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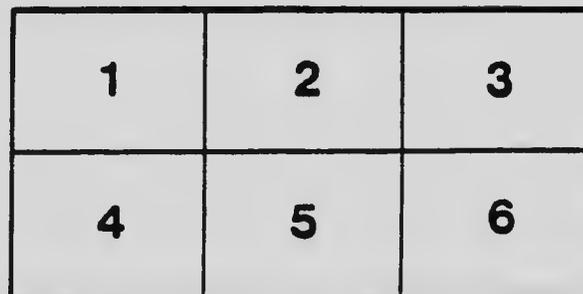
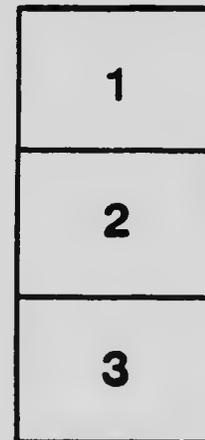
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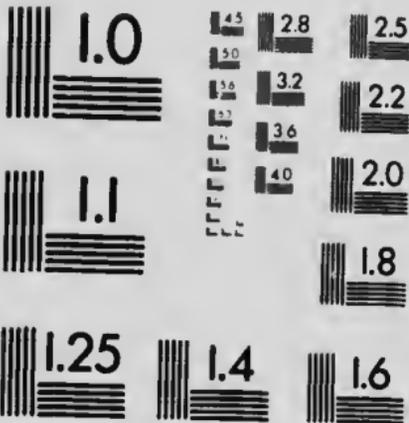
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5

DEPARTMENT OF FISHERIES

WILLIAM SLOAN, Commissioner

Fraser River Salmon Situation A Reclamation Project

By JOHN PEASE BABCOCK

Assistant to the Commissioner

APPENDIX V. TO THE REPORT OF THE COMMISSIONER
OF FISHERIES FOR 1919



VICTORIA, B.C. :

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Hell's Gate Canyon, Fraser River. Spring of 1911. Showing the condition produced by the rock slides of 1903 and 1904. The channel was restored in 1914 (see following illustration).



Hell's Gate Canyon, Fraser River, 1915. The rock thrown into the channel of the Fraser by the rock slides of 1912-1914 has been removed and the original channel entirely restored.

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The Fraser River Salmon Situation: A Reclamation Project.

BY JOHN PEASE BARCOCK.

THE sockeye-salmon fishery of the Fraser River system was formerly the world's greatest salmon fishery. The run of salmon in those waters was greater every fourth year than in any other waters. This fishery is no longer a great fishery. A discriminating study of the significant facts in the development and decline of this fishery demonstrates the necessity of dealing with them at once in an international way. These facts have been fully established and are no longer questioned, and should be more generally understood.

The restoration of the sockeye-salmon fishery of the Fraser River system is the greatest, and at the same time the least expensive, reclamation project in which Canada and the United States can jointly engage, and if adequate measures are adopted its success is certain.

It is the purpose of this paper to briefly set forth what the sockeye-salmon fishery of the Fraser River system was, what it is to-day, and what it may again become by judicious conservation.

The prominent facts in the history of the sockeye fishery may be stated as follows:—

(1.) The waters of the Fraser River system as defined in the treaty between Great Britain and the United States include all the fishing waters in the Province of British Columbia and in the State of Washington which are frequented by sockeye salmon in their migration from the Pacific Ocean to the spawning-beds of the Fraser River basin. They include Juan de Fuca, Rosario, and Haro Straits, and the other American estuary waters leading into the Gulf of Georgia, and the waters of that gulf as well as the channels of the Fraser River up to Mission Bridge, in British Columbia.

(2.) Fishing for sockeye began commercially in the channels of the Fraser in British Columbia in 1876. It was extended to the waters of the Gulf of Georgia immediately outside the mouths of the river in 1890. Fishing for sockeye began in the State of Washington waters in 1891, with the installation of traps in the vicinity of Point Roberts. Traps became an important factor in 1897. Purse-nets came into use in American waters in 1901 and in recent years have greatly increased in number. During the period of 1900 to 1918, when

the industry was at its height, the catch of sockeye in Canadian waters produced a pack of 5,030,730 cases. During the same period the catch in American waters gave a pack of 7,382,343 cases. A combined total pack of 12,413,073 cases, of which the Canadians produced 40 per cent. and the Americans 60 per cent.

