is due to the hatchery work, as in no other stream tributary to the Columbia was there more than an ordinary run.

For detailed statement of expenditures for operation of this plant for two seasons past, and for output of same and appropriations requested for the coming two years, see tabulated statement.

Chinook River Hatchery.

The Chinook hatchery is built on Chinook Creek about one mile from the village of the same name; the season of 1900 being the fifth season that this plant has been operated. During the past two years a substantial dwelling house has been erected and quite a number of improvements made at this station. The output for the two seasons past has been very satisfactory.

For expenditures, output and necessary appropriations, see tabulated statement.

Chehalis River Hatchery.

This hatchery is situated on the Chehalis River about four miles above the city of Montesano; the season of 1900 being the third season that the same has been operated.

It was found during the season of 1898 that the water supply

was not sufficient to properly operate the hatchery if any considerable number of spawn were to be obtained. We were compelled, therefore, to take out the pipe that had been put in for that purpose and increase the size of the same, which was done at a cost of some \$700. This amount was paid from our maintenance funds, which were none too large, and leaves us short for the continuance of the operation of this plant to April 1st in about the above named sum.

The output of this plant for the past two seasons has been very satisfactory, and we believe that each year in the future we shall be able to improve the same.

We very much need in this district an eyeing station on the Humptulips River. This is very necessary for the complete success of the hatchery, and if it is built it will require an expenditure of about \$1,500.

For expenditures, output and necessary appropriations, see tabulated statement.

Hatcheries Authorized by Legislature of 1899.

In our report of 1898, we strongly advised the building of a considerable number of new salmon hatcheries, believing that the system of artificial propagation was the only salvation of the salmon industry. The Legislature of 1899 endorsed our ideas on this subject to the extent that the sum of \$44,000 was appropriated from the fish hatchery fund for the purpose of building sixteen new plants. Of this number, twelve have been completed and the thirteenth is now under construction and will be completed within the next sixty days. We also expect to have the fourteenth hatchery authorized completed before the time of the expiration of the appropriation for the same. Six of the above stations were completed and operated during the year 1899; the construction of two others was begun but they were not completed in time to be successfully operated. During the season of 1900 four additional stations have been built and the fifth is well under way. Three of the four built this season are in successful operation, the fourth not being completed in time for the run of salmon frequenting that stream. *

Wenatchee River Hatchery.

The first of the new hatcheries to be constructed was built on the Wenatchee River, a tributary of the Columbia River, about

one and one-half miles from the station of Chiwaukum on the Great Northern railway. This has proved to be an excellent location, and but for an unprecedented rise in the river during the latter part of October resulting in the destruction of the main rack on the river, this station would have made a remarkable showing for the past season.

The appropriation for this plant to be used during the two seasons was \$5,000. Owing to its isolated location and the extra cost of material and labor, the expense of constructing this hatchery was somewhat more than we had estimated. In my judgment, the ideal character of the location and its great success during the first year of its operation have warranted the extra expense which we were compelled to incur. In order to complete the work in a proper manner, it was necessary to exceed our appropriation somewhat, and this amount has been taken from our maintenance funds.

The season of 1899 was a very successful one; but for the unavoidable accident mentioned above, the plant during the year 1900 would have made an extraordinary showing.

In order that this plant may be a complete success, we advise that an appropriation be made for an eyeing station to be constructed lower down the river for the purpose of taking the earlier runs of the chinook salmon, quite a number of which spawn some fifteen or twenty miles below our hatchery site. Every point being considered, I deem this an ideal salmon hatchery location.

The buildings comprising this plant are as follows: The main hatchery building is 40x100 feet containing 110 hatchery troughs with a capacity of ten million fry annually; superintendent's dwelling, one and a half story building containing seven rooms 24x28; wood house and store room 20x30.

We have an excellent water system giving about 50 feet pressure and furnishing with the appliances we have on hand a very fair fire protection. This is undoubtedly one of the best equipped hatcheries on the Pacific coast.

Nooksack River Hatchery.

The second of the new hatcheries to be constructed was built on Kendall creek, a tributary of the Nooksack River, and about three hundred yards from the same. A site of about seven acres was purchased in the triangle formed by Kendall creek and the

Nooksack River. This has proved to be a remarkable location, the output of this hatchery being the largest of any new hatchery ever constructed on the Pacific coast.

The appropriation for this plant to be used for the two seasons was \$5,000. Being very successful in taking spawn at this plant, an extra expense was incurred, as it was absolutely necessary that we have more room and better accommodations for hatchery work and for the boarding and housing of our crew. This increased the cost of the plant materially, which was paid from the maintenance fund. Both seasons of 1899 and 1900 have been very successful at this station.

The buildings comprising the plant are as follows: Main hatchery building 40x100 feet, containing 110 hatchery troughs, with a capacity of 10,000,000 fry annually; two one and one-half story houses of six rooms each, both having a ground measurement of 26x30 feet; a substantial one-story wood house and store room 20x30 feet.

The water for hatchery use at this station is raised with two water wheels which have so far worked very satisfactorily. The excellent work of this hatchery may be greatly increased by the building of an eyeing station on the south fork of the Nooksack River. It is my opinion that we could get a larger number of the type salmon at this location than can be obtained at our present one. The building of this station would make our Nooksack plant one of the most successful and complete in the state, and we strongly advise the same. This is certainly one of our best plants.

Skokomish River Hatchery.

The third hatchery constructed during the season of 1899 was built about four miles from the mouth of the Skokomish River. The site consists of twenty-four acres of land purchased at a cost of \$500. A neat dwelling house was on the property when purchased.

