

**INTERNATIONAL PACIFIC SALMON
FISHERIES COMMISSION**

**APPOINTED UNDER A CONVENTION
BETWEEN CANADA AND THE UNITED STATES FOR THE
PROTECTION, PRESERVATION AND EXTENSION OF
THE SOCKEYE SALMON FISHERIES IN
THE FRASER RIVER SYSTEM**

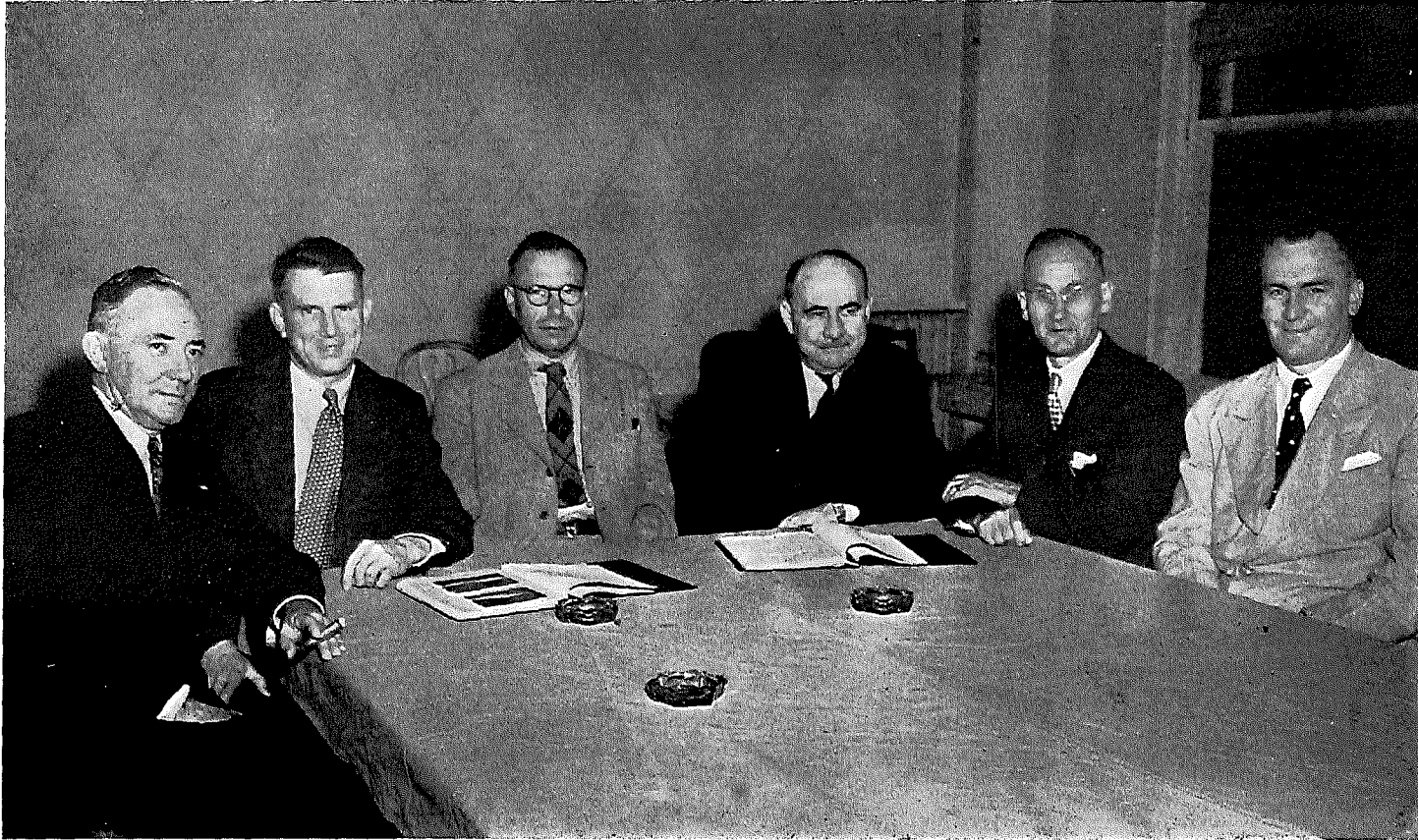
**ANNUAL REPORT
1945**

COMMISSIONERS

**EDWARD W. ALLEN
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TOM REID
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**NEW WESTMINSTER,
CANADA
1946**



Members of the International Pacific Salmon Fisheries Commission, left to right: Fred J. Foster; A. J. Whitmore, *Secretary*; Edward W. Allen, *Chairman*; A. L. Hager, *Vice-Chairman*; Tom Reid, M.P.; Charles E. Jackson.

REPORT OF THE INTERNATIONAL PACIFIC SALMON FISHERIES COMMISSION FOR THE YEAR 1945

The International Pacific Salmon Fisheries Commission was created by treaty between the United States and Canada which was concluded July 28, 1937. The treaty provided that the Commission shall be composed of six men, three to be appointed from each country. It is charged with the investigation and regulation of the sockeye salmon fishery in the territorial waters and high seas of the coast of Canada and the United States between the 48th and 49th parallels of latitude, within the Strait of Juan de Fuca and the San Juan Islands, the Strait of Georgia below Lasqueti Island and in the Fraser River.

The Commission is empowered to investigate the natural history of the sockeye salmon of the Fraser River, hatchery methods, spawning ground conditions and related matters. It may conduct fish cultural operations, improve spawning grounds or stock the Fraser with sockeye by such methods as it may deem advisable and recommend removal of obstructions to migration. It is empowered to limit or prohibit the taking of sockeye salmon in Convention waters. For purposes of regulation these waters are divided into three areas which include the waters outside a line marking the entrance to the Strait of Juan de Fuca, United States waters inside this line, and Canadian waters inside this line. To the end that there shall be a proper escapement of sockeye salmon, the Commission is given the power to regulate the sizes of mesh in all fishing gear and appliances used in Convention waters during the chinook (spring) salmon season. During the remainder of the year (or November to April) any gear authorized by the respective governments can be used in their own waters. But on the high seas only such fishing gear may be used in any open season as the Commission may approve. The catch of sockeye shall be distributed as equally between the two countries as is practicable.

The Convention was ratified with the understanding that the Commission would have no power to authorize any type of fishing gear which was contrary to the laws of the United States or Canada. Moreover, the Commission was not empowered to promulgate or enforce regulations until eight years of scientific investigation had been completed. This year marked the last of this period of preliminary investigation.

During these eight years of work, the Commission has set up a system for gathering accurate statistics of the catch that will make it possible to regulate the fishery during each season on the basis of records that can be gathered and summarized within twenty-four hours after the actual landings. Methods have also been developed to obtain records of the Indian catch and investigations have been undertaken to determine the effect of this fishery on the individual races. The Commission has also undertaken the study and development of methods for

the accurate and practical evaluation of the size of the spawning populations and has nearly completed the exploration of the entire Fraser River watershed. Progress has been made in determining the relation of the commercial fishery to the different races inhabiting each stream. Data on the history of the Fraser River fisheries have also been compiled which cover the records of this fishery from the earliest times to the present. The presence and importance of blocks to the migration of sockeye have been established at Hell's Gate, Bridge River Rapids and Farwell Canyon. Elimination of the block at Hell's Gate was practically complete at the end of the year, and work was in progress to remove the obstruction at Bridge River Rapids. Plans have been made to eliminate other barriers below important spawning grounds as quickly as the necessary studies have been completed.

The Commission's work has already borne fruit in the increase of sockeye in 1945 in some of the most depleted runs of the watershed. Increases shown in those runs that reached and passed through Hell's Gate in 1945 during the time that water levels prevailed which had been proven in the past to block fish, may be ascribed to the elimination of this blockade.

Our first Commission meeting of 1945 was held on April 20 at Vancouver, B. C. Progress in the construction of the fishways at Hell's Gate was reported and consideration was given to the elimination of the blockade conditions at Bridge River Rapids as well as to the removal of the dam at Adams River. Approval was given for a joint survey of the McGregor River with the Department of Fisheries. The Commission decided to discontinue the investigations at Cultus Lake.

On August 9, 10 and 11 the Commission met at Seattle, Washington. The problems of the Hell's Gate project were again considered and plans for the proposed fishways at Bridge River Rapids were presented. At this meeting, Dr. W. F. Thompson, Director of the School of Fisheries, University of Washington, was requested to continue to serve as consulting biologist. Dr. W. A. Clemens, Head of the Department of Zoology, University of British Columbia, was also requested to serve as consulting biologist.

A meeting of the Commission was held on December 3, 4 and 5 at Vancouver, B. C. The final plans for the installation of the fishways at Bridge River Rapids were reviewed by the Commissioners, and the contract was awarded. On Tuesday, December 4, the Commission met with the Advisory Board to discuss the regulation of the fishery in 1946. A review of the spawning escapement for 1945 was given with proof of the successful operation of the partially completed fishways at Hell's Gate.

The members of the Advisory Board attending the meeting were as follows:

<i>Organization Represented</i>		<i>Canada</i>	<i>United States</i>
Packers	Richard Nelson		C. J. Collins
Gill Net Fishermen . .	Homer Stevens		Chester Karlson
Troll Fishermen . . .	A. E. Carr		
Purse Seine Fishermen	George Miller		Lee Makovich
Sport Fishermen . . .	M. W. Black		

Also in attendance were Major J. A. Motherwell, Chief Supervisor of Fisheries, Vancouver, B. C., and Mr. Milo Moore, Director of Fisheries, State of Washington.

