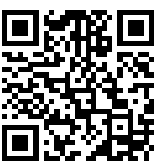
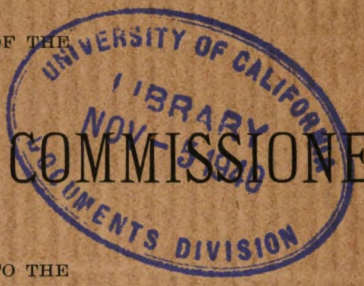


STATE OF WASHINGTON.

NINTH ANNUAL REPORT

OF THE

STATE FISH COMMISSIONER



TO THE

GOVERNOR OF THE STATE OF WASHINGTON.

A. C. LITTLE, Commissioner,
Tacoma.

1898.

OLYMPIA, WASH.:
GWIN HICKS, . . . STATE PRINTER.
1898.

STATE OF WASHINGTON.

Dept. of fisheries and game

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TACOMA, WASH, December 20, 1898.

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

SIR—In accordance with the provisions of the statute, I have the honor to submit herewith the Ninth Annual Report of the Department of Fisheries for the year ending December 20, 1898.

Respectfully submitted, A. C. LITTLE.

Fish Commissioner.

REPORT OF FISH COMMISSIONER.

DELAY ON REPORTS.

On account of a number of the firms engaged in the fishing industry not furnishing me with their reports, I have been greatly delayed, and am now unable to make as complete a report as should be made upon the fishing industry, as it exists today. The law says all persons who are interested in any way with the packing and disposal of fish, shall make an annual report to the fish commissioner, but it does not provide any penalty for disobeying the law. This should be remedied by the legislature. It is but little work for the individual to fill out the blanks, which my office furnishes to anyone connected in any way with the industry. When the people once appreciate the good results to be derived from a knowledge of the condition existing in all parts of the state in this industry, there will be but little hesitation manifested in sending out these reports. They will be a source of encouragement to some who, it may be, are not meeting with the success they should.

EXPENSE FUNDS.

The work of this department during the past season has been seriously crippled for want of necessary expense funds. Since the first of May last, we have had no funds that could be used for the collection of licenses, or for the enforcement of the law, and as a result we are compelled to report a considerable loss in our license fees, and also that violations of the law could not be prosecuted.

The legislature of 1897 increased the work of this department fully one thousand per cent. and the appropriation for expenses was lowered twenty-five per cent. The small amount of this appropriation and the large increase in the work, has made it impossible for much necessary work to be done. An amount fully as large as the total expense appropriation for this department in 1897, should have been expended in the investigation of

the different streams of the state, with a view of determining the cause of the decreased run of fish, and also for the best locations for hatchery stations.

From our experience during the past season, we are satisfied that it will be impossible to do the work necessary in the line of the collection of license fees, and the enforcement of the law without at least twice the amount of the last appropriation for this purpose. If our hatchery work is increased it will undoubtedly require more labor and more expense funds. The loss noted this year in license fees should be sufficient to warrant proper appropriations for this purpose.

INCREASED INTEREST IN FISHING INDUSTRY.

During the last two years there has been a remarkable increase in the interest manifested by the citizens of the state in the fishing industry, especially is this true of those directly interested. With almost one accord we find the fishermen, cannerymen, and all parties engaged in the industry, favorable to any reasonable proposition which is for the betterment and furtherance of this great industry. A great many persons, who even one year ago, knew very little of the scheme of artificial propogation, have investigated the matter, and are to-day the strongest adherents and supporters of this means for keeping up, and the rebuilding of the great salmon industry of the state. This expansion of thought means much good to the industry, for with broadened views on the subject will come broader and wiser legislation.

The season of 1898 shows a considerable falling off in the output of the fisheries of this state. This decrease in output has varied in the different fishing districts of the state, and for that reason we shall speak of them separately.

Columbia River District.

The shortage in the Columbia river district of the salmon pack is not far from ten per cent. of that of 1897. The output from the Columbia river district fisheries taken as a whole is not materially less than for the season of 1897, but the Washington side of the river shows a greater falling off in proportion than that shown by the whole district including both states. The season has been a disappointment to a large portion of the pound-net fishermen of Baker's Bay and adjacent localities.

One of the principal canneries of this district, situated at

Ilwaco, was burned, after a considerable part of their annual pack had been made, and necessitated their leasing and operating a plant on the Astoria side, for the balance of the season. In our tabulated report of the output of this district we have included the entire output of this firm. The cannery is being rebuilt, and will be operated the coming season with its old time energy.

Extensive cold storage plants have in the last few years been erected and operated on the Oregon side of the river, the output from which forms a very important part of the total product of the Columbia river district. This undoubtedly has kept up the price of fish during the last two years, and without a doubt in the future will handle and form a very important part of the total product of the Columbia river fisheries.

We have met with no serious trouble in this district during the last two seasons, and believe that a better feeling exists between the different classes of fishermen than ever before, but we shall in our future work attempt to bring closer together the different interests of this district, and believe that the good feeling now existing will continue. Radically opposed ideas as to the best method of fishing and the class of gear to be used to best further the interests of this great fishing district, have led to serious trouble in the past, and while a great amount of opposition is met with from certain sources on the same old lines, the opinion is general, and all parties interested have agreed, that the main proposition now before those engaged in the fishing industry, is that the system of artificial propagation already well inaugurated by the United States Fish Commission and our own state, should be extended as far as possible, and thereby supply the decrease of the salmon on their natural spawning beds, caused by the enormous annual catch and other destructive influences.

The above purpose being foremost in the minds of all parties interested in this industry, we have in our work during the last year and three months endeavored to, as far as possible with our limited expense funds, find the best localities wherein hatcheries might be established for the best furtherance of this scheme of artificial propagation. The result of our investigations on certain lines will be found in another part of this report. We have determined beyond all doubt that there are three excellent loca-

tions for hatcheries on the upper river, and one on the lower river yet unoccupied. The hatchery locations above noted on the upper river are situated on the following streams, namely, the Wenatchee, Methow and Little Spokane rivers. The best unoccupied location on the lower river, from our present knowledge, is that on the Wind river in Skamania county.

We understand that it is the intention of the Oregon commission, if sufficient appropriations are obtained, to establish three hatcheries, also in the Columbia district. If my recommendations, and that of the Oregon commission are carried out, there will then be operated some ten or twelve hatcheries tributary to the Columbia river, which if operated to their full capacity would yield an annual output of about 75,000,000 fry. This, in my judgment, is the least number that can be liberated annually in this district, and the returns hoped for realized; that is, the insrease of the present run of salmon to that of the runs of ten or twelve years ago. During the past season, partially owing to the lack of funds, but largely due to the fact that the laws of the states were not concurrent with regard to license fees, we have been unable to collect a great number of gill net licenses in this district. Undoubtedly our hatchery fund has lost, in this district, at least $500.00 from this and other sources, directly due to the above cause, the lack of concurrent legislation. The special session of the Oregon legislature, which convened in September of this past year, remedied this in a very large degree. There are, however, several points that still need the attention of the legislatures of the two states, and in this connection, I would advise that the legislature of each state be asked to appoint a committee for the especial purpose of satisfactorily arranging the differences existing in the laws governing the fisheries industry in this district. That the law should conform in many respects is very necessary for the proper enforcement of the same. Some of the laws enacted by the late Oregon legislature are excellent, and in another portion of this report we speak of them in detail, and advise their enactment into the laws of this state.

For the statistical output of this district, see tabulated report on page 14.

Puget Sound District.

The report from the district of Puget Sound, shows a still more marked decrease in the output in the salmon fisheries than

does that of the Columbia river. The enormous run of Fraser river salmon during the season of 1897, increased the annual output of this district to a remarkable degree. Stimulated by this great run of fish, several new canneries have been built this season, and in fact, the capacity of the canneries of the sound was nearly doubled.

The season has been one of disappointment to many of these cannerymen. While a few of the new firms have done well, considering the short supply, the majority have failed to realize their expectations, and many of the plants operated in 1897, show a remarkable falling off in output.

As we have stated in another portion of this report, the run of other classes of salmon for the season of 1897, with the exception of the Fraser river fish, was not materially larger than in former years. The decrease in the output of the past season is entirely in the early runs of salmon. The fall varieties show an increased catch over the year 1897. The increased fall output was largely due to the shortage of the spring catch, and energetic work on the part of the fishermen and canneries to make up for the spring shortage, by a large pack of the fall varieties.

The shell fish output of this district shows a great increase over that of 1897, bringing up the total output for the district to not far from that of last season. The needs of this district in the line of keeping up the source of supply through a system of artificial propagation are discussed in another portion of this report. In our judgement it is absolutely necessary that at least five new hatcheries be put in operation in this district immediately, if the supply of salmon of the past few years be kept up, and this important part of the fisheries industry be not allowed to decline.

A small hatchery has been established in this district by private parties interested in the fishing industry, near Samish lake in Whatcom county, a description of which will be found in connection with the hatcheries of the state in another portion of this report. I believe that work of this character demonstrates fully that the fishing industry is alive to its needs, and is willing to support any reasonable proposition for the permanence of this industry. I think it very advisable that this station be operated in future from the state hatchery funds, and the private interests be relieved of the burden. In doing this we have in view the object of encouraging this class of work. The location is a good

one for at least three varieties of salmon, and a good sized station can be operated successfully.

The locations that we advise for the new hatcheries spoken of above are situated on the Nooksack, Snohomish, Skokomish, White and the Nisqually rivers. Excellent locations on all of the above streams have been investigated by me personally during the past year. If my recommendations in this matter are carried out we will have seven (7) hatcheries tributary to the Puget Sound district, which in my judgment are none too many if the old time supply of salmon is to be maintained.

The shell fish industry of Puget Sound district, shows a marked increase in the ouput for this season. The extensive natural beds in this district in times past have not been properly protected. We advise that laws that will cover necessities in connection with this industry be modified giving the fish commissioner and the oyster commissioners of the different counties more authority and provide better means for the protection of beds against star fish and other natural enemies of the oyster.

The output of shrimp for this district shows considerable increase and bids fair in time to come to be a valuable addition to the fisheries of the state. The output of the crab fishing industry also shows an increase, and as with the shrimp, bids fair to soon become an important part of the fisheries.

For a tabulated report of the output of this district, see page 12.

Willapa District.

The past season has been a fairly successful one in the Willapa harbor district. The supply of fish while not materially larger than that of 1897, has brought better prices, aud while the pack has not been increased, a larger amount than ever before has been shipped by the fresh fish dealers to the eastern markets, and to canneries operated in other portions of this state and Oregon.

As we have stated in another portion of this report, this district shows a considerable decrease in the number of salmon reaching their natural spawning grounds, and we advise that a hatchery at once be established on one of the principal tributaries of this harbor.

The shell fish output of this district is not materially different from that of the season of 1897. In connection with this indus-

try, we wish to state that some of the natural oyster beds are being seriously depleted, which in time to come will certainly decrease the annual output of this district unless better protected. We have already made some moves in this direction, and shall advise that better laws with regard to this matter be enacted that will properly protect these beds.

The output of shell-fish from this district, consisting of crabs and clams is not materially larger than for the year 1897.

For a tabulated report of the output of this district, see page 17.

Gray's Harbor District.

The season just closed has been a very successful one for the Gray's Harbor district. The run of fish is the largest that has visited this district for the last three seasons, and while the catch is not up to what it has been some seasons in the past, better prices have have prevailed than for some years. The increase in price is largely due to the shortage noted in the two large fishing districts of the state, the Columbia river and Puget Sound. But one cannery was operated in this district during the past season, the pack being about the same as for the season of 1897. The large increase in the amount of fish handled by the fresh market and also the large amount salted, increases the totals from this district to a considerable degree. This district, as with the others already noted, shows a great decrease in the amount of salmon reaching their natural spawning beds. As stated in another portion of this report, the legislature of 1897, provided for the establishment of an artificial propagation station on the Chehalis river, which will undoubtedly in the next few years show grand results in keeping up the salmon supply.

The output of shell-fish from this district, consisting of clams and crabs, is not materially larger than for the year 1897.

For a tabulated report of the output of this district, see page 15.

TABULATED REPORT OF FISHING INDUSTRY, PUGET SOUND DISTRICT, YEAR ENDING DECEMBER 20, 1898.

CANNERIES AND FISHING APPLIANCES OPERATED.

	No.	Value.
Canneries	18	$358,500 00
Capital	.....	743,200 00
Pound nets	150	368,000 00
Purse seines	40	29,500 00
Seines, other	59	15,500 00
Gill nets	271	45,230 00
Set nets	435	13,050 00
Steamboats	38	110,000 00
All other appliances	.....	87,000 00
Total	.....	$1,769,980 00

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

NUMBER OF MEN EMPLOYED IN FISHING INDUSTRY.

HOW EMPLOYED.	No.	Average Annual Earnings	Total.
In canneries	1,400	$200 00	$280,000 00
With pound nets	700	200 00	140,000 00
With purse seines	250	230 00	57,500 00
With seines, other	140	240 00	33,600 00
With gill nets	542	260 00	140,920 00
With set nets	220	200 00	44,000 00
Oysters	195	250 00	48,750 00
Clams and mussels	45	200 00	9,000 00
Crabs	18	300 00	5,400 00
Shrimps	6	500 00	3,000 00
Totals	3,516	.....	$762,170 00

TOTAL SALMON PACKED.

SALMON.	Number of cases.	Value.
Sock-eye	252,000	.....
Chinook (Tyee)	11,200	.....
Silver	98,600	.....
Comax	38,400	.....
Total	400,200	$1,600,800 00

FRESH, SALT AND SMOKED FISH SHIPPED AND CONSUMED LOCALLY.

VARIETY.	No. of pounds.	Value.
Salmon, fresh	8,530,000	
Salmon, salt	2,820,000	
Salmon, smoked	744,000	
Sturgeon, fresh	62,000	
Smelt, fresh	1,213,000	
Smelt, salt	234,000	
Halibut, fresh	2,840,000	
Halibut, smoked	87,000	
Cod, fresh	227,000	
Soles, fresh	26,000	
Flounders, fresh	33,000	
Mackerel, fresh	14,500	
Trout, all kinds, fresh	32,600	
Herring, smoked and fresh	273,000	
Carp, fresh	2,200	
Shad, fresh	11,700	
Catfish, fresh	7,400	
All other kinds, fresh	26,200	
Total	17,183,600	$456,575 00

In addition to the above, 130,000 fish, valued at $1,650.00, were shipped to British Columbia canneries.

NOTE.— The term "cod" includes ling, rock, tom and black cod.

SHELL FISH OUTPUT.

VARIETY.	Output.	Value.
Oysters from natural beds	3,000 sacks	$6,000 00
Oysters from cultivated beds	23,500 sacks	58,750 00
Clams	16,000 sacks	16,000 00
Mussels	400 sacks	400 00
Crabs	11,400 dozen	6,840 00
Shrimps	67,500 pounds	4,050 00
Total		$92,040 00

The cultivated oyster beds in this district comprise 835 acres.

TOTAL VALUE OF OUTPUT FOR 1898.

Salmon packed	$1,600,800 00
Fresh, salt and smoked fish	472,825 00
Shell fish	92,040 00
Total value	$2,175,265 00

TABULATED REPORT OF THE FISHING INDUSTRY, COLUMBIA RIVER DISTRICT, FOR YEAR ENDING DECEMBER 20, 1898. (STATE OF WASHINGTON SIDE.)

CANNERIES AND FISHING APPLIANCES OPERATED, NUMBER AND VALUE OF SAME.

	No.	Value.
Canneries	9	$145,000 00
Capital		240,000 00
Pound nets	374	267,000 00
Seines	18	10,800 00
Wheels	31	34,500 00
Gill nets	210	33,600 00
Boats	230	23,000 00
Set nets	208	6,280 00
Steamboats	26	48,500 00
Pile drivers, scows and boats	178	44,500 00
All other appliances		12,500 00
Total		$865,680 00

NOTE.—The term "canneries" includes shore property, machinery, etc.; the term "steamboats" includes launches, etc.

NUMBER OF MEN EMPLOYED IN FISH INDUSTRY AND ANNUAL EARNINGS.

	No.	Average annual earnings.	Total.
In canneries	570	$205 00	$116,850 00
With pound nets	485	230 00	111,550 00
With seines	112	230 00	25,760 00
With wheels	78	270 00	21,060 00
With gill nets	420	230 00	96,600 00
With set nets	110	200 00	22,000 00
Totals	1,775		$393,820 00

SALMON PACKED.

	No. of cases.	Value.
Chinook	78,450	
Blue back	15,645	
Silver	8,750	
Steel heads	8,680	
Totals	111,525	$473,981 25

FRESH, SALT AND SMOKED FISH SHIPPED AND CONSUMED LOCALLY.

	No. of pounds.	Value.
Salmon, fresh	3,680,000	
Salmon, salted and smoked	319,000	
Smelt, fresh and salted	287,000	
Trout, all kinds	26,000	
Sturgeon, fresh	139,000	
Shad	227,000	
Cod, all kinds	36,000	
Cat fish	19,000	
All other kinds	29,000	
Totals	4,762,000	$164,895 00

VALUE OF OUTPUT FOR 1898.

Salmon packed	$473,981 25
Fresh, salt and smoked fish	164,895 00
Total value	$638,876 25

TABULATED REPORT OF FISHING INDUSTRY, GRAY'S HARBOR DISTRICT, FOR YEAR ENDING DECEMBER 20, 1898.

CANNERIES AND FISHING APPLIANCES OPERATED.

	No.	Value.
Canneries	2	$19,000 00
Capital		20,000 00
Gill nets	44	5,720 00
Set nets	78	2,340 00
Boats	112	8,960 00
Steamboats, launches, etc		3,200 00
All other appliances		1,900 00
Total		$61,120 00

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

MEN EMPLOYED IN FISH INDUSTRY.

	No.	Average annual earnings.	Value.
Canneries	65	$200 00	$13,000 00
Gill nets	88	230 00	20,240 00
Set nets	43	200 00	8,600 00
Clams and crabs	16	230 00	3,680 00
Total	212		$45,520 00

SALMON PACKED.

	No. of cases.	Value.
Fall Chinook	5,100	.....
Silver	4,800	.....
Comax	2,200	.....
Total	12,100	$43,560 00

FRESH, SALT AND SMOKED FISH SHIPPED AND CONSUMED LOCALLY.

	No. of pounds.	Value.
Salmon, fresh	1,753,500	$34,070 00
Salmon, salt and smoked	144,500	7,225 00
Sturgeon	9,200	460 00
All other kinds	13,400	201 00
Total	1,920,600	$41,956 00

SHELL FISH OUTPUT.

	Output.	Value.
Clams	2,700 sacks	$2,700 00
Crabs	1,130 boxes	2,825 00
Total	.....	$5,525 00

TOTAL VALUE OF OUTPUT, 1898.

Salmon packed	$43,560 00
Fresh, Salted and smoked	41,956 00
Shell fish	5,525 00
Total	$91,041 00

TABULATED REPORT OF FISHING INDUSTRY, WILLAPA HARBOR DISTRICT, FOR YEAR ENDING DEC. 20, 1898.

CANNERIES AND FISHING APPLIANCES OPERATED—NUMBER AND VALUE OF SAME.

