INTERNATIONAL PACIFIC SALMON FISHERIES COMMISSION

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

ANNUAL REPORT
1968

COMMISSIONERS

A. J. WHITMORE
W. R. HOURSTON
RICHARD NELSON
DeWITT GILBERT
CLARENCE F. PAUTZKE
THOR C. TOLLEFSON

NEW WESTMINSTER
CANADA
1969

INTERNATIONAL PACIFIC SALMON FISHERIES COMMISSION

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AND PERIOD OF SERVICE
SINCE THE INCEPTION OF THE COMMISSION
IN 1937

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Fred J. Foster	1943-1947
Milo Moore	1946-1949 1957-1961
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H. R. MacMillan, C.B.E., D.Sc.	1952-1956
F. D. Mathers	1956-1960
W. R. Hourston	1960-
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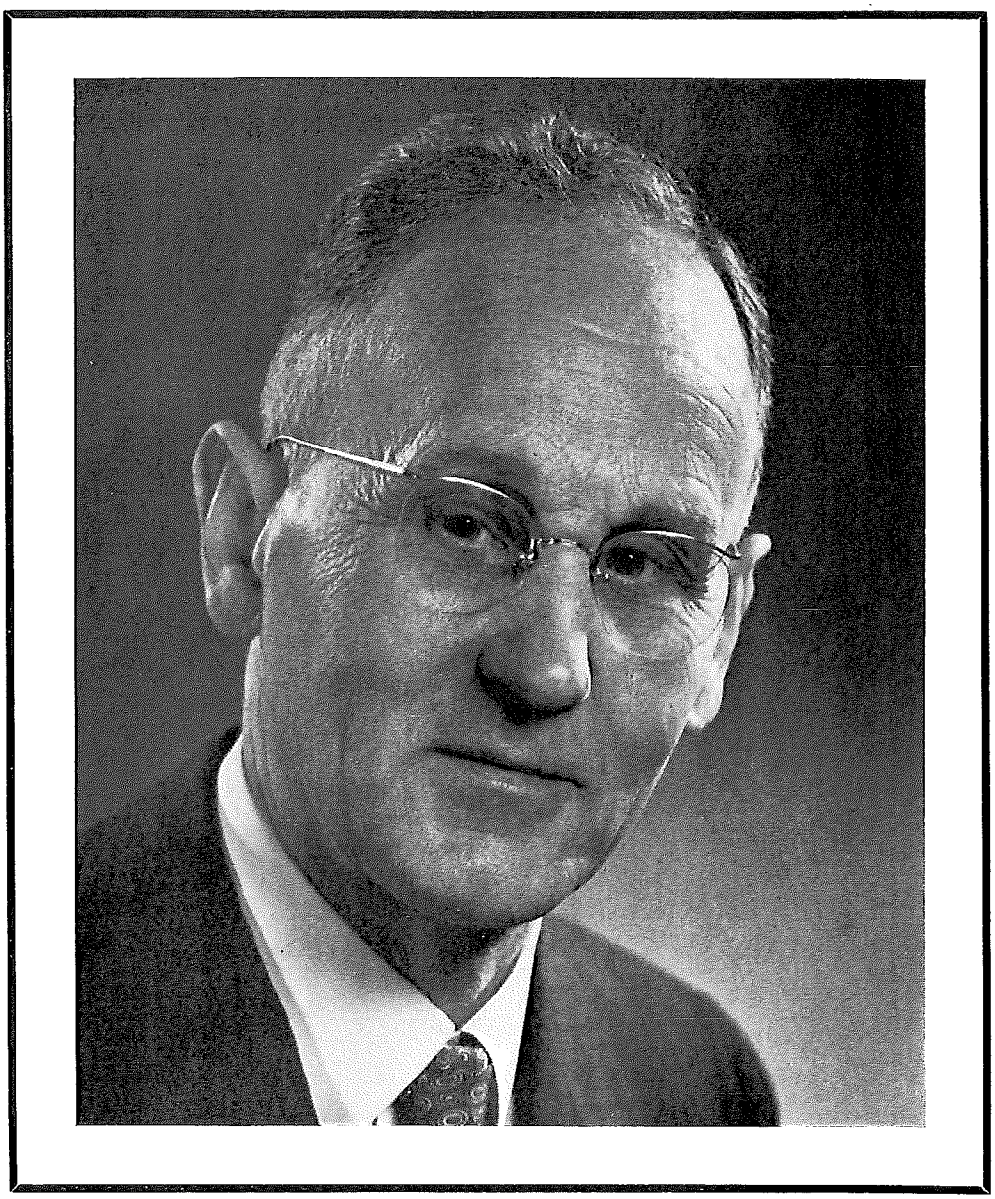
DIRECTOR OF INVESTIGATIONS
LOYD A. ROYAL

NEW WESTMINSTER
CANADA
1969



THE HONOURABLE SENATOR THOMAS REID

In honour of the late Senator who was a member of the International Pacific Salmon Fisheries Commission for a period of thirty years. Senator Reid's personal dedication throughout most of his life was to protect and preserve the Fraser River salmon.

REPORT OF THE
INTERNATIONAL PACIFIC SALMON FISHERIES COMMISSION
FOR THE YEAR 1968

The fishing industry of Canada and the United States has a vital interest in the operations of the International Pacific Salmon Fisheries Commission. The degree of success achieved by the Commission in protecting and expanding the sockeye and pink salmon populations is under constant scrutiny and the common question by fishermen and operators alike is, "What is the future potential of the Fraser River salmon populations?"

Every fisherman is vitally concerned, and there are thousands who harvest Fraser River sockeye and pink salmon. Each year many of these fishermen are faced with the problem of whether to keep their depreciated fishing boats or to invest additional thousands of dollars in new and more efficient equipment. An individual may have an investment of $5,000 or $250,000 in fishing equipment, depending on the type of gear, his fishing ability and his degree of confidence in the future.

Corporate facilities for buying, handling, processing and distributing the product to the consumer require constant planning to meet competitive costs. The modernizing of multimillion-dollar processing plants to include technological advances involves large investments which cannot be absorbed in just a few years. Such investments require confidence in the long-range future of the Fraser River salmon fisheries.

Although the salmon fishery of two other major river systems on the Pacific Coast has decreased considerably, an examination of their history leads to an optimistic forecast for the future of the Fraser River salmon fishery. The Sacramento-San Joaquin River system has been a major producer of chinook salmon. Unfortunately, this system lies in a semi-arid region of extremely valuable farm land. The available flow has and is being developed to its full capacity, primarily for irrigation, and for domestic and industrial water supplies as well. As a result, the fishery has suffered. In contrast, the Fraser River watershed encompasses limited farm land requiring extensive irrigation and any conceivable requirements for this purpose would be small in relation to the water available. Only a major diversion of the Fraser River to other areas would in this respect place the Fraser River salmon fishery in serious jeopardy.

Like the Sacramento-San Joaquin River runs, the Columbia River salmon fishery has declined substantially. Irrigation development several decades ago destroyed or permanently decimated the salmon populations of many major tributaries. In more recent years, the main Columbia and Snake Rivers have been utilized for hydroelectric power. The salmon populations produced in the upper Columbia and Snake Rivers are now declining in abundance and may eventually become of little commercial importance. In the Fraser system, however, there is limited need for irrigation water. More important, in the absence of assurance that salmon and other fisheries can be adequately protected, British Columbia Government policy has opposed development of the Fraser's hydroelectric capacity, pending improvements in thermal generation of electric power. From this we gain confidence that the salmon industry of the Fraser River will not be

affected by the disastrous forces which are impairing or have destroyed major salmon producing areas in the Columbia and Sacramento-San Joaquin Rivers.

The policy of the Provincial Government in not developing the hydroelectric power potential of the Fraser River is all-important to the future of the fishery. The obstruction at Hell's Gate caused by railroad construction from 1911 to 1913 has already amply demonstrated the devastating effect of blocks and delays to the upstream migration of Fraser River salmon. Sockeye runs declined to the extent that annual production dropped from an average of 9.5 million sockeye for the 1898-1913 period to an annual average of only 1.2 million fish for the 1921-1924 period, a drop in production of 87 per cent. Similarly, the extensive pink salmon escapements above Hell's Gate became nonexistent beginning in 1913, resulting in an immediate drop in the index of abundance of this species from an average of 284 to 67, a decline of 76 per cent (Rounsefell and Kelez, 1938)[1].