The buildings comprising this plant are as follows: Main hatchery building 40x100 feet, containing 110 hatchery troughs with a capacity of 10,000,000 fry annually; a two-story wood-house and store room 20x30 feet, the upper rooms of which are used for sleeping quarters for the hatchery crew.

This station, also, as will be noted on examining the report of the hatchery output of the state for 1899 and 1900, shows a re-

markable output for a new plant. During the summer of 1899 an eyeing station was erected on the North Fork of the Skokomish River, at which were taken about 1,500,000 steelhead spawn. This station was erected in the cheapest manner; and, as will be noted in our estimates for improvements for the next two years, we ask an additional appropriation for the purpose of increasing the size and completing the plant. This is a most excellent hatchery location.

Willapa River Hatchery.

The fourth of the new hatcheries was built on Trap creek, a tributary of the Willapa River, and is situated about two hundred yards from the same. The appropriation for the construction of this hatchery for the past two seasons was \$4,000, a portion of which yet remains unexpended.

This hatchery station has not been as successful as we had hoped. For two seasons, the remarkably high water has seriously interfered with our fishing operations, and the amount of spawn taken has been very small. We have, however, from the past two years' experience gained the knowledge which we believe will in the future be of great benefit, and we hope that we shall be much more successful.

The buildings comprising this plant are as follows: Main hatchery building, 32x66 feet, containing 64 hatchery troughs and having a capacity of about 5,000,000 fry annually; superintendent's dwelling house, one-story and a half building, 24x28, containing six rooms; a one-story wood house and store room 18x24.

This plant is a very neat and complete one, and we sincerely hope that in the coming years it will be as successful as the others.

Wind River Hatchery.

The fifth of the new hatcheries was built on the south branch of the Wind River about one mile from the mouth. The appropriation for this plant was \$2,500 to be used during the two seasons. The location, however, was found to justify and demand a somewhat increased expenditure to take care of the spawn that could be easily obtained. It was found that a gravity system could not be constructed that would furnish the water necessary for the operation of this plant without a greater expense than was provided for in our appropriations. We therefore pur-

chased a pump and boiler which have been in operation for two seasons, giving very satisfactory results.

The output of this plant for the last two seasons may be greatly increased in the future by the addition of larger buildings and some considerable expense in removing from the spawning beds a number of obstructions.

The buildings comprising this plant are as follows: Main hatchery building, 40x60 feet, having a capacity of about 4,000,000 fry annually; superintendent's dwelling and boarding house (two-story building containing six rooms).

The output of this plant has been very satisfactory, as will be noted in our tabulated report. The plant needs a number of improvements, which we have provided for in our estimates for maintenance and improvements of hatcheries.

Samish River Hatchery.

The sixth of the new hatcheries was constructed on Friday creek, a tributary of the Samish River, and is situated about one mile from the mouth of the creek. The appropriation for the construction of this plant was \$1,500. It was found, however, that the location was an excellent one for a small plant and that the appropriation was insufficient to build and equip such buildings as were really necessary to properly handle the output easily obtained. A portion of the expense of the building and equipment was paid from the maintenance fund.

This is a very neat and complete plant, and the showing made during the past two seasons, in my judgment, has warranted the extra expense.

The buildings comprising this plant are as follows: Main hatchery building, 32x56, having a capacity of about 3,000,000 fry annually. (The present season's work has crowded this capacity to its utmost.) The superintendent's dwelling and boarding house is a story and a half building, 24x28 feet, containing seven rooms. We also have a substantial wood house and store room 18x24 feet.

This is one of the best of the smaller plants.

Little Spokane Hatchery.

The seventh of the new hatcheries provided for in the appropriations made by the legislature of 1899 was built on the Little Spokane River about ten miles from its mouth and about nine

miles north of the city of Spokane. This stream was formerly a very important spawning ground for the Columbia river salmon. The supply of fish, however, has been greatly diminished, and during the past season the catch at this station was almost a failure. The buildings were not completed in time for the hatchery to be operated to any extent during the season of 1899, very few spawn being taken for that reason. We, however, shipped an overplus from the Wenatchee hatchery, which were successfully liberated in the stream.

The past season's record has been a great disappointment to me, and from present knowledge I am inclined to believe that the plant can never be a very successful one for the reason that very few salmon reach the hatchery location. We may, however, obtain many more spawn this coming season than we have in the past two, as residents of the vicinity state that the run of salmon for the last two seasons has been remarkably short. In our examination of this location in 1898, we found a large number of salmon spawning in the stream and believed that the location would be an excellent one for a small plant.

If our suggestions are carried out in regard to naming the Little Spokane as a trout stream, in my judgment it would be a good plan to use this plant as a trout hatchery, it being admirably fitted for the same. We have one of the finest water systems at this plant, and the location is excellent for the purpose of building rearing ponds necessary in the artificial propagation of trout.

The buildings comprising the plant are as follows: The main hatchery building is 32x56, having a capacity of about 3,000,000 salmon fry annually; one story-and-a-half building, containing six rooms, for superintendent's dwelling and boarding house; a substantial wood house and store room having ground measurements of 18x24 feet.

This is the only plant of those constructed, the prospects of which are not bright for the future.

Snohomish River Hatchery.

The eighth of the new hatcheries was constructed on the west bank of the Skykomish River a few miles from its mouth. The construction work of this plant was begun in 1899, but was not completed in time for the hatchery to be operated during that season.

The output for this year has made an excellent showing for the first year's work, and I believe that the coming season will prove this location to be as good as any other in the state. It being such an admirable one, it was found necessary, in order to handle the spawn that was obtained, to increase the cost of construction in quite a considerable amount, which was paid from the maintenance fund. We believe that the showing made justifies this extra expense, as the appropriation for a plant of the size we have built was too small by at least \$2,000. The improvements necessary for this plant are shown in our tabulated statement.