	No.	Value.
Canneries	2	$21,000 00
Capital	.....	30,000 00
Pound nets	25	11,250 00
Gill nets	27	2,970 00
Set nets	47	1,410 00
Boats	72	5,040 00
Launches	3	3,600 00
Pile drivers and scows	13	2,700 00
Total	.....	$77,970 00

MEN EMPLOYED IN FISHING INDUSTRY.

HOW EMPLOYED.	No.	Average annual earnings.	Value.
With canneries	115	$200 00	$23,000 00
With pound nets	45	230 00	10,350 00
With gill nets	54	200 00	10,800 00
With set nets	23	200 00	4,600 00
With oysters	300	260 00	78,000 00
With clams and crabs	13	200 00	2,600 00
Totals	550	.....	$129,350 00

SALMON PACKED.

SALMON.	No. of cases.	Value.
Fall Chinook	5,865	.....
Silver	9,809	.....
Comax	5,746	.....
Total	21,420	$77,112 00

FRESH, SALT AND SMOKED FISH SHIPPED AND CONSUMED LOCALLY.

VARIETY.	No of pounds.	Value.
Salmon, fresh	517,000	.....
Salmon, salt and smoked	33,000	.....
Sturgeon, white	2,700	.....
Sturgeon, green	6,300	.....
All other kinds	12,200	.....
Totals	571,400	$12,324 00

SHELL FISH OUTPUT.

VARIETY.	Output.	Value.
Oysters	46,500 sacks.	$93,000 00
Clams	2,100 sacks.	2,100 00
Crabs	830 boxes.	2,075 00
Total		$97,175 00

The cultivated oyster beds of this district comprise 2,200 acres.

TOTAL VALUE OF OUTPUT FOR 1898.

Salmon packed	$77,112 00
Fresh, salt and smoked fish	12,324 00
Shell fish	97,175 00
Total value	$186,611 00

GRAND TOTAL OUTPUT OF FISHERIES, STATE OF WASHINGTON, 1898.

PUGET SOUND DISTRICT.

	Output.	Value.
Salmon packed	400,200 cases.	$1,600,800 00
Fresh, salt and smoked fish	17,183,600 pounds.	456,575 00
Fish shipped to British Columbia	130,000 pounds.	16,250 00
Shell fish		92,040 00
Total		$2,175,265 00

COLUMBIA RIVER DISTRICT, WASHINGTON SIDE.

	Output.	Value.
Salmon packed	111,525 cases.	$473,981 25
Fresh, salt and smoked fish	4,762,000 pounds.	164,895 00
Total		$638,876 25

GRAY'S HARBOR DISTRICT.

	Output.	Value.
Salmon packed	12,100 cases.	$43,560 00
Fresh, salt and smoked fish	1,920,000 pounds.	41,956 00
Shell fish		5,525 00
Total		$91,041 00

WILLAPA HARBOR DISTRICT.

	Output.	Value.
Salmon packed	21,420 cases.	$77,112 00
Fresh, salt and smoked fish	571,400 pounds.	12,324 00
Shell fish		97,175 00
Total		$186,611 00

Total value for the state **$3,082,193.25**

STATE FISH HATCHERIES.

NAME AND VALUE OF HATCHERIES.

Kalama	$5,600 00
Chinook	4,200 00
Baker Lake	6,400 00
Chehalis	5,000 00
Total	$21,200 00

IMPROVEMENTS ON HATCHERIES, 1898.

Kalama	$100 00
Chinook	650 00
Baker Lake	200 00
Chehalis	.....
Total	$950 00

CONSTRUCTION OF HATCHERIES, 1898.

Chehalis	$1,184 77

AMOUNT EXPENDED IN MAINTENANCE OF HATCHERIES, 1898.

Kalama	$2,738 58
Chinook	1,796 55
Baker Lake	3,310 14
Chehalis	2,100 88
Total	$9,946 15

CONSTRUCTION OF FISH-WAYS.

Total	$534 47

OUTPUT OF FISH HATCHERIES, SPAWN ON HAND AND FRY TURNED OUT, YEAR 1898.

Kalama	6,500,000
Chinook	1,400,000
Baker Lake	7,500,000
Chehalis	1,600,000
Total	17,000,000

NUMBER OF LICENSES ISSUED FOR FISHING DURING THE YEAR ENDING DECEMBER 20, 1898.

No.		
157	Pound nets, Puget Sound district, at $25 each	$3,925 00
390	Pound nets, Columbia river district, at $15 each	5,850 00
25	Pound nets, Willapa Harbor, at $10 each	250 00
572		$10,025 00

273	Gill nets, Puget Sound district, at $2.50 each	$682 50
87	Gill nets, Columbia river district, at $2.50 each	217 50
35	Gill nets, Grays Harbor district, at $2.50 each	87 50
7	Gill nets, Willapa Harbor district, at $2.50 each	17 50
402		$1,005 00
435	Set nets, Puget Sound district, at $1 each	$435 00
208	Set nets, Columbia river district, at $1 each	208 00
74	Set nets, Grays Harbor district, at $1 each	74 00
27	Set nets, Willapa Harbor district, at $1 each	27 00
744		$744 00
40	Seines, Puget Sound district, at $25 each	$1,000 00
3	Seines, Puget Sound district, at $15 each	45 00
9	Seines, Puget Sound district, at $10 each	90 00
48	Seines, Puget Sound district, at $2.50 each	120 00
100		$1,255 00
9	Seines, Columbia river district, at $15 each	$135 00
3	Seines, Columbia river district, at $10 each	30 00
6	Seines, Columbia river district, at $2,50 each	15 00
18		$180 00
19	Scow wheels, Columbia river district, at $15 each	$285 00
7	First class wheels, Columbia river district, at $25 each	175 00
4	Second class wheels, Columbia river district, at $15 each	60 00
30		$520 00
6	Canneries, Puget Sound district, at $50 each	$300 00
1	Cannery, Puget Sound district, at $60	60 00
2	Canneries, Puget Sound district, at $75 each	150 00
4	Canneries, Puget Sound district, at $100 each	400 00
6	Canneries, Columbia river district, at $50 each	300 00
1	Cannery, Columbia river district, at $60	60 00
1	Cannery, Gray's Harbor district, at $50	50 00
2	Canneries, Willapa harbor district, at $50 each	100 00
23		$1,420 00

LICENSES ISSUED, 1898.

572	Pound nets	$10,025 00
402	Gill nets	1,005 00
744	Set nets	744 00
118	Seines	1,435 00
30	Wheels	520 00
23	Canneries	1,420 00
	Total	$15,149 00

SALARY AND EXPENSES, FISH COMMISSIONER AND DEPUTIES, DECEMBER 1, 1897, TO DECEMBER 1, 1898.

SALARY FUND, TRAVELING AND INCIDENTAL EXPENSE FUND.

NAME.	Office.	Salary.	Expenses.
A. C. Little	Commissioner	$2,000 00	$222 73
Stephen Butts	Deputy commissioner	200 00	11 10
J. A. Gale	Deputy commissioner	112 50	47 35
A. D. Boardman	Deputy commissioner	310 00	24 95
Total		$2,622 50	$305 13

STATE HATCHERIES.

ESTIMATES FOR MAINTENANCE AND IMPROVEMENTS, HATCHERIES NOW IN OPERATION, TWO YEARS, APRIL 1, 1899, TO APRIL 1, 1901.

LOCATION.	Maintenance, annually.	Improvements and repairs.
Kalama	$3,000 00	$800 00
Chinook	2,500 00	400 00
Baker Lake	4,000 00	1,000 00
Chehalis	2,500 00	
Total for one year	$12,000 00	$2,200 00
Total maintenance for two years		24,200 00
Total maintenance and improvements for two yrs.		$26,200 00

TOTAL APPROPRIATION FROM FISH HATCHERY FUND, JANUARY 1, 1893, TO DECEMBER 1, 1898.

1895.	Maintenance and construction	$20,000 00
1897.	Maintenance and construction	1,000 00
1897.	Maintenance and construction	20,000 00
1897.	Chehalis river hatchery	5,000 00
1897.	Des Chutes river fish-way	500 00
1897.	Skokomish river fish-way	500 00
1897.	Spokane river fish-way	500 00
	Total	$47,500 00

TOTAL AMOUNT EXPENDED OF ABOVE APPROPRIATION, TO DECEMBER 1, 1898.

1895-96.	Maintenance and construction	$20,000 00
1897.	Maintenance and construction	842 97
1897-98.	Maintenance and construction	17,945 06
1897-98.	Chehalis river hatchery	4,987 16
1887-98.	Des Chutes river fish-way	493 42
1897-98.	Skokomish river fish-way	43 05
	Total	$44,311 66

AMOUNT OF APPROPRIATION TO BE RETURNED TO TREASURY.

Skokomish river fish-way fund	$456 95
Spokane river fish-way fund	500 00
Des Chutes river fish-way fund	6 58
Maintenance	157 03
Total	$1,120 56
Total appropriation	$47,500 00
Returned to treasury	1,120 56
Total amount expended and to be expended of appropriation	$46,379 44

TOTAL AMOUNT PAID INTO FISH HATCHERY FUND FROM ALL SOURCES, DECEMBER 1, 1898.

Total amount of fish hatchery fund	$60,175 45
Total amount of appropriation to be expended	46,379 44
Balance unappropriated	$13,796 01

AMOUNT EXPENDED ON CONSTRUCTION AND MAINTENANCE OF HATCHERIES, TO DECEMBER 1, 1898.

Columbia river hatcheries	$24,910 62
Puget Sound hatcheries	12,005 26
Puget Sound fish-ways	534 47
Chehalis river hatchery	6,874 15
Total	$44,324 50

BALANCE IN MAINTENANCE FUND, DECEMBER 1, 1898.

Balance in maintenance fund	$2,054 95

TOTAL AMOUNT OF FISH HATCHERY FUND, DECEMBER 1, 1898.

Paid by Columbia river district	$36,915 00
Paid by Puget Sound district	20,403 25
Paid by Willapa Harbor district	1,159 50
Paid by Gray's Harbor district	477 50
Total amount collected from fines, etc	1,220 20
Total	$60,175 45

TABULATED STATEMENT OF OUTPUT OF WASHINGTON STATE FISH HATCHERIES—FRY AND SPAWN ON HAND AND TURNED OUT—FROM 1895 TO DATE.

KALAMA HATCHERY.

1895-96	4,000,000
1896-97	3,000,000
1897-98	3,000,000
1898-99	6,500,000
Total	16,500,000

CHINOOK HATCHERY.

1896-97	1,500,000
1897-98	1,750,000
1898-99	1,400,000
Total	4,650,000

BAKER LAKE HATCHERY.

1896-97	5,500,000
1897-98	6,000,000
1898-99	7,500,000
Total	19,000,000

CHEHALIS HATCHERY.

1898-99	1,200,000
Furnished from Kalama hatchery	300,000
Total	1,500,000

SAMISH HATCHERY.

(Operated by citizens of Whatcom county.)

1898-99	210,000
Furnished from Kalama hatchery	200,000
Furnished from United States hatchery, California	100,000
Total	510,000

TOTAL OUTPUT.

Kalama hatchery	16,500,000
Chinook hatchery	4,650,000
Baker Lake hatchery	19,000,000
Chehalis hatchery	1,900,000
Samish hatchery	510,000
Total output	42,560,000

TABULATED STATEMENT OF THE OUTPUT OF THE UNITED STATES FISH HATCHERIES, TRIBUTARY TO THE COLUMBIA RIVER, FROM 1877 TO DATE.

Year.	Hatchery.	Eggs collected.	Eggs distributed.	Fry distributed.
1877-78	Clackamas	88,680	.....	.....
1878-79	"	2,085,000	.....	.....
1879-80	"	2,038,100	.....	.....
1880-81	"	2,838,000	.....	.....
1887-88	"	1,500,000	.....	.....
1888-89	"	4,500,000	.....	4,500,000
1889-90	"	4,314,000	1,000,000	2,766,475
1890-91	"	5,860,000	700,000	4,902,000
1891-92	"	2,036,000	.....	1,332,400
1892-93	"	4,444,000	.....	4,100,000
1893-94	"	277,000	.....	.....
1894-95	"	23,000	.....	.....
1895-96	"	3,687,000	.....	3,389,300
1896-97	"	8,842,500	.....	.....
1897-98	"	5,500,000	.....	.....
1897-98	Upper Clackamas	5,045,000	.....	.....
1897-98	Salmon River	1,216,600	.....	.....
1897-98	Little White Salmon River	12,649,000	.....	.....
1898-99	" " "	7,176,000	.....	.....
1898-99	Upper and Lower Clackamas	3,925,000	.....	.....

FRASER RIVER HATCHERY.

The following are tables of the Fraser river pack and of the fry hatched at Harrison Lake hatchery from 1876 to date.

Year.	No. of canneries operated.	No. of cases packed.	Year.	No. of canneries operated.	No. of cases packed.
1876	3	9,849	1888	12	76,616
1877	5	64,387	1889	16	308,132
1878	8	105,101	1890	17	329,521
1879	7	50,490	1891	21	77,989
1880	7	42,155	1892	19	89,115
1881	8	142,516	1893	25	474,237
1882	11	199,204	1894	28	363,566
1883	13	109,701	1895	31	432,920
1884	6	38,437	1896	34	375,344
1885	6	89,617	1897	41	860,459
1886	11	99,177	1898	45	202,259
1887	12	130,088			

SALMON FRY HATCHED AND TURNED OUT.

Year.	Amount.	Year.	Amount.
1884-5	1,800,000	1892-3	5,764,000
1885-6	2,625,000	1893-4	6,340,000
1886-7	4,414,000	1894-5	6,390,000
1687-8	5,807,000	1895-6	6,393,000
1888-9	4,419,000	1896-7	5,929,000
1889-90	6,640,000	1897-8	6,000,000
1890-1	3,603,300	1898-9	5,500,000
1891-2	6,000,000		

ARTIFICIAL PROPAGATION.

In the history of the salmon fisheries of the Atlantic coast there is a warning against the extravagant manner in which our Pacific coast salmon fisheries have been carried on for many years past. There is also a lesson to be learned, which, if taken in connection with the warning, may be the means of preventing a recurrence of the destruction of a great industry.

For many years the different states to which this industry was tributary enacted laws innumerable, restricting fishing in every possible way, and still allow the industry to be carried on. Laws were enacted making long close seasons, restricting fishing to a certain kind of gear, limiting the time that salmon might be caught in the harbors and streams; and in spite of all restrictive legislation, the salmon industry declined with an ever-increasing ratio until the year 1870.

About this date, through the efforts of the different state commissions and the United States government, the propagation of Atlantic salmon was commenced. For several years the results were not marked, but gradually by unceasing experiments and prosecution of the hatchery proposition. the supply of this splendid fish began to increase, and although the results have not been all that might be wished for, undoubtedly in the next eight or ten years this fish will again become more plentiful on the Atlantic coast.

The warning that we should heed is the putting off the time when sufficient work is done to compensate for the great catch, and other destructive infiuences of this matchless fish, and the lessons we may learn from the experience of the Atlantic states in this respect is, that we cannot depend upon restrictive legislation to accomplish this result. Only through a complete system of increasing the amount of fish supply by artificial propagation, can we hope to save our industry from the experience of that of the eastern states.

Restrictive legislation composed of close seasons and restricting certain gear to certain localities, and limiting the extent of fishing on the part of other classes of gear, will undoubtedly aid in the work of artificial propagation, as it is absolutely necessary that a sufficient number of the fish be allowed to enter the rivers, and there be obtained at our hatchery stations, that will give us the proper number of spawn to supply these hatcheries. But

from the experience, as we have stated above, of the Atlantic states, it can be readily seen that restrictions alone will not save the industry and allow fishing to be carried on to the extent that it is profitable.

With many classes of deep sea fish, when they become scarce from any cause whatever, the business becomes unprofitable, and for that reason fishing of that character, practically ceases. These fish then for a time are allowed to occupy their natural spawning grounds undisturbed, and in the course of a few years materially inercase their numbers. But with our salmon there is a great difference, as these fish, as we have stated in another part of this report, invariably ascend the rivers and streams at stated periods for the purpose of reproduction; and while fish in a commercial way might not be profitable, large numbers of them will be caught by residents living adjacent to the streams for their own use, and putting the surplus on the market. This can be done by certain classes of fishing gear at a very small cost.

Also the experience of the East has been that as the fish become scarce the price is wonderfully increased, and the ease with which the fish may be caught, even though limited numbers only enter the streams, impel the fisherman to continue his labors until the species is practically extinct.

History of Artificial Propagation.

The matter of the early propogation of fish by artificial means, is not well known by the public, and being of interest to all who are striving to assist in building up this one of our greatest industries, I will quote extracts from an article by Hon. Livingstone Stone, delivered before the national fishery congress at a recent meeting:

"About a third of a century ago, a strange story began to be spread abroad in the country that a man in western New York was hatching trout eggs, thousands upon thousands, and that he was rearing fish and feeding them in ponds, and that there was literally no end to the number of fish he could hatch. The story naturally made a decided sensation throughout the country, but of all the people who heard the story, there were very few who at first believed it. The present age of almost daily recurring marvels had hardly begun then, and people were more incredulous, and slower to accept apparent miracles than they are now; and then again, the country being in the throes of civil war at the time, it followed that discoveries in peaceful arts

did not attract the attention that they would have done in quieter times. But the story about the man who was hatching thousands upon thousands of trout steadily gained ground. Presently the great New York dailies took it up, and soon after it came to be an accepted fact that something very wonderful was certainly being done by this New York trout hatcher. In the meantime the man himself, quietly working away in Caledonia, had succeeded in actually proving beyond a doubt that the hatching of trout on an immense scale, not as an experiment, but as a practical industry, was within the easy reach of human skill. It was the first time that this had been accomplished. Amateur and scientific experiments on a small scale had been made by various parties at various times, and the method of hatching fish artificially had been known for a century, but it remained for Seth Green to introduce into America the hatching of fish as a practical and valuable industry, and to him belongs the credit and the honor of opening the way to the vast practical work that has since been accomplished in this country in hatching and rearing fish, and to him eminently belongs the title justly earned of the 'father of American fish culture.'

"A year or two after Seth Green had inaugurated American Fish Culture at Caledonia, the writer established the Cold Spring trout ponds at Charlestown, New Hampshire, but strange to say, up to this time, although Seth Green's operations in New York, had been so fascinating and so promising, no one else in this country had taken up the breeding of trout, at which he had been so successful.

"The time, however, was now ripe for the spread of trout culture, and very soon after the establishment of the Cold Spring trout ponds, trout breeding places sprung up in all directions. Raising trout suddenly became fashionable and popular. During the first two years of this trout breeding experience the writer received letters from almost every state in the Union, written by persons actually engaged in, or more or less interested in trout culture. The interest in trout breeding became universal, and everything written about it was eagerly read by all who were interested in fish at all. These were the palmy days of trout breeding in the country. Prices were high. Trout eggs brought $10.00 per one thousand, and young trout fry $40.00 per one thousand. Trout large enough for the table brought $1.00 a pound at the ponds, and the city hotels paid seventy-five cents a pound for regular weekly consignments. There was a large demand for trout eggs and a fair demand for young fry and for trout for the table. Trout breeding prospered and with it all there was a novelty about the work which had not then had time to wear off, and the business of trout breeding, for it had now become a legitimate business, came to be a pleasant, prosperous and profitable occupation.