The adverse effects of the Hell's Gate obstruction on Fraser River sockeye culminated in the Sockeye Salmon Fisheries Convention ratified by Canada and the United States in 1937. By the terms of the Convention, the International Pacific Salmon Fisheries Commission was created in the same year to protect, preserve and extend the fishery for this species. After eight years of scientific investigation and research, as required by the Convention, the Commission assumed regulatory responsibility. In 1945 the major Hell's Gate fishways were completed, and in 1946 new regulations were inaugurated to adjust fishing in the interest of conservation and division of the catch, thus commencing the fulfillment of the Commission's terms of reference.

The following table shows the historical value of the Fraser River sockeye fishery until 1913, the following decline (e.g., 1921-1924), and the extent of rehabilitation in recent years in terms of both fish and dollars. The years 1958 to 1961 are used to show current production since adverse environmental conditions temporarily reduced production of both sockeye and pink salmon during the years from 1962 to 1966. Since 1966, reproductive environment and survival rates appear to be regaining favorable levels, but a full quadrennial cycle has not yet been completed.

Production History — Fraser River Sockeye

Years	*Average Annual Catch*	*Value to Fishermen 1968 Prices*	*Processed Value 1968 Prices*
1898-1913	9,494,000	$22,008,500	$39,115,000
1921-1924	1,213,000	$ 2,812,000	$ 4,997,500
1958-1961	4,770,000	$11,058,000	$19,653,000

Fraser River pink salmon runs also underwent a serious decline after the Hell's Gate slide but have recently begun to return to their former abundance. Total catch figures are not available for the years prior to 1913, since the lack of demand at that time resulted in considerable wastage, and no records exist at all

[1] Rounsefell, George A. and George B. Kelez. 1938. The salmon and salmon fisheries of Swiftsure Bank, Puget Sound, and the Fraser River. U.S. Bureau Fish., Bull. 27.

for the Canadian fishery. For this reason, Rounsefell and Kelez used an abundance index based on United States trap catches to reflect the size of the pink salmon runs before and after the Hell's Gate obstruction. The complete loss of pink salmon escapement above Hell's Gate in 1913 was reflected immediately in a decline in this abundance index from 284 to 67, a drop of 76 per cent. Thus a major recovery of the escapement to this area in recent years becomes very important, as indicated in the following table:

Pink Salmon Escapement Recorded Above Hell's Gate

Prior to 1913	—Reported to be in the millions.
1913 to 1945	—No fish observed or reported.
1945 to 1955	—Increasing as a result of Hell's Gate fishways.
1967	—717,441 fish.

To establish a reasonable and conservative comparison between the size of the original pink salmon run, the average size of the 10 cycle runs following 1913, and the 1967 run, the abundance indexes of 284 and 67 established by Rounsefell and Kelez have been used for the first two periods and an index of 100 has been applied to the 1967 run. It has been estimated that the 1967 pink salmon catch, worth $6,380,000 to the fishermen and $18,676,000 in processed value to the two countries at 1968 prices, can eventually be doubled and perhaps tripled, according to historical evidence. With the escapement above Hell's Gate increasing to substantial levels once again, there is no reason to believe that this potential production cannot be achieved in a few cycle years of favorable survival rates.

Combining actual values for Fraser River sockeye and estimated minimum values for pink salmon (twice 1967 production), the original populations of the two species prior to their decimation in 1913 were worth an estimated $28,389,000 annually to the fishermen and $57,791,000 after processing to the two countries based on 1968 prices. The value of this industry dropped to $4,950,000 to the fishermen and $11,254,000 when processed during the period following immediately after the 1913 slide and has since recovered due in a large part to the operations of the Commission. The current annual value is $14,248,000 to the fishermen and $28,991,000 after processing, an annual increase of $9,298,000 and $17,737,000, respectively, over the previous period.

To regain all the original wealth produced by the sockeye and pink salmon populations of the Fraser River and possibly to increase this value through extension of the populations beyond their original levels depends on several factors. Certain major sockeye populations, including the Horsefly and Late Stuart runs, may have been depleted so severely that the original racial structure of the populations was destroyed. In this case, full restoration may be slow, since the residual population, now increased substantially in number, may not be entirely adjusted to the reproductive environment utilized by the original population. Evidence that this adjustment can occur is available in the recent history of a successful transplant of Skagit River sockeye made to Lake Washington in the State of Washington in 1936 (Royal and Seymour, 1940)[2]. The transplanted population has now adapted to several new reproductive environments over a seven generation period and annual production has now increased substantially, with the timing of the total run changed considerably.

[2] Royal, L.A. and A. Seymour. 1940. Building new salmon runs. Prog. Fish-Cult. No. 52.

A second factor affecting the restoration of some populations of Fraser River sockeye and pink salmon is the change in the reproductive environment brought about by logging of the watershed. Some small populations have already been affected adversely and only artificial aids can prevent a decline in the populations concerned. Artificial spawning channels, incubation channels, temperature control and, more recently, artificial rearing have been investigated by the Commission. These artificial aids will act not only as substitutes for lost or damaged spawning grounds, but also as potential methods for extending the populations to levels greater than those possible under natural conditions.

As will be described later, all of these methods except temperature control and artificial rearing have been developed through research and prototype operation to a point where the Commission is optimistic over their relatively unlimited application. Although fish culture is one of the principal directives in the Sockeye Fisheries Convention, the Commission has proceeded carefully in this field. Hatchery operations using past methods have not been particularly successful with sockeye and pink salmon. The Commission's experiments with fingerling transplants have failed completely and eyed-egg transplants have been only moderately successful.

However, the rehabilitation picture may change within the next two years. There is reason to believe with additional data in terms of returning adults, forthcoming during this two-year period, that a rapid expansion in artificial aids to sockeye and pink salmon reproduction will be justified. These artificial aids, with their success already indicated, will provide a means of greatly extending the potential sockeye production in such large natural and relatively unused rearing areas as Francois Lake and Stuart Lake. Artificial spawning channels providing thermal control of the reproductive environment may eliminate in part the need for genetic readjustment of the residual Horsefly sockeye population. In areas where the reproductive environment of either sockeye or pink salmon is being changed by logging or other watershed developments, artificial aids will be required to maintain the populations. Through this activity, the Commission fully expects not only to preserve the original populations of Fraser River sockeye and pink salmon but also to extend these populations beyond their original size.

The activities of the Commission to date have been a most fruitful investment. The current annual value of the Fraser River sockeye and pink salmon fishery has increased by $9,298,000 to fishermen and $17,737,000 in wholesale value since the years immediately following the Hell's Gate obstruction. To achieve a similar or even greater increase in the annual value of the Fraser River sockeye and pink salmon fishery, an added investment of some magnitude will soon be required. Once the investment has been justified, and such justification is already partially available, there will be a need for an immediate program of artificial propagation. This program must be extensive enough to bring about substantial gains and thus ensure that local government policy continues to prevent the Fraser River from being developed in a manner adverse to the maintenance of a very valuable fishery and food resource. Without the support of the government directly concerned with the development of the Fraser River watershed, the salmon fishery will gradually disappear.

To achieve the *full* purpose of the Sockeye Fisheries Convention between the United States and Canada will require a new budget concept on the part of the two Governments, particularly the United States, from that predicated on past operation of the Commission which has been limited primarily to research and management of the fishery.

COMMISSION MEETINGS

The International Pacific Salmon Fisheries Commission held eleven formal meetings during 1968 with the approved minutes of these meetings being submitted to the Governments of Canada and the United States. The first meeting of the year was held on February 1 and 2 with Mr. DeWitt Gilbert serving as Chairman and Mr. W. R. Hourston as Vice-Chairman and Secretary. Mr. A. J. Whitmore was welcomed upon his reappointment to the Commission. On February 1 the Commission met with its Advisory Committee composed of the following members:

United States	*Canada*
Charles Mechals Troll Fishermen	R. H. Stanton Troll Fishermen
Robert Christenson Gill Net Fishermen	K. F. Fraser Salmon Processors
N. Mladinich Purse Seine Fishermen	Peter Jenewein Gill Net Fishermen
Howard Gray Sport Fishermen	Frank Bublé Purse Seine Fishermen
John Brown Reef Net Fishermen	Robert Wright Sport Fishermen
	W. Patterson (alternate for H. Stavenes) Purse Seine Crew Members

The tentative recommendations for regulatory control of the 1968 sockeye salmon fishery in Convention waters, as submitted to the Advisory Committee by the Commission on December 19, 1967, were reviewed and certain revisions made on the basis of representations of the Committee.