(3.) Dr. C. H. Gilbert, of Stanford University, in his "Contributions to the Life-history of the Sockeye" (see British Columbia Fisheries Reports, 1913 to 1918), has demonstrated by scale-reading that the sockeye that run in the Fraser River system are hatched in the watershed of that river in British Columbia, live for the first year or more of their lives in its lake waters, then migrate to the sea, where they remain and grow until the summer of their fourth year, and then seek to return to the Fraser River basin in order to spawn, and after spawning die.* Dr. Gilbert's findings are unquestioned by any authority.

(4.) The Fraser River basin formerly produced more sockeye salmon every fourth year—known as the "big year"—than any other known river-basin, and even in the following years—known as the "small years"—produced runs of commercial importance.

* There are, however, exceptional cases in which fish proceed to sea immediately on hatching, and there are certain proportions which return in their third and fifth year.

The following statement gives the entire pack of sockeye in American and Canadian waters of the Fraser River system for the years 1891 to 1919, inclusive:—

SOCKEYE-SALMON PACK OF FRASER RIVER SYSTEM, 1891 TO 1919, INCLUSIVE.

Year.	Canadian Waters.	American Waters.	Total.
	Cases.	Cases.	Cases.
1891.....	176,954	5,538	182,492
1892.....	79,715	2,954	82,669
1893.....	457,797	47,852	505,649
1894.....	363,967	41,791	405,758
1895.....	395,984	65,143	461,127
1896.....	356,984	72,979	429,963
1897.....	860,459	312,048	1,172,507
1898.....	256,101	252,000	508,101
1899.....	480,485	499,646	980,131
1900.....	229,800	228,704	458,504
1901.....	928,669	1,105,096	2,033,765
1902.....	293,477	339,556	633,033
1903.....	204,809	167,211	372,020
1904.....	72,688	123,419	196,107
1905.....	837,489	847,122	1,684,611
1906.....	183,007	182,241	365,248
1907.....	62,617	96,974	159,591
1908.....	74,574	155,218	229,792
1909.....	585,435	1,005,120	1,590,555
1910.....	150,432	234,437	384,869
1911.....	62,817	126,950	189,767
1912.....	123,879	183,896	307,775
1913.....	736,661	1,664,827	2,401,488
1914.....	198,183	336,251	534,434
1915.....	91,130	64,584	155,714
1916.....	27,394	78,476	105,870
1917.....	148,164	411,538	559,702
1918.....	19,697	50,723	70,420
1919.....	34,063	50,000*	84,063*
Totals.....	8,493,431	8,752,294	17,245,725

* Estimated.

The foregoing table gives a complete record for six four-year cycles and for the first two years of the present cycle. The outstanding features therein shown are: (1) The great packs made every fourth year; (2) the comparatively small packs made in the three intervening years; (3) the gradual but pronounced decline in the runs in the small years; and (4) the startling decline in the pack in the last big year, 1917.

As far back as written records exist, a phenomenally big run of sockeye to the Fraser is shown every fourth year. All the early

explorers record it, and quote the Indians as saying it had always existed. It has been a characteristic peculiar to the Fraser and unknown in any other river. Up to 1917 the Fraser River District produced more sockeye every fourth year than the combined catches made in Alaskan waters during all but one of those years, as the following statement shows:—

THE SOCKEYE-SALMON PACK OF THE FRASER RIVER SYSTEM AND IN ALASKA.

Year.	Alaska	Fraser River System.
	Cases.	Cases.
1901.....	1,319,335	2,033,765
1905.....	1,574,428	1,684,611
1909.....	1,705,302	1,590,555
1917.....	2,484,881	559,702

(5.) The sockeye-salmon runs to the Fraser River system in the big years has been alarmingly depleted, and the runs in the small years are no longer of commercial importance. Both are threatened with extinction.

Complete records exist of conditions on both the fishing and the spawning grounds of the Fraser system since 1900. The record of the pack shows the catch, because the entire catch is marketed in tins. The number of fishermen employed and the amount of gear used are also recorded. There are adequate data also for a comparison of conditions on the spawning-beds since 1900. Dr. Gilbert, in "The Sockeye Run on the Fraser River,"* says: "No other sockeye-stream has received such close and discriminating study. Annual inspection has been made of the spawning-beds of the entire watershed, and predictions of the run four years hence have been fearlessly made. It is a matter of record how consistently these prophesies have been fulfilled." The observations of conditions on the spawning-beds have been made by the same observer since 1900.