"It is a fact worth recording, and one that seems very strange in the light of present events, that while so many at first went to raising trout, no one seemed to think that it was worth while to hatch any other kind of fish; and it is also a fact worth noticing that if artificial fish culture had been confined to the raising of trout, as it was the first three years of its career in this country, the vast and beneficient work that is being done at present would have been unknown. It again remained for the bold and adventurous spirit of Seth Green, with his far reaching vision, to enter the larger and more important field for hatching fish that had a standard commercial value. Everyone knows of his attempts, his failure, and his final success in hatching shad. Those efforts of Green, in demonstrating that other and more valuable fish could be hatched as easily as trout, did indeed open up a field for fish culture so vast and beneficial to mankind that the previous trout culture work shrinks into insignificance beside it. Thus it was that Seth Green, earned a second time his claim to the title of 'Father of American Fish Culture.' All the present magnificent work of our State Fish Commissioners, and the United States Fish Commission, owe its origin to Seth Green's shad hatchery on the Connecticut in 1867. In 1868, the writer in connection with Mr. Joseph Goodfellow, erected a salmon breeding station on the Miramichi river in New Brunswick. This was on a large scale and was the first effort at systematic, practical salmon breeding in America.

"As illustrating the high prices for fish eggs that prevailed then, I may mention that the writer received over $1,000.00 for a good sized water pail of salmon eggs from the Miramichi in 1869. This station would have been a valuable source of supply for salmon eggs had not public sentiment in Canada been so strong against exporting Canadian salmon eggs to the United States, that the enterprise had to be abandoned; but the Canadian government took it up soon afterwards, and sold salmon eggs to this country for the enormous price of $45.00 per one thousand or nearly $1,000.00 per gallon.

"I must not forget to mention, as among the most important events of the early days of fish culture in this country, that the state of New Hampshire, with singular foresight, established a fish commission in 1864, the same year that Seth Green began operations in Caledonia. New Hampshire was soon followed by Massachusetts and other states, and in 1871, the United States Commission of Fish and Fisheries, through the efforts of Prof. Spencer T. Baird, was created by congress, and the same year also the American Fish Culturists' Association was formed, now the American Fisheries Society. By this time there were also innumerable trout culturists in the field, and fish culture in the United States may be said to have passed the days of its infancy, and to be fairly on its feet.

"In looking back over those early years and contrasting them with the present when such an immense mass of information is available, one is forcibly struck by the almost universal ignorance on the subject, that prevailed at that time. This was true, not only of people generally, but of well informed men also, for even scientists who rightly deserved the name, and university graduates and accomplished scholars, who prided themselves on the variety of their knowledge, and reading men who kept up with the magazines and newspapers, could tell you nothing of this new art of fish culture. Yet this was not so very surprising, for all books had not then been published in this country on the subject. Magazine articles about it had not appeared; encyclopedias did not contain the information, or at most only the outline of it, and unless one happened to come across the not easily accessible reports of specialists, there was no avenue open to the public by which more than a superficial knowledge of the subject could be reached.

"People generally were so utterally ignorant, indeed of the whole subject that almost any story told about fish eggs would pass unchallenged. How different from the present day, when the minute fish life of the very bottom of the oceans is closely and thoroughly studied and the fish food furnished by the miscroscopic life of the fresh water lakes, is measured and classified."

From the small beginnings which had been made thirty years ago until the present time, the propagation of food fish by artificial means has steadily grown, and at the present time there are in operation in different parts of the union, under the control of the United States fish commission, twenty-six hatching stations, situated in nineteen states, and during the fiscal year ending June 30, 1897, there had been distributed of fish and eggs 586,144,000, embracing thirty species and one crustacean. Besides those operated by the United States several states have hatcheries, notably California two, Washington four, besides one operated by private parties. British Columbia has also one which is doing good work. In this state the output this season has been about 17,000,000, which we expect to increase somewhat before the season closes. As far as work done by the Pacific Coast states in this line is concerned Washington heads the list, although the number turned out from the government stations in California is in excess of our output.

It will be of interest to many to become informed with reference to the methods employed in this artificial propagation. The methods used at our state hatchery, at Kalama, will in a

general way hold good with reference to the other hatcheries in the state. In order to understand this part of the work, I will briefly describe the apparatus in use. The building used for hatchery building at this station is forty by one hundred feet in dimension. The lower floor being used for the hatchery proper. In this room there are series of troughs sixteen (16) feet in length, fourteen (14) inches wide and seven (7) inches deep, which are divided into six (6) compartments by square pieces of galvanized iron called ripples. Those partitions between each section are double, the first coming within about two (2) inches of the top, over which the water flows into a space about two and one-half inches wide, made by a second piece of galvanized iron, which is about one and one-half inches from the bottom, under which the water flows, and rises through the hatching tray placed just below. This tray is raised about one inch from the bottom of the trough. By this method the eggs and spawn, which are contained in a wire basket or tray twenty-four (24) inches long, twelve inches wide and six (6) inches deep, the meshes of which are one-fifth by three-fourths of an inch, are kept in proper condition by the water rising evenly through them. A stream of pure water is kept running through these troughs constantly. The first step is to secure the fish from which the eggs and milt are obtained. This is done in various ways, as the necessities of the condition demand. At Kalama a gill net is used in the same manner as a seine. To obtain the eggs a female salmon is selected which is ready to spawn or "ripe," as it is termed, and placed in a narrow V shaped box, the top of which at one end is covered with canvass under which the head of the fish is placed, a string is wound around the tail, and then the operator standing above the box presses with both hands on the side of the fish moving them towards the vent; about four movements of this kind are sufficient to empty the fish into a pan which has been rinced out so as to be dampened and held under the fish, into which the eggs fall. The milt or fertilizing fluid is obtained from the male salmon in the same manner as the eggs from the female, and is placed upon the eggs as soon as possible and stirred thoroughly so that every egg will come in contact with the fertilizing fluid. The pan is then set in the shade about five minutes when a small amount of water is added, and let stand about one and one-half hours, when they

have absorbed water and become quite firm to the touch. They are now washed clean and are placed in the baskets or trays above described, about 19,000 in each tray. This is two times the number the same space will accommodate when hatched. About two or three days before the eggs are ready to hatch, they are placed in a bucket of water and a syphon is allowed to play upon them, this washes the eggs and destroys any unimpregnated ones. All are now placed in baskets and the dead ones picked out with tweezers. The eggs are now ready to hatch, and as soon as this takes place each tray is moved forward to the first empty space, and this movement of the trays continues, so that the whole time the young fish can be kept clean and the eggs also kept in clear water. As the baskets are moved from one space to another they are washed by means of a hose with three-fourths of an inch bore used as a syphon, the water being stirred causing the egg shells and dirt to rise to the surface, while the fry go to the bottom. For the first four or five days after the eggs are placed in the troughs the trays are lifted and moved from side to side and any dead eggs are picked out. They are then let alone for fifteen days, when they are again handled in the same way. The period which must elapse before hatching takes place depends upon the temperature of the water. When the water has a temperature of 50 deg. F. it usually takes forty-five to sixty days. At Baker lake, it will take, in a cold winter, from three to four months. While the spinal column is forming in the tiny fish held in the egg, they cannot be moved without great danger, but after twenty days they may be handled and shipped. After hatching they are watched carefully and nearly every day stirred up and kept clean by means of a syphon which is the safest way in which they may be handled, as the dead fish and slime are drawn off at the top of the trough. It is necessary that the fish be not allowed to become too numerous in any compartment, as they are liable to smother. The water supply is increased as the fish grow older. When the fish hatches the larger part of the substance of the egg is held in a sack in the belly of the young fish, this becomes absorbed as the fish grows, and at last entirely disappears. This usually takes from seventy to seventy-five days, and if it is not desired to feed the fish after this point is reached they are turned out in the streams to shift for themselves. It usually takes at this station at the tempera-

ature of water maintained, from sixty to sixty-five days for the eggs to hatch.

Some Reasons for Artificial Propagation.

Salmon of all varieties are anadromous—passing from the sea into the fresh water streams at stated periods for the purpose of reproduction, this natural characteristic making them the easy prey of the intelligent fishermen. While on their way to the spawning beds they must travel over certain courses, which being known, enable the fisherman to cast his nets across their paths (which are as a rule in or near the mouths of the rivers), and with certain success take a large number of the different schools for his own use and the commerce of the world. Another characteristic more peculiar to salmon than to any other anadromous fish, that makes them more easy of capture and destruction, is that fact of their certain return to the streams in which they were spawned or planted. That they practically all return, as above stated, has been proven beyond a doubt. This makes their destruction certain, if from any cause they are driven from any stream, as they are not liable to return to salt water and ascend another.

If from the cause of a large catch or from obstructions being placed in the streams only a small number reach the spawning beds, the result three or four years hence must inevitably be a short run of fish; and if none are able to ascend the streams, four or five years later, not a salmon will be found in that locality. It is therefore absolutely necessary that some of the fish ascend the streams and spawn, or that the supply be kept up from fry planted, produced in other localities.

A showing as to the falling off of the run of salmon on their natural spawning grounds in the different districts of the state is, in my judgment, the best means of explaining why these fish are not as numerous as formerly. With this idea in view I obtained all the information possible from reports of the United States fish commissioner and other sources. Not being satisfied with the showing there made, I have traveled over three thousand miles along the upper tributaries of the Columbia river and the different streams on the Sound, for the purpose of personally investigating the conditions there to be found, and give the following outline of the results of my experience. I carefully investigated numerous streams forming the head-waters of the Columbia river, and in some localities where thousands of Chi-

nook salmon of the May and June run used to spawn, during the past season hardly a fish was to be found. In the Tucannon river, in the northern part of Columbia county, ten or twelve years ago, thousands of June salmon spawned, but during the past season not a dozen have been seen. The Yakima river is also another example. A large number of Indians up to the last two or three years annually obtained their winter supply of fish from this stream. The run of salmon in the last two years has so fallen off that they have abandoned the Yakima almost entirely, and this season obtained their supply of fish from the Wenatchee river. The Touchet river, a tributary of the Walla Walla, was also a great stream in which salmon spawned, but at the present time very few salmon are seen. From the best information that we can get not ten per cent. of the number spawned, the past season in the Touchet, as did ten years ago.

The Little Spokane river is one of the finest spawning streams of the upper Columbia, and was at one time especially noted for the large run of Royal Chinook. Not five per cent. of the run of former years are there at present, though a sufficient number still remain, if properly protected, to again make this a valuable breeding ground for the matchless Chinook.

What is true of the above rivers is also true of a great many others. In my judgment it will require at least 50,000,000 fry turned out annually on the head-waters of the Columbia to keep up the supply of the May and June run of Chinook to the amount of the last four or five years.

Our hatcheries on the lower river with the assistance of the government and our sister state of Oregon, will, if my recommendations in this matter are carried out, have a capacity of about fifty-five million spawn, none too many if they succeed in doing the work expected of them. This work, carried on in an experimental manner and not one tenth the amount done that should be, can only result in raising a prejudice in the minds of many people not well acquainted with the needs of the institutions nor the benefits to be derived from them, that artificial propagation is a failure. It will, in my judgment, require at least three times the output of the present season (and the season has been fairly successful taking the hatcheries as a whole) on the Columbia river to keep the supply up to the past season's catch in years to come, and fully five times as many to bring the

run of Chinook salmon up to what it has been in years gone by. The cost of the above work will not, when better understood and put on a practical business basis, exceed one per cent. of the aggregate output of the fisheries industry on the Columbia river. This tax properly distributed among all parties engaged in the industry will hardly be felt, and it is not one-fifth of the amount the wheat farmers of the eastern part of the state pay for the seed wheat which they are compelled to annually sow to reap their harvest. Neither are their returns so large in comparison and not so certain. Again, if this work had been taken up in time the fish supply could have been kept up at much less expense than we can now raise it after having allowed the run to fall off to such an alarming extent. Every year lost, will, with an ever increasing ratio, see this great industry decline, for with all classes of fish of this character, when once on the downward road they travel rapidly, for many reasons. The scarcer the fish the greater the price received for them, and the more energetic and effective will become the fishermen in capturing them; the causes of loss from civilization and an increasing amount of sewage and other polution cast into the waters, must necessarily increase, making it more difficult each year to stem the current of destruction.

With the apparent results of propagation, each year becoming smaller and smaller, the existing skepticism as to its usefulness will grow and will increase the labor of the fish commissioner, for he will have to combat public opinion.

There are many engaged in the fishing industry of the Columbia river, who do not agree with me in my estimate of the decrease in the run of the Chinook salmon, and appeal to the annual output of the last three or four years to sustain their position. It is true that the output compared with that of former years does not show the decrease that would be indicated by the shortage of the run on the spawning grounds, but when the fact is taken into consideration that the salmon spawned this year, do not return to the river mature for some three or four years afterwards, it can be readily understood why the decrease in the run, as shown by the annual output, is not more marked. Again in times past every season there were different periods when the fishermen are limited in their catch. Every fisherman on the Columbia river, will bear me out in this statement that up

to the last three years, every season during the heaviest runs of salmon, their catch was limited to a certain number. The canneries and the markets being able to handle only a limited amount. During the last three seasons this has not been the case. Every fish that could be caught by every device known to the fishing fraternity has been marketed, and still the supply has not been equal to that of former years, when during the periods of the limited catch thousands and tens of thousands of these salmon were allowed to ascend the river to their natural spawning grounds. Again, a few years back, only the best of the fish, namely the Royal Chinook, were handled by the canneries. The Steel-heads and Silver-salmon for a great many years were not deemed of sufficient good quality to be worthy of canning in large amounts, but during the latter years the fresh market has taken Steel-heads and a good part of the Silver-salmon, and the fall run of salmon not considered worthy of canning, has been made a part of the annual output from this district. These points, taken in in connection with the fact that the loss from the spawning ground will not be felt until three or four years afterwards, proves to my mind, that the run of salmon that reach their old time haunts and natural spawning beds does not exeeed sixty per cent. of that of some eight or ten years ago. Indeed there are many who are well posted on this subject and have made a limited investigation of conditions on the upper river who claim that my estimate in this matter is altogether too high. As we have stated, in some localities that in former years were the main spawning grounds of the Chinook, at the present time not to exceed ten per cent. can be found there; and again we say that the above facts conclusively prove that at least three times the annual output of our present hatcheries must be turned into the waters of the Columbia river, to keep up the run of salmon to that as shown by the output of the year 1898.

QUINNAT SALMON.

Our investigations during the past year of the Quinnat Salmon, have led us to believe that there are at least three distinct runs of this species of salmon on the Columbia river. The first, or what may be termed the earliest run entering the river the fore part of January, and continuing through February and March. The majority of this run of fish has been in the

Clackamas river, a limited number entering other streams and a small number ascending to the head waters of streams of like character tributary to the lower Columbia. The second run begins about the first of May, continuing through May, June and well into July. This run of salmon are the Royal Chinock, which has given the Columbia river salmon its world-wide reputation. It is by far the most valuable fish found in any of the waters of the United States, and is found only in the Columbia river during these months in its finest condition. This run of salmon, the choicest of all salmon, spawn largely in the head waters of the Columbia, very few, if any, of them entering any of the streams below the Dalles, or tributary of what I shall term the lower Columbia river district. This class of salmon largely spawn in streams heading high in the Cascades and the Blue mountains; also in tributaries of the Snake river rising in the Rocky mountains. Nature has provided these fish with a sufficient amount of nourishment within itself to make the long run from the mouth of the Columbia to the head waters of the stream, thus giving it its prime quality and making it the most valuable of salmon.

The third run of Quinnat salmon commences to enter the Columbia river the latter part of July, continuing through August and September and well into October. The first to appear of this latter run of fish can hardly be distinguished from the last observed of the Royal Chinook, which spawn in the headwaters of the river. This latter run of Quinnat salmon, at least the large majority of them, spawn in the streams tributary to the lower Columbia, the Cowlitz, Kalama, Wind river, the Little White Salmon in the State of Washington, and in other streams in the State of Oregon, being their natural spawning grounds. Very seldom indeed is seen one of the earliest runs of Quinnat salmon in any of the tributaries of the Columbia, save the Clackamas and Sandy rivers in the State of Oregon. Again, of the second run, namely, the Royal Chinook, very few indeed have been observed in any of the streams tributary to the lower Columbia district; and still again, very few, if any, of the latter run get beyond the Dalles, the great natural obstruction in the Columbia river. There are many reasons why these different runs of salmon spawn in the different localities mentioned. In the early spring, namely in February and March, the upper Columbia

river is at a very low stage. Usually at this time of the year its tributaries in the lower district are high from the abundant rainfalls occurring at this time of the year west of the Cascade mountains. The melting snows in the Cascade mountains, the Blue mountains and in the Rockies during May and June, causes a very high stage of water in the upper Columbia, and also decrease the temperature of the water in the lower river, and makes more easy of ascent the great natural obstruction in the river known as the Dalles. This large rise in the river comes at a time of year that the Royal Chinook salmon enter the Columbia, and this fish instead of passing into the streams on the lower river, which vice versa are at a lower stage than usual, immediately ascend to the headwaters, its natural spawning grounds. Again at the time that the latter run of salmon enter the river, the high stage of the Columbia is past, the obstruction at the Dalles is more difficult of ascent for the salmon, and these fish instead of attempting to reach the headwaters to spawn, enter the streams tributary to the lower river. These facts are well known to every intelligent fisherman on the Columbia, and from them as well as from personal investigation, have the facts been obtained on which we base our position as to the three distinct runs of Quinnat salmon. If the above position is correct the greatest effort in the line of artificial propagation should be directed towards increasing the supply of the matchless Royal Chinook. During the height of the run of this class of fish for several years past they have readily sold in the market for from four to six cents per pound in the round. No other class of salmon has sold for anything like this price, but the latter run, namely, the fall run of the Quinnat, rarely exceed two cents per pound, and have not averaged that price for the past three years. The Royal Chinook are much larger than either of the other runs, making each individual fish much more valuable.

Being thoroughly convinced that our position, as stated above, is correct, we have made an especial effort to closely investigate the cause of the diminishing run of the Royal Chinook salmon, and also to determine the best locations at which this noble fish might be best artificially propagated We have stated in another part of this report our findings as to the falling off of the run. On three of the streams forming the headwaters of the

Columbia, we have found excellent locations for hatcheries for this variety of salmon, and at one of these locations, the summer steel-heads may also be artificially propagated. In this connection, let us state that this is the only location at present known in the state where a sufficient number of the run of summer steel-heads may be obtained to furnish an ordinary hatchery with the proper amount of spawn.

We are also satisfied from our investigations that the Columbia river is the only stream in the world having two distinct varieties of Steel-heads (*Salmo gairdneri*). The summer run of this variety of fish enters the Columbia river during the latter part of June, and usually continues running through July and well into August; the main run being in July. The winter run enters the river about the first of December, and continues through December, January, February, March and well into April. It seems to have been generally understood that the summer steel-head was simply an early run of the Steel-head variety, and spawn in the early spring the same as the winter variety, but we have found this to be an error. On the 14th of October of the past season, during a visit to the Wenatchee river we counted over one hundred of this variety, the early summer run of steel-heads, spawning on a ripple of the Wenatchee river, some two and one-half miles above the village of Leavenworth.