On May 13 and 14, 1968 the Commission met in executive session to examine current operating problems. Staff reports were presented on the following subjects: 1. A summary of sockeye and pink fry, and sockeye smolt enumeration at various sites in the Fraser River watershed, 2. A review of the measured effectiveness of current pollution abatement facilities, 3. Details of a proposed diversion of water from Shuswap River to Okanagan Lake to meet the irrigation and domestic water requirements of the Okanagan Valley. Progress reports were also presented on spawning channels and temperature control projects, the beaver problem, the Indian fishery, and other matters related to the Commission's terms of reference. The Commission examined and approved the operational and construction budgets proposed for the 1969-70 fiscal year. On May 14, 1968 the Commission toured the Shuswap River to Mabel Lake to examine the proposed diversion sites and the sockeye spawning grounds that would be affected by this development.

Seven formal meetings and four telephone conferences were required between July 24 and September 12, 1968 to achieve, by adjustment of fishing regulations, the desired escapement and equitable division of the allowable catch of sockeye salmon.

The Commission again met in executive session on October 17 and 18, 1968 to examine and deal with a number of subjects. On October 17, the Commission toured the Sweltzer Creek Field Station and observed and heard staff reports on the various research projects under way. The following staff reports were presented to the Commission on October 18: 1. A review of the 1968 sockeye run, 2. A report of the results of investigations related to prespawning mortality, 3. A report on the indicated increase in adult sockeye production resulting from the Pitt River incubation channel and hatchery. The Commission discussed other matters pertaining to the Commission's operation and inspected the Weaver Creek artificial spawning channel.

The eleventh and final meeting of the year was held on December 11, 12 and 13, 1968 with the first two days devoted to general business. The Commission unanimously approved the reappointment of Mr. H. Stavenes to represent the Canadian purse seine crew members. The annual open meeting was held with the Advisory Committee on December 13, 1968 and was attended by approximately 500 representatives of the fishing industry and interested government agencies. The Chairman noted with regret the passing of Senator and Mrs. Reid and asked those present to stand in a silent memorial. Summaries of research being conducted at the Sweltzer Creek Field Station and other field investigations were presented. The characteristics of the 1968 fishing season, a summary of possible factors influencing the size of the 1969 sockeye and pink salmon runs in Convention waters, and the tentative proposals for regulation of these fisheries were presented to the meeting for consideration by the Advisory Committee and their respective segments of the fishing industry.

1968 REGULATIONS

Recommendations for regulations governing the 1968 sockeye salmon fishery in Convention waters were adopted at a meeting of the Commission held on February 2, 1968 and submitted to the two national governments for approval and to the State of Washington for implementation on February 7, 1968. The recommendations for Canadian Convention waters were implemented by the Government of Canada by an Order-in-Council dated June 5, 1968 and for United States Convention waters by an Order of the Director of the Washington State Department of Fisheries on March 27, 1968.

The recommendations of the Commission were as follows:

Canadian Convention Waters

"The International Pacific Salmon Fisheries Commission appointed pursuant to the Convention between Canada and the United States of America for the protection, preservation and extension of the Sockeye Salmon Fisheries in the Fraser River System, signed at Washington on the 26th day of May, 1930, as amended by the Pink Salmon Protocol signed at Ottawa on the 28th day of December, 1956, hereby recommends that regulations to the following effect, in

the interests of such fisheries, be adopted by Order-in-Council as amendments to the Special Fishery Regulations for British Columbia, for the season of 1968, under authority of the Fisheries Act, namely:

1. No person shall fish for sockeye or pink salmon in the waters of the southerly portion of District No. 3 embraced in Area 20 with nets from the 4th day of July, 1968 to the 10th day of August, 1968, both dates inclusive.

2. No person shall fish for sockeye or pink salmon in the waters of the southerly portion of District No. 3 embraced in Areas 17 and 18 and in the waters of District No. 1 by means of nets:

(a) From the 30th day of June, 1968, to the 13th day of July, 1968, both dates inclusive, except for those sockeye or pink salmon taken in gill nets having mesh of not less than 8 inches extension measure for linen and 8½ inches for synthetic fibre as authorized for the taking of chinook salmon by the Regional Director of Fisheries for British Columbia and pursuant to the provisions of the British Columbia Fishery Regulations, and

(b) From the 14th day of July, 1968, to the 28th day of September, 1968, both dates inclusive, except from eight o'clock in the forenoon of Monday to eight o'clock in the forenoon of Wednesday of each week.

3. No person shall fish for sockeye or pink salmon, except by angling or trolling for the purpose of personal consumption and not for sale or barter, in the Convention waters of Canada (the waters of Howe Sound excepted) lying easterly and inside of a straight line projected from Gower Point at the westerly entrance to Howe Sound to Thrasher Rock light, thence in a straight line to Salamanca Point on the southerly end of Galiano Island, thence in a straight line to East Point on Saturna Island, thence in a straight line towards Point Roberts light to the intersection with the International Boundary line, thence following the International Boundary line to its intersection with the mainland from the 18th day of August, 1968, to the 28th day of September, 1968, both dates inclusive, except at the times that net fishing other than with chinook salmon nets may be permitted within that area.

All times hereinbefore mentioned shall be Pacific Daylight Saving Time."

United States Convention Waters

"The International Pacific Salmon Fisheries Commission appointed pursuant to the Convention between Canada and the United States of America for the protection, preservation and extension of the Sockeye Salmon Fisheries in the Fraser River System, signed at Washington on the 26th day of May, 1930, as amended by the Pink Salmon Protocol signed at Ottawa on the 28th day of December, 1956, hereby recommends to the Director of Fisheries of the State of Washington that regulations to the following effect, in the interests of such fisheries, be adopted by him for the year 1968 by virtue of authority in him vested by Section 6 of Chapter 112 of the Laws of the State of Washington of 1949, namely:

1. No person shall fish for sockeye or pink salmon in the Convention waters of the United States of America lying westerly of a straight line drawn from Angeles Point in the State of Washington across Race Rocks to William Head in the Province of British Columbia with nets from the 4th day of July, 1968, to the 10th day of August, 1968, both dates inclusive.

2. No person shall fish for sockeye or pink salmon in the Convention waters of the United States of America lying easterly of a straight line drawn from Angeles Point in the State of Washington across Race Rocks to William Head in the Province of British Columbia from the 27th day of June, 1968, to the 13th day of July, 1968, both dates inclusive, except in those waters lying southerly of a line projected from Dungeness light to Smith Island light to Lawson Reef light to Langley Point on Fidalgo Island which will be closed from the 4th day of July, 1968, to the 13th day of July, 1968, both dates inclusive.

3. (1) No person shall fish for sockeye or pink salmon in the Convention waters of the United States of America lying easterly of a straight line drawn from Angeles Point in the State of Washington across Race Rocks to William Head in the Province of British Columbia with purse seines:

(a) From the 14th day of July, 1968, to the 10th day of August, 1968, both dates inclusive, except from half past five o'clock in the forenoon to half past nine o'clock in the afternoon of Monday, Tuesday and Wednesday of each week; and

(b) From the 11th day of August, 1968, to the 31st day of August, 1968, both dates inclusive, except from five o'clock in the forenoon to nine o'clock in the afternoon of Monday, Tuesday and Wednesday of each week.

(2) No person shall fish for sockeye or pink salmon in the waters described in subsection (1) of this section with reef nets:

(a) From the 14th day of July, 1968, to the 10th day of August, 1968, both dates inclusive, except from

(i) twelve o'clock (noon) Sunday to half past nine o'clock in the afternoon of Sunday; and

(ii) half past five o'clock in the forenoon to half past nine o'clock in the afternoon of Monday and Tuesday; and

(iii) half past five o'clock in the forenoon to twelve o'clock (noon) of Wednesday of each week; and

(b) From the 11th day of August, 1968, to the 31st day of August, 1968, both dates inclusive, except from five o'clock in the forenoon to nine o'clock in the afternoon of Monday, Tuesday and Wednesday of each week.

(3) No person shall fish for sockeye or pink salmon in the waters described in subsection (1) of this section with gill nets:

(a) From the 14th day of July, 1968, to the 20th day of July, 1968, and from the 28th day of July, 1968, to the 3rd day of August, 1968, all dates inclusive, except from seven o'clock in the afternoon of Sunday to nine o'clock in the forenoon of Wednesday; and

(b) From the 21st day of July, 1968, to the 27th day of July, 1968, and from the 4th day of August, 1968, to the 10th day of August, 1968, all dates inclusive, except from seven o'clock in the afternoon of Monday to nine o'clock in the forenoon of Thursday; and

(c) From the 11th day of August, 1968, to the 17th day of August, 1968, and from the 25th day of August, 1968, to the 31st day of August, 1968, all dates inclusive, except from six o'clock in the afternoon of Sunday to nine o'clock in the forenoon of Wednesday; and

(d) From the 18th day of August, 1968, to the 24th day of August, 1968, both dates inclusive, except from six o'clock in the afternoon of Monday to nine o'clock in the forenoon of Thursday.

