REPORT

—OF—

FISHERIES COMMISSIONER FOR BRITISH COLUMBIA.

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VICTORIA, BRITISH COLUMBIA,
December 15th, 1901.

Hon. D. M. Eberts,
Attorney-General.

SIR,—I have the honour to submit that, upon receiving my appointment as Fisheries Commissioner on October 15th, 1901, I came to Victoria, and at a conference with the Executive Council it was determined that, as at this time the sockeye salmon interests of the Fraser River were of the greatest commercial value, I should at once proceed to investigate the spawning grounds and habits of the sockeye (*O. Nerka*) of that river, with a view to the location of suitable hatchery sites. During the investigation which immediately followed, I visited Harrison Lake and River, and most of their tributaries. I ascended the Fraser River to Lillooet, and spent a week at Seton and Anderson Lakes. I then went up the Fraser's largest tributary, the Thompson, to its head at Shuswap Lake. In the Harrison and Lillooet Districts I found the sockeye spawning in large numbers. The spawning season was over in the Shuswap country, and I spent but little time there. I was fortunate, however, in being able to spend a day with Mr. William Roxburg at the new hatchery at Tappen Siding, on the Salmon Arm of Shuswap Lake, and he gave me much information regarding the seasons and movements of the sockeye in that vicinity. Upon my return from the Thompson it was considered desirable that I should proceed to Rivers Inlet and go over as many of the streams entering Oweekayno Lake as the season would permit. I spent the week of November 18-25 there, and examined many of the streams tributary to the lake, which are the spawning grounds of the sockeye and the other salmon that pass up Rivers Inlet.

On the trip to Harrison River I was accompanied by Mr. C. B. Sword, Inspector of Fisheries of the Dominion Government, and I desire in this public way to make known to him my hearty appreciation of his courteous manner and the valuable information he gave me. With Mr. Sword I went to the spawning station on Morris Creek, situatedf our miles below Harrison Lake. His assistants were there collecting the eggs of the sockeye, which he was forwarding to the hatchery at Bon Accord, on the Fraser River, a few miles above New Westminster. The late run of the sockeye congregates in considerable numbers at Morris Creek, and the Dominion Government has operated at this point in the collection of their eggs since 1884. This is the only point where spawn has been taken up to 1901, at which time eggs were also secured at Scotch Creek, a tributary of Shuswap Lake, and transported sixty miles to the new hatchery at Tappen. In addition to expressing my obligation to Mr. C. B. Sword and Mr. William Roxburg, I desire to acknowledge my indebtedness to Mr. George S. McTavish, the Superintendent of the British Columbia Canning Company at Rivers Inlet, for his entertainment during my stay there; for arranging the details of my trip up Oweekayno Lake; for selecting the Indian boatmen, and for accompanying me on the trip at great inconvenience to himself. His services were invaluable.

With the above statement of my movements, I submit the following suggestions for consideration:—

The salmon of the Province being the most valuable of its fishery interests, it commands first consideration. The sockeye (*O. Nerka*), being the most important of the salmon runs

both in number and value, its propagation is first considered. As the run of sockeye in the Fraser River is the most important, the greatest number of fishermen and cannery employees are engaged there, and the capital invested is the largest of any section of the Province, it is suggested that the first efforts of the Government should be directed towards the support and maintenance of the run of fish in that great river; and that, as moneys are available, other sections should, in accordance with their needs and importance, be taken up and considered. The hatchery system of the Province, to be adequate, must be comprehensive and expansive. An ideal hatchery location, to be available, should be situated upon a stream naturally frequented by spawning fish, where the run of such fish can be depended upon with the greatest certainty, where climatic conditions are the most favourable, where the eggs can be immediately transferred to the hatchery, where the young fish can be liberated at the least cost, and where sufficient local labour is assured. Such a location is found on the Fraser River at the outlet of Seton Lake, in Lillooet District. Seton Lake is situated some fifty miles north of the point where the Thompson enters the Fraser River, and three miles from the town of Lillooet. The lake is seventeen miles in length, seldom exceeds a mile in width, is of great depth, and is bounded on each side by high, snow-capped mountains that descend abruptly to the shores.

Seton Lake is connected at its western end by a short stream with Anderson Lake, which is its counterpart, though a mile less in length, and heads in the mountains farther to the south.

The outlet of Seton Lake, known as Lake Creek, empties a mile from the lake into Cayoosh Creek, a large stream coming from the mountains a short distance south of Seton Lake, and which empties into the Fraser River three miles below the lake. The outlet, while carrying a considerable volume of water, is wide and shallow, and at several points affords excellent opportunities for the placing of weirs to intercept the fish, and the location of the hatcheries immediately adjoining. The sockeye enters Cayoosh Creek in great numbers every year. The run begins late in July, and usually continues until about October 1st. The first of the run passes through Seton Lake and Portage Creek into Anderson Lake. Later than this first run, vast numbers spawn in Seton Lake and the outlet streams. During the past season the run is said to have been the largest in twenty years, and it continued some three weeks longer than usual. During the time of my inspection of these places (October 30th to November 3rd) the fish were still running. The shores of the lakes and their tributary streams were covered with dead fish and the whitened bones of those of the earlier run. Dead, dying and spawning fish were seen in large numbers in Cayoosh, Lake and Portage Creeks. The air along these streams and at the end of Seton Lake was sickening from the stench of the dead salmon. I was told, however, that it had been much worse a month before, and was as offensive every year during the run.