On the Wenatchee river, we are satisfied, that an extensive hatchery can be located, from which a large amount of the May and June run of the Royal Chinook salmon, and also of the summer run of the Columbia river Steel-heads, may be produced. We advise that a hatchery be at once located on this stream, in order that it may be ready for operation by the time the early runs of this salmon begin to spawn in the Wenatchee river.

Willapa Harbor.

What has been found true with regard to the shortage of the run of salmon on their main spawning grounds in the headwaters of the Columbia river, is also true of the different salmon streams in other localities of the state. In several of the main streams of the Willapa Harbor district, not twenty-five per cent. as many salmon reach the main spawning grounds in the streams as did some years ago. On quite a number of the streams extensive logging operations have been carried on, and dams have

been placed in the streams with no proper means for the ascent of the salmon, and also a great amount of refuse, in times past, has been cast into these streams. These causes combined with the extensive fishing carried on in this district have materially depleted the run of fish that reach the spawning grounds. No artificial propagation of any kind has ever been attempted in this district. On at least three of the main tributaries of the harbor can be found excellent locations for hatcheries, and immediately there should be placed on at least one of them, and on others as soon as possible, hatcheries in order that the supply be not further diminished.

Gray's Harbor.

What is true of the Willapa Harbor district is also true of the Gray's Harbor country. Several of the large tributaries of Gray's Harbor, notably the Hoquiam and Wishkah rivers, that ten or twelve years ago teemed with thousands of salmon, at the present time hardly a fish of that charatcter is to be found. The run of trout has also diminished in these streams until it practically amounts to nothing. This decrease has been caused mainly on account of extensive logging operations carried on in these rivers. Large dams have been built for the purpose of splashing the streams in order to drive the logs to tidewater, and even had these dams, which they have not, proper fishways for the ascent of the fish, the flooding of the streams during the period when the salmon spawn, in its most critical stage, must inevitably drive the fish entirely from the river. In this district, however, there are many other streams in which the run has not been decreased materially from the above mentioned causes. During the past season this district has enjoyed an excellent run of fish, larger than for the two years previous, but from close investigation I am thoroughly satisfied that even the large run of this season does not exceed sixty per cent. of the runs in some former years. With this district, as we stated in connection with the Columbia river fisheries, every season until the last two, during the heavier runs of fish in the river, each boat and fisherman was limited in his catch to the capacity of the market and canneries. During the last two seasons there has been no limit. Every fish that could be caught has been marketed, and even then the catch was not up to that of some former years.

But it is not this year that we should expect to note a large decrease. Two or three years hence we must inevitably see a wonderful decrease unless the system of propagation provided for this district is able to turn out a large number of spawn, thereby keeping up the supply. This district, as has the Willapa Harbor district, has many streams that head in the mountains and hills adjacent to the harbor, that civilization cannot contaminate or destroy as spawning grounds, for many years to come, and with judicious work, and sufficient assistance through the system of artificial propagation, we may well expect to be able to keep up tbe supply of fish.

Puget Sound.

What is true of the three districts already mentioned, is also true of the Puget Sound district. The numerous streams tributary to Puget Sound have in years gone by teemed with what seemed to be an inexhaustible supply of salmon, and while in a number of these streams the supply does not seem to have diminished materially, in many of them there has been a wonderful decline, so much so that complaints during this season, and even during the season of 1897, when there was a phenominal run of Sockeye salmon on the Sound, have come to us from different localities in which a great decrease of the run of fish on certain streams have been noted. During the season we have examined some fourteen different rivers tributary to the Sound with a view to better understanding the conditions prevailing with regard to the run of fish, and also for locations available for the establishment of hatcheries. In every instance, from the people and fishermen living along the streams, has come the complaint of remarkable decrease in the run of salmon. While this may be attributed to some extent to an off year, yet we find that during the season of 1897 very much the same conditions prevailed in many localities. Nature has done everything that could be done to protect these magnificient fish, and to supply in a natural way the loss by destruction from one cause and another. The majority of the main streams tributary to the Sound, head in the mountainous districts which will not be invaded by civilization in many years to come, in a manner that would be derogatory to the fish, but in spite of this the enormous catch on the part of the fishermen, and from many other causes that I have mentioned in connection with other districts,

has cut down the run of fish to their natural spawning beds at least thirty per cent. in the Puget Sound district, taken as a whole.

The small amount of work at present being done on the Sound in the line of keeping up seed supply is confined practically to one stream, the Skagit river. This hatchery, known as the Baker Lake hatchery, has turned out in the last three seasons, and with those now on hand, nearly twenty million fry. If the size of this hatchery were increased fifty per cent. and a supply of fish obtained sufficient to run it to its full capacity, in my judgment the run of fish on this particular stream could be kept up to its old time numbers, and increased somewhat, but that is all that could be hoped for from this individual hatchery. Every prominent stream on the Sound in which a sufficient supply of fish could be obtained to stock an average sized hatchery should have one of these institutions in operation thereon.

If my recommendations in regard to this matter, found in another part of this report, are carried out we shall be able to turn out from sixty to seventy-five million spawn, if the hatcheries are run to their full capacity. By the turning out of this number our greatest hope from the same will be realized, if we are able to keep up the run of fish sufficiently that a catch may be obtained as great as that of the year 1897. Certainly anything less than the number of hatcheries stated will not accomplish that result. In this connection let me state that a careful inquiry into the output and catch of 1897 will show that only in those localities tributary to the Fraser river was the catch greater than in the average year. It was the phenominal run of the Fraser river salmon of 1897 that brought the remarkable output of that year up to the amount as shown by our report for said year. The run of this class of salmon during the year 1898, from best information to be obtained on the subject, was not thirty per cent. of that of the year 1897. In every district tributary to the Fraser, during the season of 1897, consisting of the lower sound and Gulf of Georgia, and also the river itself, large numbers of salmon were caught that could not be utilized by the canneries, resulting in a very considerable waste. Also an immense number of these fish ascended to their spawning grounds, and while the output does not indicate so great a per-

centage of loss when taken in connection with the previous years experience, persons understanding the conditions, I am satisfied, will readily agree with me that my estimate of this years run compared with that of last years, is liberal. From the above we can only say that the run of fish in the streams tributary to Puget Sound was not materially larger in 1897 than in 1898. In fact, we are inclined to believe that the fall run, consisting of the silver salmon and the dog salmon was not as large as that of 1898. We know of no other class of fish where the decreasing run is so marked in the different districts of the state as is that of the so-called steel-head salmon. This magnificient fish is the favorite with the fresh fish dealers for shipment to the eastern markets. It is especially adapted to this trade from its firm flesh, and larger bones than that of the salmon proper, and for this reason reaches the eastern markets in better condition than that of any other fish shipped from this coast. The winter run also comes at a time of year when the run of salmon proper is over, and also when the weather prohibits, in quite a large degree, the fishing for other classes of fish in the open channels and waterways of the Sound. The large majority of this class of fish are canght with a class of gear, termed set nets. This class of fish does not seem to run in large schools for short periods, the same as does the salmon. Their run begins usually about the same time in all of the districts of the state, namely the first of December, and continues well into the spring, usually until the first of May. In times gone by the large catch of this class of fish has formed a very important part of our fisheries output. It has also been the mainstay of a large portion of our fishermen during the winter months, when the real, active fishing season is over, and it has been fairly lucrative. The run of this class of fish in the state on the the whole has greatly depreciated, and the output for the present season from the best information possible is not fifty per cent. of what it was two or three years ago. Very little has been done towards the protection of this class of salmon, and it should certainly be taken up and carried on in connection with the different hatcheries.

We have endeavored, in reciting the conditions prevailing at present in the different fishing districts of the state, to impress upon the public the importance of something being done to keep

up the seed supply of this matchless fish, the different varieties of salmon and Steel-heads, and while quite a number of persons engaged in the fishing industry do not agree with us in many of our views, in the main we have found that a majority, and a large majority too, of those engaged in the fishing industry, cannerymen, fishermen and shippers do agree with our proposition that something is necessary to be done, and immediately too, in the line of replenishing the sources of supply, or in the next few years this great industry must be on the wane instead of on the increase, as it certainly ought to be from the great natural resources of the state. No other state in the Union, indeed no other like amount of territory in the world, has been so especially endowed by nature as has been the State of Washington in the possibilities of its fisheries, and while in a great many respects our fisheries have only been developed to a very small degree, the development of the salmon fisheries has, in my judgment, reached the highest point attainable unless radical measures are taken towards keeping up the supply. In no way can this be done successfully but by artificial propagation. Close seasons, restricted fishing, will assist materially, but if we expect to increase our salmon fisheries it can only be done as we have stated above, in the seeding of the different salmon streams in the manner as above stated.

The Benefit of Artificial Propagation as Shown by Work Done on the Atlantic Coast.

In the minds of many persons, as we have already stated in other parts of this report, there is an opinion which is not based, we are certain, on anything like a close investigation of the subject of artificial propagation that the work being done has not been so great as claimed. As evidence that their position is wrong, and that ours is correct, and that this system will, if properly handled and maintained, not only keep up the run of fish to what it has been in former years, but will increase the same, we offer the following facts taken from the United States Fish Commissioner's Report, and from the reports of the different State Commissioners of what the work of artificial propagation of fish has already done for the fisheries industry of the United States, and for the world.

"Sometime about 1882 or 1883, by the united effort of New York, New Jersey and Pennsylvania, all obstructions were torn from the Del-

aware river at an expense of some $5,000 and through the heavy stocking on the part of the United States commission and the Pennsylvania state commission, the shad industry of Delaware was brought from the value of between $60,000 and $80,000 to nearly $500,000 at the nets every year, and a consumer's value of more than $1,000,000 for the year 1896. The total of shad yield on the Atlantic coast in 1880 brought 5,162,315; in 1888 it was increased to 10,181,605; in 1896 it was further increased to 13,067,469, twenty-nine per cent. greater than in 1888, and nearly three times as great as in 1880. While this increased yield was preceded by increase in the quantity of apparatus used, yet it was made possible by the greater returns due to artificial propagation. Comparing 1880 with 1896 it is observed that the increase in the yield numbered 7,905,154; at twenty cents each, which is the average price paid by consumers, this great increase of $1,581,030 in value, more than fifty times the expenditure for shad propagation, a result probably unexcelled in any other line of public appropriation. The number of persons employed in this fishing industry, and the present inability of natural reproduction to maintain the supply, make it certain that no decrease be made in this important branch of fish culture. At present nearly one-half of the total yield on the Atlantic sea port is obtained in salt water, and those fisheries are becoming more extensive each year. During the year 1896 6,252,464 shad, over forty-seven per cent. of the total yield were caught in streams where half a century ago yielded none whatever."

The above statements are taken from the United States commission reports, and from an address delivered by the Honorable W. E. Meehan before the National Fisheries Congress, held in Florida during the past year. Access to suitable spawning grounds in sufficient numbers to compensate for the loss by capture and natural causes, was absolutely impossible in the district comprised in the above statement, and had it not been for the active and energetic work of the United States Fish Commission, and the different state fish commissions interested in the above mentioned district to-day the shad industry fisheries of the Atlantic coast would have been a thing of the past.

During the '70s the return from the fisheries of this district reached their minimum, then the result of artificial propagation began to appear, not only restoring the former abundance of shad, but even, as before noted doubling and tripling the catch.

Again streams have been stocked on the Atlantic coast with salmon, in which no salmon were ever found until planted there as a result of artificial propagation. The Hudson river is a notable example of the work of this character.

"The experiment of stocking this stream with Atlantis salmon (*Salmo salar*) was begun in 1882, at which time 225,000 fry were planted in the small streams tributary to the head of the river, about 260 miles above Sandy Hook. Nothing was heard from this plant until 1886, or four years after, when adult salmon returned to the river, weighing from 9 to 16 pounds, and ascended to Troy, where they were stopped by the state dam. Every year since, with one exception, plants of salmon fry of yearlings have been made in the river, and every year adult fish have been captured in the lower river by the nets of fishermen. It is of record that in one year over three hundred adult salmon weighing from ten to twelve pounds each were taken in the nets of the lower Hudson, every fish being taken contrary to law, and this in waters in which salmon were never known until the fry had been planted in the upper river.

"Col. McDonald, former United States Fish Commissioner, has made this statement with regard to the Hudson river. He says 'the Hudson river of to-day with its sewage from towns and poisons from mills and factories does not deter salmon from entering from the sea once the fry are planted in its headwaters, and with fishways in all the obstructions, natural and artificial, it could be made a self-sustaining salmon river if the netters would obey the law, while the state fisheries Commission aided nature in keeping up the supply of young fish by artificially hatching the eggs,' and on more than one occasion he made the statement 'that if the Hudson were open to salmon, and proper efforts were made to keep up the supply of young fish, and netting regulations were enforced, the river would, from its salmon, add $100,000 a year of profit to the state financially, while largely augmenting the food supply.'"

STURGEON.

The remarkable decline of the sturgeon fisheries on the Columbia river is a startling example of the destruction of a great industry, and furnishes us with unsurmountable evidence of what is liable to befall the other fisheries of this state, provided sufficient protection is not immediately given, and radical measures taken to at once replenish the drain caused by the great catch, and other destructive influences.

The following is from the Fourth Annual Report of the State Fish and Game Protector of the State of Oregon:

"No more striking illustration of the necessity of protective laws for the preservation of our fisheries, could be cited, than the almost total extinction within a little over half a decade of our valuable sturgeon fisheries. Some eight or nine years ago an eastern firm commenced operations by establishing experimental fishing stations on the Columbia river with a view to determine the abundance and location of the sturgeon. They shipped a half dozen car loads of the frozen fish to the eastern markets as an experiment, and the undertaking proved a suc-

cess. From this beginning the industry grew until there were five firms engaged in the business; three located at Portland, one at Ranier and one at Kalama; and the catch had increased from nine hundred and sixty thousand, seven hundred and five pounds in 1889, to three million, three hundred thousand six hundred and seventy-five pounds in 1892, and the number of fishermen and shore employes engaged in the industry increased from one hundred and fifty to three hundred and fifty.

"The sturgeon fishing was a clear gain to most of the fishermen engaged in it, for the reason that it did not interfere with their salmon operations, being prosecuted mainly after the close of the salmon season. This resulted, during the period from 1889 to 1892, in adding annually from $30,000 to $40,000 to their income. Since 1892, because of the absence of any protective laws, the industry has declined sixty-five per cent. in volume."

The reports for the season of 1898 show that this branch of the Columbia river fisheries has declined until it is not ten per cent. of what it was in 1892.

HATCHERY LOCATIONS.

Many mistakes have been made in the past in the locations of these stations for the purpose of artificial propagation. The probability being that quite a number of new stations will be erected in the near future, we offer what in our judgment are the essential points to be observed in the location of a hatchery.

The first and most important point is a sufficient number of fish from which spawn can be obtained to supply the hatchery. Second, a sufficient amount of good, pure water, and third, the hatchery to be located as near as possible to the natural spawning grounds of the fish to be propagated.

The second and third conditions, as above stated, may be modified somewhat, and natural conditions overcome to quite a considerable extent, but it is absolutely necessary that the first point should be properly sustained. A hatchery located to comply with the three points as stated, will almost invariably prove a success. Where these conditions are to be overcome to any extent a question of doubt as to the successful operation arises.

The four hatcheries that the state now possesses are examples of these conditions, and in the degree of their success can be marked how closely they are located to comply with the above conditions. Further, the experience and better understanding of the different conditions prevailing in different localities will

undoubtedly modify this proposition to some extent, but we are satisfied from experience that as near as possible the above requirements should always be complied with in the location of these stations.

DESCRIPTION OF HATCHERIES IN OPERATION.

Kalama Hatchery.

This hatchery, built four years since, is situated about four miles north of Kalama. Its location is near a beautiful stream about one hundred and fifty feet wide. The water used is obtained from a small stream and is brought about fifteen hundred feet in a flume.

Here is a two-story building, the lower floor of which is used as the hatchery and the upper floor is used for the employes. It is a most excellent location and with a few improvements could be made an ideal hatchery. In its present condition it has a capacity of about six million spawn yearly. With a re-arangement of troughs and by crowding them somewhat closer, the capacity may be easily raised to ten million. In connection with this hatchery is needed a building situated about three miles down the river, to be used for an egg station.

From the experience gained from this season's operations I am satisfied that a greater number of spawn can be taken at a cost much lessened proportionally by making an improvement of this character. This season the capacity has been crowded to its utmost, more spawn has been taken than the size of the hatchery could accommodate and five hundred thousand have been shipped to other hatcheries in the state. The expenditure has not been proportionally great for the reason that the fish were taken more rapidly and during a shorter period of time. The fry now in the hatchery are in excellent condition and are an invincible argument in favor of the system which is employed in the hatcheries of this state. With the completion of the improvements suggested and with as good a run of fish as entered the rivers this season we shall undoubtedly be able to turn out double the number of the output this year.

The estimates of expense for these improvements is found in connection with expense of improvements and construction of other hatcheries in another part of this report.

Chinook Hatchery.

This station was built by the former fish commissioner for an egg station, and operated for two seasons in that manner, the spawn having been taken from the salmon and held in the hatchery until they were in the eyed stage and then shipped to the Kalama hatchery. During the season of 1897 the spawn taken at this station was held and hatched out at that point. The work was very successful considering the difficulties that surrounded the operations.

At this station a different plan from any of the others is carried out, and while not as successful up to the present time as could be wished, is well worthy of the support, as the experiment being made there, if proven successful, will add materially to the scope of our hatchery work. The fish from which the spawn are obtained at this station are caught in pound nets in Baker's Bay, one of the greatest fishing grounds in the Columbia river district. If this plan of hatching salmon, as we stated before, proves successful the possibilities of it from this source are almost unlimited as a sufficient supply of fish can be obtained to stock numerous hatcheries.

The season of 1897 demonstrated to us that the plan of obtaining water for the hatchery was not practical, and during the past season a pipe line was laid thirty-six hundred feet to the station, but owing to the faulty construction it was not a success, and the weather following prevented the proper relaying of the pipe. We have up to the present time received no benefit therefrom, but at no very large expense this water system can be made perfect, and when so the hatchery will have as good water supply as any in the state.

Quite a number of improvements are needed, an estimate for which will be found in another part of this report. The present season has not yet closed, and we hope to materially increase our output. Through the kindness and enthusiasm of the fishermen in this locality, the expense of obtaining fish for hatchery purposes this season has been very small, the use of the pound nets, as well as a quite a number of fish, being donated by the pound-net fishermen.

The station consists of a hatchery building 30 by 80 feet, which, under the new arrangements made during this season, has a capacity of about four million spawn. We have also the

dwelling house, 18 by 24 feet, a story and a half high, for the use of the superintendent and employes, under construction. If the proper improvements are made, we believe that this hatchery can be operated as successfully as the others.

Baker Lake Hatchery.

This hatchery is situated on the south side of Baker Lake, Skagit county, about thirty-five miles northeast of Hamilton, the nearest railroad point. The lake is about one and three-quarters miles long, and one and one-half miles wide, and is drained by Baker river, which is a tributary of the Skagit. The lake has two inlets, Sutter river and Noisy creek, besides several small streams.