4. No person shall fish for sockeye or pink salmon in the Convention waters of the United States of America lying northerly and westerly of a straight line drawn from Iwersen's dock on Point Roberts in the State of Washington to the flashing white light on Georgina Point at the entrance to Active Pass in the Province of British Columbia from the 1st day of September, 1968, to the 22nd day of September, 1968, both dates inclusive.

5. (1) The foregoing recommended regulations shall not apply to the following United States Convention waters:

(a) State fishing Area No. 7 including all Convention waters known as Bellingham Bay lying inside of a line extending from Point Frances through the Post Point bell buoy to the mainland, and

(b) That portion of State fishing Area No. 3 lying easterly and inside of a line projected from Carter Point on Lummi Island to the most northerly tip of Vendovi Island, thence to Clark Point on Guemes Island including the waters of Samish Bay, and

(c) State fishing Area No. 4, commencing July 28, and

(d) Preserves previously established by the Director of Fisheries of the State of Washington for the protection of other species of food fish.

All times hereinbefore mentioned shall be Pacific Daylight Saving Time."

Emergency Amendments

In order to provide for adequate racial escapements of Fraser River sockeye salmon and for an equitable share of the season's catch by the fishermen of the United States and Canada, the approved regulations as detailed above were later amended on recommendation of the Commission. A detailed list of the regulatory amendments is as follows:

July 24, 1968 — To reduce the early escapement of Chilko sockeye, which are particularly vulnerable to prespawning mortality, the Commission recommended an additional 24 hours fishing or a fourth day in all United States Convention waters

lying easterly of the Angeles Point-William Head line, such additional fishing time being considered necessary in view of the small size of the Puget Sound fleet. In addition, to aid Canadian fishermen in obtaining an equal share of the allowable sockeye catch the Commission recommended a 24-hour delay in the scheduled opening in all United States Convention waters for the week commencing July 28, with reef nets starting at 12:00 noon Monday, July 29, and gill nets at 7:00 p.m. the same day. Purse seines would commence fishing at 5:30 a.m. Tuesday, July 30. The Commission also recommended that fishing time in Canadian Convention waters lying easterly of the Angeles Point-William Head line start as scheduled and fishing time be increased from 48 hours to 72 hours for the week commencing July 28.

August 2, 1968 — In the interest of equalizing the catch of sockeye between the fishermen of the two countries and to insure proper escapement the Commission recommended a delay of 24 hours in the scheduled opening of United States Convention waters lying easterly of the Angeles Point-William Head line with fishing time in these waters reduced by 24 hours for the week commencing August 4 to allow only two days fishing. Reef nets would begin fishing at 12:00 noon Monday, August 5, and purse seines and gill nets at the regular starting hours August 6.

August 7, 1968 — In an effort to achieve proper division of the allowable sockeye catch the Commission recommended that two additional days or a total of four days fishing be allowed in all United States Convention waters lying easterly of the Angeles Point-William Head line effective Wednesday, August 7.

August 9, 1968 — With the Chilko sockeye run exceeding pre-season estimates and the escapement proceeding satisfactorily, the Commission's remaining concern was equality in the catch of the two countries. Therefore the Commission recommended that fishing time in all United States Convention waters lying easterly of the Angeles Point-William Head line be extended by 24 hours to a total of four days fishing for the week commencing Sunday, August 11.

August 13, 1968 — In view of the higher than expected United States catch in Convention waters and the lower than anticipated catch in the Fraser River, the Commission recommended that fishing time in United States Convention waters lying easterly of the Angeles Point-William Head line be reduced by 24 hours for a total of three days fishing, with purse seines, reef nets and gill nets terminating their fishing at normal hours on Wednesday, August 14. In order to obtain an

equitable division of the catch between the two countries and since the Chilko escapement appeared adequate the Commission recommended an additional 24 hours fishing in all Canadian Convention waters lying easterly of the Angeles Point-William Head line commencing at 6:00 p.m. Thursday, August 15.

August 16, 1968 — In order to obtain an adequate escapement to the Birkenhead River the Commission recommended that fishing for the week commencing Sunday, August 18, in Canadian Convention waters lying easterly of the Angeles Point-William Head line be restricted to a 12-hour period from 8:00 a.m. to 8:00 p.m. Monday, August 19.

August 21, 1968 — Since adequate escapement to the Birkenhead River had not been achieved to date the Commission recommended that fishing in all Canadian Convention waters lying easterly of the Angeles Point-William Head line be restricted for the week commencing August 25 to a 12-hour period from 8:00 a.m. to 8:00 p.m. Wednesday, August 28.

August 27, 1968 — To aid in achieving an adequate escapement for the late running races of sockeye the Commission recommended that fishing in Canadian Convention waters lying easterly of the Angeles Point-William Head line be restricted for the week commencing September 1 to a 12-hour period from 7:00 a.m. to 7:00 p.m. Tuesday, September 3.

September 5, 1968 — In the interest of increased escapements of the late runs of sockeye the Commission recommended that fishing in Canadian Convention waters lying easterly of the Angeles Point-William Head line be reduced for the week commencing September 8 from 48 hours to 12 hours effective 7:00 a.m. to 7:00 p.m. Tuesday, September 10.

September 11, 1968 — To further insure adequate escapements of the late running races of sockeye the Commission recommended that fishing time in Canadian Convention waters lying easterly of the Angeles Point-William Head line be reduced for the week commencing September 15 from 48 hours to 12 hours effective 7:00 a.m. to 7:00 p.m. Tuesday, September 17. Also, in view of the small numbers of sockeye being caught in United States Convention waters the Commission recommended that its control over United States Convention waters lying westerly of the Iwersen's dock-Active Pass line be relinquished effective Sunday, September 15.

September 18, 1968 — The Commission relinquished control of all Canadian Convention waters lying easterly of the Angeles Point-William Head line effective Sunday, September 22 thus completing the Commission's regulatory obligations in Convention waters for the 1968 season.

SOCKEYE SALMON REPORT

The Fishery

The 1968 run of Fraser River sockeye entering Convention waters totaled 2,559,301 sockeye of which 1,805,962 were caught commercially, an estimated 124,002 were taken by the Indian fishery and 629,337 were recorded on the spawning grounds (see Tables in Appendix). The total 1968 Fraser River sockeye population, including a calculated catch of 355,000 fish in Johnstone Strait, was estimated at 2,914,000. The calculated catch in Johnstone Strait represented 16.4 per cent of the total catch and 12.2 per cent of the total Fraser sockeye run. The relative number of sockeye migrating to the Fraser River through the northern passage appeared to be lower than that experienced in 1967. This decline is consistent with the evidence that solar activity may influence the number of sockeye approaching the Fraser River from the northern direction.

The 1968 Convention waters catch of 1,805,962 sockeye was up substantially from the brood year catch in 1964 of 1,023,000. Much of the increase in catch was due to the larger than expected Chilko run. As noted in the 1967 Annual Report, it had been anticipated that smolt-to-adult survival for the 1968 Chilko run could be favorable, based on the high flow during smolt seaward migration in 1966, but could be greatly reduced because of possible changes within the Chilko dominance pattern. Until recently, the dominant Chilko run appeared to have stabilized on the 1960-64-68 cycle, but a recent imbalance in annual escapements may have shifted the dominant run to the 1959-63-67 cycle. If dominant runs were to appear on the 1959-63-67 cycle, the historical pattern of Chilko populations indicates that the subdominant run would form on the year preceding the dominant run (i.e., on the 1958-62-66 cycle), and runs returning in 1968 and 1969 and at subsequent four-year intervals would ultimately form the two small off-year runs of the normal dominance pattern.

Thus in predicting the 1968 run, it was anticipated that in spite of the favorable flow conditions during smolt migration, the forces operating to control this pattern of dominance could become evident in a reduced smolt-to-adult survival rate of the 1968 run. The poor condition of the smolts leaving Chilko Lake in 1966 and destined to return in 1968 tended to support this view, as did the very small number of three-year-old jacks returning in 1967. However, the 1968 Chilko population was larger than predicted, although not as large as could have been expected based on flow conditions alone. The actual smolt-to-adult survival rate was only 7.2 per cent compared with 10.7 per cent indicated by the flow-survival relationship. It therefore appears that the effects of any dominance-controlling forces cannot as yet be separated from the indiscriminate effects of the physical environment in assessing annual productivity. The somewhat lower smolt-to-adult survival rate of the 1968 Chilko population in relation to flow, and the poor condition of these smolts would indicate the possibility of a dominance factor being operative, although its total effect was offset temporarily by a favorable physical environment.