Results of the 1945 Investigations

In accordance with the scientific program initiated in 1938, emphasis was placed upon the collection of adequate statistics of the total sockeye run. In 1945, a total of 1,686,129 sockeye salmon were taken within the Treaty Waters—969,444 by the Canadian fishery and 716,685 by the American fleet. The total catch was only 46 per cent of that taken in 1941. The Indian fishery took approximately 44,000 sockeye in 1945 while for 1941 their catch totalled 52,900. In contrast to the decrease in the commercial and Indian fisheries, the spawning escapement increased to 116 per cent estimated for 1941. An important factor undoubtedly responsible for the decrease in the 1945 catches was the serious loss suffered by the spawning runs to the Chilko, Stellako, Adams and Little Rivers in 1941 due to the prolonged blockade at Hell's Gate.

Tagging was carried on at Sooke in 1945 to obtain further records of the intensity of the fishery and the routes and times of migration of the individual races of sockeye salmon as they pass through the commercial fishery. From the 1,428 tags released in this experiment, 555 tags were recovered.

The year 1945 attains prominence in the Commission's activities with the completion of one of the fishways at Hell's Gate. The sockeye salmon were able to ascend the fishway around this difficult stretch of water with little or no delay for the first time since 1911-1913. The two ladders at Hell's Gate are to be completed before the next migration moves through the Gate. The contract for construction of two fishways at Bridge River Rapids (on the Fraser River six miles north of Lillooet) has been awarded and the work already begun.

In preparation for the removal of all obstructions to the migration of sockeye salmon, biological and engineering surveys have been continued at Farwell Canyon, Skookumchuck, Keighley Holes, and at a number of other minor obstructions.

Statistics of the Commercial Catch

Statistics of the Puget Sound and Swiftsure fishery for sockeye salmon were collected in 1945 as in past years. Minor changes were made in methods of obtaining cannery landings to increase their accuracy and the speed of collection. In addition to total catch, log records of the operations of purse seine boats, gill net boats and reefnetters were obtained for the study of intensity of fishing.

Statistics of the commercial fishery in Canadian Treaty Waters were collected in 1945 in a manner similar to that used in previous years, with the added help of a small cabin cruiser, the M. V. STATISTIC, which was built in 1945 in order to make it possible to obtain current records of landings in the Fraser River Area and to maintain effective contacts with the fishermen. Landings were obtained currently throughout the season from the fish buyers and were later checked against cannery records. Information as to the intensity of fishing was collected

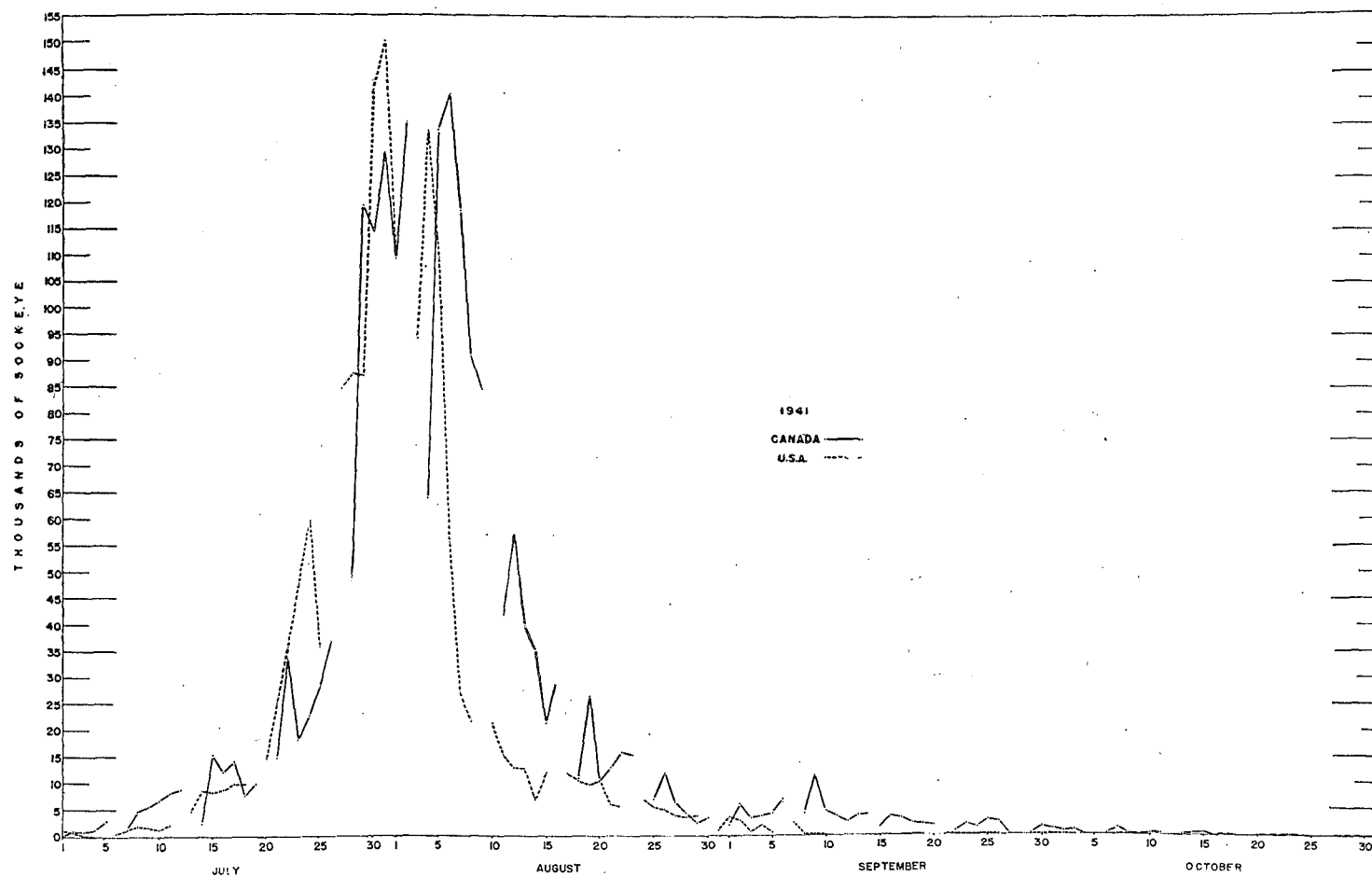


FIG. 1.—Seasonal occurrence of sockeye, showing the daily landings of sockeye in treaty waters in the year 1941.

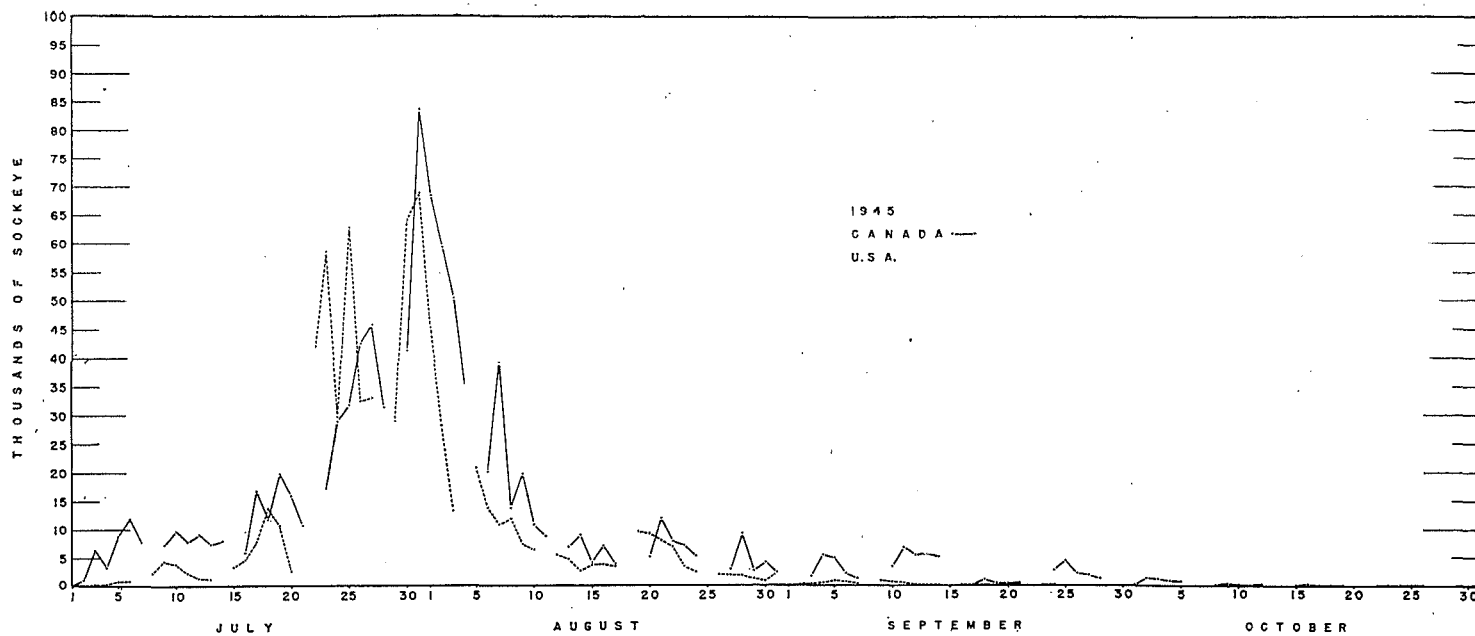


FIG. 2.—Seasonal occurrence of sockeye, showing the daily landings of sockeye in treaty waters in the year 1945.

directly from record books kept by the gill net and purse seine fishermen. The Dominion Department of Fisheries provided figures on total seasonal cannery receipts as well as on the catch at Sooke traps. Tests run during this season proved that the total landings, which will form the basis for regulation of the fishery during the season, can be gathered in the field, sent to headquarters in New Westminster and summarized within twenty-four hours of delivery of fish to the cannery. This speed is essential in controlling the sockeye salmon fishery in this area.