In this lake, also in Sutter river and Noisy creek, are the only known important spawning beds of the Sock-eye salmon in the Puget Sound basin. Besides Sock-eyes, Silver salmon and Steel-heads also run here in large numbers. The Chinook salmon also come here in small numbers. This is the only hatchery under state control that is directly tributary to Puget Sound. It is an ideal site for a station of this kind, for it is the natural spawning grounds of the different varieties mentioned, and the only known place to secure enough Sock-eyes with which to supply a station, tributary to Puget Sound.

The buildings are constructed of split cedar boards, and consist of a hatchery building, 40 by 100 feet, and dwelling house for the superintendent and the employes, 24 feet by 40 feet, and one and one-half stories in height, one store room and wood shed 18 feet by 24 feet, besides several smaller buildings.

The water supply is taken from a mountain stream by means of a flume about three hundred feet in length. This hatchery is well equipped, and has been very successful this season, over seven and one-half million of spawn being on hand at the present time, and the season for taking spawn not yet over.

We expect at this station to take a large number of Steel-heads spawn during the coming March and April, provided the legislature make appropriation for the work. In our estimates for improvements on hatcheries will be found estimates of the needs of this station, which if carried out, will double the capacity of the same. The experience of this season's work has demonstrated

that with the above improvements made, we shall be easily able to double the average output of the last two years.

Chehalis Hatchery.

This hatchery is situated on the Chehalis river about four miles above the city of Montesano. The legislature of 1897 authorized the construction and equipment of this hatchery and appropriated the sum of five thousand dollars ($5,000) for that purpose. The site was secured and in October of 1897, the construction began, but owing to bad weather and extreme high water, which prevailed through the following four months the work could not be completed in time to be put in operation during the seasons of 1897 and 1898. Some experiments as to the methods to be employed in catching the needed fish were made, but the results were not highly satisfactory, owing to the high water and the run of Steel-heads, the fish mostly sought being very poor. The work at this station this season has not been as successful as I desired. We have now learned the way in which we can procure fish for our work here and in the future believe that success is sure to follow our efforts. There are about two million of spawn and fry now on hand, having received not far from three hundred thousand from the Kalama hatchery. The work here has demonstrated the necessity for an experimental station more fully than work at any of the other stations. As new stations are constructed it necessitates the employment of new methods in the securing of the necesssary fish for their proper work. Even expert fishermen meet with difficulties in securing fish on account of different conditions prevailing in each locality. The difficulties we have met with at this hatchery usually confront all new locations. At the end of one season's work we are ordinarily able to meet successfully the new conditions, and with each year's experience we shall soon be able to so systemize our work that failure will be impossible.

Samish Lake Hatchery.

This is a new enterprise that should attract the attention of the people of the state, who are not directly interested in the fishing industry. It is situated near Lake Samish, a few miles from Fairhaven, and is a private hatchery, the necessary money being raised by subscription among the residents of Fairhaven and vicinity. On November 8th the first lumber was placed on the

ground, and by the 26th of the same month the hatchery was nearly completed, and over three hundred thousand spawn placed therein. About two hundred thousand of the Royal Chinook salmon were received from the Kalama hatchery, and the remainder were eggs secured from Silver salmon taken from the creeks upon which the hatchery is located.

The plans for this hatchery were suggested by me, and the superintendent was chosen by myself. It differs but little in construction from the several state hatcheries, the small capacity being the greatest difference.

The manner in which the money for the construction of this station was raised reflects credit upon those who contributed. It shows that public sentiment is being rapidly developed in the line of artificially securing what natural conditions once supplied, but what is now impossible on account of the depletion of the salmon by the great catches, which have been made in years past, and the loss from obstructing the streams and from other causes.

Trout Hatchery.

We advise that at each of our hatchery stations, where a sufficient number of the best varieties of trout may be obtained for hatchery purposes that this branch of fish culture also be carried on to the extent necessary for the stocking of the principal trout streams of the state. By judicious management streams that are not salmon streams to any great extent may be thus stocked, furnishing not only a material supply of excellent fish, but also a great amount of pastime for the citizens of the state. In our judgment the funds to pay for this class of work should be appropriated from the general funds of the state, as the trout fisheries do not furnish any revenue for this purpose, and we are of the opinion that every dollar paid in by the salmon fishermen of the state should be applied to the keeping up of their industry.

The proposition of stocking the different streams with trout is so general and wide-spread throughout the state, and the benefits to be derived from the same are so widely distributed among all classes of people that in our judgment, no serious objections can be maintained against the appropriation of the funds to carry on this work, from the general funds of the state. Certainly the small amount of money necessary, and the successful accom-

plishment of this class of work cannot better be appropriated for any other purpose that will furnish the citizens of this state with a favorite pastime, and also be of material addition to the general food supply.

NEEDED LEGISLATION.

Pound Nets.

One of the first points under this head that we shall note is the fact that the present law does not define pound nets. Many of the different pound nets operated in the state, have what is usually termed a "jack pot," having leads and double pounds, and a double system of hearts. This has caused considerable dissension during the past season, but the uncertainty of the law in regard to the matter has not allowed us to interfere.

We are of the opinion that if this system of pound nets is to be allowed, that the payment of a double fee for the same is perfectly justified by the returns, and advise that the law be made to conform to this idea.

Set Net.

The definition of the term "set net" has also been in doubt, and this too should be defined so that there can be no misunderstanding as to the full intent of the law. In many instances parties holding locations upon which they expect to erect pound nets at some later date, are holding the location at the present time with a set net license. No fish can be caught with a set net on locations of this character, and it is simply the means of evading the intent of the law, which in our judgment expect the payment of the pound net fee for locations of this kind.

The law is also uncertain as to whether this appliance (set net) can be used in the different streams tributary to Puget Sound and Gray's Harbor. This should be remedied as fully ninety per cent. of the latter number of this class of gear are used in the streams of this state. There has been considerable trouble in the Puget Sound and Gray's Harbor districts, between fishermen, over set net locations, the law not defining the manner in which a location might be held. We advise in this connection that throughout the state a set net be allowed three hundred feet of space, or in other words, no two locations of this character shall be closer than three hundred feet, and also provide for the marking of the location.

We also consider it advisable that these nets, and for that matter any class of gear, be not allowed to extend more than one-third of the width of any river or stream. These regulations we have found will be very satisfactory to a large portion of this class of fishermen, settling endless disputes.

The license fee also from this class of gear hardly warrants the amount of expense required for the collection of the same and we believe it will be satisfactory to the fishermen using these nets if the license fee is considerably raised, provided their locations may be marked and the law also provides that their locations be not encroached upon by other fishermen.

Seines.

The law in reference to drag seines should also be remedied so that a person taking out a seine license of this character should be able to mark and hold certain seining grounds under the license. Considerable trouble has arisen in different parts of the state in this matter. Persons holding valuable seining grounds and paying their license fees therefor, have been encroached upon by parties driving locations for fixed appliances thereon and excluding them from the grounds.

The law should also provide that ordinary drag seines might be used within one mile of the mouths of the streams on Puget sound and Gray's harbor.

Closed Seasons.

The law covering the closed seasons of the state should also be modified in a number of respects. In our judgment the early close season on the Columbia river should be extended to the first of April, and the open season for fishing should be extended a few days at least longer than the present law allows.

On Puget Sound the closed season governing the rivers should be extended to the entire Sound, as only in this manner shall we be able to get a sufficient supply of fish at the different hatchery stations.

Closing of Rivers.

It is absolutely necessary for the success of our scheme of artificial propagation that the different streams on which hatcheries are located should be, in many instances, entirely closed against all forms of fishing with the exception of rod and line. On those that are not closed entirely, as stated above, the commissioner should have discretion when to have the fishing season

closed in order that he may thereby control the supply of fish that should ascend the streams to the hatchery station. In fact our experience has proven the necessity of this discretion with regard to all of the streams of the state. In many of these streams certain fishing season might be allowed with no particular detriment to the industry.

Again there are seasons, owing to the scarcityof the fish, when the rivers should be absolutely closed against any form of fishing. It is absolutely necessary, in any event, that the above recommendations shall apply to the streams on which hatchery stations have been, and are to be, established.

License Fees.

There are many points that are wrong in the present law with regard to the license fees paid by the different classes of fishermen. These fees should be based as near as possible on the catch and on the ability to pay the same. In every instance there is injustice done to many of the fishermen. Many of the pound nets of Baker's bay give very poor returns for the cost of construction and maintenance. We advise that the fees for the different classes of gear, as stated above, be based on the catch, and on the value of the output. There are branches of the industry that now pay no fees. These should be brought under the system and compelled to bear their portion of this burden. A very small tax on all branches of the industry properly distributed can be easily borne, and the results from which will enable us to obtain sufficient funds to successfully carry out and maintain the system of artificial propagation recommended in other portions of this report.

Test of Citizenship to Obtain License.

The new fisheries law passed by the late special session of the Oregon legislature contains a provision that all parties engaged in fishing for salmon and sturgeon should be citizens and residents of the state, and that each person so engaged pay an annual license fee of one dollar ($1.00). We advise the enactment of this provision of the law as the proper enforcement of the same would be of material benefit to the resident fishermen of this state and also further increase our own hatchery fund.

We also advise that all classes of fishing in the waters of the state, of whatsoever kind or character, be compelled to pay a

limited fee into the fish hatchery fund. It will be only a question of time when other species of fish found in our waters will need the benefits of artificial propagation as well as salmon. If the different parties engaged in fishing are compelled to pay a small annual fee, and also to report their catch annually to the fish commissioner, a better idea and better understanding of the needs of the different classes of this fishing will be arrived at, and when the time comes that it is necessary to artificially propagate the fish, the information necessary for the furtherance of the project will be found much to the advantage of, and making more sure of success, any scheme for the betterment of any particular branch of this industry.

Law in Respect to Deputies.

The present law with regard to deputy fish commissioners is entirely wrong. With present conditions prevailing, instead of three deputies serving fifty days annually, as under the present law, the fish commissioner should have one deputy who can serve the year round, and sufficient expense funds provided to allow him to do the work required of him. Under the present system a deputy's work is not much more than started before the time allowed him is used up, and much information gained in the few days of his employment is lost on account of his inability, in so short a period, to cover any amount of territory more than once.

Many violations of the law require two and sometimes three and four trips to a certain locality to obtain a conviction, and for the proper enforcement of the law. This cannot be done under the present system, and therefore we advise that if the present conditions are to prevail and the amount of labor required of the commissioner and his deputies is not increased, that he be allowed one deputy, who shall put in his full time in the service of the department. This change coupled with another that we have advised in another portion of this report, will enable this department to properly handle all the work at the present time demanded of us.

Special Deputy Fish Commissioners and Game Wardens.

The present system of special deputy fish commissioners is entirely wrong. No man should be compelled to receive a part of any fine as payment for his labor in enforcing the law. We believe that the law providing for special deputy fish com-

missioners should be repealed and instead a law providing that the different county game wardens be special deputy fish commissioners, enacted.

Under the present law the different game wardens may receive a small salary from the different counties in which they are appointed. If this office and that of the special deputy fish commissioners were combined, undoubtedly excellent results would be returned.

We have also, in another portion of this report, advised that the fish commissioner be made game warden of the state and have control of the enforcement of the game laws. If this were done, and our recommendations with regard to deputy game wardens and special deputy fish commissioners carried out, the combination would undoubtedly produce vastly better results than are obtained at the present time.

In this connection we call your attention to the discussion of this point under the heading of "game and game protection" found in another portion of this report.

Boundary Line on the Columbia River Between Oregon and Washington Should Be Designated.

For many years more or less friction has arisen between the Columbia river fishermen on account of the line between Washington and Oregon not being known. It is necessary that this contention be settled in order that the laws can be properly enforced. We advise that the legislature take joint action with Oregon in this matter and settle this quesrion for all time.

SHELL FISH.

Oysters.—Closed Seasons.

The natural oyster beds of the state have been very much depleted in the last few years and require radical measures in the line of better protection that they may again become a prolific source of seed supply. Many of the laws with regard to oyster lands are very conflicting. In my judgment several sections of the present law should be repealed and others be enacted to take their place, harmonizing the whole.

Many persons engaged in the oyster industry are of the opinion that the present closed season for the taking of oysters from the natural beds is too long and advise that the open season be of not more than three months duration. The season commencing

on the 15th of March and running to the 15th day of June, it is claimed, will give the young growth a much better opportunity to mature and result in the natural oyster beds furnishing a much larger supply of seed oysters. My investigation in this matter coincides with these views and I am of the opinion that the natural oyster beds will have much better protection, provided this change in the close of the season is made.

Clams.

It was once thought the supply of clams in the different districts of the state and especially Puget sound, Gray's harbor and Willapa harbor was inexhaustible, but recent developments have shown that this is not true. It is very necessary that some action be at once taken for the protection of this shell fish. Also some system or plan for the leasing of natural beds should be adopted at once, and give this excellent product the proper protection it deserves. A closed season of at least two months is advisable and we advise that the legislature enact laws in conformity with the above recommendations.

Shrimps.

It has also been advised that a close season be enacted for this species of shell-fiish. In times to come the shrimp fisheries of the state are bound to form a very important part of the annual output. At the present time this branch of the fish industry is not well developed, and the amount put upon the market is comparatively small as compared with the large supply. It is, however, increasing yearly in importance, showing an increase during the past season of twenty-five per cent. Good care should be taken of these different shell-fish that the supply be not diminished, as our increasing population will, in the near future, tax our resources to the utmost to supply the market with these valuable food fish.

TEXT OF LAWS RECOMMENDED.

In another portion of this report we have recommended the enactment of certain laws, and the following sections, we believe to be in conformity with those recommendations, and advise their being placed upon the statutes.

SEC. —. It shall be unlawful for any person to take, catch or fish for salmon, sturgeon, shad, herring or smelt in any of the waters of this state, unless such person be a citizen of the United States, or had de-

clared his intention to become such, one year prior thereto, and has been a bone fide resident of the state of Washington for the period of six months. Provided, license issued by the state of Oregon, shall be deemed valid as to gill nets for use on the Columbia river, as though issued by the fish commissioner of this state.

SEC. —. Any person desiring to obtain a license to take or catch salmon, sturgeon, shad, herring or smelt in any of the waters of this state, in any manner whatever, either working upon as employer or employe of any pound net, fish trap, set net, gill net, fish wheel, seine or any other devise or apparatus used for the purpose of catching salmon, sturgeon, shad, herring or smelt, whether such person is the owner of such appliance or otherwise, shall present in writing to the fish commissioner his application, which application shall be accompanied by the affidavit of said applicant that he is a citizen of the United States, or has declared his intention to become such one year prior to the making of such application and that he is and has been, for the six months next preceding such application, a bone fide resident of the state of Washington, and shall deposit with the said fish commissioner a license fee of one dollar, and thereupon a license shall issue to such applicant, authorizing him to engage in taking and catching fish in any of the waters of the state. In addition to the said license aforesaid, any licensed fisherman desiring to engage in the business of operating a fish trap, pound net, set net, gill net, fish wheel, seine or other appliance not prohibited by law, for the purpose of catching fish, shall make application in writing to the said fish commissioner, specifying with convenient certainty the character of the appliance that the applicant desires to obtain a license for, together with the number of his individual license as provided in this act, and upon the payment of a license fee as hereinafter provided, the fish commissioner shall issue to such person a license to operate the character of appliance desired in said application.

SEC. —. It shall be unlawful for any person, without written authority from the fish commissioner, to place in any of the waters of this state, excepting inland lakes which have no connection whatever with any flowing streams at any stage of water, any species or variety of fish whatever.

SEC. —. Any person or persons, corporation or corporations, owning in whole or in part, or leasing, operating or having in charge any mill-race or irrigation ditch or canal, taking or receiving its waters from any river, creek, stream or lake, in which fish have been placed or may exist, shall put or cause to be placed, and maintain over the inlet of such ditch, canal or mill-race, when required to do so by the fish commissioner, a wire screen of such construction, fineness, strength and quality as shall prevent any fish from entering such ditch, canal or mill-race. Any person or persons violating any of the provisions of this section, or who shall fail or neglect to construct and maintain such screen, shall be deemed guilty of a misdemeanor, and upon conviction shall be punished as in this act hereinafter provided.

SEC. —. The fish commissioner is authorized by this act, to propagate and stock the various waters and streams of this state, with good quality of trout, or other game or food fish, not inimical to, or destructive of salmon, and for the purpose of protecting same and for the purpose of protecting the native trout, he is hereby authorized to close any streams or any designated portion thereof, in this state, frequented by trout, or any stream which he has stocked, and prevent any person taking, fishing for, or catching any trout or game fish therein.

Should the fish commissioner desire to close any stream or designated portion thereof, frequented by trout, or any stream or designated portion thereof, which he has stocked with game fish, he shall cause notice thereof to be filed in the office of the county clerk in each county in which such streams or designated portion thereof desiring to be closed lies, and shall publish such notice in some weekly newspaper published at the county seat in such county or counties, for four successive weeks. Such notice shall designate as nearly as practicable the stream or designated portion thereof to be closed, and shall state that on and after a date therein stated, it will be unlawful to fish for, or take or catch, any mountain or brook trout, or game fish, therein, which date shall not be less than thirty days from the date of the first publication, and shall cause said notices to be posted for such time in three conspicuous places, on the banks of said stream, or designated portion thereof.

Upon the completion of the publication of such notice, the same, with proof of the publication and posting thereof, shall be filed with the original notice in the office of the county clerk, and it shall be unlawful at any time after the expiration of the date specified in said notice, for any person to fish for, or take, or catch any mountain, brook or other species of trout, or any game fish stated therein, until a notice shall be filed and likewise published by the fish commissioner, of the opening of such stream or designated portion thereof to the public for fishing.

SEC. —. It shall be unlawful to take or fish for salmon in the Columbia river, or its tributaries, or within three miles outside of the mouth of said Columbia river, by any means whatever, in any year, between 12 M. the 15th. day of March and 12 M. the 15th. day of April, or between 12 M. the 20th. day of August, and 12 M. the 20th. day of September; provided that it shall be unlawful at any time to take or fish for salmon by any means whatever, except with hook and line, commonly termed angling, in the Chinook river, Kalama river, Wind river, Little White Salmon river, Wenatchee river, Methow river, and Little Spokane river, and within the Columbia river within one thousand feet of the mouths of the above named rivers.

OYSTER CULTURE.

Willapa Harbor and Puget Sound.

Some of the methods employed in the east are used in this state in the cultivatiou of the native oysters. There has not been the attention paid to oyster culture here as in the older

settled portions of the country. When the first settlers came they found the natural oyster beds and from these they have secured large profits from the merchantable product, besides seed with which to stock new beds. As a whole the business, when intelligently pursusd, has been one which, for the money invested and the labor employed, has yielded large profits. Our markets demand more than we will be able to furnish for many years to come. In my opinion this is one of the most inviting fields for one who wishes to go into the fishing business. There are many hundred acres of ground, which, if properly prepared, will be excellently adapted to oyster culture and it has been largely a lack of knowledge of the business that this ground has not been improved.

Climatic conditions, it seems to me, are such that this line of the fishery business will never suffer from the extremes that the same business in the east is subjected to. Our inland seas, Puget sound and Willapa harbor, never have the extremes of climate, either heat or cold, which prove so detrimental to the proper propagation of the oyster. We are protected from the fierce gales which sometimes prove so destructive in other parts.