The buildings comprising this station are as follows: Main hatchery building, 40x100 feet, having a capacity of about 10,000,000 fry annually; a story-and-a-half building, 24x30, containing seven rooms, for superintendent's dwelling house; a substantial wood house in connection.

The water system has not sufficient capacity for the amount of spawn now in the plant, and if the catch for the coming year exceeds the present will require some improvements.

White River Hatchery.

The ninth of the new hatcheries was constructed on Soos creek, which empties into a tributary of the White River, the location being about two and one-half miles from where the Green River joins the White River. The appropriation for this plant was \$2,000, which has been entirely expended. The record of the past season's work at this hatchery proves that the location is an excellent one, and we request that an additional sum be allowed for improvements for the coming year.

The buildings comprising this plant are as follows: Main building, 30x52 feet, one end of which is used for the mess house of the hatchery crew; a substantial wood house and store room in connection.

We expect that this will prove to be one of our best locations.

Nesqually River Hatchery.

The tenth of the new hatcheries was built on Muck creek about one-half mile from the Nesqually River. The appropriation for this plant was \$2,000, which has been entirely expended. The record of the season's work shows this to be one of our best hatchery locations, the catch being remarkable for so small a crew and plant.

The buildings comprising the station are a hatchery building, 30x56 feet, with a capacity of 3,000,000 fry annually, one end of which is used for the mess house of the crew; a substantial wood house in connection.

We shall certainly be justified in doubling the capacity of this plant for another year, as we might easily have taken six to eight million spawn during the past season. The additional appropriations required may be noted in our tabulated estimates.

Methow River Hatchery.

The eleventh of the new hatcheries was built about twenty-two miles from the Columbia river, on the Methow river, at the point where it is joined by the Twisp. This is undoubtedly an excellent location, and would without question have been very successful this season, if we had not been seriously interfered with by the Indians, who constructed a fish trap entirely across the Methow but a short distance from its mouth. This obstructed the ascent of the fish to our hatchery location to the extent that but few spawn were obtained. We finally prevailed upon the Indians to remove their obstruction, but it was found to be too late to be of much benefit to our hatchery.

We sincerely hope that the Legislature will provide some means by which we can prevent the placing of obstructions of this character on any of our hatchery streams.

The buildings comprising this plant are as follows: Main hatchery building, 30x56 feet, having a capacity of about 3,000,000 fry annually, one end of the building being used for the living rooms of the hatchery crew; a substantial wood house in connection.

This plant is well equipped and very complete, and we believe that the coming season will show that it is one of the best of our smaller stations.

Colville River Hatchery.

The twelfth of the new hatcheries has been constructed on the north bank of the Colville River, about one and one-half miles from its mouth. This station was not finished in time to be operated during the past season. I believe that this will prove to be one of the best locations that we have on the Columbia River, where the early run of the Chinook salmon may be obtained. A large number of these fish spawned in the stream below the hatchery location this season. The location is an ex-

cellent one in all other respects, our water system and the opportunity for the building of rearing ponds being of the very best.

The buildings comprising the plant are as follows: Main hatchery building, 30x56 feet, with a capacity of about 3,000,000 fry annually; a substantial wood house, 16x20 feet.

It is believed that we can obtain a considerable number of steelheads at this station. The plant is fully equipped, and operations will be begun as soon as the fish begin to run.

Klickitat River Hatchery.

The thirteenth of the new hatcheries is now under construction. This station is located on the east bank of the Klickitat River, about six miles from its mouth. The plant, when completed, will consist of a main hatchery building, 30x52 feet, with the necessary outbuildings. I have every reason to believe that this will prove to be a most excellent location.

Stillaguamish River Hatchery.

We have also secured a location for the Stillaguamish hatchery, and the same will be erected within the next sixty days. This location will undoubtedly be one of our very best, as this stream has a large run of the best quality of salmon.

Hatchery Apparatus.

We have on hand a full equipment for all of the above hatcheries, consisting of hatchery trays, stoves and general fixtures.

My Assistants.

The great amount of work accomplished by our department during the past two years has been largely the result of the hearty co-operation and able assistance of my efficient deputies, hatchery superintendents and other employes. I believe that my corps of employes are as industrious and capable as can be found in any state department, and the record we have made in the construction and operation of our hatchery plants is without parallel in the United States.

If the Legislature will provide us with the proper appropriations and assistance, we believe that the coming two years will show a remarkable increase over the last two years in the labor performed and results accomplished.

Skokomish River Fishway.

The Legislature of 1899 appropriated \$400 for the purpose of building a fishway over the falls of the north fork of the Skokomish River. As soon as the appropriation was available, we entered into negotiations with Mr. J. W. Dow, of Hoodspout, for the construction of the fishway. A contract was finally made with him for this work, and in addition to the work we succeeded in obtaining a right-of-way over the land owned by Mr. Dow and associates, and a small plot of the same to be used for an eyeing station in connection with the Skokomish hatchery. The work was completed according to contract and will, in my judgment, prove to be a great benefit to the steelhead salmon which frequent this branch of the Skokomish River in considerable numbers. The eyeing station site was also a valuable part of the consideration. The full amount of the appropriation was expended in the construction of the fishway and procuring the eyeing station site.

REPORT OF GAME WARDEN.

The Legislature two years ago, at my suggestion, enacted a law making the Fish Commissioner *ex officio* Game Warden. When the suggestion was made that the Fish Commissioner be made State Game Warden, I believed that an appropriation would be made, at least, for expenses in the collecting of data on which to base a proper report of the game and game preserves of the state, and also that an additional sum would be furnished for his use, in a limited amount at least, for the purpose of superintending the enforcement of the law. This appropriation was not made, and it has been impossible, with the increasing duties and responsibilities of the Fish Commissioner's office, to do anything substantial in the line of my original suggestions in the 1898 report.