An observer was stationed at Alert Bay and covered the area from the Nimpkish River to Glendale Cove and from Sointula to Growler Cove in Johnstone Strait to try to determine the proportion of Fraser River fish in the total annual catch made in the Johnstone Strait area. The Commission has no power to regulate this fishery but nevertheless complete records of the size of the run are necessary in order to evaluate the total run to the Fraser River. The records will be incomplete until this information is obtained.

The success or failure of salmon runs can be measured by comparing the catch in any year with that of the year which produced it. For this reason, the catch of 1945 is compared with that of 1941. Both the Canadian and U. S. production decreased approximately 64 per cent in 1945 from that of 1941. In both years the Canadian fishermen took 57.5 per cent of the total catch. The daily total landings of Fraser River sockeye in the U. S. and Canada are shown in figures 1 and 2. In both years the heaviest run occurred between July 15 and August 15 and the heaviest catches occurred around August 1.

TABLE I
NUMBER OF SOCKEYE CAUGHT IN TREATY WATERS

<i>Year</i>	<i>Canadian Waters</i>	<i>American Waters</i>	<i>Total</i>
1941	2,116,723	1,560,482	3,677,205
1945	969,444	716,685	1,686,129

TABLE II
NUMBER OF CASES OF SOCKEYE PACKED FROM
TREATY WATERS

<i>Year</i>	<i>Canadian Pack</i>	<i>American Pack</i>	<i>Total Pack</i>
1941	159,279	110,605	269,884
1945	79,781½	53,054½	132,836

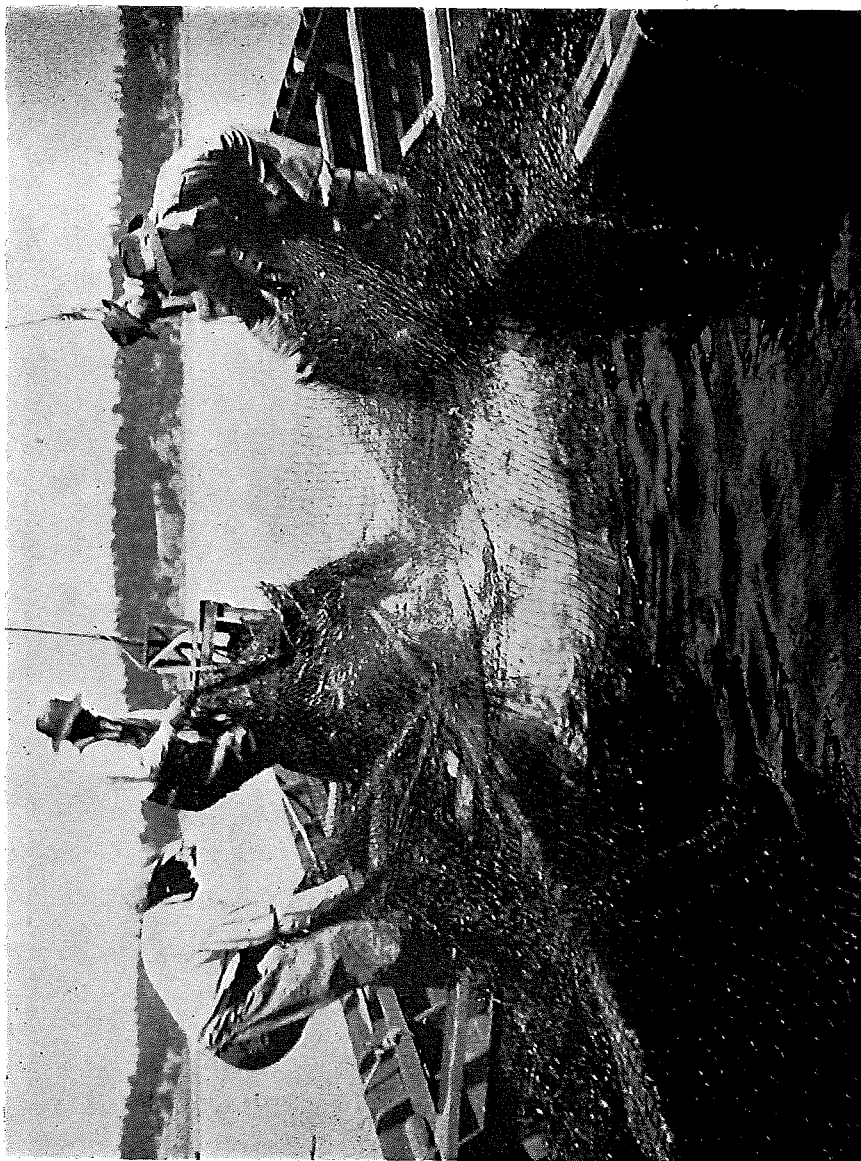


FIG. 3.—Lifting a Reef Net.



FIG. 4.—Weighing fish on a collecting boat.

Salt Water Tagging Experiment

The tagging of sockeye at the Sooke traps in 1945 was carried on with the cooperation of the Canadian Department of Fisheries and the trap operators. Between May 10 and September 17, a total of 1,428 sockeye were tagged. A total of 555 tags or 38.9 per cent were returned from the commercial fishery areas and from the spawning grounds.

The number of tags released and the percent recovered for the eight years of tagging at Sooke are given below:

<i>Year</i>	<i>Number Tagged</i>	<i>Number Recovered</i>	<i>Percentage Recovered</i>
1938	980	439	44.8
1939	1,042	558	53.5
1940	930	439	47.2
1941	849	503	59.2
1942	1,800	793	44.1
1943	1,053	502	47.7
1944	1,063	439	41.3
1945	1,428	555	38.9

For the first time the International Pacific Salmon Fisheries Commission attempted to carry out a tagging program at Swiftsure Banks with the cooperation of the Washington State Fisheries Department. The program was unsuccessful due to a lack of fish. A total of only 48 tagged fish were released, 29 of which have since been recovered.

While the returns were too few to be of much value, an estimate was obtained of the time of migration from Swiftsure Banks to the Puget Sound fishery. Eleven Swiftsure tags were returned from the Puget Sound banks after an average migration time of six to seven days.

Catch Statistics of the Indian Fishery

The statistics of the Indian fishery for 1945 are summarized in Table III with comparable data for the brood year of 1941. These figures are collected each year to determine the numbers of sockeye taken from the different runs after they have entered the river and passed through the commercial fishery.

A decrease of 8,961 fish is shown in the total catch. Most of this decrease occurred on the Chilcotin River and was a result of the smaller run that returned to that river this year. The same decrease in size of run was felt at Bridge River Rapids where the total Indian catch was 3,854 fish less than that of 1941. The larger escapement into the Stuart Lake Area is reflected in the large catches made by the Indians there.

TABLE III
THE INDIAN CATCHES OF SOCKEYE SALMON IN THE FRASER RIVER WATERSHED
BY DISTRICTS AND AREAS WITHIN THESE DISTRICTS
1941 AND 1945

<i>District and Areas</i>	1941			1945		
	<i>Catch</i>	<i>Per Cent of Total Catch</i>	<i>No. of Fishermen</i>	<i>Average No. per Fisherman</i>	<i>Catch</i>	<i>Per Cent of Total Catch</i>
HARRISON-BIRKENHEAD						
Skookumchuck	225		4	56	102	
Lillooet Lake	408		—	—	135	
Birkenhead River	3,313		—	—	4,005	
TOTAL	3,946	7.5	—	—	4,242	9.7
LOWER FRASER						
Seabird Island	440		5	88	502	
Katz and Ruby Creek	1,826		16	114	500	
TOTAL	2,266	4.3	21	108	1,002	2.3
CANYON						
Union and American Bars	2,761		14	197	728	
Yale	3,398		23	148	2,352	
Spuzzum	356		4	89	381	
Lower Gorge	126		3	42	140	
Upper Gorge	765		10	77	672	
Boston Bar	125		5	25	98	
Boothroyd	879		14	63	1,049	
Cisco	1,280		14	91	3,676	
TOTAL	9,690	18.3	87	111	9,096	20.7
LYTTON TO LILLOOET	2,940	5.5	32	92	3,346	7.6
BRIDGE RIVER RAPIDS						
Lillooet	3,500		20	175	1,408	
Rapids	10,000		35	286	7,581	
Pavilion	400		6	67	1,057	
TOTAL	13,900	26.2	61	228	10,046	22.9

THE INDIAN CATCHES OF SOCKEYE SALMON IN THE FRASER RIVER WATERSHED
BY DISTRICTS AND AREAS WITHIN THESE DISTRICTS—*Continued*
1941 AND 1945