The native oyster (ostaea lurida) of California, Oregon and Washington, is found in many places along the coast. The size is much smaller than the eastern oyster, but its flavor is considered by many as being superior to those from the east.

LOCATION OF NATURAL AND PLANTED OYSTER BEDS.

Willapa Harbor.

In these waters are found the most extensive beds of the native oyster to be found on the coast. This species has always been abundant there, and for many years has been shipped to San Francisco, where it was the only oyster used prior to the introduction of the eastern oyster to the waters of the coast. These oysters are taken from their natural beds and sorted; the largest being placed upon the market, the smaller ones being placed in suitable beds for future growth.

The cultivation of this oyster constitutes the principal fishing industry of the bay, employing about three hundred and fifty persons. The quantity of Willapa bay oysters amounts to about fifty thousand sacks annually, the total acreage of transplanted

beds is over twenty-two hundred, and the value of small boats and other appliances of the fishery is over $35,000.00.

Willapa bay is situated in the southwestern part of the state, a few miles north of the Columbia river. It is about twenty-five miles in length, with an average width of five miles. On account of extensive shoals and tide flats, it was formerly called Shoal Water bay. Deep navigable channels make nearly all parts accessible to the largest vessels. The localities where oyster cultivation is carried on are Bay Center, Bruceport, Oysterville, North Cove and Toke Point; no transplanted beds being located in the southern part of the bay. Oysters for planting are generally derived from the natural deposits.

Puget Sound—Oyster Bay.

This bay has about an area of about four hundred and fifty acres of cultivated beds and employ not far from one hundred and fifteen persons. The output this year has been about seventeen thousand sacks. The area for successful oyster culture here is extensive, and in a few years the output will be greatly augumented.

Big Skookum.

There is an area of about one hundred and eighty acres of cultivated beds in this locality, and employ forty persons. The output this year has amounted to twenty-five hundred sacks. The acreage has been increased during the past year, and a great deal of inrerest is taken in this branch of the fishery business.

Mud Bay.

In this locality there are under cultivation about two hundred acres, producing this year four thousand sacks, and employing forty persons. The acreage will be increased in the future.

CRAB FISHERIES.

There is at the present time what appears to be an almost inexhaustible supply of crabs in three of the fishing districts of the state.

Willapa Harbor.

This district has in seasons past furnished an important portion of this product, as will be noted by the reports.

Gray's Harbor.

This district also has extensive fisheries of this character, and the output has been increased considerably in the past season.

Puget Sound.

There are several localities in this district that furnish large numbers of this shell fish; the city of Dungeness being the center of this class of fisheries at the present time. From this locality large numbers of these fish have been shipped to the sound cities and to interior points. These fish are becoming more popular each year, and will without doubt, in the near future, through their increase, add materially to the output of our fisheries.

SHRIMPS.

In the Puget Sound district are found extensive beds of this very desirable shell-fish. As we have stated in another portion of this report, this industry is in its infancy. The importance of this class of fish is just coming to the attention of the commercial fishermen and undoubtedly the future will show a remarkable increase in the output. But few firms are at present engaged in the industry, and at this time are able to supply the market demand. The demand, however, is increasing rapidly, and bids fair to soon offer opportunities to others wishing to engage in the fishing industry of the state.

CLAMS.

The clam beds of the different districts of the state furnish a a large amount of an excellent quality of food shell-fish. There are several varieties found in each district and are, of all kinds, valuable as a food product. They are becoming very popular, and the annual output is rapidly increasing yearly. There has been established, in the last year, canneries for this classs of shell-fish in both the Puget Sound and Gray's Harbor districts. We have not been able to get reports from these institutions, and for that reason are unable to state the annual output. Undoubtedly these establishments will be largely increased during the coming year, and as with the other shell-fish above named, will increase the output from our fisheries.

OIL AND FERTILIZER WORKS.

There has been established in the Puget Sound district, a factory of the above character, during the past season. We have

not yet received a report from this firm, and at present cannot give the output. We understand, however, that the profits from this enterprise have been fairly satisfactory, and that the plant will be run to its full capacity during the coming year.

The principal part of the raw material used in this plant is obtained from the different canneries located in that vicinity, being the waste that cannot be used in those establishments. The field for operations of this character are extensive, and undoubtedly this class of factories will be largely increased in the coming year.

SCIENTIFIC AND EXPERIMENTAL STATION.

The need of an experimental station in connection with our state hatcheries and the proposition of artificial propagation of fish can only be appreciated by persons who have some practical knowledge of the workings of these institutions, and for that reason we fear that in this, our recommendations on the subject, we shall not be able to properly interest those to whom we must look for support in this most necessary adjunct to the fisheries department of the state.

Many states in the union, notably the state of New York, have appropriated large sums of money and have built extensive establishments for the purpose of doing this class of work, but in none of these states that have taken this matter up can the results ever prove as beneficial to their fisheries as would a properly handled station of this character be to ours.

Questions arise almost daily in our hatcheries as to the best plan of meeting some unexpected occurrence and also the best and safest means of handling our fish and spawn during the freshets when the water is badly discolored. In fact different questions of procedure arise, which the superintendents of our hatcheries are not certian as to the best means of meeting and handling successfully. In an experimental station the different plans and different ideas as to the best manner of handling the different propositions that come up could be carefully investigated and a system of procedure thoroughly demonstrated that would be of invaluable benefit to our different hacthery superintendents. It may be asked here, cannot these experiments be made at our hatcheries? We answer that in the first place no more help is kept than is needed for the actual work necessary to be done at the institutions and the possibilities for experiments are extremely limited for both want of time and apparatus to properly handle the same. In fact to be certain that an experiment has been properly tried and the conditions have been properly investigated, some person should give it his whole time and thoughts. In the ordinary hatchery it would be impossible for any one man to do this, for there are times when the work neces-

sary to be done at a hatchery is really more than can be properly performed by those who are kept steadily employed and of necessity an extra man handling some separate proposition would be pressed into service, probably at the cost of the experiment he had undertaken. More than this we do not deem it practical for the superintendent of each hatchery to make these experiments. They inevitably must cost more than if handled in some institution built and equipped especially for that purpose and where a superintendent's whole time and thought is given up to work that is not well understood, and to that which is up to the present time in the experimental stage.

Our hatcheries in the past have been handled too much in an experimental manner. It is our desire and determination to place these hatcheries on a purely practical and business basis. Our aim is to make a fish hatchery purely a source of seed supply for the harvest that is to follow in years to come. To do this, matters of an experimental nature must be eliminated from them. If one experiment is tried it usually calls for another, and the time that should be given to the practical working of the hatchery will inevitably be used in the experiments, and must end in poor results from a business standpoint.

We ask for the experimental station in connection with our artificial propagation of fish for the above reasons. Many questions are before us at the present, but we simply call attention to a few illustrations in connection with this class of work.

At our Baker lake hatchery during the very cold weather it is almost impossible to keep the water running through our troughs more than two or three degrees above the freezing point. Experience has shown that the temperature of water of about 40 degrees is best suited to the healthy condition of our spawn and fry at this station. When the temperature descends six or seven degrees lower than mentioned the hatching process in the spawn seem almost to cease, and where the eggs should hatch in from seventy-five to eighty-five days, the records show that they have been kept in the hatchery one hundred and twenty-seven days before hatching. If an experiment could be properly tried it is the opinion of several of our superintendents, that a temperature of water could be obtained by artificial heat at about forty degrees, and that the time required for the hatching of the spawn would be from some twenty-five to thirty days less than at pres-

ent. This would be worth from four to five hundred dollars annually at this one station. In other stations matters of like character every day arise of which the proper solution is not too well understood, and many times a great amount of work is done that need not have been. The knowledge obtained in the successful experiments could be used by the superintendents of the hatcheries, and much good result therefrom.

Another point to be made in favor of our experimental station would be in connection with the propagation of sturgeon. For some years the sturgeon fisheries of the state formed a very important part of the fishing industry. The methods of fishing and class of gear used in catching this fine fish has depleted the run until at the present time very few fish of marketable character can be found.

A law was passed by the legislature of 1897 for the protection of this valuble fish, but the remedy came too late. The immense run of this fish that prevailed in former years has fallen off until the fish is practically extinct. Only through the means of artificial propagation can we hope to increase and return to our waters this fish in marketable quantities.

Experiments have been made by the United States Fish Commissioner and different state commissioners throughout the United States, and while up to the present time none have been very successful, yet enough has been done to demonstrate that the work may be practical.

We believe that we have locations within our state at which more practical experiments may be made than in any other state in the Union, for the reason that a sufficient supply of the fish may be had from points where they can be handled at less expense, and with less danger of injury to the fish while being handled. If we could, through experiments at a station of this character, successfully propagate sturgeon in a practical manner, it undoubtedly would add many thousands of dollars, in times to come, to the value of our fisheries.

Introduction of Eastern Oysters.

I have made this article on oyster culture extensive for the purpose of calling your attention to the necessity of proper experiments with this species of shell-fish, with reference to its introduction from the east. I believe that well conducted experiments will prove that it is possible to raise eastern oysters

in the waters of Willapa Bay and Puget Sound. These experiments must be under the guidance of some one conversant with the proper culture of the oyster, and one who will give it all the attention necessary from which to derive his conclusions. The efforts made in the past have been proven failures as far as material results are concerned, more, I believe, from a want of knowledge of the natural conditions existing where deposited, and the conditions needed for the success of the effort.

Oysters of many species are found nearly all over the world; the British Isles, the Mediterranean, Holland, Belgium, Germany, Denmark, Norway, part of Russia, Australia and China. Oysters are plentiful in the Hawaiian Islands, and are quite numerous on certain parts of the Asiatic shores. Oysters were highly esteemed as an article of diet by the ancients. Going back into history we find that they were written of by the ancients as of prime importance in their accounts of feasts of the wealthier Romans.

Over 1,900 years ago Sergius Grata turned Lake Avernus, in Italy, into an oyster bed. Some 2,000 years ago Sallust seems to have thought the oyster the only good thing that the Britons had. Juvenal, A. D. 60, speaks of the Brirish oyster, as of high repute among the luxuries of that day.

When the first settlers landed on the shores of America they found the oyster an article of food among the Indians, and vast beds of oyster shells are found extending from the Gulf of Mexico to Newfoundland. The oyster industry of the world is chiefly in the United States and France. Natural beds yet remain in Great Britain, and on the shores of France, the latter country having the best conducted oyster culture in the world.

In the census of 1890 the United States is credited with an annual catch of 5,550,000,000; France, 680,400,000; Great Britain, 1,600,000,000, and Canada 12,000,000. The catches of the other countries of the world are small. The eastern coast of North America produces as much as all the rest of the world combined.

Something like one hundred years ago the French and English oyster supply was supposed to be inexhaustible, yet it was not long before they had to enact laws for their protection.

The annual output of the oyster business of the United States

is estimated to be worth $17,000,000, about one-third of the entire yearly value of our fisheries.

On the eastern coast of North America there is but one species of oyster (*Ostrea Vicginiana*), which occurs along the northern side of the Gulf of Mexico, on the Atlantic coast from Florida to Cape Cod, and along the Gulf of St. Lawrence. Oyster fisheries are located in every coast-wise state from Texas to Massachusetts, the most important being in Cheaspeake bay, mainly upon natural beds, and in Long Island Sound, principally upon planted beds. The Canadian oyster beds are on the decline and efforts are being made for their protection.

In the European oyster the individuals are both male and female; in the eastern oyster the sexes are separate, each individual being male or female. It is not possible from external oppearances to distinguish the sexes. Only by an examination of the genital glands or products can the sex be distinguished. The season of spawning differs with the locality. As a rule they may be said to ripen earlier in the south, and also in more shallow water, presumably due to the temperature of the water. In South Carolina they spawn from the middle of March to the middle of August. In Chesapeake Bay oysters are found spawning from April to October. In Long Island Sound the time varies according to locality but, is duriug May, June, July and August. Not only the time of spawning but the quantity of spawn are affected by climatic conditions. Sudden storms during the spawning season are liable to kill millions of the minute oyster, and a change in transferring from one place to another during this period is highly detrimental to the proper work performed by the female. The number of eggs discharged varies with the size, and according to good authority, the average sized one will yield 16,000,000 eggs each, while a very large one will yield as high as 60,000,000. While the fecundity of the individual oyster is enormous, the great waste that constantly goes on during the best conditions is apalling, the greater part of the eggs being wasted. Neither the eggs or the vitalizing fluid lives long after leaving the parent, and if fertilization does not take place immediately it is lost. While the oyster is very young it is preyed upon by many forms of aquatic life, and lucky indeed is the bivalve that succeeds in reaching that stage in which it attaches itself to some substance at the bottom of

the water. At this time it is about one-eighteenth or one-nineteenth of an inch in diameter, and in this stage the shell is very thin and delicate, easily sustaining injury. It attaches itself by one of the shells, and its rate of growth varies with the temperature of the water, and the available food; warm water being more conducive to rapid growth. Its food consists of minute organisms, which float about in the water. Water in which the oyster lives is of widely varying temperature, both as to its average and to the extremes during the year. In Chesapeake Bay it is from freezing point to 90 F. In New Jersey the shallow water oysters are frequently frozen, which does not kill them if gradually thawed. The salinity of the water is also to be taken into consideration, too much salt water being injurious, and prolonged exposure to its influence proving fatal. It has been found that in some places the best results have been obtained in brackish water, it probably being due to the fact that it is warmer, and that food is abundant. It, however, depends upon the species of the oyster, some thriving where others will not.

As regards the proper bottom best suited to eastern oyster that is found best which has a shallow covering of mud overlaying a hard sub-strata. Hard objects distributed over the bottom serve as collectors of the young so long as the service remains clear and free from slime and sediment. It takes only a thin film of mud to smother the young, so the beds should be away from the mouths of rivers and streams, which deposit sediment. Large oyters are not so susceptible to its influence, although any great deposit of sediment is liable to prove ruinous to the bed. Tides and currents are important factors in the growth of the oyster, it brings about the aeration of the water and oxidation of dead organic ingredients. The vertical range of the cultivated oyster beds is from the shore line to the depth of 15 fathoms. In New Jersey, Chesapeake Bay, South Carolina and other places, there are beds which are partially exposed to low water, while in Long Island Sound successful oyster culture is carried on in depths as great as 15 fathoms, the average over planted grounds in that region, five to six fathoms. Until comparatively a recent date the seed supply was drawn from the natural oyster beds which were originally so vast that it was a common saying that they were inexhaustible. This is a fallacy, as it has been proven that the beds have been decreasing in supply to meet an increasing demand.

DESCRIPTION OF NATURAL EASTERN OYSTER BEDS.

Dr. Brooks thus describes a natural bank of eastern oysters:

"An examination of a coast survey chart of any part of the Chesapeake Bay, or of any of its tributaries, will show that there is usually a mid-channel, or line of deep water, where the bottom is generally soft and where no oysters are met with, and on each side of this an area where the bottom is hard, running from the edge of the channel to the shore. This hard strip is the oyster area. It varies in width from a few yards to several miles, and the depth of water varies upon it from a few feet to five or six fathoms, or even more. But there is usually a sudden fall at the edge of the channel where the oyster stops, and we pass on to hard bottom; and a cross-section of the channel would show a hard, flat plane with oysters on each side of the deep muddy channel. The oyster bottom is pretty continuous, except opposite the mouth of a tributary, there it is cut across by a deep, muddy channel. The solid oyster rocks are usually situated along the outer edge of this plateau, although in many cases they are found over its whole width nearly up to low tide mark or beyond. As we pass south along the bays and sound of Virginia and North Carolina, we find that the hard borders of the channel come nearer and nearer to the surface until in the lower part of North Carolina there in on each side of the channel a wide strip of hard bottom which is bare at low tide, and covered with oysters up to high water mark, although the oysters are most abundant and largest at the edge of the deep water, where they form a well defined reef. In our own waters there is usually a strip along the shores where no oysters are found, as the depth of water is not great enough to protect them in winter. The whole of the hard belt is not uniformly covered with oysters, but it is divided up into separate oyster rocks, between which comparatively few can be found.

"The boundaries of a natural rock, which has not been changed by dredging, are usually well defined, and few oysters are to be found beyond its limits. The oysters are crowded together so closely that they cannot lie flat, but grow vertically upwards side by side. They are long and narrow, are fastened together in clusters, and are known as 'coon oysters.'

"When such a bed is carefully examined it will be found that most of the rock is made up of empty shells, and a little examination will show that the crowding is so great that the growth of one oyster prevents adjacent ones from opening their shells, and this crowds them out and exterminates them. Examination shows, too, that nearly every one of the living oysters is fastened to the open or free end of a dead shell, which has thus been crowded to death; and it is not at all unusual to find a pile of five or six shells thus united, showing that number two has fastened, when small, to the open end of number one, thus raising itself above the crowd. After number one was killed, number two continued to grow, and number three fastened itself to its shell, and so on. Usually the oysters upon such a bed are small, but in some places shells

twelve or fourteen inches long are met with. The most significant characteristic of a bed of this kind is the sharpness of its boundaries. In regions where the oysters are never disturbed by man it is not unusual to find a hard bottom extending along the edge of the shore for miles and divided up into a number of oyster rocks, where the oysters are so thick that most of them are crowded out, and die long before they are full grown, and between these beds are areas where not a single oyster can be found. The intervening area is perfectly adapted for the oyster, and when a few bushels of shells are scattered upon it they are soon covered with young, and in a year or two a new oyster rock is established upon them, but when they are left to themselves the rocks remain sharply defined.

"What is the reason for this sharp limitation of a natural bed? Those who know the oyster only in its adult condition may believe that it is due to the absence of powers of locomotion, and may hold that the young oysters grew up among the old ones, just as young oak trees grow up where the acorns fall from the branches. This cannot be the true explanation for the young oysters are swimming animals, and they are discharged into the water in countless numbers, to be swept away to great distances by the currents. As they are too small to be seen at this time without a microscope it is impossible to trace their wanderings directly, but it is possible to show indirectly that they are carried to great distances, and that the water for miles around the natural beds are full of them. They serve as food for other marine animals, and when the contents of the stomachs of these animals are carefully examined with a microscope, the shells of the little oysters are often found in abundance. While examining the contents of the stomach of lingula in this way I have found hundreds of the shells of the young oysters in the swimming stage of growth, although the specimens of lingula were captured several miles from the nearest oyster bed. As lingula is a fixed animal the oysters must have been brought to the spot where the specimens were found, and as the lingula has no means of capturing its food, and subsists upon what is swept within its reach by the water, the presence of so many inside its stomach shows that the water must have contained great numbers of them.

"It is clear then that the sharp limitation of the area of a natural oyster bed is not due to the absence in the young of the power to reach distant points. There is another proof of this, which is familiar to all oystermen, the possibility of establishing new beds without transplanting any oysters. The following illustration of this was observed by one of your commissioners: On part of a large mud flat, which was bare at low tide there were no oysters, although there was a natural bed upon the same flats, about half a mile away. A wharf was built from high tide mark across the flat out to the edge of the channel, and the shells of all the oysters which were consumed in the house were thrown onto the mud alongside the wharf. In the third summer the flat in the vicinity of the wharf had become converted into an oyster bed, with a few medium sized oysters, and a very great number of young, and the bot-

tom, which had been rather soft, had become quite hard; in fact, the spot presented all the characteristics of a natural bed. Changes of this sort are a matter of familiar experience, and it is plain that something else besides the absence in the oyster of locomotive power determines the size and position of a bed.