The records for the fishing-grounds show that the runs of sockeye to the Fraser River system in the big years 1901, 1905, 1909, and 1913 produced an average pack of 1,927,602 cases, and that in 1917, the last year in the cycle of big years, it produced a pack of but 559,732 cases, or 70 per cent. less than the average of the four preceding big years. The startling decrease in 1917 is due to the fact that the great spawning runs of 1913 did not reach the spawning-beds

* British Columbia Fisheries Report, 1917.

of the upper section of the Fraser basin, for the reason that the river's channel at Hell's Gate was blocked by a great slide of rock following the construction of the Canadian Northern Pacific Railway through the canyon of the Fraser. A tunnel was driven through the rock cliff that overhangs the narrow channel immediately above Hell's Gate. During the spring of 1913 the action of frost caused a section of that cliff, including a portion of the tunnel, to slide into the river's channel, which formed an obstruction that the main portion of the run of fish could not get over. After frantic and continued efforts to surmount the obstruction the fish became exhausted, and were swept downstream by the rapid current, where they died in the channels below without having spawned.

The British Columbia Fisheries Report for 1913 states that the number of sockeye that escaped capture on the fishing-grounds, and that later reached Hell's Gate that year, was fully as great, if not greater, than in the four preceding big years. The conditions created at the principal spawning-beds of the Fraser by the obstruction is told in the following excerpt from the report of John P. Babcock, in the British Columbia Fisheries Report for 1913:—

"I feel fully justified from my investigations in concluding that the number of sockeye which passed above the fishing limits was as great this year as any preceding big year of which we have a record, and I think even greater. The sockeye made their appearance in the canyon above Yale in June, and during the high waters of that month and July large numbers passed through to Quesnel and Chilko Lakes. The greater proportion of the run of sockeye in late July, and in August and September, was blockaded in the canyon by rock obstructions placed in the channel, incident to the construction of the Canadian Northern Pacific Railroad, so that few were able to pass through during that time. No humpbacks succeeded in passing through the canyon. The blasting of temporary passage-ways enabled a large proportion of the sockeye run of October and November to pass through the canyon. In August sockeye were seen drifting downstream, between Hell's Gate and Yale; the movement was very pronounced in September, and continued until the middle of October. The streams which enter the Fraser between Hell's Gate and Agassiz were filled with sockeye from the middle of August until the end of October, while they had not been observed in those streams in previous years. Very few sockeye spawned in any of these streams and most of them died without spawning. Great numbers of dead sockeye, which had died without spawning, were found on the bars and banks

of the Fraser between Yale and Agassiz in September and October. The number which reached Quesnel Lake was little more than an eighth of the number which entered that lake in 1909. The run to Chilko Lake was equally small. The sockeye run to Seton Lake was 30,000, as against 1,000,000 in 1909. The August and September run of sockeye to Shuswap and Adams Lakes was much less than in any former big year, and the October and November run was also less. The sockeye-eggs collected there this year totalled but 9,000,000, as against 27,500,000 four years ago and 18,000,000 in 1905. The run to Lillooet Lake was less than in any recent year. Finally, the run to Harrison Lake was slightly better than in 1909.

"These facts, in my opinion, warrant the conclusion that the number of sockeye which spawned in the Fraser River watershed this year was not sufficient to make the run four years hence even approximate the runs of either 1905, 1909, or 1913."

The disastrous effect of the 1913 blockade was manifested on both the fishing and spawning grounds in 1917, since the run in the latter year was the product of the 1913 spawning. The catch of 1917 produced a pack of but 559,732 cases as against 2,401,488 cases, or 76 per cent. less than in 1913, notwithstanding the fact that more fishermen and more gear were employed than in 1917 and the price paid for fish was higher.

Small as was the catch of 1917, too great a proportion of the run of that year was captured. That is, a sufficient number of fish were not permitted to reach the spawning area. In place of the millions of sockeye that reached Hell's Gate in 1913, only hundreds of thousands reached there in 1917. The obstructions having been removed, the fish had no difficulty in passing through to the spawning-beds above. The numbers that passed through in 1917 were far less than in 1913, notwithstanding the blockade of the latter year. In place of the 4,000,000 that entered Quesnel Lake in 1909 and the 552,000 that entered its waters in 1913, less than 27,000 passed into that great spawning area in 1917, and the numbers that reached all the other great lake sections were proportionately less than in 1913.* The number of sockeye that reached the Fraser basin in 1917 was not, in most sections, greater than in some recent small years. The result of the spawning in 1917 will not produce in 1921 a run even approximately as great as that of 1917. In other words, it may be expected to be very much less. The great run of the big years was destroyed

* British Columbia Fisheries Report, 1917, page 21.

by the 1913 blockade. The remnant of that run cannot withstand the drain made upon it in 1917. It is already so small that it must hereafter be classed with the runs in the small years. And like the runs in the small years it will be completely wiped out if present conditions shall continue.