Historical records of the runs to certain major producing areas of the Fraser River watershed, including Chilko, show that these areas have never accommodated major escapements on an annual basis. All available evidence indicates that this continues to be true. Of course, as each annual run provides more information concerning the forces controlling maximum and cyclical production, the complex dynamics of the Fraser River's sockeye populations eventually will be understood more completely. In the meantime, the Commission's management policies (unless interrupted by unforeseen fishing stoppages by industry) remain based on present knowledge of the forces controlling production.

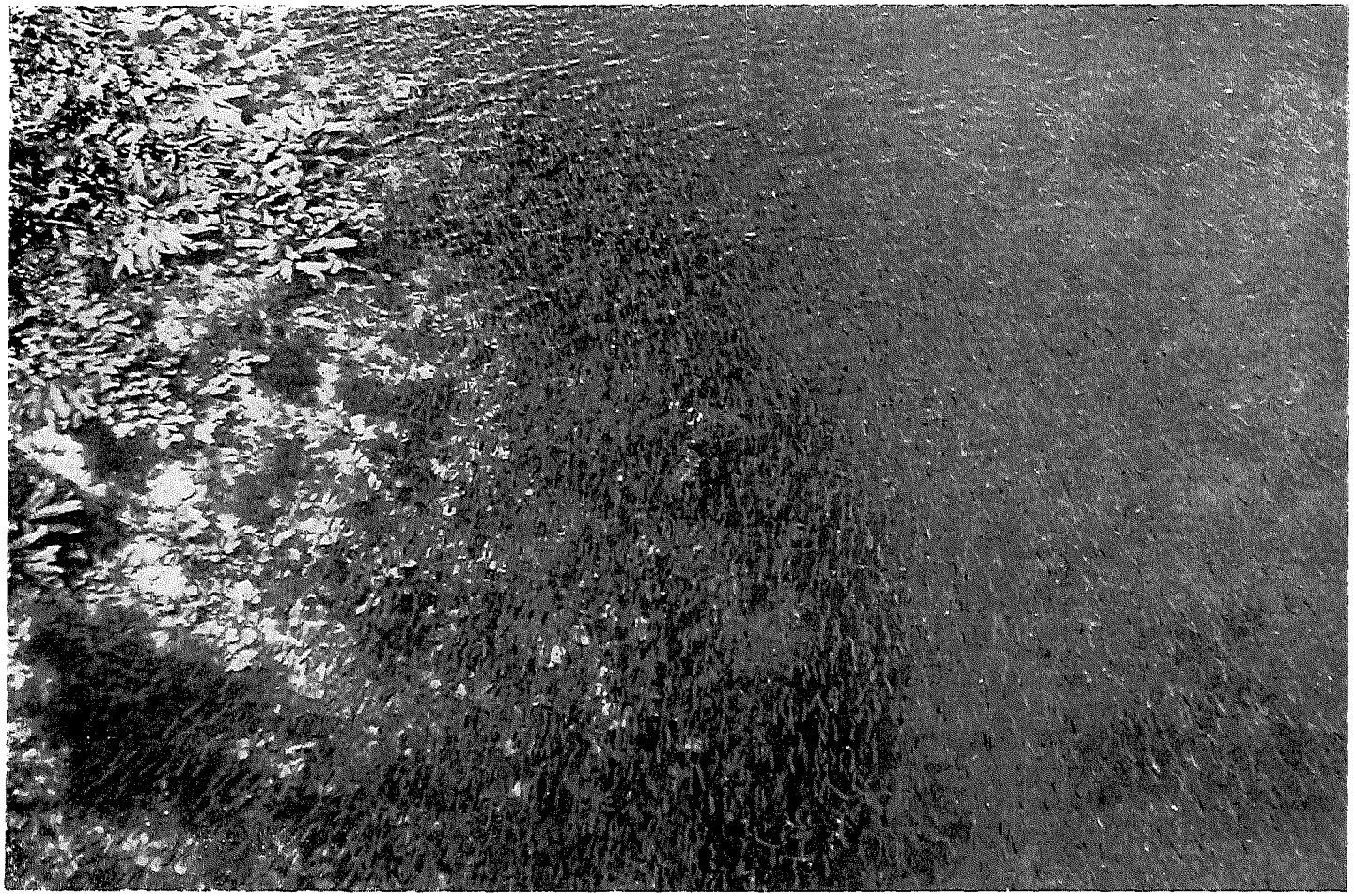
Canadian fishermen caught 920,092 sockeye and United States fishermen caught 885,870 for a total of 1,805,962—sharing the catch on a basis of 50.95 per cent and 49.05 per cent, respectively (Appendix Tables I and II). The catch in Convention waters was 77 per cent greater than that of the brood year of 1964. The average weight of four-year-old sockeye was 5.81 pounds, slightly smaller than the cycle average of 6.04 pounds.

The Canadian fishery in Juan de Fuca Strait was closed during passage of the main 1968 sockeye run since the expected run was considered too small to permit a practical fishery in two major fishing areas. With very few sockeye available after the closure was lifted on August 11, the total sockeye catch in this area was relatively small, as it was in the brood year of 1964. The following table shows recent annual sockeye catches in Juan de Fuca Strait as a percentage of the total Canadian Convention waters catch:

Per Cent of Canadian Sockeye Catch Taken in the High Seas and Juan de Fuca Strait		*Per Cent of Canadian Sockeye Catch Taken by Purse Seines in Juan de Fuca Strait**		*Per Cent of Canadian Sockeye Catch Taken by Gill Nets in Juan de Fuca Strait**	
Cycle Year	*Per Cent*	*Maximum P. S. Units*	*Per Cent*	*Maximum G. N. Units*	*Per Cent*
1968	10.10	31	1.56	138	4.78
1967	52.96	102	34.84	341	15.08
1966	53.24	77	30.53	287	22.00
1965	16.73	89	8.30	238	7.72
1964	7.37	17	1.45	190	5.31

*Troll catches not listed.

The 1968 United States purse seine and reef net fleets were smaller than in any previous cycle year in recent history. As a result, the share of the total United States sockeye catch by these two types of gear declined from that recorded in 1964. The gill net fleet, with an increased number of units operating, harvested 40.05 per cent of the total catch, an increase from 34.99 per cent taken in 1964 and 21.12 per cent taken in 1960 (Table I).



Fraser River pink salmon fingerlings about 1½ inches in length observed off the northeast coast of Galiano Island near Porlier Pass. The photograph was taken in early May, 1968 during Commission studies of the estuarial habitat and survival of young pink salmon prior to their emigration to the high seas.

Escapement

The net escapement of 629,337 sockeye represented 24.6 per cent of the 1968 run to Convention waters and 21.6 per cent of the calculated total run. Most of the individual escapements were higher than those recorded in the brood year (Table VI). These increases in escapement were attained because of favorable marine survival of all races, as well as special closures during passage of the late runs beginning with the one destined for Birkenhead River.

The 1968 Early Stuart escapement suffered from high water conditions during its passage upriver for the third consecutive time on this cycle. A substantial share of the escapement passing Hell's Gate failed to reach the Early Stuart spawning grounds because of high velocities in the Fraser River. Fortunately, 1968 was an off-cycle year, and sufficient spawners did arrive to maintain the potential for future increases in the run when more favorable environmental conditions prevail.

Increased fishing time granted to reduce the early part of the Chilko escapement resulted in a substantial percentage of the runs to Upper Pitt River and Gates Creek being taken in the commercial fishery. However, in spite of heavy fishing mortality, the Upper Pitt escapement increased over the brood year because of the good return of fish produced by the incubation channel. The Gates Creek escapement was substantially below that of the brood year, representing only 14.3 per cent of that run entering Convention waters. The Gates Creek spawning channel became operative for the first time in 1968, and 6,284 of the total of 10,289 available spawners were diverted into the channel. With the Upper Pitt River incubation channel already returning substantial adult runs, and with the first adult returns to Gates Creek channel in 1972, it is anticipated that the problems caused by deteriorating spawning grounds and heavy fishing mortality of these two runs will be solved.