Mr. John Marshall, who has lived on Cayoosh Creek below Seton Lake for the past twenty years, says that every year there is a large run of sockeye salmon, though the run is much larger every fourth year; that the fish have not failed to run during August and September ever since he has lived there; that the run this season was one-third greater than in any previous year; that the young salmon pass out of the lake on the first high water in the spring, and continue to pass down until July; that the Indians annually catch many thousands of the young salmon as they pass out of the lake.

Mr. E. S. Peters, who has lived at the outlet of Seton Lake for many years, and who operates the saw-mill there, says the sockeye run begins in July and continues until October; that there is a good run every year, and that it is noticeably larger every fourth year; that the first of the run passes through Seton into Anderson Lake; that in passing up Seton Lake they keep close to the surface and run in vast schools; that early in October, during the past season, the surface of Seton Lake was covered with dead salmon; that the young fish begin to pass out of the lake about May 1st, on the rising water; that they pass down in a continuous procession, and that the Indians at that time, by means of traps, catch great numbers of them every year.

The statements of Messrs. Marshall and Peters are confirmed by Mr. William Durban and Mr. John Dunlap, who live near the outlet of Seton Lake, and by the Indians living at Seton and Anderson Lakes.

Because of the statements above quoted, and those made by other residents of Lillooet, and from my own observations, I am satisfied that there is a sufficiently extensive run of sockeye every year to warrant large hatchery operations at Seton Lake. This location offers

exceptional opportunities for the establishment of large hatcheries. The climatic conditions could not be improved. As no rain falls during the spawning season the streams are not subject to freshets, and weirs can be easily maintained and the fish thus successfully impounded at the hatchery site. The waters of the outlet are clear, of equable temperature, and have sufficient fall to make them available for use in the hatchery. There are numerous sites on the stream where the necessary hatchery buildings can be erected, and where the eggs can be taken and at once transferred to them. There is a saw-mill at the outlet of Seton Lake, which will ensure cheap lumber at the hatchery site. The necessary labour can be obtained from the town of Lillooet and the Indian villages close at hand, and finally and most important there is an abundance of ripe fish and suitable waters for the distribution of the young fish. I consider this location one of the best, if not the best site I have ever seen for the establishment of a large hatchery. On Portage Creek, which unites Anderson and Seton Lakes, is situated a hatchery site equally as desirable as that at Seton Lake, except that the expense of securing lumber and labour would be larger. In my judgment, during the past season, one hundred millions of eggs could have been secured at Seton and Anderson Lakes.

Attached hereto is a sketch map of Seton Lake and its outlet stream that may prove of interest in considering the location.

In consideration of the fact that, during the season of 1901, some twenty-five millions of adult sockeye were taken from the waters of Puget Sound, the Straits of Georgia and the Fraser River, while on their way to that stream to spawn, it must be conceded that hatching operations should be conducted upon a large scale if the salmon interests are to be maintained and a large run of fish insured every season. It is well known that there is a greater yearly fluctuation in the numbers of the sockeye which run in the Fraser River than in any other stream in the Pacific Coast. This periodicity is very marked, and never more so than during the past two seasons. In 1900 only 311,000 cases of salmon were packed on the Fraser, while in 1901 the pack was over 1,000,000 cases, and could have been larger had the market conditions warranted. In my opinion, the periodicity of the big runs can be overcome by planting millions of fry every year for a considerable period. If this result could be accomplished, or even if there were only a remote likelihood that such a result could be attained by the propagation of millions of fry, how gross would be the neglect not to undertake it.

The value of the salmon pack of the Fraser District in the year 1901 reached $5,000,000, while the pack of 1900 did not reach $2,500,000. I do not propose to consider, in this report, the causes which occasion the remarkable fluctuations in the run of salmon in the Fraser River, but simply refer to them to contrast the fluctuation in value and volume of the salmon interests from year to year, in order to show the advantages of the proposed propagation.

To this end the following brief comparison is made between the natural and the so-called artificial method of propagating the salmon.

Few authorities believe that ten per cent. of the eggs of the salmon naturally reach the fry stage of development, and some experts believe the number is very much less. By the hatchery method ninety per cent. of the eggs produce swimming fish. Under natural conditions the eggs are fertilised in the water after they leave the female. The eggs, being heavier than the water, settle upon the bottom where they are helpless. If by good fortune the egg has come in contact with the milt of the male and is fertilised, and after settling upon the bed of the stream it is swept by the currents under the stones and out of sight, and there remains undisturbed during the four to six months which is necessary for its development into a swimming fish, in water of the temperature of the streams under consideration, nature's method has been accomplished. In other words, the egg is sterile when it is expressed from the female, and in nature it must come in contact in the water with the germs of the male within two and one-half minutes after it is expressed by the female, and it must then escape the attention of its many enemies for months if it is to develop into a young salmon. Considering these facts it is plain that under natural conditions only a small percentage of the three thousand or less eggs of the average female sockeye ever reach the swimming stage of development.