"Now, what is this something else? If the planting of dead-shells will build up a new bed, may we not conclude that a natural bed tends to retain its position and size because the shells are there? This conclusion may not seem to be very important, but I hope to show that it is really of fundamental importance and is essential to a correct conception of the oyster problem.

"Why should the presence of shells, which are dead and have no power to multiply, have anything to do with the perpetuation of a bed?

"We have already called attention to the fact that oysters are found on the hard bottom on each side of the channel, while they are not found in the soft mud of the channel itself, and it may at first seem as if there was some direct connection between a hard bottom and the presence of oysters, but the fact that no oysters are found upon the hard, firm sand of the ocean beach shows that this is not the case. As a matter of fact, they thrive best upon a soft bottom. They feed upon the floating organic matter which is brought to them by the water, and this food is most abundant where the water flows in a strong current over soft organic mud. When the bottom is hard there is little food, and this little is not favorably placed for diffusion by the water, while the water which flows over the soft mud is rich in food.

"The young oysters which settle upon or near a soft bottom are therefore most favorably placed for procuring food, but the young oyster is very small, so small that a layer of mud as deep as the thickness of a sheet of paper would smother and destroy it. Hence the young oysters have the habit of fastening themselves to solid bodies, such as shells, rocks or piles or floating bushes, and they are enabled to profit by the soft bottoms without danger.

"Owing to the peculiar shape of an oyster shell, some portions usually project above the mud long after most of it is buried, and its rough surface furnishes an excellent basis for attachment. It forms one of the very best supports for the young, and a little swimming oyster is especially fortunate if it finds a clean shell to adhere to when it is ready to settle down for life. Then, too, the decaying and crumbling shells are gradually dissolved in the sea water, and thus furnishes the lime which the growing oyster needs to build up its own shell. As long as the shell is soft and thin the danger from enemies is very great, and this danger is greatly diminished as soon as the shell becomes thick enough to resist attack. It is, therefore, very necessary that the shell should be built up as rapidly as possible, and an abundant supply of food in general will be of no advantage unless the supply of lime is great enough for the growth of the shell to keep pace with the growth of the body. All sea water contains lime in solution, but the percentage is, of course, greatest near the source of supply. It is well known that on coral reefs,

which are entirely made of lime, all kinds of shelled mollusks flourish in unusual abundance, and have very strong and massive shells, and our common land and fresh water snails are much larger and more abundant in a limestone region than in one where the supply of lime is scanty. In such regions it is not unusual to find the snails gathered around old decaying bones, to which they have been drawn in order to obtain a supply of lime for their shells.

"From all other causes combined it results that a young oyster which settled upon a natural oyster bed has a much better chance of survival than one which settles anywhere else, and a natural bed thus tends to perpetuate itself and to persist as a definite, well defined area; but there is still another reason. As the flood tide rushes up the channel it stirs up the fine mud, which has been deposited in the deep water. The mud is swept up onto the shallows along the shore, and if these are level much of the sediment settles there. If, however, the flat is covered by groups of oysters, the ebbing tide does not flow off in an even sheet, but is broken up into thousands of small channels, through which the sediment flows down to be swept out to sea.

"The oyster bed thus tends to keep itself clean and for these various reasons it follows that the more firmly established an oyster bed is the better is its chance of perpetuation, since the young sprat finds more favorable conditions where there are oysters, or at least shells, already than it finds anywhere else.

"Now, what is the practical importance of this description of a natural oyster bed? It is this: Since a natural bed tends to remain permanent because of the presence of oyster shells, the shelling of bottoms where there are no oysters furnishes us with a means of establishing new beds or of increasing the area of the old ones.

"The oyster dredgers state, with perfect truth, that by breaking up the crowded clusters of oysters and by scattering the shells the use of the dredge tends to enlarge the oyster beds. The sketch which we have just given shows the truth of this claim. but this is a very rough and crude way of accomplishing this end."

From the above accounts of natural and cultivated oyster beds of the Atlantic coast, it must be evident to any well informed person that with the conditions prevailing in many localities on Willapa Harbor and Puget Sound there is undoubtedly excellent ground on which eastern oysters may be made to grow and propagate. The above account is given for the purpose of attracting attention to the great possibilities of our inland seas in this line.

As we have elsewhere stated it is our firm conviction that with a proper series of experiments this result can be obtained. The expense involved in this attempt of eastern oyster culture is so remarkably small in comparison with the results to be obtained that we are at a loss to understand how any person, making even

a limited investigation into this matter, should oppose our proposition.

From inquiries received from the east in regard to oyster culture on the Sound and from personal interviews with persons engaged in the industry, sufficient facts have been obtained which make certain the success of the experiments in this line, provided sufficient funds are obtained to carry out our proposition in a practical way.

LOBSTER PROPAGATION.

This is a subject which has come to the attention of some who have been interested in our fisheries, but it has not received the thought it deserves. I believe that we have excellent locations for the propagation and protection of this species of shell-fish. The waters of Puget Sound teem with shrimp, and annually many thousands of pounds find a place in our markets. These shrimp are excellent, but do not find the place in the markets of the world that the lobster finds. The latter properly canned, is shipped to all nations, and finds a ready market. In years past a few have been placed in our waters, and the matter of their culture turned over to the fish commissioner. It has been impossible with the limited means at his disposal to give but very little attention to the details of matters of this character when there have been other things demanding more thought and more work than one man can possibly do. I believe that success can come in this work only by means of an experimental station in the hands of an expert, a place in which the needs and conditions of all fish imported to our state may be studied in the light of all the knowledge that science can throw upon it. We have access to the knowledge gained by experiments in this line extending over a period of thirty years, and from nothing the work has grown until we see the magnificent results attained by the United States fish commissioner, and the various state fish commissioners, last year.

The young of this fish is very delicate, and feed upon pelagic organisms. The food of the older and adult stage is largely of animal origin, with but slight addition of vegetable material, consisting chiefly of fish and invertebrates of various kinds. The large and strong prey upon the small and weak. It seems to me that if they will thrive in our waters a propagation station situated in some of the coves of Puget Sound could be con-

structed, and turn out each year many millions, soon stocking our waters. With this species of fish, as with all others, the greatest danger comes when the fish is very young and helpless. When they are able to take care of themselves little loss occurs.

To give an idea of the rapidity in the propagation of this fish, I will quote from remarks made by the Professor of Biology at Adelbert college, Prof. Francis H. Herrick:

"The number of eggs laid varies with the size of the animal. The law of production may be arithmetically expressed as follows: The number of eggs produced at each productive period varies in a geometrical series while the length of the lobster producing these eggs varies in an arithmetical series. According to this law an eight inch lobster produces five thousand eggs, a ten inch lobster ten thousand, a twelve inch lobster twenty thousand. This high rate of production is not maintained beyond the length fourteen to sixteen inches. The largest number of eggs recorded for a female is 97,440. A lobster ten and one-half inches long produces, on an average, nearly thirteen thousand eggs. The young, after hatching out, loose from their mothers, rise to the surface of the ocean, and lead a free life as pelagic larvae. The first larvae is about one-third of an inch long. The swimming period lasts from six to eight weeks, or until the lobster has molted five or six times, and is three-fifths of an inch long, when it sinks to the bottom. It now travels towards the shore, and if fortunate establishes itself in the rock piles of inlets or harbors, where it remains until driven out by ice in the fall or early winter. The smallest, now from one to three inches long, go down among the loose rocks, which are exposed at low tide. At a later period, when three to four inches long, they come out of their retreats and explore the bottom, occassionly hiding or burrowing under stones. Young lobsters have also been found in eel grass and sandy bottoms in shallow water."

On the Atlantic coast artificial propagation is carried on extensively on account of the rapid decrease in the number of fish existing there. Last year the United States liberated 115,606,000; Canada the year before 1,000,000,000, and the year before Newfoundland 174,800,000. With this enormous output the catch is constantly on the increase. In 1869 the Canadian fishery was valued at $15,275; in 1891 at $2,250,000. In twenty-two years its value increased nearly one hundred and fifty fold. The value of the products of this industry in the United States was nearly half a million dollars; in 1880 it was $488,432, and in 1892 over $1,062,392.

In 1896 there were 14,285,157 cans of lobsters packed in Canada, having a value of $2,400,000. The average price per pound in 1883 was nine and one-half cents; in 1893 it had risen

to nineteen cents and at the present time it is eighteen and three-fourths cents.

These are the conditions prevailing upon the Atlantic coast. The price is constantly rising and has been for some time, the food being at the present time a luxury. Although this industry has been increasing constantly and the output enormous, the demand in the markets have increased at a much more accelerated rate. It will be many years; if ever, before the markets can be supplied and this branch of the fishing industry will be a source of profit to those engaged in it.

In several instances lobsters have been planted in the waters of the Pacific coast, notably in the Monteray bay in 1888. It is reported that no captures have ever been made from those, although no extensive efforts have been made to do so. It could not be expected that they would be caught by methods employed in catching other forms of fish.

In 1896 the Canadian fisheries had a consignment of eastern lobsters planted on the coast of British Columbia. The consignment from the east numbered six hundred adults and all but one hundred and ninety-six died in transit. It is reported that a few months afterwards a lobster was caught fully seventy-five miles from the locality where first deposited. The time elapsing since this experiment was made has been so short that it is impossible to reach any conclusion as to the results accruing. I believe that if the experiments to be made in the future are of a practical nature, they will meet with success and that this may be made a valuable adjunct to our present remunerative industry.

GAME AND GAME PROTECTION.

All good citizens should be interested in the development and preservation of our natural resources, in any line which may add wealth and happiness to ourselves and our posterity. Especially is this true in the interest which should be taken in the preservation of our game, which abounds so abundantly in nearly all parts of our favored state.

It has been placed here by the benificent Creator to add to our happiness; it has cost us nothing in the way of money or of labor, and if wisely protected will increase as the years go by. We should think of the great good which will follow the proper protection of the game now existing, and strive to steer public opinion in the direction of having better laws enacted for its preservation. I would that I could more forcibly present this to your attention, but in a brief report like this I have not space to do so, neither have I any statistics as to the amount and value of the game annually consumed in the state.

There has not been in the past, nor is there now, any method by which the proper information could be obtained. This department of our natural resources has not received the attention which should be given it. In order that you may be informed as to the benefit to be derived from such legislation, I will quote from several authorities, which unquestionably are as well prepared to accurately state the facts as any which can be found.

At the annual meeting of the National Fishery Congress in January of this year, Hon. L. T. Carlton of Maine, among other remarks with reference to this subject, said:

"Maine in this respect as in many others, leads the world. In her limitless forests roam countless numbers of the monarch of the forest, the gigantic moose, the bounding cariboo, and the graceful, beautful Virginia deer. In her more than two thousand inland seas and lakes are found in greater abundance than elsewhere the square-tailed trout and the land-locked salmon. The great dailies and sporting papers of the American continent are in the habit of referring to Maine as the "Paradise of the Sportsman," and this is a very appropriate title, as nowhere else is there such sport to be had for either rod or rifle.

"We have an area of about 30,000 square miles in extent, and from the nature of the soil and climate, affording food and cover for numberless herds of deer, cariboo and moose, not to speak of the countless flocks of birds, both resident and migratory, including the ruffled grouse, woodcock, snipe, wild goose, black duck, wood duck, and an endless va-

riety of sea-birds, and the whole world is fast learning of our advantages in this respect. In her majestic rivers, those great highways from the mountains to the sea, is found in increasing numbers the best fish that swims the ocean blue, the Atlantic salmon. Wise, well considered laws we have and an enlightened public sentiment. Ten thousand citizens of other states during the open season last year, now just closed, came to Maine to fish and hunt, employed over 1,300 registered guides and spent $4,000,000 among our people, and killed ten thousand deer, two hundred and fifty moose, two hundred and thirty cariboo, and one hundred and sixty bears, while $6,000,000 more were spent there by non-residents last year, by visitors to our seashore, and inland summer resorts, making $10,000,000 expended in Maine last year by non-residents for pleasure. Do you wonder that the people of Maine are marvelously interested in fish and fisheries? We follow the example of the great apostle Peter, we go fishing, and invite everybody to come and do likewise."

Another author says:

"A few years ago it was thought that the highly prized moose was decreasing rapidly, and it was prophesied that in a brief time it would be exterminated. This led to a better enforcement of the laws, and to prohibiting the killing of the cow and calf moose at any time in the year. In a surprisingly short time the benefit of these acts became apparent. It was stated by the game commissioner and trustworthy woodsmen that moose were holding their own; later the commissioners were convinced that moose were on the increase. The Virginia deer is found in every county in the state. It has been asserted by Col. E. C. Farrington, secretary of the Maine sportsman's association, that ten thousand deer a year could be spared, and the condition of the deer be benefitted by the killing of that number.

"Unless one is familiar with the resources of this state, it is difficult to imagine the great number of deer which may be found in Maine. It is no uncommon sight during the warm weather to see fifteen or twenty of these animals during a paddle of a few miles along some of the rivers in the morning or evening."

Chief Game Warden Finsley, of Ontario, estimates that on November 1 there were fully six thousand sportsmen in the northern hunting grounds of that province in chase of deer. He bases his calculation on the number of licenses issued this season to hunters and settlers. Supposing that each hunter kills one it would mean a loss of six thousand deer. Warden Finsley when asked as to the relative number of deer compared with former years said:

"Instead of decreasing, they are on the contrary, increasing. The clearing of large timber tracts and their replacement in the course of nature by thick undergrowth is one of the prime factors in this increase

for it not only affords protection to the deer in places impenetrable by huntsmen, but also gives them a better supply of food."

Mr. M. E. Davis, of Montreal, general passenger and ticket agent of the Grand Trunk Railway, who is greatly interested in sportsmanship, writes:

"The deer are increasing each year throughout the northern district. This is owing to the fact that the open season only runs from November 1 to 15 and during the close season the game wardens and inspectors are very much alert for any breach of the law."

These quotations give the conditions as they now exist in Maine and Eastern Canada. How much different than those presented thirty years ago when one had to penetrate the wildest portions of Northern Maine in order to find a single specimen of any of the species which abounds so numerously. The change in these conditions has not been brought by increased fecundity of the deer and other game, but by protecting them from the inroads of the hunter by limiting the number killed by each and limiting the hunting season to a few months or days. The same methods which brought about the destruction of game in New England have been applied here, and if continued will, in a short time destroy the game to the extent that one will be compelled to search among the wildest portions of the mountainous districts to find specimens of what is now quite numerous in so many parts of our state. It has been only a few years since any precautionary measures were adopted to preserve this important resource, and then only such measures as could be employed at a minimum of expense and labor. Let us see what the conditions now are after thirty years of indiscriminated hunting with dogs, and by the employment of any other method, which could be used to capture the denizens of the forest and prairie. The antelope is a thing of the past. The deer, in the southeastern part of the state, are confined to the Blue mountains, in which are left enough if protected to furnish a rich field for the sportsman for many years to come. The northern and northeastern parts of the state are well stocked with several varieties of deer, and in these sections is found some of the best hunting in the northwest. It, however, is being rapidly settled, and in a few years the condition will be the same as in the earlier settled portions of the country, if not properly watched. The section within the limits of the Cascade mountains and contiguous territory con-

tains great numbers of several varieties of deer and a limited number of elks, mountain goats and mountain sheep. The western part of the state, within the section embraced by the Olympic mountains and its spurs, contains a great many elks and deer of several varieties. In years past the elks ruthlessly have been killed during the deep snows, and if the hunter is allowed to employ the same methods in the future, this, the noblest species of game found within our border will become extinct or nearly so. Most parts of the state are well stocked, and by proper care and and watchfulness ten deer may, in a few years, be found where there is only one now. I believe the present laws with reference to the destruction of game adequate, if properly enforced, to bring about this most desired condition. While we cannot expect to receive the income from our game that the people of Maine and other portions of our country receive, we may have a field for sport unrivalled within our land, and our residents will not be compelled to go beyond the confines of our own state for all the sport they may desire.

LAWS AND METHODS OF ENFORCEMENT.

The provisions of the law with reference to the methods of enforcement, are as follows:

Section 126, game laws, law of 1897:

"The county commissioners of the respective counties in the State of Washington are hereby empowered and authorized to and may upon application in writing of one hundred resident free-holders and tax-payers of said county, appoint a suitable person, who shall be a qualified elector and tax-payer of said county, as game warden for such county, who shall be vested with all the authority of a sheriff to perform the duties prescribed in the following section. Such game warden, so appointed, shall receive a salary of not more than twenty-five dollars per month, to be paid in the same manner as other county officers."

Section 127:

"It is hereby made the duty of every game warden so appointed, and every sheriff, deputy sheriff, constable, city marshal, police officer, within their respective jurisdictions in the State of Washington, to enforce all the provisions of this act, and all laws for the protection of game, birds, and animals, fish and wing birds, and such sheriffs, deputy sheriffs, constables, city marshals, police officers, and each of them, by virtue of their election and appointment, are hereby created and constituted ex-officio game wardens for their respective jurisdiction, and they and each of them, and each and every game warden, so appointed, under the provisions of the preceding section shall have authority to

and it shall be their duty to inspect all depots, warehouses, cold storage rooms, store houses, store rooms, hotels, restaurants, markets, and all packages or boxes held either for shipment or storage which they shall have reason to believe contains evidence of the infraction of any of the provisions of this act, and if, upon inquiry, said officer discovers evidence sufficient in his judgment to secure a conviction of the offender, or shall have good cause to believe that sufficient evidence exists to justify the same, he shall at once institute proceedings to punish the said alleged offenders."

Section 128, Law 1897.

"All moneys received and all fines collected under this article shall be paid to the treasurer of the county in which the suit, action or proceeding shall have been commenced, or in which the offence shall have been committed, and the prosecuting attorney or treasurer of such county, upon the payment of any fine or judgment, may satisfy the same of record for the state. One-half of such money, exclusive of costs, shall be paid to and belong to the informer, whether such informer be the sheriff, deputy sheriff, constable, city marshall, police officer or other person other than the game warden, provided for in section 126, who caused to be brought the action or proceeding in which such fine and penalty shall be recovered, and shall be paid to such persons by the county treasurer within thirty days after the same shall be received by such treasurer, upon the certificate of the prosecuting attorney, justice of the peace or judge, who prosecuted or heard said action that such action or proceeding was brought or caused to be brought by such person, and that he is entitled to one-half of said fine, and the other half of said fine shall be retained by the county treasurer to be applied to the payment of the game warden appointed for such county."

I do not believe that the employment of this method in the enforcement of the law is adequate to the needs in the protection of our game. One county may appoint a game warden, and another county may not; in one county the law may be enforced, but the benefit derived may be over-balanced by the failure to enforce the law in an adjoining county. There are no provisions with reference to a report as to the good derived from the law. It should be ascertained by the best authority year by year, whether our game is increasing or decreasing, and, if the latter, more stringent laws should be enacted as to the closed season.

These results can only be reached by having one system covering the entire state, and the head of that system require and receive annual reports from all counties in the state, with reference to different species of game. I believe that were the state fish commissioner appointed state game warden,

and that he together with the county commissioners of each county, appoint deputy game and fish wardens, the desired good result could be better obtained in both the game and fish departments. The two departments would then be combined, and each render assistance to the other. A more careful study of the conditions existing in our fisheries ought to be made, and in this way reliable information from all parts of the state could be obtained at a minimum of expense to each department.