District and Areas	1941				1945			
	Catch	Per Cent of Total Catch	No. of Fishermen	Average No. per Fisherman	Catch	Per Cent of Total Catch	No. of Fishermen	Average No. per Fisherman
CHILCOTIN								
Farwell Canyon	2,971		18	165	1,348		17	79
Hance's Canyon	1,029		12	86	630		2	315
Martin's	599		3	200	166		6	28
Anahim	600		6	100	195		3	65
Alexis Creek	2,745		20	137	1,704		9	189
Bull Canyon	1,226		6	204	nil		—	—
Siwash Bridge	4,532		20	227	2,031		20	102
Keighley Holes	2,445		8	306	1,398		12	116
Henry's Crossing	400		—	—	172		3	57
TOTAL	16,547	31.3	93	180	7,644	17.4	72	106
UPPER FRASER								
Alkali Creek to Shelley	1,699	3.2	63	27	990	2.2	—	—
NECHAKO								
Nautley Reserve	528		8	66	1,424		7	203
Stella Reserve	679		9	75	225		4	56
TOTAL	1,207	2.3	17	71	1,649	3.7	11	150
STUART LAKE								
Fort St. James					1,811		16	113
Tachie Reserve					1,060		9	118
Trembleur and Takla Lakes					1,892		8	237
All Stations	725		42	17				
TOTAL	725	1.4	42	17	4,763	10.8	33	144
THOMPSON								
North Thompson River	No Fishing				56		4	14
South Thompson River					1,125		13	87
TOTAL					1,181	2.7	17	69
GRAND TOTAL	52,920				43,959			

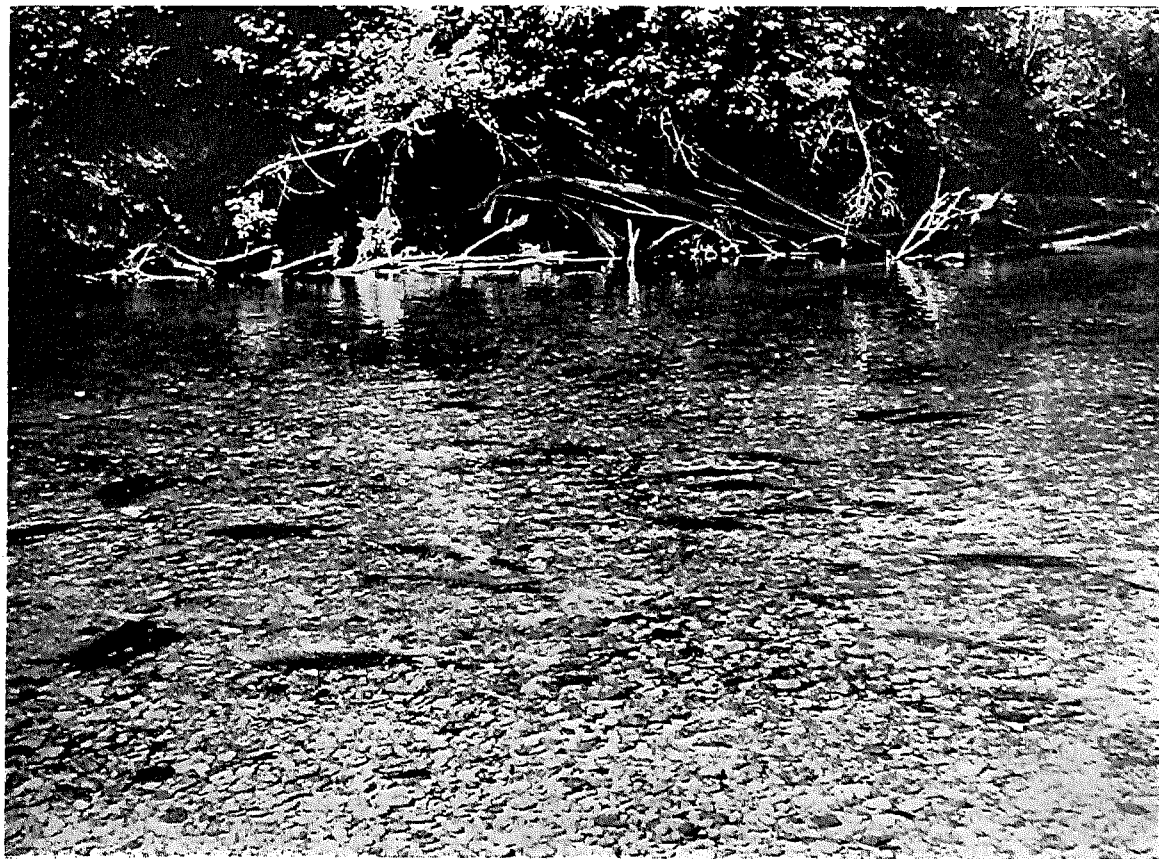


FIG. 5.—Live sockeye in Kynoch Creek, Stuart District,

Escapement to Spawning Grounds

The numbers of sockeye which reach the different spawning grounds each year combined with the total catch make up the total number of fish that return from the run which spawned four years before. The size of each spawning population when compared with that of the brood year gives evidence of the increase or decline in abundance of each run. This information must form the foundation of all plans for rebuilding depleted races as well as the basis for the formulation and the measure of success of regulations.

In keeping with the importance of obtaining accurate counts of the number of sockeye in the different spawning runs, considerable effort has been made in the past to develop methods to accomplish this purpose. Due to the necessity of diverting much of the energies of the staff for several years to the location and study of blocks to the migration of salmon, this problem has not yet been solved. It remains, therefore, as one of the most important problems awaiting solution.

In 1945, the watershed was divided into five main districts: Lower Fraser, Harrison-Lillooet-Canyon, Seton-Thompson, Chilcotin and the Northern Districts (Quesnel-Nechako-Stuart Lake-Northeast). Accurate estimates were obtained of the number of sockeye found in each of 27 important streams within these districts. The less important streams were covered but once or twice during the season and in some cases the information is necessarily based upon reports from local inhabitants.

A summary of the spawning escapement is given at the end of this report. In contrast with the escapement tables appearing in the Annual Reports for 1940-1944, the summary for 1945 gives additional information on the completeness of spawning of the females (as percent spawned out) and an estimate of the number of eggs deposited.

The total spawning escapement to the key streams in 1945 was 515,320.

The Lower Fraser District includes tributaries of the Fraser River below the Harrison River. Most important spawning areas are in the Pitt River, Sweltzer Creek and Cultus Lake. Only 9,231 sockeye were counted in Cultus Lake and Sweltzer Creek in 1945. This is the smallest run since 1937 and represents the return from 18,164 sockeye that spawned there in 1941. A critical examination of the Pitt River District, undertaken for the first time in 1945, revealed a spawning population of 35,685 sockeye in the Upper Pitt River, Boise, Seven and Four Mile Creeks. Approximately 1,200 sockeye were found in Widgeon Slough, a tributary to the Lower Pitt River.

The important spawning areas within the Harrison-Lillooet District are Weaver Creek, Harrison River Rapids, Big Silver Creek, Birkenhead River and streams tributary to the Harrison River and Lake on to the Lillooet River and Lake. During the last few years the water level in Weaver Creek in the Harrison River Area has been so low at the time when sockeye arrive—during the first week in October—that the lower three hundred yards have been completely dry. Sockeye and other species of salmon were held in Morris Lake from ten days to

three weeks in 1942 and again in 1945. Recommendations have been made for the correction of this condition. Weaver Creek with 12,944 spawners showed a small increase over the number recorded in 1941 while the Harrison River Rapids population with 16,060 fish represented only 30 per cent of the 53,000 that spawned there in the brood year. The size of the runs entering Lillooet Lake and River above Harrison Lake was estimated by tagging to number 96,600 sockeye, an increase of 37,300 over the cycle year of 1941. Approximately 83 per cent of the 1945 Lillooet run or 80,500 fish spawned in the Birkenhead River; the remaining 16,100 spawned in Lillooet Slough, the Upper Lillooet River and adjacent tributaries.

The Seton-Thompson District includes the nearly barren Seton-Anderson Lakes system with its former sockeye spawning areas in Seton, Portage and Gates Creeks as well as the extensive Thompson drainage with such important salmon streams as the Adams and Little Rivers in the South Thompson or the Raft River on the North branch. Approximately 3,300 sockeye were found in the Raft River this year. This run arose from 250 fish which spawned there in 1941. The Raft River sockeye have been affected each year by the block at Hell's Gate and the increase noted this season is no doubt due to its removal which not only allowed more fish up the river, but also made it possible for them to get there unscarred.

It was expected that the sockeye population in the Adams River during 1945 would be small because of the heavy mortality at Hell's Gate in 1941 when fewer than 50 sockeye reached these spawning grounds. However, the return of adult sockeye (4 and 5 year olds) this season was estimated to be 1,000 of which approximately 700 were females. In addition to the adult fish there were 57,000 "jack" or 3 year old sockeye. All females examined were completely spawned. In the other streams of the South Thompson District were found 9,700 sockeye. Further evidence of the effect of improved conditions at Hell's Gate were noted in the lack of scars on the fish entering these streams and in the appearance of a remnant of the early Scotch Creek run in August. Before the slide at Hell's Gate in 1913 this early run furnished large numbers of eggs to the Dominion Hatcheries, but in the last twenty years no fish have been recorded in that stream.

The small runs into Portage and Seton Creeks indicate that the fish that appeared there in 1941 as well as in 1945 were from streams farther up-river and had dropped back into these creeks when they were blocked at Bridge River Rapids. Eight fish were recovered that had been tagged at Bridge River Rapids and had later dropped back down the Fraser and had moved up Portage and Seton Creeks to spawn.