Mortalities of unspawned sockeye occurred at Chilko and Birkenhead Rivers in 1968 with no known cause. Exhaustive tests were made of the dying fish but no pathogens or parasites of significance were observed. Histological examinations also failed to reveal any apparent abnormalities. While some mortality of unspawned fish has always occurred in the Fraser River watershed, the extent and frequency of mortality seem to have increased in recent years. In certain years, columnaris disease has caused prespawning mortality during periods of warm water, but death from unknown causes has occurred in some years when water temperatures were normal. Studies dealing with the biochemical changes in adult sockeye during upstream migration, which were initiated by the Commission several years ago through the Fisheries Research Board of Canada, will be reactivated by the Commission staff to investigate the variability of these changes. It is possible that within this variability lies a cause of stress leading to prespawning mortality.

In summary, the 1968 spawning escapement was most satisfactory and spawning conditions were generally favorable.

Rehabilitation

Article III of the Sockeye Salmon Fisheries Convention, ratified in 1937, provides that the Commission:

"shall conduct the sockeye salmon fish cultural operations in the waters described in paragraphs numbered 2 and 3 of Article I of this Convention, and to that end it shall have the power to improve spawning grounds, construct, and maintain hatcheries, rearing ponds and other such facilities as it may determine to be necessary for the propagation of sockeye salmon in any of the waters covered by this Convention, and to stock any such waters with sockeye salmon by such methods as it may determine to be most advisable."

This provision was amended in 1957 to include pink salmon. To fulfill these terms of reference, the Commission has examined several different methods of expanding salmon propagation.

From 1949 until 1962, the Commission experimented with eyed-egg transplants to barren streams reported to have had sockeye runs in earlier years. Minor successes were achieved in inaugurating sockeye runs which apparently are now self-sustaining. In Barriere River, Fennell Creek, Scotch Creek, Eagle River, Middle Shuswap River, Upper Adams River, and Portage Creek, small runs are now returning in cycle years reported earlier as barren of sockeye as a result of the Hell's Gate obstruction. However, the degree of success of these transplants has not been of major commercial importance to date, although the modest funds expended have been more than justified and will be returned many times over in future years.

The Commission has also conducted extensive research into the reasons why previous sockeye hatchery operations failed in their purpose of building up the Fraser River sockeye runs. The results of this research have been detailed in previous Annual Reports but, in summary, it has been found that hatchery-produced fry are smaller and weaker than wild fry, develop sooner and thus enter their lacustrine life earlier than normal. Because of these disadvantages, the hatchery-produced fry did not survive at a rate sufficient to increase the returning runs. However, research by other organizations on coho and chinook salmon has shown that the adverse effects of hatchery incubation can be offset by artificial rearing of fry, with economic benefits gained in terms of adults produced.

The gradual but increasing instability of several natural spawning grounds of pink and sockeye salmon caused by watershed logging, and the loss of a valuable pink salmon spawning ground on Seton Creek due to hydroelectric power development have literally forced the Commission to use artificial aids in an attempt to maintain the affected runs. Using information obtained through laboratory research, an incubation channel was designed and built in Upper Pitt River watershed. Artificial spawning channels were constructed for sockeye on Weaver Creek and Gates Creek. Similar channels were built for pink salmon on Seton Creek. While these channels have been designed to eliminate the adverse effects on fry caused by hatchery incubation, the early life history of salmon involves delicate and perhaps critical relationships with the environment, all of which may not have been defined. Thus even though these channels produce increased numbers of fry apparently having the same ability to survive as wild fry, only an increase in the number of returning adults can verify the initial optimism based on laboratory findings.

The Upper Pitt sockeye incubation channel has been in operation since 1963. Here the eggs are spawned artificially, incubated in an unlighted hatchery until they reach the eyed stage, and then planted in a prepared gravel bed provided with an upwelling flow. The resulting fry emerge naturally and at their own time. A record of the fry produced from natural spawning and from the incubation channel shows that the channel fry now form a major part of the total fry production of Upper Pitt River:

Sockeye Fry Production in Upper Pitt River

	NATURAL SPAWNING			INCUBATION CHANNEL		
Brood Year	*Eggs Spawned (Millions)*	*Estimated Fry Produced (Millions)*	*Per Cent Survival*	*Eggs Spawned (Millions)*	*Fry Produced (Millions)*	*Per Cent Survival*
1960	51.60	2.11	4.1			
1961	21.30	4.01	18.8			
1962	33.46	2.30	6.9			
1963	18.96	1.15	6.1	3.19	2.42	75.9
1964	10.41	1.87	18.0	3.70	3.26	88.1
1965	14.29	1.56	10.9	2.13	1.78	83.6
1966	38.15	1.91	5.0	3.66	2.87	78.4
1967	15.02	0.60	4.0	4.53	3.30	72.8
Mean	25.40	1.94	9.2	3.44	2.73	79.8

The survival rate of incubation channel fry cannot be measured apart from that of wild fry produced in Upper Pitt River except by circumstantial evidence because the fry are too small to mark without inflicting a serious mortality. However, recent adult returns produced by the total Upper Pitt River spawning population indicate favorable survival of channel fry. In the following table, note that 1963, the first year of channel operation, produced the second largest run in 13 years in spite of a relatively small escapement and poor survival conditions for wild fry. When a large run was produced by the 1955 escapement, conditions for natural survival were favorable for both the egg-to-fry and smolt-to-adult stages. The large runs returning from the 1950 and 1951 broods were produced by escapements several times larger than that in 1963.

Adult Sockeye Production in Upper Pitt River

Brood Year	*Escapement*	*Total Run at Maturity*		
		4₂	*5₂*	*Total*
1950	42,800	83,800	54,500	138,300
1951	37,800	40,900	79,200	120,100
1952	48,900	39,800	32,300	72,100
1953	18,700	12,400	12,400	24,800
1954	17,600	37,900	12,900	50,800
1955	17,600	79,400	86,900	166,300
1956	32,300	27,400	40,900	68,300
1957	12,300	2,000	24,000	26,000
1958	10,400	12,700	3,200	15,900
1959	15,700	21,800	39,900	61,700
1960	24,500	5,800	27,400	33,200
1961	11,200	26,300	74,500	100,800
1962	16,600	24,100	32,700	56,800
1963	12,700	88,600	46,000	134,600
1964	13,800	68,000		

Not only was the adult return from the first year of channel operation favorable, but the number of four-year-olds produced by the 1964 brood suggests that the total return including five-year-old fish will approximate that of the previous brood year. After analyzing all available data it is estimated that the incubation channel operation in 1963 produced approximately 84,600 adult fish, including a commercial catch worth $174,000 to the fishermen and $330,000 after processing. With a similar income apparently assured for the second year of operation, and since operation and depreciation costs have not exceeded $12,000 annually, this channel appears to be a sound economic investment. In addition, this small incubation channel with a capacity of only 4,000,000 eggs appears capable of increasing the Upper Pitt River run in spite of poor natural fry production and the heavy fishing mortality required to properly harvest the Chilko and Horsefly runs migrating at the same time.

The Weaver Creek artificial spawning channel, designed to accommodate 20,000 adult sockeye, operated for its fourth consecutive year in 1968. The maximum spawning population has been 6,541 sockeye, but if the run increases as expected, and improved facilities for diverting fish into the channel are constructed, the channel will soon be fully utilized.

In the first three years of operation (1965 to 1967), an average of 2,680 females spawned in Weaver Creek channel, producing an average of 7,700,000 fry for a survival rate from eggs deposited of 75.1 per cent. Measurement of natural production in Weaver Creek from 1951 through 1959 revealed that an annual average of 9,886 females produced 2,510,000 fry for an egg-to-fry survival rate of only 7.6 per cent. In essence, the channel is now producing more than three times as many fry from less than one third the number of spawners that produced previous runs from the natural spawning areas in Weaver Creek. These data are detailed in the following table:

Egg-to-Fry Survival Rates at Weaver Creek

Brood Year	*Female Spawners*	*Migrating Fry (Millions)*	*Per Cent Survival*
	Natural Spawning		
1951	7,492	1.8	5.4
1952	9,013	1.0	3.5
1953	5,226	1.9	7.8
1955	13,126	1.3	2.4
1956	5,931	2.2	8.4
1957	11,409	2.3	5.0
1958	21,813	4.8	5.2
1959	5,074	4.8	22.9
Mean	9,886	2.5	7.6
	Artificial Channel Spawning		
1965	2,986	7.8	68.4
1966	3,424	10.8	82.0
1967	1,631	4.5	75.0
Mean	2,680	7.7	75.1

While the first adult run produced by the Weaver Creek channel will not return until 1969, the return of over 700 three-year-old jacks in 1968 is a favorable sign. Based on rare occasions in the past when similar numbers of jacks returned to Weaver Creek, there is reason to believe that the 1969 run will exceed 100,000 adults. This would represent a minimum return of nine adult fish per spawner and would be an outstanding financial success.