The runs of sockeye to the Fraser system in the small years are no longer of commercial importance. Dr. Gilbert, in his article entitled "The Sockeye Run on the Fraser River,"* says:—

"The history of the Fraser River sockeye runs show unmistakably that the three small years of each four-year cycle were overfished early in the history of the industry. During the early years, when fishing was confined to the regions about the mouth of the river and drift-nets alone were employed, no evidence exists of overfishing. The last cycle in which these conditions obtained was 1894-96. During each of the small years of that cycle (1894, 1895, and 1896) there were packed approximately 350,000 cases on the Fraser River and about 60,000 cases in Puget Sound. During each of those years, therefore, about 5,000,000 sockeye were taken from the spawning run and used for commercial purposes. It should have been considered at that time an open question whether enough salmon to keep the runs going had been permitted to escape to the spawning-grounds. Apparently, however, a third of a million cases a year could be safely spared, for the following cycle shows no decrease. If from the beginning the pack had been limited to a third of a million cases for each small year, apparently the runs would still have continued in their primitive abundance.

"During the following period of four years (1897, 1898, 1899, and 1900) the traps on Puget Sound became an important matter. While the British Columbia pack shows little or no reduction, it was met by a pack on Puget Sound which nearly equalled it. The total captures during the three off-years of this cycle nearly doubled those of the preceding years and exacted an average toll of about 10,000,000 fish from the spawning run of those years. The total pack of the three small years of this cycle was over 2,000,000 cases.

"The result was quickly apparent. If 5,000,000 fish could be safely spared, this figure nevertheless must have been near the upper limit of safety, for when 10,000,000 fish were abstracted the small years of the following cycle showed such a marked decline as to indicate that we had far overstepped the line of safety. It was then during the cycle

* British Columbia Fisheries Report, 1917, pages 113-14.

of 1897-1900 that the first serious damage was done to the sockeye run of the Fraser River. By doubling the pack of the three small years, not only was the surplus fully taken, but the necessary spawning reserve was seriously encroached on, with the result that in the small years of the following cycle (1902, 1903, and 1904), in spite of the increased amount of gear employed, the pack was cut in half, while the spawning-beds at the same time were but sparsely seeded.

"The inevitable and disastrous trend of events should have been evident to the dullest. But the parties in interest refused to hold their hands and proceeded with the slaughter of the spawning remnant. The result was quickly apparent. In 1902, 1903, and 1904 the total sockeye-pack of the Fraser (river system) was cut to 1,200,000 cases, and in succeeding years it has suffered still further reduction. The pack of the three small years never again equalled 1,000,000 cases. In 1906-8 it was 750,000 cases, 1910-12, 880,000 cases; in 1914-16, 796,000. And with each year the amount of gear employed has increased by leaps and bounds. The small years of the present cycle may be expected to register a smaller total than any which have gone before."

The total catch of sockeye in the Fraser River system in the past two small years of the present cycle demonstrates the correctness of Dr. Gilbert's forecast. The catch of 1918 produced a pack of but 70,420 cases, as against 534,434 cases in the preceding fourth year; and the catch in 1919 gave a pack of but 84,063 cases, as against 155,714 cases in 1915.

The evidence of the decline in the runs of sockeye in the Fraser River system is overwhelming. The runs in all years have already become so depleted that it is evident that under existing conditions the sockeye will be exterminated within a short period.