Sockeye salmon spawning in the Chilcotin District, which includes the Chilko River and Lake, accounted for more than 37 per cent of the total 1945 escapement to the tributaries of the Fraser River. Approximately 186,000 sockeye spawned in Chilko River and an additional 6,500 sockeye entered Chilko Lake making a total of about 192,500 fish in this area. The 1945 population at Chilko was only 68 per cent as large as that found in the brood year of 1941. The condition of the fish as they arrived on the spawning grounds indicated, however, that

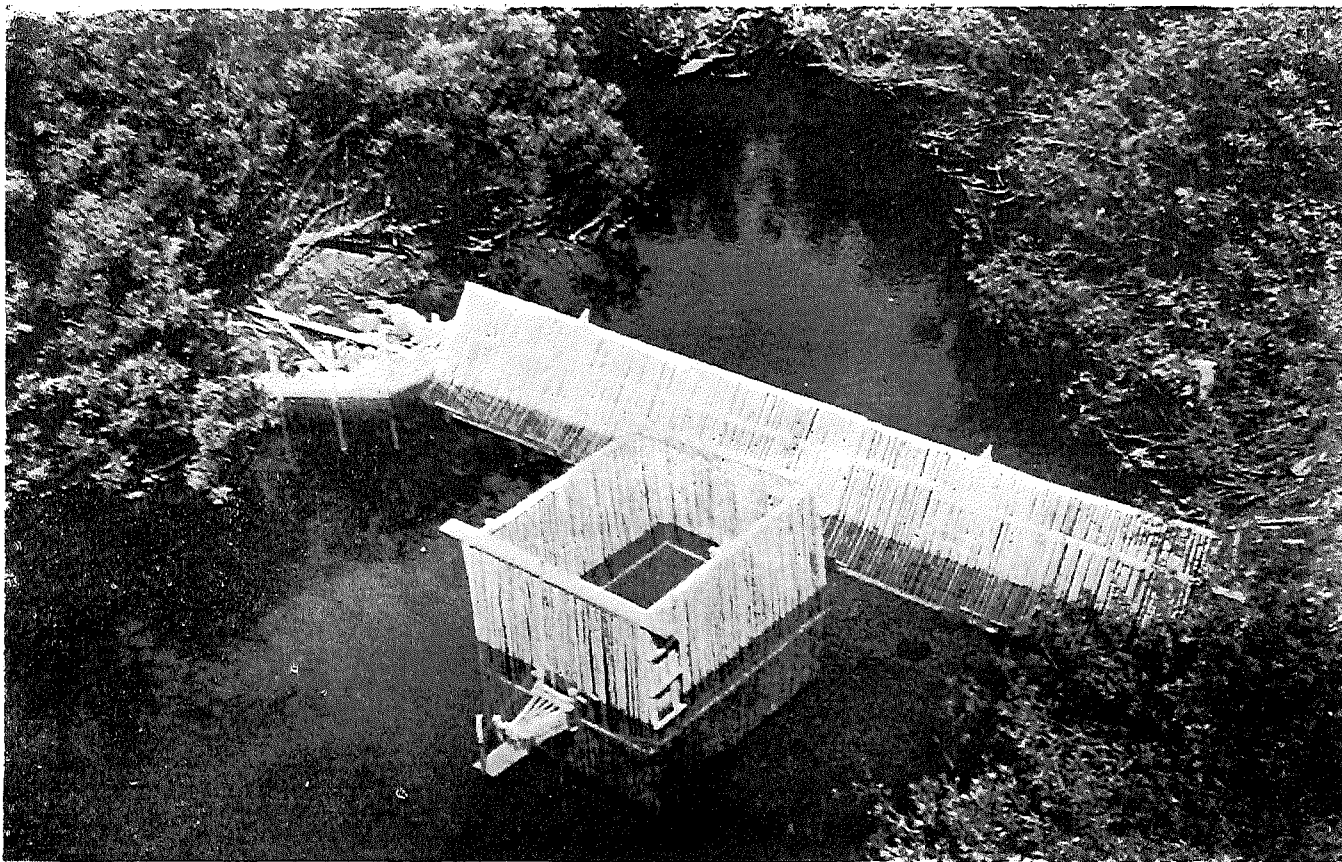


FIG. 6.—Weir at Forfar Creek, Stuart District.



FIG. 7.—Examining sockeye on the spawning grounds,

Hell's Gate had little or no effect on the 1945 run but tagging experiments carried out at Bridge River Rapids proved that the obstruction there blocked a portion of this run near the end of the season with a loss of some fish.

The Northern District includes four of our former watershed divisions: Quesnel, Nechako, Stuart and Northeast Districts, and includes all tributaries to the Fraser River above the entrance of the Chilcotin River. This year's spawning escapement of sockeye to this district was the most encouraging of any years since 1913. Increases in the size of the runs ranged from three to five times the spawning escapement of 1941, and were apparent in every important spawning stream. The escapement shown in Table IV totalled 80,411 sockeye as compared to 19,690 in 1941, an increase of over 4 times the number that were found in 1941. The later runs arrived in a more mature condition than that of the early run fish but badly scarred fish were lacking in contrast to the runs of previous years when the sockeye were blocked at Hell's Gate.

TABLE IV
COMPARISON OF 1941 NORTHERN DISTRICT SOCKEYE RUNS
WITH THOSE OF 1945

Area	Estimated No. of Sockeye		Percent Increase
	1941	1945	
STUART LAKE			
Early Run	6,306	28,213	447.
Late Run	5,500	23,554	428.
NECHAKO DISTRICT			
Stellako River	5,230	20,286	388.
Other Streams	485	1,280	264.
NORTHEAST DISTRICT			
Bowron River (including Moose and Sus Creeks)	1,119	4,078	364.
QUESNEL DISTRICT			
Horsefly River	1,050	3,000	286.
TOTAL	19,690	80,411	474.

The spawning runs in the Stuart District occur in two periods. The early run spawns during July and August and is confined at present chiefly to Kynoch, Forfar, Rossette and Gluske Creeks. The late run to the Stuart District spawns during the months of September and October in Middle and Tachie Rivers, which connect the three large lakes of this area. These runs in 1945 were over four times larger than the parent runs of 1941. The largest run to the Nechako District spawns in the Stellako River during the months of September and October. The 1945 run was nearly four times larger than that of 1941. Several small streams

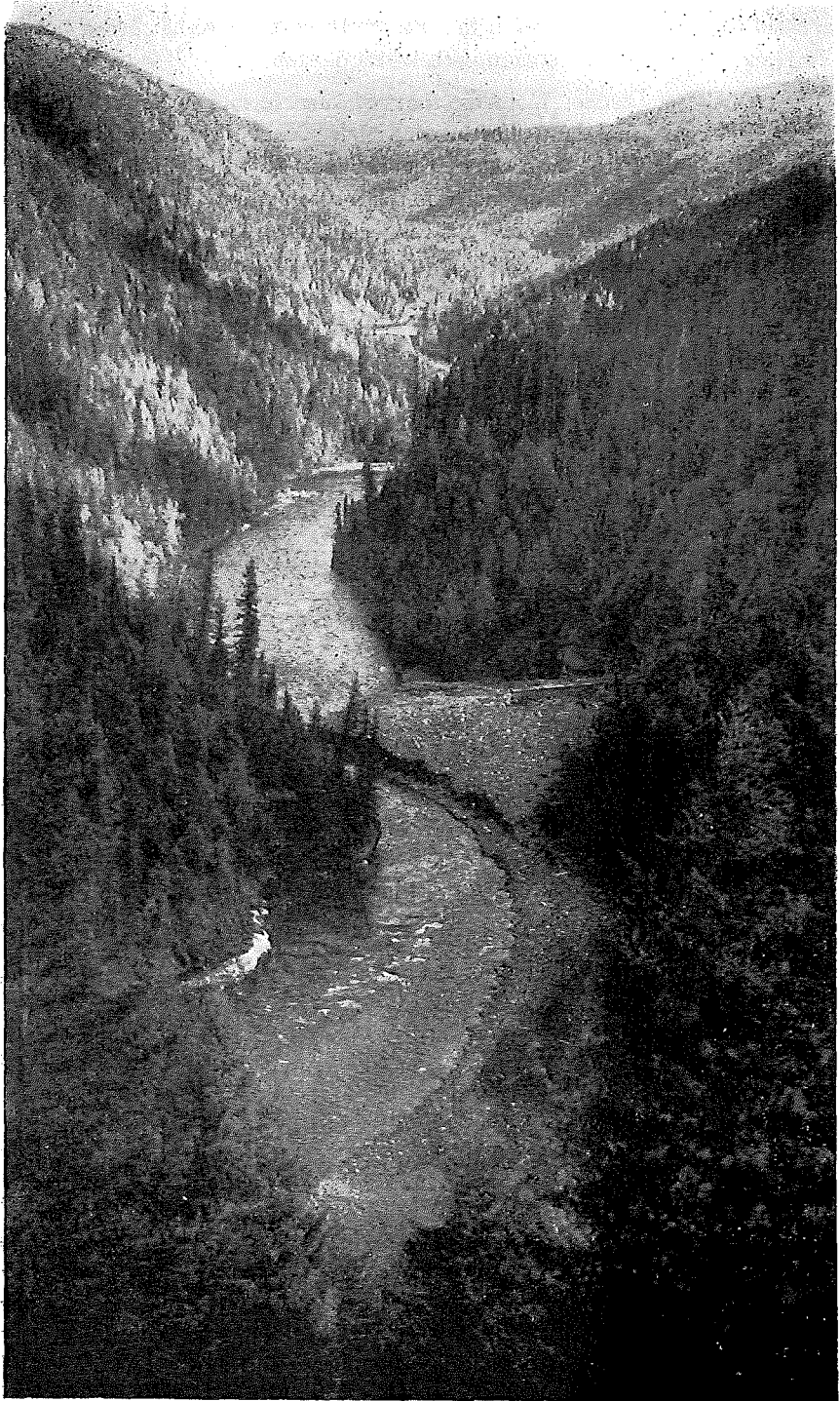


FIG. 8.—Mine tailings on the Quesnel River.

make up the balance of the spawning areas in this district and these also showed an increase in size of runs in 1945. The runs to the Bowron River have never been large in recent years, but they increased this year to over three and one half times the size of the parent run.