I, however, offer the following report and argument in favor of better laws and appropriations for the purpose of the protection and preservation of the game, believing that sufficient interest has been aroused on the subject by the many rod and gun clubs organized in the state that more satisfactory legislation may be had on the subject and the proper funds provided for the right enforcement of the law.

If we had been provided with sufficient assistance in our fisheries department so that a limited portion of our time could have been used in the furtherance of the interests of game protection, we would certainly have had a more comprehensive and authoritative report on the subject; but, as I stated above, it has been impossible for me to do more than to carefully investigate what is being done in other states and to make the following recommendations and suggestions:

STATE DEPUTY GAME WARDEN.

From every part of the state during the last two years has come the demand for the State Game Warden to enforce the game laws. The Legislature, in making the Fish Commissioner *ex officio* Game Warden, did not contemplate that it would be a

part of his duty to enforce the law, as they made no provision for expenses, and therefore it has been impossible for us to do anything in this line. The need of some official whose especial duty it shall be to see that these laws are enforced is apparent to all. We have on our statutes laws the equal of any state in the Union, but under the present conditions they amount to absolutely nothing. No attempt is made on the part of any of the county officials of the state to enforce the game laws, and nothing is done.

The state of Oregon has provided for a state game warden on salary, whose sole duty it is to look after this branch of the state's business. We believe that this work can be better accomplished in conjunction with the fisheries department of the state for the following reasons :

If our department was provided with a deputy at a reasonable salary, who would be required to put in his full time in the enforcement of the game laws of the state, and who could work in harmony with the deputy fish commissioners, he could be of material assistance in enforcing the fisheries law; and on the other hand, our deputy fish commissioners could, within certain limits, look after the enforcement of the game laws.

The work required of a deputy game warden would be largely in isolated and out-of-the-way districts rarely requiring the attention of the deputy fish commissioners. The deputy game warden could easily do the work necessary for the protection of the fish in these districts, and our deputy fish commissioners could look after the enforcement of the game laws in their respective districts to that extent that between the three the law would be well and properly enforced, whereas if only one person had this work in hand it could not be so well done and would also require greater expense.

Salary and Expenses of Deputy Game Warden.

I believe that a salary of one hundred dollars (\$100) per month is a reasonable one for the deputy game warden, and that he should have at least seven hundred and fifty dollars (\$750) per year of a traveling expense fund. This money should be appropriated from the general fund of the state, as the state in general will receive material benefits from the enforcement of the game law and, in my judgment, can well afford this small

portion of the expense for the enforcement of the general game laws.

We would also advise that the law providing for the system of county game wardens be repealed and that the State Game Warden be allowed to appoint deputy county game wardens, who shall be paid from a system of license fees and fines to be obtained under a law based on the following regulations:

First, That every resident of the state, of the age of sixteen years or over, hunting and killing wild game in the state, of any kind or character, except wildcats, cougars, wolves and coyotes, etc., shall pay an annual license fee of \$1.

Second, That every non-resident hunting and killing wild game in the state shall pay an annual license fee of \$10.

Third, That for each and every deer killed by a resident, or non-resident, he shall pay to the state a fee of \$1.

Fourth, For each and every elk killed by a resident, or non-resident, he shall pay to the state a fee of \$5.

Fifth, Every person, firm or corporation engaged in the business of buying and selling wild game shall pay a license fee of \$5 per annum.

Sixth, The above fees shall be paid to the State Game Warden, and shall be by him turned over on the 10th of every month to the State Treasurer, seventy-five per cent. of the same to be placed in a fund to be known as the "Fish and Game Protection Fund," and twenty-five per cent. to be used for propagation and distribution purposes. All fines collected in the enforcement of the game law to go into the Fish and Game Protection Fund.

There are other fees that should be paid by people hunting and dealing in game, but the above outlined plan indicates the source from which we expect to obtain sufficient funds for the payment of the salary of the county game wardens.

The state of Michigan has a game law of a similar character, and the fees derived therefrom are employed to pay the expenses of the enforcement of the game law. Michigan collected in the year 1898, \$7,891.50 in fees from a law based on similar regulations as stated above. They also collected something over \$6,000 in fines and costs under the enforcement of the game law, which were applied to the same purpose.

The states of Wisconsin and Minnesota have the same regulations with regard to licenses as Michigan, the latter state collecting in the year 1898 over \$18,000 from this source.

The salary of the county game wardens should be a stated per diem for the actual time employed in the enforcement of the game laws, and in addition thereto he should receive his actual traveling expenses. Parties appointed to the position of county game warden would also be expected to assist in the enforcement of the fisheries laws.

Providing Means for the Propagation of Game Birds and Animals by the Fish and Game Department of the State.

We believe that twenty-five per cent. of the fees collected from the sportsmen and hunters of the state as a result of the regulations mentioned above should be used for the purpose of propagation of game birds and animals and the distribution of the same in localities where game has to any great extent been exhausted.

This work can be carried on in connection with our state fish hatcheries at a very small expense and would be of material benefit to our fisheries department, in that it would provide for a small portion of the expense of these establishments at times when only a small amount of work is being done in connection with the fisheries. As we stated in other portions of this report, the work of properly caring for the game of the state is necessarily a part of the work to be done by this department, and being handled in conjunction with the same can be done at a much less expense and in a much more satisfactory manner.

Fish and Game Protection Fund.