(6.) The Fraser River basin has an area of 90,903 square miles. It contains sixteen great lakes that have a total area of 2,351 square miles. No other river on the Pacific Coast drains so extensive an area of lake water adapted to the propagation and rearing of sockeye. In the past it has produced greater runs of sockeye than any other river because this great spawning area was abundantly seeded every fourth year. It has been shown that sockeye spawn in streams tributary to lakes and on the shoals of lakes, and that their young remain in the lake-waters for a year or more after hatching and then migrate to the sea. Knowing that the sockeye were bred in the watershed of the Fraser, we therefore know that the great runs of sockeye

in the big years 1901, 1905, 1909, and 1913 originated there. The runs of those years produced an average pack of 1,927,602 cases and at the same time afforded in the first three named years a sufficient number to seed the entire spawning area. Therefore the amount of the average pack of the big years 1901, 1905, 1909, and 1913 may be safely taken from the run without an overdraft, whenever the spawning-beds are as abundantly seeded as they were in 1901, 1905, and 1909. The spawning area of the Fraser has not been lessened or injured. Its spawning-beds have not been damaged or interfered with by settlement, factories, mining, or irrigation. Its gravel-beds and shoals are as extensive and as suitable for spawning as they ever were. Its lake-waters are as abundantly filled as ever with the natural food for the development of young sockeye. The channels of the Fraser are open and free to the passage of fish. All that is required to reproduce the great runs of the past is a sufficient number of spawning fish to seed the beds as abundantly as they were seeded in 1901, 1905, and 1909, and in former big years. The fishery cannot be restored in any other way.

Neither Canada nor the United States acting singly can provide measures that will ensure the seeding of the spawning-beds of the Fraser. That can only be done by concurrent action. Joint and uniform regulations that will afford free passage for the fish through both Canadian and American waters must be provided and made effective. Sufficient fish must be permitted to pass through the fishing-waters and to reach and seed the beds. The interests of both Canada and the United States in this question are great. It is not alone a Canadian question. It is not alone an American question. It is an international question, and cannot be dealt with except in an international way. Recognizing these facts, both Great Britain and the United States, as far back as 1908, signed a convention dealing with the Fraser River situation. This convention failed to receive the approval of the United States Senate and was withdrawn. But, as we have already seen, in the years that followed matters went from bad to worse, and in 1918 an International Commission was established, consisting of the Honourable Sir J. D. Hazen, Chief Justice of New Brunswick, G. J. Desbarats, Deputy Minister of Naval Service, Ottawa, and William A. Found, Superintendent of Fisheries for the Dominion of Canada, representing Great Britain; and the Honourable Wm. C. Redfield, Secretary of Commerce and Labour of the United States, Edward F. Sweet, Assistant Secretary of Commerce and

Labour, Washington, D.C., and Dr. Hugh M. Smith, Commissioner of Fisheries for the United States, representing the United States. The Commission held sittings in Seattle, Wash., and Vancouver, B.C., during the summer of 1918, and in the fall of that year embodied in a report to their respective Governments their unanimous findings, which resulted in the convention of 1919. That convention provides for "the times, seasons, and methods of sockeye-salmon fishing in the Fraser River system" and for "the conduct of investigations into the life-history of the salmon, hatchery methods, spawning-ground conditions, and other related matters" by an International Fisheries Commission, to consist of four persons, two to be named by each of the high contracting parties, and that the convention shall remain in force for fifteen years, and thereafter for two years from the date when either shall give notice of desire to terminate it. The convention has been signed by both Governments, approved by the Canadian Government, and is now awaiting the approval of the United States Senate.

The American Government up to 1918 had expended \$125,000,000 on capital account to reclaim 1,100,000 acres of arid lands. The 100,000 persons that lived on the 25,000 farms of that area in 1917 produced a crop worth \$50,000,000. The lake-waters of the Fraser River basin cover an area of 1,514,000 acres that when seeded by spawning sockeye as abundantly as they were seeded in 1897, 1901, 1905, and 1909 will produce annually a run of sockeye salmon from which may be taken sufficient fish to fill 1,927,602 cases, worth \$30,000,000, without an overdraft on the run. The 1,514,000 acres of spawning area of the Fraser River basin are now almost as non-productive as were the 1,100,000 acres of arid lands of the United States before that Government expended \$125,000,000 to bring them under cultivation. The spawning area of the Fraser basin requires no expenditure to bring it into bearing. Appropriations for capital expenditure and upkeep are not required. The workers do not require dwellings or implements. Cultivation is unnecessary. If permitted to reach the beds the fish will seed them, the young will feed themselves, furnish their own transportation to and from their feeding and maturing ranges in the open sea. The fish will do all the work necessary to produce a crop worth \$30,000,000 a year, provided the Governments of Canada and the United States will furnish to a sufficient number of them safe passage through the fishing-grounds of the Fraser River system.

We repeat, in conclusion, that the restoration of the sockeye-salmon fisheries of the Fraser River system is the greatest reclamation project in which Canada and the United States can jointly engage, and that, too, with the least expense and most certain results.

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