The Quesnel District in former years was credited with being the greatest spawning area of the Fraser River system. This year's run spawned in the Horsefly River and, while still small in size, it increased to 286 per cent of the size of the parent run. It is the only run left in this district of the four-year cycle. The run arrived on the spawning beds about August 14 which was ten days earlier than in the brood year, 1941. This date is nearer the time of the former big runs as ascertained from old records, and indicates that this year the sockeye reached the spawning beds at the natural time and were not delayed by water conditions at Hell's Gate.

The Biological Investigations of Obstructions

In 1945, tagging experiments were conducted at Bridge River Rapids, Farwell Canyon, Keighley Holes, and Skookumchuck Rapids to study the movements of sockeye through these areas of difficult passage to determine the need for fishways and to provide a basis for their correct design. Similar studies were made at Hell's Gate to study the efficiency of the partially completed fishways.

HELL'S GATE

The Commission has carried out tagging experiments at Hell's Gate each year since 1938. The results have shown that an obstruction to migrating sockeye existed at Hell's Gate and that heavy mortalities were suffered prior to 1945. A report was submitted to the governments of the United States and Canada in January, 1944, recommending the removal of this hazard to migrating salmon by the construction of fishways and a report on the effects of the obstruction was published in Bulletin 1, 1945 (*Effect of the Obstruction at Hell's Gate on the Sockeye Salmon of the Fraser River*).

The nature and effects of the block were studied by tagging fish below and above the block area and analyzing the movements shown by recaptured fish. In general the tagging experiments showed that periods of delay at Hell's Gate were associated with water gauge levels between 25 and 40 feet, and at certain levels between 40 and 50 feet.

Construction of the fishways was begun on both banks of the river at Hell's Gate in the fall of 1944. By the time high water prevented further work in the spring of 1945, the right bank fishway and the lower end section of the left bank fishway were virtually completed except for minor details.

The water level at the beginning of tagging operations at the Gate this season was 55.0 ft. on June 29. The level dropped gradually with minor fluctuations as the season progressed, to below 26 feet on August 25, and stayed below 26 feet for the balance of the season except for a brief period from August 30 to September 2. These levels are similar to those which prevailed in 1942 and were such that all the runs above the Gate, with the exception of the Adams River run

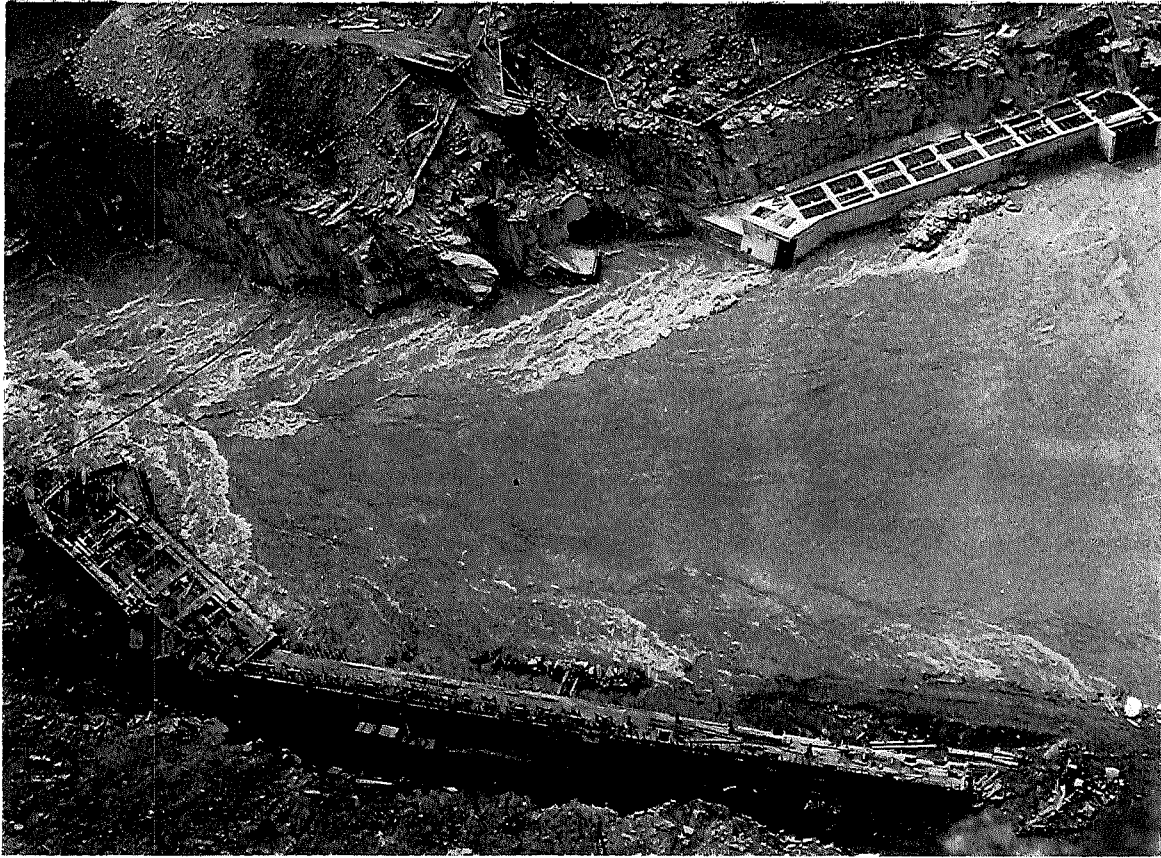


FIG. 9.—Right and Left Bank Fishways, Hell's Gate.

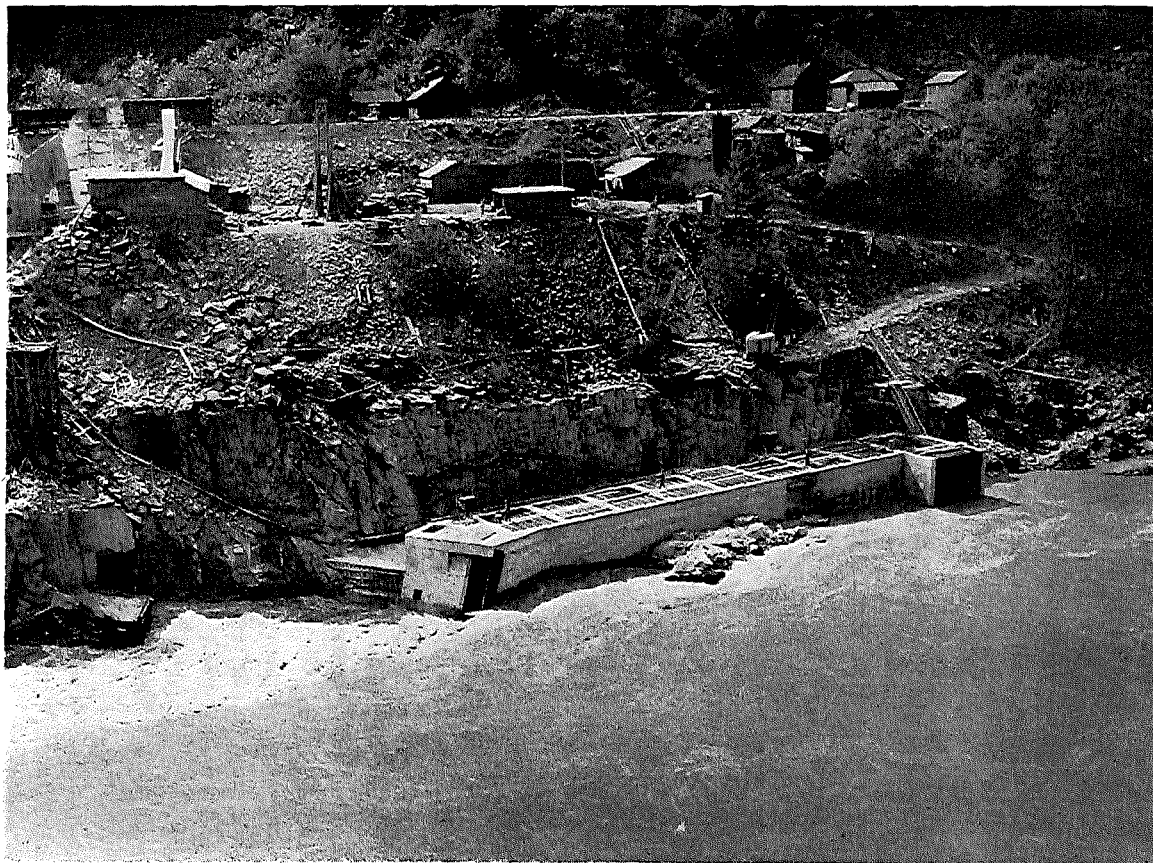


FIG. 10.—Right Bank Fishway, Hell's Gate.

which passes the Gate late in the season, would have been adversely affected. A total of 4,044 sockeye were tagged below Hell's Gate. The recoveries below Hell's Gate by the Indians and by the tagging crews are shown for each year since 1939 in Table V. Also shown are the numbers of tagged fish recaptured by the tagging crews which had been out more than three days. The increased relative numbers of all of these figures during the years when blocks occurred at Hell's Gate differ markedly from the small number of recoveries made below the fishways in 1945. The few recaptures below the Gate by the taggers themselves, and the analysis of tags recovered between Hell's Gate and Bridge River Rapids show that the sockeye had easier passage this year at the Gate than for any other year of tagging.