On other portions of this report we ask that a fund be established to be known as the "Fish and Game Protection Fund," and that certain license fees and all fines collected in the enforcement of the law in regard to game and fish be placed therein to be appropriated for the enforcement of the game and fisheries law of the state. We believe that a considerable fund can be collected from these sources and it should be appropriated for the payment of deputy county fish commissioners and game wardens.

The game is the property of the state, and the parties receiving the benefit of the same should be compelled to pay the larger amount of the expense of its protection.

In this connection, we respectfully call your attention to another portion of this report dealing with new regulations in regard to trout and other food fish of the state which will undoubtedly furnish considerable revenue, which should be used for the payment of the salary and expenses of the county deputy fish commissioners and game wardens.

Limiting the Amount of Game to be Killed in Any One Day or Season.

It has been the experience of the older states, which for many years have had presented to them the problems of the better enforcement of the game laws, that to limit by law the number of game birds and animals that may be taken in a single day or during the open season in any one year, has been one of the most effective means for the preservation of the game and the enforcement of the law. By this means the game hog and pot hunter are compelled to desist from their ruthless slaughter, the average hunter thereby having some opportunity for successful results from his hunting excursion.

While our laws have some regulations of this character, we believe that it would be advisable to extend the same, limiting still farther the number of birds that may be taken in a single day, and the number of animals that may be taken in any one open season. A bill will be prepared, covering amendments to the present game law on this line, and presented to the Legislature, which we sincerely hope will receive their endorsement.

Hunting Deer With Dogs.

I earnestly recommend that the law allowing the use of dogs in hunting deer be repealed. The effect of this plan of hunting is to drive other kinds of game as well as deer entirely out of certain districts, and should not be allowed under any circumstances. Quite frequently complaints come to us of parties killing spotted fawn in this manner. If deer cannot be obtained without using dogs, they should not be allowed, as in a locality where they are so scarce and hard to get none should be taken.

Sale of Game.

Very many complaints are made against the present law in regard to the sale of game. Average citizens believe that they should have a right to purchase game killed legally, and I recommend that the present law be changed, so that during the open seasons

when game may be legally taken, it may be sold by dealers who shall pay a license for the privilege of dealing in game products.

By licensing the dealers we not only will meet the requirements of those who wish to purchase game, but will also have a check on those killing the same, and thereby be better able to enforce the law. If the law can be strictly enforced, there is no reason for preventing the sale of game legally taken.

THE RIGHT OF THE STATE TO LEGISLATE IN REGARD TO GAME.

Very many people with whom we have discussed the advisability of certain laws and restrictions in regard to the killing and shipping of game, have expressed themselves as being doubtful as to the constitutionality of the statutes proposed to be enacted.

To meet these objections and once for all settle the matter of the right of the state to legislate as they deem proper for the protection of game, we call your attention to the following statement in this respect, prepared by the United States Department of Agriculture and found on pages 45-6 of a bulletin issued by them recently, being a digest of the laws regulating the transportation and sale of game :

The last forty years have witnessed a steady development in laws relating to game. In 1864 only eighteen states and the District of Columbia had enacted such legislation; in 1874 this number had increased to twenty-four, and at the present time every state and territory has restrictive measures of some sort on its statute books. The earlier laws were concerned chiefly with fixing seasons and methods of capture, but of late, markets have come to be regarded as the chief factor in game destruction and more attention has been given to the restriction of export and sale. The importance of the question of transportation has become so great as to receive attention from congress, and during the present year a federal law has been enacted which prohibits inter-state commerce in game killed in violation of local laws.

Not only have the regulations concerning capture, transportation and sale, increased in number and complexity, but there is a growing tendency toward uniformity in the different state statutes, and various principles are gradually receiving more general recognition. Prominent among these is the principle of state ownership of game, which has been stated as follows:

"The wild game within a state belongs to the people in their collective sovereign capacity. It is not the subject of private ownership except in so far as the people may elect to make it so, and they may, if they see fit, absolutely prohibit the taking of it, or traffic and commerce in it, if it is deemed necessary for the protection or preservation of the public good."*

This principle, as thus defined by the supreme court of California, has been upheld by the supreme court of Minnesota and by the supreme court of the United States. It forms the foundation of all modern legislation affecting trade in game. Every state and territory in the Union, except Georgia, Kentucky, Louisiana, Mississippi, Missouri, Nebraska, and Virginia, deems it "necessary for the protection or preservation of the public good" to prohibit traffic and commerce in game to a greater or lesser extent. And two of the excepted States, Missouri and Nebraska, have until recently, had laws of this kind.

It is important to note that not only is the killing of game a privilege and not a right, but that the ownership of game differs from that of other property in that even after it has been reduced to possession it is subject to certain restrictions. On this principle are based the non-export laws now in force in forty states; the Massachusetts statute,† which prohibits sale during close seasons of game artificially propagated upon private lands, in spite of the fact that such game is declared by the law to be the exclusive property of the person propagating it, and also the statutes of Illinois,‡ Minnesota,§ and Wisconsin,|| which declare that possession of fish or game by any person at any time, whether taken within or without the state, shall be deemed a consent of such person that the title shall remain in the state for the purpose of regulating the use and disposition of such fish or game. The qualified character of private ownership of game is thus asserted by the supreme court of the United States:

"The power of a state to protect by adequate police regulation its policy against the adulteration of articles of food, * * * although in doing so commerce might be remotely affected, necessarily carries with it the existence of a like power to preserve a food supply which belongs in common to all the people of the state, which can only become the subject of ownership in a qualified way, and which can never be the object of commerce except with the consent of the state and subject to the conditions which it may deem best to impose for the public good."¶

Matters connected with the killing of game, as regulated by game laws, may be grouped under three heads: (1) Manner of capture, (2)

* *Ex parte Maier*, 103 Cal., 476.