If this could be done it would warrant the expenditure of more money than has been used in the two departments in the past. Certain portions of our state have been stocked by private individuals with game birds, and these appear to be thriving in their new enviorments. Undoubtedly the Mongolian pheasant, if protected, will increase in numbers rapidly and in a few years the section west of the Cascades mountains will be well supplied with them. This bird was brought to Oregon in 1880 and 1881. Altogether there were imported about one hundred birds, male and female, and they are now found in every county in that state west of the mountains. It has been estimated that in 1895 over ten thousand of these birds were marketed. They have been sent for stocking purposes to over twenty states in the union. Anyone was prohibited from killing these birds for a period of six years after introduction.

I have no statistics from which I can estimate the number and value of the trout annually consumed in our state, but I know it is something surprising in its value. Our mountain streams are exceedingly well stocked with several species and in the sections embrased by the Blue, Cascade and Olympic mountains, one may find as good fishing as the world affords. Instances have been recorded where individuals have caught, with hook and line, several hundred pounds of this fish in a single day. If the east is considered a good field for the fishermen, what can be said of this state with reference to this form of sport?

In conclusion, I wish to draw your attention to our unsurpassed natural game reserves. In our nearly seventy thousand square miles of territory there are fully twenty thousand which will always form an ideal breeding place for different species of game. Among our mountains are three forest reserves in which game may breed for many, many years to come before their haunts will be disturbed or incroached upon by advancing civiliza-

tion. These reserves will be the sportsman's land of promise, if proper care and protection are given to the present denizens of the forest, allowing them to re-produce themselves in sufficient quantities that the supply be not diminished.

We ask careful consideration of our ideas on the question of of game preservation from a commercial as well as a sportsman's view. Undoubtedly our state furnishes the greatest opportunity in this line of any state in the union.

As before stated, a combination of the fisheries department with that of the game must of necessity mean well for both.

TABULATED REPORT OF THE FISHING INDUSTRY, STATE OF WASHINGTON, YEAR OF 1897.

Our annual report of 1897 not having been printed, we herewith append tabulated part of the report, showing output for that year.

TABULATED REPORT OF FISHING INDUSTRY, PUGET SOUND DISTRICT, YEAR ENDING DECEMBER 31, 1897.

CANNERIES AND FISHING APPLIANCES OPERATED.

	No.	Value.
Canneries	12	$255,450 00
Capital	.....	571,225 00
Pound nets	160	368,000 00
Purse seines	46	28,520 00
Seines, other	59	13,570 00
Gill nets	419	67,040 00
Set nets	652	19,560 00
Steamboats	37	100,000 00
All other appliances	.....	82,000 00
Total	1,385	$1,505,365 00

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

NUMBER OF MEN EMPLOYED IN FISHING INDUSTRY.

HOW EMPLOYED.	No.	Average Annual Earnings	Value.
In canneries	1,200	$200 00	$240,000 00
With pound nets	750	200 00	150,000 00
With purse seines	240	230 00	55,200 00
With seines, other	110	240 00	26,400 00
With gill nets	684	260 00	177,840 00
With set nets	230	200 00	46,000 00
Oysters	100	250 00	25,000 00
Clams and mussels	40	200 00	8,000 00
Crabs	15	300 00	4,500 00
Shrimps	6	500 00	3,000 00
Totals	3,375	.....	$735,940 00

TOTAL SALMON PACKED.

SALMON.	Number of cases.	Value.
Sock-eye	312,048	
Chinook (Tyee)	9,500	
Silver	91,900	
Humpbacks	57,268	
Comax	23,310	
Total		$1,850,000 00

FRESH, SALT AND SMOKED FISH SHIPPED AND CONSUMED LOCALLY.

VARIETY.	No. of pounds.	Value.
Salmon, fresh	11,680,000	$175,200 00
Salmon, salt	3,720,000	74,400 00
Salmon, smoked	672,000	40,320 00
Sturgeon, fresh	110,000	4,400 00
Smelt, fresh	1,028,000	20,560 00
Smelt, salt	227,000	4,540 00
Halibut, fresh	3,102,000	93,060 00
Cod, fresh	736,000	14,720 00
Soles, fresh	23,000	460 00
Flounders, fresh	35,000	700 00
Mackerel, fresh	17,000	510 00
Trout, all kinds, fresh	37,000	2,220 00
Herring, smoked and fresh	254,000	5,080 00
Carp, fresh	1,700	34 00
Shad, fresh	3,800	114 00
Catfish, fresh	6,500	335 00
Total	21,653,000	$436,653 00

In addition to the above, 420,000 fish, valued at $33,600.00, were shipped to British Columbia canneries.

NOTE.— The term "cod" includes ling, rock, tom and black cod.

SHELL FISH OUTPUT.

VARIETY.	Output.	Value.
Oysters from natural beds	2,000 sacks	$5,000 00
Oysters from cultivated beds	14,000 sacks	35,000 00
Clams	11,250 sacks	11,250 00
Mussels	300 sacks	300 00
Crabs	9,600 dozen	5,760 00
Shrimps	54,750 pounds	3,285 00
Total		$60,595 00

The cultivated oyster beds in this district comprise 820 acres.

TOTAL VALUE OF OUTPUT FOR 1897.

Salmon packed	$1,850,000 00
Fresh, salt and smoked fish	436,653 00
Shell fish	60,595 00
Total value	$2,347,248 00

TABULATED REPORT OF THE FISHING INDUSTRY, COLUMBIA RIVER DISTRICT, FOR YEAR ENDING DECEMBER 31, 1897. (STATE OF WASHINGTON SIDE.)

CANNERIES AND FISHING APPLIANCES OPERATED, NUMBER AND VALUE OF SAME.

	No.	Value.
Canneries (7 operated 1897)	9	$145,000 00
Capital	.....	240,000 00
Pound nets	370	259,000 00
Seines	45	27,000 00
Wheels	40	35,200 00
Gill nets	229	36,640 00
Boats	225	22,500 00
Set nets	197	5,910 00
Steamboats	25	48,000 00
Pile drivers, scows	178	43,000 00
All other appliances	.....	13,000 00
Total	1,318	$875,250 00

NOTE.—The term "canneries" includes shore property, machinery, etc.; the term "steamboats" includes launches, etc.

NUMBER OF MEN EMPLOYED IN FISH INDUSTRY AND ANNUAL EARNINGS.

	No.	Average annual earnings.	Total.
In canneries	560	$205 00	$114,800 00
With pound nets	470	230 00	108,100 00
With seines	130	230 00	29,900 00
With wheels	80	270 00	21,600 00
With gill nets	420	230 00	96,600 00
With set nets	105	200 00	21,000 00
Totals	1,765	.....	$392,000 00

SALMON PACKED.

	No. of cases.	Value.
Chinook	109,400	.....
Blue back	3,200	.....
Silver	12,700	.....
Fall Chinook	13,200	.....
Steel heads	6,300	.....
Totals	144,800	$580,000 00

FRESH, SALT AND SMOKED FISH SHIPPED AND CONSUMED LOCALLY.

	No. of pounds.	Value.
Salmon, fresh	2,722,000	.....
Salmon, salted and smoked	427,000	.....
Smelt, fresh and salted	344,000	.....
Trout, all kinds	42,000	.....
Sturgeon, fresh	237,000	.....
Shad	218,000	.....
Cod, all kinds	27,000	.....
Cat fish	23,000	.....
All other kinds	21,000	.....
Totals	4,061,000	$158,000 00

TOTAL VALUE OF OUTPUT FOR 1897.

Salmon packed	$580,000 00
Fresh, salt and smoked fish	158,000 00
Total value	$738,000 00

TABULATED REPORT OF FISHING INDUSTRY, GRAY'S HARBOR DISTRICT, FOR YEAR ENDING DECEMBER 31, 1897.

CANNERIES AND FISHING APPLIANCES OPERATED.

	No.	Value.
Canneries (only one operated, 1897)	2	$19,000 00
Capital	.....	20,000 00
Gill nets	72	8,720 00
Set nets	86	2,580 00
Boats	114	6,820 00
Steamboats, launches, etc	.....	3,000 00
All other appliances	.....	1,700 00
Total	.....	$61,820 00

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

MEN EMPLOYED IN FISHING INDUSTRY.

	No.	Average annual earnings.	Value.
Canneries	85	$200 00	$17,000 00
Gill nets	120	230 00	27,600 00
Set nets	45	300 00	9,000 00
Clams and crabs	13	200 00	2,600 00
Total	263	.....	$56,200 00

SALMON PACKED.

	No. of cases.	Value.
Fall Chinook	3,100	.....
Silver	8,300	.....
Comax	1,900	.....
Total	13,300	$39,900 00

FRESH, SALT AND SMOKED FISH SHIPPED AND CONSUMED LOCALLY.

	No. of pounds.	Value.
Salmon, fresh	772,500	$17,380 00
Salmon, salt and smoked	56,500	1,695 00
Sturgeon, fresh	13,300	532 00
All other kinds	12,600	378 00
Total	854,900	$19,985 00

SHELL FISH OUTPUT.

	Output.	Value.
Clams	2,200 sacks	$2,200 00
Crabs	900 boxes	2,250 00
Total	.....	$4,450 00

TOTAL VALUE OF OUTPUT, 1897.

Salmon packed	$39,900 00
Fresh, Salted and smoked	19,985 00
Shell fish	4,450 00
Total	$64,335 00

TABULATED REPORT OF FISHING INDUSTRY, WILLAPA HARBOR DISTRICT, FOR YEAR ENDING DEC. 31, 1897.

CANNERIES AND FISHING APPLIANCES OPERATED AND NUMBER AND VALUE OF SAME.

	No.	Value.
Canneries	2	$21,000 00
Capital	.....	30,000 00
Pound nets	38	19,000 00
Gill nets	57	7,125 00
Set nets	70	2,100 00
Boats	70	4,860 00
Launches	3	3,600 00
Pile drivers and scows	13	2,700 00
Totals	253	$90,325 00

MEN EMPLOYED IN FISHING INDUSTRY.

HOW EMPLOYED.	No.	Average annual earnings.	Value.
With canneries	120	$200 00	$24,000 00
With pound nets	50	230 00	19,500 00
With gill nets	70	200 00	18,000 00
With set nets	35	200 00	7,000 00
With oysters	300	260 00	78,000 00
With clams and crabs	13	200 00	2,600 00
Totals	588	.....	$149,100 00

SALMON PACKED.

SALMON.	No. of cases.	Value.
Fall Chinook	8,100	.....
Silver	14,600	.....
Comax	6,900	.....
Totals	29,600	$88,800 00

FRESH, SALT AND SMOKED FISH SHIPPED AND CONSUMED LOCALLY.

VARIETY.	No of pounds.	Value.
Salmon, fresh	230,000	$5,900 00
Salmon, salt and smoked	22,500	1,125 00
Sturgeon, white	30,000	1,200 00
Sturgeon, green	50,000	1,500 00
All other kinds	11,800	354 00
Totals	344,300	$10,079 00

SHELL FISH OUTPUT.

VARIETY.	Output.	Value.
Oysters	45,000 sacks.	$90,000 00
Clams	2,000 sacks.	2,000 00
Crabs	1,000 boxes.	2,500 00
Total		$94,500 00

The cultivated oyster beds of this district comprise 2,200 acres.

TOTAL VALUE OF OUTPUT FOR 1897.

Salmon packed	$58,800 00
Fresh, salt and smoked fish	10,079 00
Shell fish	94,500 00
Total value	$193,379 00

GRAND TOTAL OUTPUT OF FISHERIES, STATE OF WASHINGTON, 1897.

PUGET SOUND DISTRICT.

	Output.	Value.
Salmon packed	494,026 cases.	$1,850,000 00
Fresh, salt and smoked fish	21,653,000 pounds.	436,653 00
Shell fish		55,990 00
Total		$2,342,643 00

COLUMBIA RIVER DISTRICT.

	Output.	Value.
Salmon packed	144,800 cases.	$580,000 00
Fresh, salt and smoked fish	4,061,000 pounds.	158,000 00
Total		$738,000 00

GRAY'S HARBOR DISTRICT.

	Output.	Value.
Salmon packed	13,300 cases.	$39,900 00
Fresh, salt and smoked fish	854,000 pounds.	19,985 00
Shell fish		4,450 00
Total		$64,335 00

WILLAPA HARBOR DISTRICT.

	Output.	Value.
Salmon packed	230,000 cases.	$88,800 00
Fresh, salt and smoked fish	344,300 pounds.	10,079 00
Shell fish		94,500 00
Total		$193,379 00
Total value of output		**$3,338,357 00**

STATE FISH HATCHERIES.

VALUE OF STATE FISH HATCHERIES DECEMBER 31, 1897.

Kalama	$5,500 00
Chinook	3,600 00
Baker Lake	6,200 00
Chehalis	3,815 23
Total	$19,115 23

IMPROVEMENTS ON HATCHERIES, 1897.

Baker Lake	$1,200 00
Kalama	220 00
Chinook	230 00
Total	$1,650 00

CONSTRUCTION OF HATCHERIES, 1897.

Chehalis	$3,815 23

AMOUNT EXPENDED IN MAINTENANCE OF HATCHERIES, 1897.

Baker Lake	$3,269 62
Kalama	3,050 68
Chinook	1,838 76
Total	$8,159 06

TOTAL EXPENDITURES FROM FISH HATCHERY FUND, 1897.

Improvements	$1,650 00
Construction	3,815 23
Maintenance	8,159 06
Total	$13,624 29

OUTPUT OF FISH HATCHERIES, SPAWN ON HAND AND FRY TURNED OUT, YEAR 1897.

Kalama	3,000,000
Baker Lake	6,000,000
Chinook	1,750,000
Total	10,750,000

NUMBER OF FISHING LICENSES ISSUED UNDER LAW OF 1893, AMOUNT OF CASH RECEIVED FROM SAME AND TURNED INTO HATCHERY FUND.

No.		
8	Set nets, Puget Sound district, at $2.50 each	$20 00
14	Set nets, Columbia river district, at $2 50 each	35 00
60	Pound nets, Puget Sound district, at $10 each	600 00
4	Pound nets, Columbia river district, at $10 each	40 00
5	Wheels, at $10 each	50 00
91		$745 00

LICENSES ISSUED IN 1897 UNDER THE ACT OF MARCH 16, 1897.

147	Pound nets, Puget Sound district, at $25 each	$3,675 00
400	Pound nets, Columbia river district, at $15 each	6,000 00
43	Pound nets, Willapa Harbor, at $10 each	430 00
590		$10,105 00
419	Gill nets, Puget Sound district, at $2.50 each	$1,047 50
229	Gill nets, Columbia river district, at $2.50 each	572 50
72	Gill nets, Grays Harbor district, at $2.50 each	180 00
66	Gill nets, Willapa Harbor district, at $2.50 each	165 00
786		$1,965 00
652	Set nets, Puget Sound district, at $1 each	$652 00
197	Set nets, Columbia river district, at $1 each	197 00
86	Set nets, Grays Harbor district, at $1 each	86 00
70	Set nets, Willapa Harbor district, at $1 each	70 00
1005		$1,005 00
46	Seines, Puget Sound district, at $25 each	$1,150 00
13	Seines, Puget Sound district, at $15 each	195 00
19	Seines, Puget Sound district, at $10 each	190 00
27	Seines, Puget Sound district, at $2.50 each	67 50
105		$1,602 50
35	Seines, Columbia river district, at $15 each	$525 00
8	Seines, Columbia river district, at $10 each	80 00
8	Seines, Columbia river district, at $2.50 each	20 00
51		$625 00
31	Scow wheels, Columbia river district, at $15 each	$465 00
8	First class wheels, Columbia river district, at $25 each	200 00
5	Second class wheels, Columbia river district, at $15 each	75 00
44		$740 00
15	Canneries, at $50 each	$750 00
1	Cannery, at $60	60 00
4	Canneries, at $75 each	300 00
20		$1,110 00

TOTAL LICENSES ISSUED AND CASH RECEIVED.

654	Pound nets	$10,745 00
786	Gill nets	1,965 00
1027	Set nets	1,060 00
156	Seines	2,227 50
49	Wheels	790 00
20	Canneries	1,110 00
2692		$17,897 50

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.

STATE OF WASHINGTON.

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OLYMPIA, WASH.
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1901.

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 Commissioner.

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 ndustry, 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 printthe 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 bookkeeper 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 hatcherv 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 1¼ 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 considearble 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 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 reseeding, 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 controled 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 PROPAGATION 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 luridia*, 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 spawing 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:

	Temp. of air.	*Temp. of water at surface.*	*Specific gravity.*
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^2O)	97.040	97.470	97.500
Fe and Al oxides	trace	trace	trace
Ca oxide	.057	.058	.056
Mg oxide	.169	.155	.145
Na^2O	1.075	1.042	.945
K^2O	.035	.021	.023
SO^3	180	.173	.161
P^2O^5	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^2O (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.

	July 11 to 20.	*July 21 to 31.*	*August 1 to 10.*	*August 11 to 20.*
Maximum	77.	78.8	73.4	73.4
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.

	July 11 to 20.	*July 21 to 31.*	*August 1 to 10.*	*August 11 to 20.*
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 æration, 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 abundently 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 phycocycanim. The green matter is soluble in the digestive juices of the oyster, and passes into the tissues affecting principally the blood corpusles. 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, atthough 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	7,180 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	$598,780 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	1,590,006 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	38	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	37,230	.....
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	37,300	.....
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	.....	$83,570 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	$71,300 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 80
Willapa Harbor district	196,094 00
Grays Harbor district	129,247 00
Total	$6,389,142 80

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

COLUMBIA RIVER FISH WHEELS.

8	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	
			35 00
	Total fishing gear licenses		$27,368 50

INDIVIDUAL LICENSES.

834	Individual licenses, Columbia River, at $1 each	$834 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	
			$2,140 00

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		$6,000 00

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		$16,876 44

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	8,380	
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
Seines, 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	230 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	$34,272 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	1,693
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	103,740 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	
28	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		$13,077 09

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.

	Maintenance.	Construction.	Improvements.
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 18
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 DECEMBER 20, 1898, TO JANUARY 1, 1901.

HATCHERIES.	From appropriation 1898-99.	From appropriation 1899.
Baker Lake	$673 55	
Kalama	862 42	$5,101 17
Chinook	431 05	3,672 01
Chehalis	426 88	4,251 90
Wenatchee		7,238 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	$2,393 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		385 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 (300,000 from Wenatchee)	360,000
Total	17,827,000

PUGET SOUND DISTRICT.

Nooksack River hatchery	10,368,000
Skokomish River hatchery	8,032,000
Samish River hatchery	2,564,000
Total	20,964,000

GRAYS HARBOR DISTRICT.

Chehalis River hatchery (150,000 from Kalama)	2,617,000

WILLAPA HARBOR DISTRICT.

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

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

WILLAPA HARBOR DISTRICT.

Willapa River hatchery	726,000

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	$6,837 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 tyee 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 undred 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 considerabe 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 Hoodsport, 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 Legislalature, 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., 535.

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-residsnts 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 clubhouses 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 re-stocked.

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.