TABLE V
NUMBER OF SOCKEYE TAGGED AND RECOVERED BELOW
HELL'S GATE 1939-45

Year	No. Tagged Below	No. Recovered Below		Total	No. Rec. Below by Taggers out more than three days
		by Indians	by Tagging Crew		
1939 . . .	4,344	612	266	878	216
1940 . . .	5,194	161	147	308	119
1941 . . .	12,023	2,671	131	2,802	93
1942 . . .	6,847	195	112	307	80
1943 . . .	6,491	250	474	724	359
1944 . . .	4,460	111	143	254	75
1945 . . .	4,044	9	50	59	15

BRIDGE RIVER RAPIDS

The Commission has been studying Bridge River Rapids, located on the Fraser River six miles north of Lillooet, since 1940. Tagging programs were conducted at this point of difficult passage in 1942, 1943 (small number tagged). 1944 and again, on a larger scale, during 1945. Prior to the 1945 season, specific low water levels causing delay and block conditions had been defined from the pattern of salmon tag recoveries. However, the effect that Hell's Gate may have had upon the ability of the salmon to negotiate the rapids could not be eliminated until this year. It was necessary to tag as many sockeye as possible during the season of 1945 to determine the effect of the block at Bridge River Rapids after the conditions at Hell's Gate had been improved. This year's work has confirmed conclusions drawn in previous years concerning the water levels at which fish cannot get through the rapids. The block occurs at all water levels below 651* feet on the gauge.

Its presence is shown by the numbers of tags recovered below and above the rapids at water levels above and below 651 feet. These are shown in Table VI. Block conditions commenced at the rapids on September 4 below the 651 foot water level and persisted throughout the remainder of the season.

* NOTE: 651 feet on the Bridge River gauge corresponds to the altitude above sea level. On most other gauges it measures the height above an arbitrary base established as convenient.

TABLE VI
RECOVERY OF TAGS RELEASED BELOW BRIDGE RIVER
RAPIDS, 1945

<i>Dates</i>	<i>Water Levels</i>	<i>No. Tagged</i>	<i>No. Re- covered Above</i>	<i>%</i>	<i>No. Re- covered Below</i>	<i>%</i>
July 7 - Sept. 3	Above 651 ft.	1,627	511	31.4	85	5.2
Sept. 3 - Oct. 15	Below 651 ft.	353	21	5.9	133	37.7

FARWELL CANYON

Study of the suspected obstruction at Farwell Canyon (on the Chilcotin River) was continued and the period of delay was tentatively established. Tagging experiments indicated that water conditions impede the ascent of sockeye at and above 90.1 feet (this is an arbitrary scale established to measure the changes in water level on a gauge located in Farwell Canyon). However, it is clearly shown that during the difficult stages, the Canyon forms at least a partial obstruction and many fish are unable to get through.

KEIGHLEY HOLES

Keighley Holes is a suspected obstruction in the Chilko River approximately 71 miles above Farwell Canyon. The first tagging program was attempted in 1945 at this point but due to the clear water it was found difficult to catch the fish and only 67 tags were released. However, since fish were consistently observed passing through the questionable stretch of water, it is believed that at the water levels of 1945, no serious obstruction was presented to the migration of sockeye salmon.

SKOOKUMCHUCK RAPIDS

In 1945, during the latter part of August and the month of September, 1,784 sockeye were tagged at Skookumchuck Rapids, located on the lower Lillooet River twenty miles above the head of Harrison Lake. The data indicate that at water levels experienced in 1945 these runs are not subjected to a delay at this point. However, it is known that high water levels act as a partial barrier to their migration, and that such conditions did occur in 1940. If it later appears warranted, further work may clarify the situation in regard to these conditions.

Engineering Operations

Engineering activities have been divided as follows: construction of Hell's Gate Fishways, construction of the Bridge River Rapids Fishways, removal of the Adams River dam, field surveys for preparation of plans for the removal of blocks to sockeye migrations in the Chilcotin River system, and preliminary reconnaissance work on the other proposed projects.



FIG. 11.—Partially completed Left Bank Fishway, Hell's Gate.

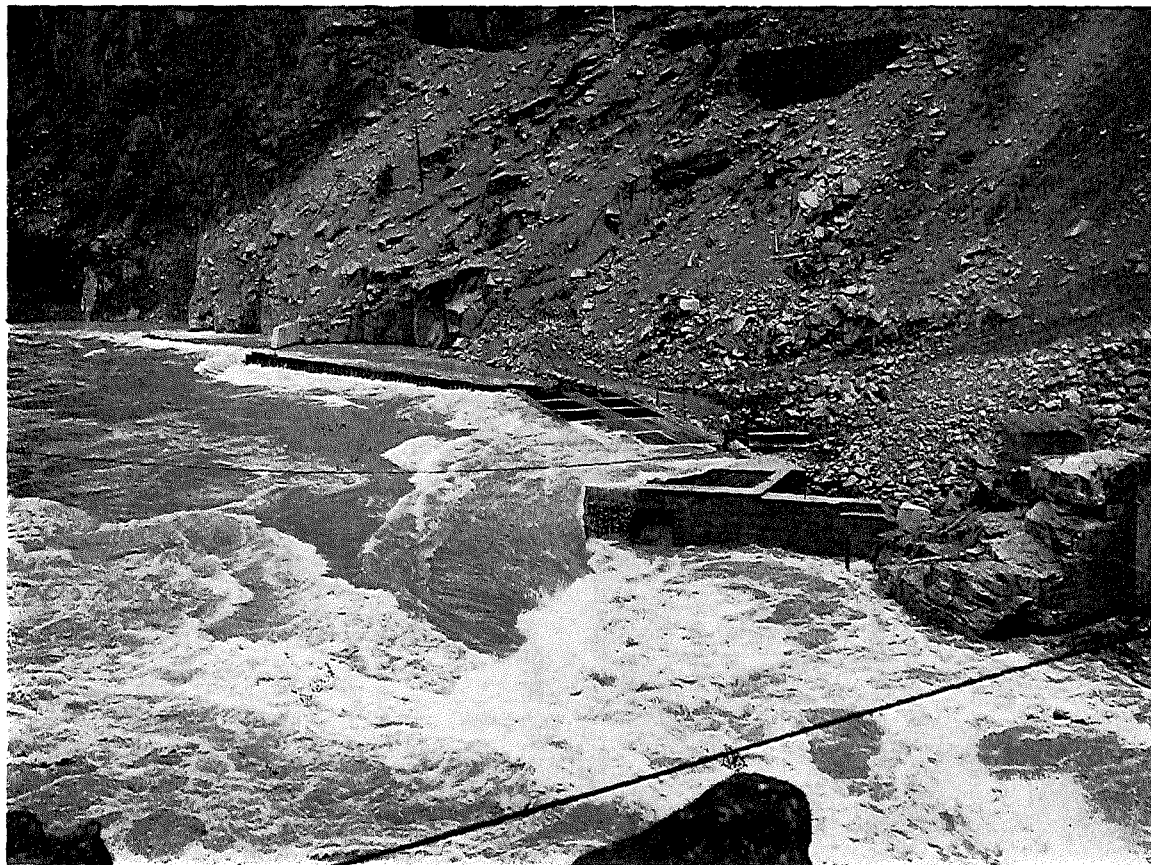


FIG. 12.—Left Bank Fishway, Hell's Gate, at immersion level.

HELL'S GATE FISHWAYS

Work on this project continued from January 1 until May 25. On May 27 the fishway decks were submerged by the rising river and were not accessible again until June 30. At high water on June 3, the river rose to a depth of some 20 feet over the decks. Work was resumed to complete the structures November 7 and by the end of the year preparations were being made for the final concrete pours on the upper end of the left bank fishway.

The right bank structures and the lower end of the left bank fishway were operated to pass the sockeye runs of this year. However, the operating gates of the right bank fishway, both in the baffles and at the entrance, were not installed and no check of the flexibility of operation of this structure could be made. In order to prevent damage the fishways were closed off by temporary stop logs during the high water period.

BRIDGE RIVER RAPIDS FISHWAYS

It was decided early in 1945 to construct only two fishways at this point; one each on the right bank of the upper and lower rapids. Plans and specifications were prepared and invitations to tender were submitted to the contractors in November, 1945 and the contract was awarded in December. A 1,800 foot access road between the two fishways was completed before work under the general fishway contract was started.

REMOVAL OF THE ADAMS RIVER DAM

A dam, 190 feet in length, was constructed on the Adams River in 1908 by the Adams River Improvement Company, 475 yards below the outlet of Adams Lake and 55 miles northeast of Kamloops, B.C. The dam was originally constructed to impound water for driving logs down the river and was used for this purpose until about 1930 when logging operations ceased and the dam was allowed to fall into disrepair. In order to render more readily accessible to sockeye salmon the extensive spawning grounds of Adams Lake and the Upper Adams River, it was desired that the remainder of the dam be removed from the river channel.

Clearing Streams Licence No. 4188, issued to the Adams River Improvement Company, expired in 1944 and a renewal of the licence was refused by the Provincial Water Rights Branch. Inasmuch as the company did not then comply with an order from the Dominion Department of Fisheries for the removal of the dam, the Commission did this work on instructions from that department. Actual removal of the dam began on November 3 and was completed on December 1, 1945.

During the removal operations, gauges were employed to determine whether any changes might occur in river or lake levels. From these readings it was found that the level of Adams Lake was unchanged by the removal operation. A drop of 6.25 feet still exists through the reach formerly blocked by the dam, but the drop is distributed over a river length of approximately 120 feet and, as a result, no concentrated fall is likely to exist.