Under the hatchery method the ripe fish are captured on or near their natural spawning beds. The fish when ready for spawning are removed from the water, the eggs of the female and the milt of the male are expressed at the same time into the same pan, where every egg is brought into instant contact with the germs of the male and all the healthy eggs are thus fertilised.

The eggs are then placed in the hatchery and carefully attended. They are kept free from silt and the vegetable germs that are so fatal to them, until the alevin emerges from the egg, its sack is absorbed, and it rises from the bottom of the hatchery trough a free, swimming fish, when it is at once taken to the stream and liberated. Nature's method has been improved upon. Almost all the eggs have been fertilised. The helpless egg and almost helpless alevin have been carefully cared for; and at the same time, and in almost the same place where nature intended the fry should advance and attain self-control, he is placed a healthy, free, swimming fish, where he begins his struggle for existence and his descent of the water-course to the sea. The hatchery method places over ninety per cent. of the eggs back into the water as swimming fish, while, by the natural method, only a possible ten per cent. The little fish do not know that they have been reared by other than natural means; that the State has protected them during the helpless stages of their development. Their natural instincts are unchanged. They find themselves free where nature intended them to be and fully equipped with all their natural instincts. They have in no way been changed or handicapped by this treatment. They are in every way as capable of caring for themselves as they would have been if hatched by nature's method. By means of hatchery methods a vastly larger number of healthy young fish are placed in the streams, that have an equal chance, with those hatched naturally, to pass to the sea. From even this general statement of the hatchery method there is no doubt of the efficiency or desirability of such propagation, for, in addition, we have the results attained in other sections to fully prove its value. Artificial propagation in California has restored the salmon to the Sacramento River.

In reviewing the history of the salmon and its propagation in the Sacramento River, we find that under natural conditions, before the natural spawning grounds had been destroyed, the catch in 1873 was a little over five million pounds. Hatcheries were established in 1875, and two million fry were annually planted up to 1884, when the hatcheries were closed for four years. In 1878 the catch was six and one-half million pounds. The annual catch reached its greatest in 1880, when 10,837,000 pounds were taken, and the catch in each of the ensuing three years was over 9,000,000 pounds.

Beginning with the fourth year following the closing of the hatcheries, the catch annually decreased until 1892, when the lowest figures were reached, only 3,484,000 pounds being taken, when the effect of the resumption of the hatchery work was again made manifest. The catch has annually increased. The census for 1899, issued by the United States Commission of Fish and Fisheries, gives the catch for that year as 7,232,645 pounds, and the catch for 1901 is placed by authorities at 9,000,000 pounds.

In this connection it should be remembered that the establishment of manufactories, the diversion of waters for irrigation, extensive mining and agricultural methods during the last ten years have almost entirely destroyed the natural spawning grounds of the salmon on the Sacramento River. The propagation of salmon in California alone maintains the run of fish in her streams. This statement cannot be, and is not, questioned by any authority on the subject.

Shad and striped bass which were introduced into the waters of California are now taken in great numbers. In 1879-81 a total of four hundred and fifty little fingerling striped bass (an anadromous fish like the salmon, and not previously found in the Pacific) were liberated in the Sacramento River. In 1900 over one and a half million pounds of this most valuable fish were taken from the waters of California. Similar results followed the introduction of shad. In commenting upon these results, Dr. Hugh M. Smith, of the United States Fish Commission, says:—

"Of scarcely less consequence than the actual results of shad and striped bass introduction on the west coast is the important bearing which the success of the experiment must have in determining the outcome of artificial propagation in regions in which it is not possible to distinguish, with satisfactory accuracy, the natural from the artificial conditions. If these far-reaching results attend the planting on a few occasions of small numbers of fry in waters to which the fish are not indigenous, is it not permissible to assume that more striking consequences must follow the planting of enormous quantities of fry year after year in native waters. There is no reasonable doubt that the perpetuation of the extensive shad fisheries in most of the rivers of the Atlantic Coast has been accomplished entirely by artificial propagation. On no other supposition can the maintenance and increase of the supply be accounted for."

In this report I have not touched upon the opportunities offered for propagation at other points on the Fraser and Thompson Rivers, or at Oweekayno Lake above Rivers Inlet, though

they are numerous, for the reason that I consider it advisable to first establish one large station at some point where conditions are most favourable, and there undertake the training of a sufficient number of men to make a competent hatchery force available before other points shall be determined upon.

In conclusion, I most respectfully urge that money be at once appropriated for the construction of a hatchery station at Seton Lake, with a hatching capacity of twenty-five millions of sockeye eggs. In addition, consideration should be given to the investigation of conditions affecting other fisheries and their development, and money appropriated for that purpose.

All of which I have the honour to submit.

JOHN PEASE BABCOCK,
Fisheries Commissioner.

VICTORIA, B. C.:
Printed by Richard Wolfenden, Printer to the King's Most Excellent Majesty.
1902.