† Acts of 1884, chap. 308.

‡ Laws of 1899, p. 227, sec. 11.

§ Gen. Laws of 1897, chap. 221, sec. 9.

|| Laws of 1899, chap. 312, sec. 26.

¶ *Geer vs. Conn.*, 161 U. S., 585.

time of capture, and (3) object of capture. * Under the first head may be included prohibitions against pursuing deer with hounds, netting quail, killing birds before sunrise or after sunset, killing wild fowl with swivel guns or pursuing them with steam or naphtha launches, and like regulations which are so common and so similar in their restrictions that a detailed statement by states is unnecessary. Under the second head comes close seasons, absolute protection (as in the case of insectivorous birds), protection for terms of years, and regulations against killing birds on certain days of the week. The statutes covering these points are so varied and are subject to such frequent change that no attempt has been made to compile them, but the regulations now in force are summarized and tabulated on pp. 18-29. The most important provisions under the third head are those which make it unlawful to kill big game for hides, or to capture or kill any game for sale, or for shipping beyond the limits of the county or state. These are the topics which properly come within the scope of this bulletin, and the sections which relate to them are quoted in full. For laws protecting birds other than game birds, see Bulletin No. 12 of the Biological Survey, United States Department of Agriculture.

This statement from United States authorities is sufficient, in my judgment, to meet any objection that may arise as to the constitutionality of any of the laws we have recommended.

In this connection, we also call attention to sections 3, 4 and 5 of an act of congress passed May 25, 1900, commonly known as the Lacey act, which relates to the sale and transportation of game.

AN ACT to enlarge the powers of the Department of Agriculture, prohibit the transportation by inter-state commerce of game killed in violation of local laws, and for other purposes.

SEC. 3. That it shall be unlawful for any person or persons to deliver to any common carrier, or for any common carrier to transport from one state or territory to another state or territory, or from the District of Columbia or Alaska to any state or territory, or from any state or territory to the District of Columbia or Alaska, any foreign animals or birds the importation of which is prohibited† or the dead bodies or parts thereof of any wild animals or birds, where such animals or birds have been killed in violation of the laws of the state, territory, or district in which the same were killed: *Provided*, That nothing herein shall prevent the transportation of any dead birds or animals killed dur-

* In some of the states certain facts are declared to constitute *prima facie* evidence of violation of law. Among these may be mentioned possession of game without license in Colorado, or out of season in Illinois, Iowa, Kansas, Maryland (most counties), Michigan, Minnesota, Montana, New Hampshire, New Mexico, New York, Oklahoma, Oregon, Texas, Utah, and Washington; and receipt of game for shipment in Connecticut, Maine, (unless properly tagged), Ohio, South Dakota, Vermont, West Virginia, and Wisconsin.

† Mongoose, flying fox, English sparrow and starling.

ing the season when the same may be lawfully captured, and the export of which is not prohibited by law in the state, territory, or district in which the same are killed.

SEC. 4. That all packages containing such dead animals, birds, or parts thereof, when shipped by inter-state commerce, as provided in section one of this act, shall be plainly and clearly marked, so that the name and address of the shipper and the nature of the contents may be readily ascertained on inspection of the outside of such packages. For each evasion or violation of this act the shipper shall, upon conviction, pay a fine of not exceeding two hundred dollars; and the consignee knowingly receiving such articles so shipped and transported in violation of this act shall, upon conviction, pay a fine of not exceeding two hundred dollars; and the carrier knowingly carrying or transporting the same shall, upon conviction, pay a fine of not exceeding two hundred dollars.

SEC. 5. That all dead bodies, or parts thereof, of any foreign game animals, or game or song birds, the importation of which is prohibited, or the dead bodies, or parts thereof, of any wild game animals, or game or song birds transported into any state or territory, or remaining therein for use, consumption, sale, or storage therein, shall upon arrival in such state or territory be subject to the operation and effect of the laws of such state or territory enacted in the exercise of its police powers, to the same extent and in the same manner as though such animals and birds had been produced in such state or territory, and shall not be exempt therefrom by reason of being introduced therein in original packages or otherwise. This act shall not prevent the importation, transportation, or sale of birds or bird plumage manufactured from the feathers of barnyard fowl.

Approved May 25, 1900.

From the above sections of the U. S. Statutes it will be seen that the right of the state to legislate is clearly recognized, and that congress has done all in their power to facilitate and assist in the enforcement of the game laws of the different states, prohibiting as they do traffic on game unlawfully killed, etc.

Many people seriously object to our plan of licensing sportsmen. This plan has been tried by many states, and in almost every one of them worked satisfactorily. The people, after once understanding that the fees they pay are for the better enforcement of the laws, and also for the re-stocking of certain localities where the game has been practically exhausted, pay their money without any objection, and are heartily in favor of such laws.

We would again call your attention to the following statement in regard to the different states which have adopted this plan, also prepared by the Department of Agriculture, and found on pages 42 and 43 of the above mentioned bulletin :

Licensing for Hunting or Shipping Game.