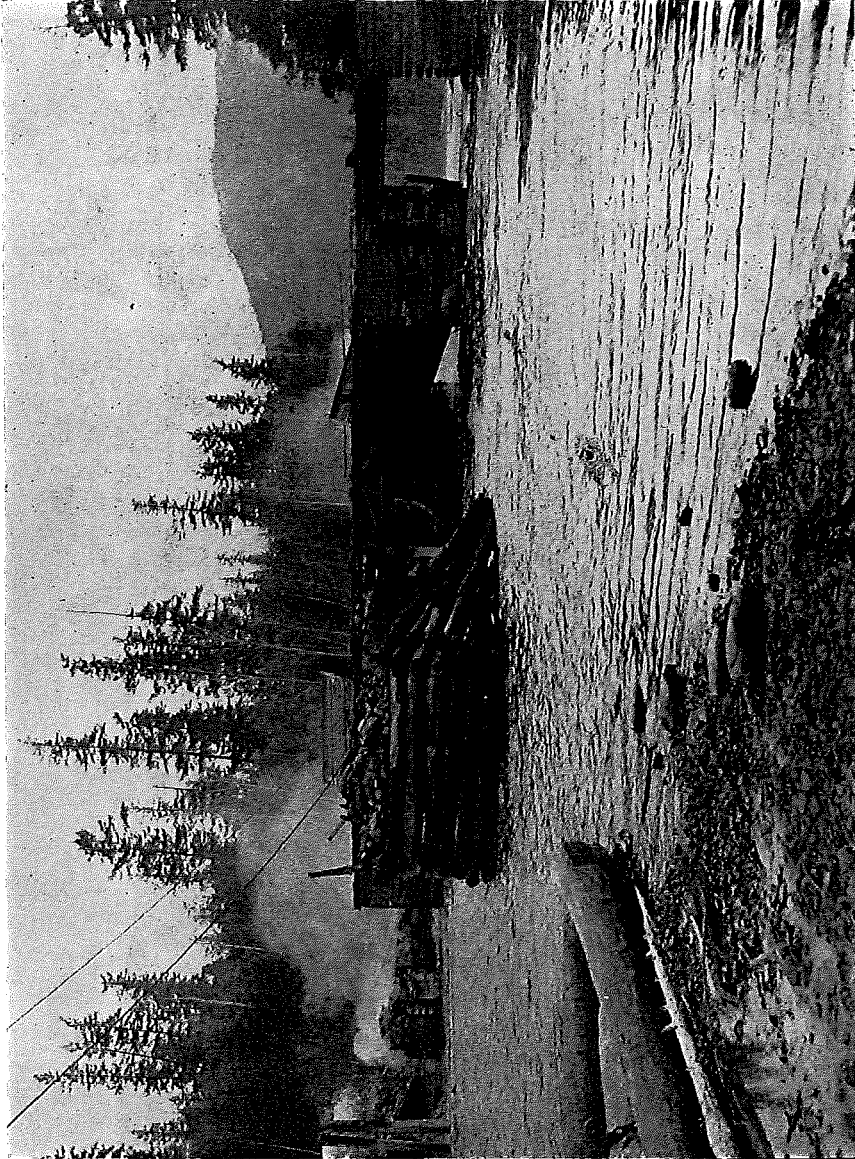


Fig. 13.—Adams River Dam.



FIG. 14.—Adams River after removal of dam.

CHILCOTIN RIVER SURVEY

A Topographic Survey, which includes water profile studies, has been made of Farwell Canyon on the Chilcotin River. The water profile studies have been correlated with the flow readings taken by the Dominion Water and Power Bureau at their major gauging stations in the Chilcotin system. This work, combined with biological studies will make it possible to investigate the extent of past blocks which may have occurred in this canyon.

An area suspected to be of difficult passage for sockeye is found at the Keighley Holes Rapids in the Chilko River and has been surveyed and water profiles taken. These field surveys will form the basis for planning the alleviation of any block conditions which may be found to exist.

RECONNAISSANCE SURVEY

A reconnaissance survey was made to gain a comprehensive picture of all other projects listed under the general Fraser River Program. As a part of this survey, a hydrographer of the Dominion Water and Power Bureau made stream measurements throughout the watershed on those streams on which flow readings were not already available. This joint survey will give the Commission basic data for planning corrections outlined under the various projects.

INTERNATIONAL PACIFIC SALMON FISHERIES COMMISSION

EDWARD W. ALLEN, *Chairman*

FRED J. FOSTER

A. L. HAGER

CHARLES E. JACKSON

TOM REID, M.P.

A. J. WHITMORE, *Secretary*

SUMMARY OF THE SOCKEYE ESCAPEMENT TO THE FRASER RIVER SPAWNING AREAS, 1945

32

District and Streams	Dates of Run		Estimated No. Sockeye Present	Standard Error	Sex Ratio (%)				% Eggs Deposited	Estimated Millions of Eggs Deposited
	Arrival	End			3-Year	Males 4-Year	Females 3-Year	4-Year		
LOWER FRASER										
Cultus Lake*	Sept. 29	Dec. 21	9,231	w	41.7	19.2	4.7	35.2	79.0	10.36
Upper Pitt River Incl. Tributaries†	Sept. 3	Oct. 8	35,985	9,922		40.0		60.0	90.1	77.16
Widgeon Slough†	Nov. 5		1,200	70	41.6		58.4		95.8	
HARRISON										
Big Silver Creek‡	Sept. 11	Sept. 29	2,000	500		65.0		35.0	92.1	2.58
Douglas Creek	Aug. 27	Sept. 22	72							
East Creek	Oct. 25	Oct. 31	27							
Harrison River†	Nov. 9	Dec. 15	16,060	7,315		35.0		65.0	99.9	41.71
Hatchery Creek‡	Sept. 13	Nov. 12	100		23.9	23.9		52.2	97.9	
Weaver Creek†	Sept. 10	Nov. 24	12,944	652	1.0	35.8		63.2	96.8	31.67
LILLOOET										
Birkenhead River†	Sept. 6	Oct. 30	80,553	4,258	8.9	30.3		60.8	95.4	186.89
Upper Lillooet Streams†	Sept. 22	Oct. 5	16,111	851						
SOUTH THOMPSON										
Scotch Creek	Aug.	Aug.	75	25						
Seymour River	Aug. 20	Sept.	150	50						
Adams River	Sept. 25	Nov. 21	58,000	14,500	96.8	0.6	1.4	1.2	100.0	3.16
Scotch Creek	Oct. 26	Nov.	1,750	485						
Little River	Sept. 25	Nov.	6,000	1,500						
Momich River	Oct.	Nov.	1,500	375						
Sinmax Creek	Oct.	Nov.	225							
NORTH THOMPSON										
Raft River	Aug. 1	Sept. 9	3,300	825		49.4		50.6	58.0	3.78
SETON-ANDERSON										
Cayoosh Creek	Oct. 14	Oct. 26	6							
Portage Creek	Sept. 15	Oct. 15	225	25					100.0	
Seton Creek	Aug. 7	Aug. 28	20	10						
CHILCOTIN										
Chilko River†	Aug. 9	Oct. 21	186,337	26,060	0.1	50.5	0.0	49.4	78.6	202.21
Chilko Lake†	Aug. 9	Oct. 21	6,547	707						

SALMON COMMISSION

SUMMARY OF THE SOCKEY ESCAPEMENT TO THE FRASER RIVER SPAWNING AREAS, 1945—(Continued)

District and Streams	Dates of Run		Estimated No. Sockeye Present	Standard Error	Sex Ratio (%)				% Eggs Deposited	Estimated Millions of Eggs Deposited§
	Arrival	End			Males 3-Year	4-Year	Females 3-Year	4-Year		
QUESNEL										
Horsefly River	Aug. 14	Sept. 30	3,000	750						
NECHAKO										
Endako River	Aug. 15	Sept. 15	80							
Nadina River	Aug. 15	Sept. 30	300							
Nithi River		Sept. 25	500							
Ormonde Creek	Aug. 20	Sept. 25	400							
Stellako River†	Sept. 15	Sept. 25	20,826	544	1.4	42.6	0.0	56.0	99.6	46.46
STUART										
Dust Creek	Aug. 8	Oct. 25	4							
Fleming Creek	Sept. 9	Sept. 3	2							
Forfar Creek*	July 22	Aug. 31	7,081	w		47.8		52.2	60.2	8.29
Gluske Creek	July 21	Aug. 29	2,783	199						
Kazchek (Hoy) Creek‡			952	68		43.5		56.4		
Kynoch Creek‡	July 22	Aug. 21	9,304	660		49.6		50.4	100.0	17.47
Middle River‡	Sept. 2	Oct. 12	22,804	4,141		44.3		55.7	99.2	46.93
Narrows Creek‡	Aug. 8	Sept. 3	109			41.0		59.0		
Rossette Creek‡	July 21	Aug. 20	6,808	486		56.6		43.4		
Tachie River‡	Sept. 9	Oct. 11	751		2.3	31.8	13.6	52.3		
Twenty-five Mile (Shale) Creek‡	Aug. 9	Sept. 7	250							
NORTH EAST										
Antler Creek			43							
Upper Bowron River* (Including Moose Creek)	July 25	Sept. 14	4,094	w		62.8		47.2		
Total for all streams examined			518,454							
Total for key streams			515,320	32,914						

* All fish counted through weir.

† Population estimated by tagging program.

‡ Population determined by indices.

§ Average number of eggs in a female taken as 4,000, except Cultus Lake, 4,036; Chilko River and Lake, 2,700; Stuart Lake Streams, 3,725.

REPORT FOR 1945