Although the real measure of the value of any channel lies in the number of adults produced, investigations by the Commission have indicated that fry produced in the Weaver Creek and Upper Pitt channels approach equality with wild fry and are superior in many respects to those produced in a hatchery. Further evidence that fry produced in artificial channels will survive at a favorable rate is found in studies by the Fisheries Research Board of Canada at Fulton River on the Skeena River watershed. Wild fry and channel fry were marked for two successive years and, when recovered as emigrating smolts, the survival rates of both groups were found to be approximately the same.

Thus all the available evidence reveals that favorable survival rates will prevail for sockeye as well as pink salmon fry produced in incubation and artificial spawning channels. Next year will complete the second return of sockeye to the Upper Pitt River channel and the first to Weaver Creek. The returns to both areas in 1969 are expected to be substantial, resulting in large economic benefits in relation to the funds expended for construction and operation. While several more years of operation may be needed to assess fully the average annual success of each project and to solve all the operating problems involved, the Commission must begin now to apply its findings on a larger scale to fulfill its terms of reference. Time is running out for extending the sockeye populations to utilize unused rearing areas and to protect spawning grounds which are becoming unstable through watershed development. The fishing industry and the public of British Columbia who are interested in economic gains to the Province from the Fraser River salmon resource can well become restive unless the Commission's fish culture program is increased substantially and at an early date. At best the benefits from a full program will be slow in coming. In the case of pink salmon, some benefits will be realized within two years, but any initial increase in the more valuable sockeye runs will not occur until four years after each project is placed in operation.

In the future, it is possible that both the spawning ground and natural rearing area of a population of sockeye might be eliminated by some water use development. In this case, an artificial substitute involving a successful hatchery and rearing system would be needed if the population were to be saved. Recent improvements in diets, disease control and the design of rearing ponds have greatly increased the adult returns from releases of hatchery-reared coho and chinook salmon. Apparently the successful rearing of hatchery-produced fry can eliminate the adverse effects suffered during incubation.

In 1966 the Commission started sockeye rearing experiments, with the knowledge that young fingerlings were subject to disastrous mortalities from disease during rearing. The failure of the experiments as a result of disease out-

break in both 1966 and 1967 is recorded in the 1967 Annual Report. In 1968 a number of different rearing environments were tested for rearing young sockeye. Over 40 individual experiments were carried out at the Sweltzer Creek Field Station using proven diets and modern fish cultural practices. The temperature of the water supply was controlled to simulate the daily temperature fluctuation encountered by sockeye fingerlings in their natural habitat. Out of the 40 experiments, only six groups of sockeye suffered an outbreak of virus infection and none were affected by bacterial gill disease.

During these studies, thermal control of the water supply proved effective in reducing the mortality from the usually serious virus infection. The total mortality to January, 1969 was 32 per cent, and only 10 per cent of the fish died in 34 experimental groups not affected by the virus disease. The mortality of all groups after September, 1968 was too small to be of any importance and by the end of the year 103,000 fingerlings appeared to be in excellent condition.

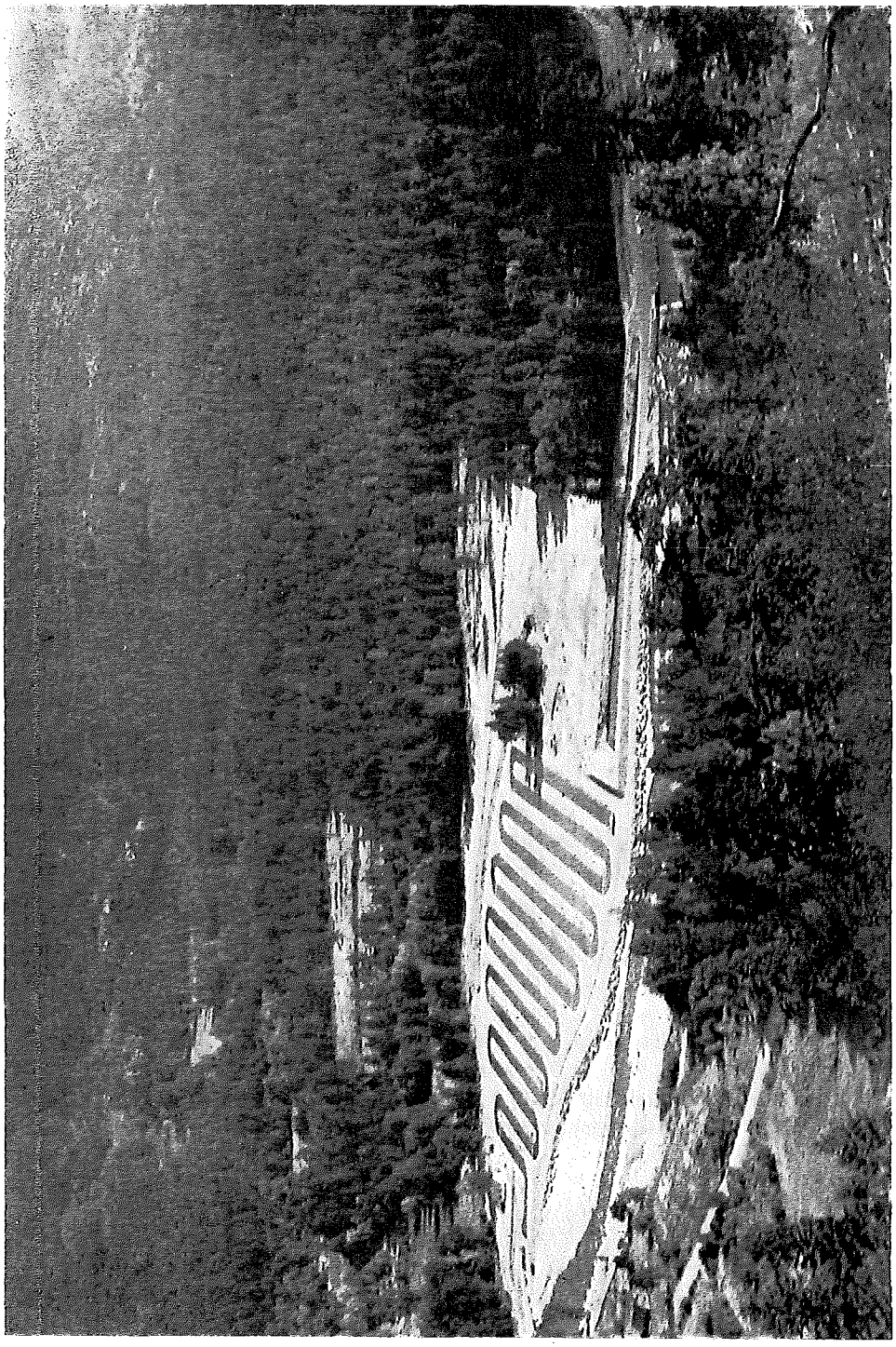
Summarizing our 1968 findings, it appears likely that yearling sockeye smolts can be produced successfully by an artificial rearing program incorporating the following procedures:

1. Limit spring and summer rearing to self-cleaning, rectangular circulating ponds of the type developed by Roger Burrows of the United States Fish and Wildlife Service. These ponds eliminate waste products rapidly and create a uniform environment with a resulting uniformity in the distribution of fish.
2. Exercise care in pond loading in respect to available space and water supply.
3. Use care in all fish cultural practices, especially in the initial feeding of young fry.
4. Maintain daily fluctuations in water temperature to restrict the outbreak of both bacterial gill disease and virus infection.
5. Do not release the yearling fish until they are known to tolerate salt water.

Adults produced from the 1969 release of Cultus hatchery-reared smolts will not return until the fall of 1971 when the real value of this program can be assessed. In the meantime, additional experiments will be conducted in 1969 to determine maximum pond loading and establish further the value of fluctuations in water temperature as a means of disease control. Coincident with these experiments, the Commission will examine possible sites for a prototype operation to determine construction and operating costs relative to potential smolt production.