In some sections of the United States, notably in Missouri, the privilege of hunting is not extended to non-residents, and in fifteen states licenses must be secured before non-residents may hunt certain game, or may hunt at all. In several of the latter, a like restriction is imposed on residents, but the fees are usually very much smaller (often merely nominal) in the case of the citizens of the state. Thus in North Dakota and Michigan the fee for residents is 75 cents, while that for non-residents is \$25. In Minnesota, 25 cents and \$25 are the respective charges for licenses to shoot big game. In Wyoming the same distinction is observed in the issue of "gun licenses" for hunting big game, residents being charged a fee of \$1, and required to secure licenses only for shooting in counties other than those in which they reside, while non-residents pay \$40 for the privilege of hunting anywhere within the state. Minnesota has a special license with a fee of \$25 for non-residents from states that issue non-resident licenses; these states are shown in the table following. Licenses are generally given only for the season, and many of them are not transferable. In five states, Florida, Illinois, Iowa, Maryland and West Virginia, they are good only in a single county, and the fees for these county licenses vary from \$5 to \$25. In Maryland there is such variation, as each county is subject to a separate law; Allegany, Anne Arundelx, Calvert, Frederick, Montgomery, Washington, Wicomico and Worcester counties have no license laws. In some states licenses are required only for hunting certain kinds of game. Thus, in Michigan they are issued only for the hunting of deer, in Maine for deer and moose, and in Florida for deer, quail and turkeys. In part of Dare county, N. C., license fees of \$25 are required of club-houses before members may shoot wild fowl. * In Illinois, Iowa, Maine and Wisconsin, licenses carry with them the privilege of shipping out of the state a limited amount of game, but generally require that it shall be properly marked, or accompanied by the owner. In Maine, dealers are obliged to secure licenses before they can sell deer, or buy, sell, or tan deer skins. California, Colorado, and Oregon issue special permits upon application, allowing shipment of game out of the state for breeding purposes, but in Oregon this permit is issued only on certification that the birds were bred in confinement. It might be well if the practice of issuing permits in the case of birds intended for propagation were more general. It is not in conflict with the spirit of non-export laws, and under state supervision will hardly interfere with their proper enforcement, while, on the other hand, it may materially assist in obtaining a supply of birds for re-stocking covers in other states.

It seems to me that this statement should satisfy the most prejudiced as to the advisability of this class of legislation. Having been tried and found to work well in other states, there is no reason that the same should not be very satisfactory in a

* But any citizen of the county may obtain a "non-residence license" on payment of \$10. (Too local for insertion in table of license.)

state like our own. A young and growing state, such as the State of Washington now is, has innumerable demands on its state funds for purposes of this character. It is impossible to meet these requirements as they could be met in older and more wealthy states. If, however, the people neglect to enforce their laws, and they cannot be enforced without sufficient money to pay for the work, long before the state will be able in point of taxable property and wealth the game will have been destroyed, and legislation in these later years, even with the appropriation of large sums of money, cannot accomplish anything like what a small amount of money can do at the present time.

The old rule of an ounce of prevention being worth a pound of cure applies in this case. More than that, in our opinion, those who receive the major part of the benefits should not object to footing the bills. I believe that the scheme above outlined, and sustained as it is by the best judgment of states which have had legislation of this kind for many years on their statute books, is the best possible means for the preservation and increase of the wild game of this state.

THE ADVISABILITY OF PROPERLY PROTECTING THE GAME
AND GAME FISH OF THE STATE, FROM A PURELY
BUSINESS STANDPOINT.

In our investigations during the last two years on the subject of game and game fish, very frequently we have found good citizens who strongly object to the state paying out any considerable amount of money from the general fund for the purpose of enforcing the game and game fish laws. It is urged by these people that only a small portion of the citizens of the state receive any direct benefits. Opposition of this character is based almost solely from a lack of information on the subject.

No state in the Union has such a large area of natural game preserves as has the State of Washington. Again, a considerable portion of this area is easy of access and close to transportation. The great United States forestry reserves in the state form a considerable portion of this area. These reserves are

under the direct control of forestry superintendents, who have expressed themselves as willing to materially assist the state if proper legislation can be had, and the state thereby showing some desire that the game and game fish be protected.

There has been within the last few years an ever-increasing influx of visitors to this state, attracted by the wonderful scenery and the superior hunting privileges found within this state. The number of tourists will undoubtedly increase to a remarkable extent within the next few years, as the beauties of the Washington scenery are being advertised by all our transportation lines and, in my judgment, the time is not far distant when no state in the Union will attract more attention in this line than will our own. During the past season one company of these people expended over \$2,500 visiting the different points of interest in the state and paying the expenses of numerous hunting trips made by the party. Another instance coming to our notice was that of three gentlemen from the east spending \$750 for supplies, for the payment of guides and transportation during a hunting trip over the Olympic mountains. In conversation with these gentlemen, they informed me that they should certainly recommend Washington to their friends in the east as presenting more points of interest to the tourist than any other like territory in the United States. Nothing attracts these people to our state more than a good supply of game and fish. The state of Maine receives annually many millions of dollars from this source and the inducements to their territory are inconsiderable compared with ours, with the exception that for several years past they have appropriated large amounts of money to properly protect their game and re-stock localities where the same had been exhausted. I do not believe it is possible for the State of Washington to expend the small sum of money asked for to accomplish this purpose in any other manner so beneficial to the interests of the state. The transportation companies, hotels and restaurants, as well as a large number of guides will receive direct benefits in no inconsiderable amounts, and these benefits accruing to these people are directly beneficial to all classes of trade. It is not necessary to make any argument on this line to a large majority of our citizens, as the benefits so accruing are so general that they readily indorse the recom-

mendations made in another portion of this report for the better protection and preservation of our fish and game.

All the above statements hold equally true in regard to the proper stocking of the different trout streams of the state with trout. The statement will be unquestioned by those well posted with the facts that if the streams of the state are well stocked with the best qualities of eastern brook trout and properly cared for, so that these fish would be allowed to increase, the value of this work from a purely commercial standpoint would amount to many thousands of dollars of benefit annually. The best varieties of eastern brook trout at two years old are a remarkably fine game fish, of good size, and are most excellent as a food fish. Small streams may be made to produce many thousands of these fish every year. No one can question but that this work would be of great benefit to the people in general, as well as furnishing a great amount of amusement and healthful recreation. From a purely dollar and cents standpoint a reasonable amount of money appropriated for this purpose will be an excellent business investment.

Game Statistics.

We had expected to be able to furnish reliable statistics as to the amount of game taken in the last two years. It has been utterly impossible to obtain anything like reliable data from which to compile a report of this character, not having any funds to pay the expense of collecting the same.

Undoubtedly the facts in regard to the amount of game killed in this state would be very interesting, as it is a well-known fact that a large amount of game has been taken in the two years past. If our recommendations are carried out we shall undoubtedly be able to furnish reliable statistics of this character each year in the future, and these statistics will undoubtedly be of value in convincing the people that they have made no mistake in the laws enacted and the plan pursued for the better protection and increase of the game. The facts at hand are so meagre that they do not warrant any attempt to give reliable data on this subject.

State Trout Hatcheries.

One serious source of trouble in regulating the fish industries of the state has been the opposition presented by the two classes

of fishermen who receive benefits from the state fisheries. The commercial fishing interests seriously and rightfully object to the increase of trout in the salmon streams. The different varieties of fresh water trout that inhabit these streams as well as those of the anadronous variety are responsible to a very great degree for the diminishing number of salmon. Naturally the commercial fishermen are very much opposed to any increase of fish which are a menace to their business. It is admitted by all concerned that the trout are such. On the other hand, the sportsmen and game fishermen take but little interest in the salmon industry, and are much more interested in the increase and preservation of their particular kind of fish. It is a fact that the two interests cannot be harmonized on the same stream.

We therefore offer the suggestion that certain streams in the state be designated as trout streams, the run of salmon being very much decreased in the same and the expense of re-stocking the streams would be considerable and not practicable as long as there are so many streams where large numbers of this class of fish may be obtained and hatcheries operated in which an immense number of fry may be produced annually at a comparatively small cost. If this suggestion is carried out, it will be wise for the legislature, as stated above, to designate certain streams in the state which shall be known as trout or game fish streams, and these should be stocked with the best varieties of trout and other game fish. In this manner the two conflicting fishing interests in the state may be harmonized and the friction which has heretofore had a tendency to block legislation for the benefit of both branches of the industry will be done away with and united action taken on the part of all engaged in the fishing industry of the state to perfect our laws in the best possible manner, re-stock our streams and increase our output.

If the above ideas shall be enacted into laws we should have at least three trout or game fish hatcheries in the state, erected on streams designated as game fish streams, and from which other streams in the state, designated as above, might be restocked.

As the commercial fishermen, through a system of license fees, support their particular branch of the industry and have created a large hatchery fund, from which the numerous hatcheries of

the state are maintained; in a like manner we believe that the sportsmen and game fishermen of the state should bear the expense of re-stocking and keeping up the supply of their particular class of fish. I believe that the proper manner to raise the fund for the support of these trout hatcheries is for each trout or game fisherman to pay a reasonable license fee for the right of fishing for trout in any of the streams of the state. The money to be placed in what shall be known as the trout and game fish hatchery fund. Also, that all dealers in the state handling trout shall pay a license fee, which shall be placed in the same fund. In this manner, in a short time, sufficient money may be obtained to operate two or three trout hatcheries, from which the supply of trout may be obtained to properly stock the different streams in the state. In connection with this matter we would suggest that the law also prohibit the taking of more than fifty trout in any one day from any of the streams designated as trout or game fish streams. Also, that it shall be unlawful for any person to take any fish from these streams of less than five inches in length, and when the same are caught they shall immediately be returned to the stream uninjured. Frequently reports come to us of a person having caught one hundred, or one hundred and fifty fish, and in some instances more than that number, in a single day. This is certainly an extravagant waste and should be stopped.

If the above suggestions are enacted into law and carried out we believe that the trout streams of the state can soon be restocked with the choicest varieties of this fish, resulting in a considerable addition to the food supply as well as furnishing amusement and recreation for a large number of our citizens.

Private Hatcheries.

During the last two years several private fish hatcheries, largely for the artificial propagation and raising of trout, have been established in the state. The proprietors of these establishments are laboring under great difficulties on account of the laws controlling the sale and disposition of trout. We recommend that a law be passed allowing persons or corporations engaged in this business the right to sell their trout at any time under proper regulations that will protect the fish in the streams under the control of the state.

A bill has been drafted which meets the approval of parties engaged in this industry, and provides that any hatchery of this character established must receive the approval of the fish commissioner as to location and other points; also, that the disposition and sale of any of the output of such hatcheries shall be under the supervision of the commissioner; and that each hatchery shall pay a license fee into the state treasury for the purpose of paying the expense of this superintendence. It also provides that dealers who handle the output of these establishments shall pay a license fee and make quarterly reports. This will undoubtedly protect the state's interests and the additional expense to our department of the superintendency of the same will be met by the license fee.

We believe that considerable sums of money will be invested in the future in this business, and that it will be a material and profitable addition to our state's industries.

Closed Season for Trout.

In many respects the present law providing a closed season for trout fails to give the desired results. On Lake Chelan undoubtedly the closed season will be best from May 1st to June 15th. It has been impossible for us to properly investigate this matter, for the reasons stated in another portion of this report, and we do not feel that we are competent to advise the Legislature at this time. We hope, however, that, given proper assistance in the next two years, this subject can be properly investigated, and we hope to formulate legislation that will meet the requirements. We would, however, suggest that the law be changed making the closed season on Lake Chelan, and in one or two other localities, from May 1st to June 15th, instead of as under the present law.