WATERSHED PROTECTION

During 1968 the fourth spawning channel built by the Commission was placed in operation. This new channel for sockeye salmon, located at Gates Creek on Anderson Lake, was constructed to compensate for the loss of natural spawning ground caused by man's activities in and around the creek. The natural spawning grounds originally provided spawning area for an estimated 150,000



The new Gates Creek spawning channel, showing the water intake structure on the right, the silt settling basin and the channel itself.

sockeye, but the creek now has deteriorated to such an extent that its capacity is limited to about 10,000 spawners. Taking into consideration the size of the existing stock and the rearing capacity of Seton and Anderson Lakes, the new spawning channel was designed to accommodate 18,000 sockeye spawners. This channel, 20 feet wide and 6,100 feet long, has a settling basin to provide a silt-free environment and a water supply system designed to control temperature by blending water from Gates Creek with water pumped from Anderson Lake. The escapement to Gates Creek in 1968 was 10,289 sockeye, of which 6,284 were diverted into the channel. During the severe winter conditions at the end of December, water flow in the channel was maintained at all times, although some problems were created by ice at the water intake and the channel entrance fishway.

At McKinley Creek, tributary to the Horsefly River, construction was started on the pilot temperature control project designed to obtain a full scale assessment of the effectiveness of reduced temperature in controlling sockeye prespawning mortality. Cold water will be withdrawn from McKinley Lake and discharged over the sockeye spawning grounds in McKinley Creek. The flow control structure at the outlet of McKinley Lake was constructed in 1968, and the submerged pipeline will be installed in McKinley Lake in 1969. The project is scheduled to be in operation during the 1969 sockeye run.

The fourth pulp mill in the Fraser River system, Intercontinental Pulp Company, Limited, started operation at Prince George early in 1968. This mill is associated with the Prince George Pulp and Paper Company mill and uses similar facilities for treating mill wastes, with some modifications based on experience at the existing mill. From the outset, the effluent from the bio-basin where toxic mill wastes are treated has met the specifications for BOD and toxicity set for fish protection, but on a few occasions the effluent from the clear-water sewer has been toxic to fish. At the Prince George Pulp and Paper Mill, performance of the bio-basin has been satisfactory with only a few occasions when the effluent specifications were not achieved, but this mill continues to have frequent discharges of toxic material in the clear-water sewer. The performance of Northwood Pulp Limited at Prince George in meeting specifications for effluent BOD and toxicity continued to be poor throughout most of 1968, although during the latter part of the year operational procedures were rectified to enable the treatment facilities to function as designed and the effluent was satisfactory. Close check of the effluent from this mill is planned to ensure continued compliance with the specifications. The effluent from the treatment facilities at Kamloops Pulp and Paper continued to meet specifications, except for a short period when a problem not associated with the treatment system resulted in a toxic effluent.

During 1968 a proposal was announced for construction of a pulp mill on the Thompson River at Ashcroft. Studies of the waste disposal problems of a mill in this location showed that it would constitute a serious threat to the salmon populations spawning, rearing, and migrating in the Thompson River. Construction of a pulp mill adjacent to the Thompson River spawning grounds at any location between Savona and Spences Bridge was considered to be incompatible with protection of the valuable fishery resource and it was recom-

mended that an alternative site be selected where the mill effluent would not be discharged onto salmon spawning grounds.

Log driving in the Stellako River was discontinued in 1968 because of a change in source of logs and a change in policy by the new management of Fraser Lake Sawmills. For similar reasons there was no log drive on the Nadina River, for the second consecutive year. Despite the cessation of log driving, the Early Nadina River sockeye run no longer utilizes the damaged lower river spawning grounds, and the 1968 run spawned only in a localized area not affected by drives in previous years. Log driving continued in the Quesnel and Tachie Rivers subject to limitations in time and other conditions set by the Department of Fisheries of Canada. Because of the different circumstances on these rivers, the current log drives are not considered incompatible with protection of the salmon stocks. The future movement of logs from the pulp harvesting area adjacent to Takla Lake and Middle River was discussed with the logging operator for two Prince George pulp mills, and arrangements were made for annual review of any proposed developments to consider the effects on local salmon stocks.

In many parts of the watershed, the reduced harvest of beaver by trappers has resulted in substantially increased beaver populations. Beaver dams are obstructing the migration of salmon to their spawning grounds in a number of streams and some spawning areas are being flooded and covered with silt. Discussions were held during 1968 with the Department of Fisheries of Canada and the Fish and Wildlife Branch of the British Columbia Department of Recreation and Conservation to determine means of minimizing the harmful effects of beaver dams on salmon streams. As a result of these discussions, a program has been developed to identify the affected streams, establish priorities, and take necessary action, through registered trappers if possible, to remove the beaver from the designated areas.

Study of the proposed diversion of water from Shuswap River to Okanagan Lake continued during the year, and the fisheries agencies collected additional data on the salmon and trout populations that would be affected by such a diversion. This study is at present being enlarged to include new considerations arising out of further reports by the Water Resources Service. It is now expected the report being prepared by the Department of Fisheries of Canada and the Commission will be completed in 1969. Since further studies are planned by the Department of Energy, Mines and Resources of Canada, it is understood that the Water Resources Service has delayed its program for the proposed diversion pending consideration of the findings of this study.

Interest in placer mining in the Fraser River system has increased substantially in recent years. A number of operations involving the use of medium-size dredges have required special restrictions to protect the fishery. While placer operations could present major problems in protection of the salmon runs, they have not proved harmful to date under the present restrictions.

1968 PUBLICATIONS

1. Annual Report for the International Pacific Salmon Fisheries Commission for 1967.

2. Progress Report Number 17.
   Toxicity of Two Chlorinated Catechols, Possible Components of Kraft Pulp Mill Bleach Waste by J. A. Servizi, R. W. Gordon and D. W. Martens.

3. Progress Report Number 18.
   Lamprey Parasitism on Fraser River Sockeye and Pink Salmon During 1967 by I. V. Williams and P. Gilhousen.

4. Progress Report Number 19.
   Responses of Young Pink Salmon to Vertical Temperature and Salinity Gradients by D. A. Hurley and W. L. Woodall.

5. Progress Report Number 20.
   Comparison of Sockeye Salmon Fry Produced by Hatcheries, Artificial Channels and Natural Spawning Areas by R. W. Mead and W. L. Woodall.

TABLE I
SOCKEYE CATCH BY GEAR

United States Convention Waters

	Purse Seines			*Gill Nets*			*Reef Nets*			*Troll*		
Year	*Units*	*Catch*	*Per-centage*	*Units*	*Catch*	*Per-centage*	*Units*	*Catch*	*Per-centage*	*Catch*	*Per-centage*	*Total Catch*
1968	88	464,544	52.43	396	354,760	40.05	34	66,404	7.50	162	0.02	885,870
1964	96	284,209	55.94	337	177,767	34.99	48	45,827	9.02	284	0.05	508,087
1960	199	843,850	70.38	422	253,211	21.12	63	100,915	8.42	993	0.08	1,198,969
1956	164	428,562	47.26	491	371,729	40.99	85	105,581	11.75	0	0	906,872
1952	207	826,304	74.21	195	175,064	15.72	66	112,107	10.07	0	0	1,113,475

Canadian Convention Waters

	Purse Seines			*Gill Nets*			*Traps*			*Troll*		
Year	*Units*	*Catch*	*Per-centage*	*Units*	*Catch*	*Per-centage*	*Units*	*Catch*	*Per-centage*	*Catch*	*Per-centage*	*Total Catch*
1968	46	13,805	1.50	1,403	869,162	94.46	0	0	0	37,125	4.03	920,092
1964	27	7,409	1.44	1,038	503,690	97.89	0	0	0	3,449	0.67	514,548
1960	77	353,482	28.16	1,466	898,826	71.61	0	0	0	2,887	0.23	1,255,195
1956	50	216,388	24.18	1,151	678,074	75.78	0	0	0	374	0.04	894,836
1952	41	122,114	10.58	1,470	966,852	83.75	5	65,417	5.67	0	0	1,154,383

NOTE: Gear counts represent the maximum number of units delivering sockeye on any single day.

TABLE II
CYCLIC LANDINGS AND PACKS OF SOCKEYE FROM CONVENTION WATERS

	United States	*Canada*	*Total*
1968			
Total Landings (No. Sockeye)	885,870	920,092	1,805,962
Share in Fish	49.05%	50.95%	
Total Pack (48-lb Cases)	72,197	77,090*	149,287
Share in Pack	48.36%	51.64%	
1964			
Total Landings (No. Sockeye)	508,087	514,548	1,022,635
Share in Fish	49.68%	50.32%	
Total Pack (48-lb Cases)	43,001	48,899**	87,900
Share in Pack	48.92%	51.08%	
1946-1968			
Total Landings (No. Sockeye)	37,261,231	36,442,565	73,703,796
Share in Fish	50.56%	49.44%	
Total Pack (48-lb Cases)	3,263,872	3,161,241	6,425,113
Share in Pack	50.80%	49.20%	
1968 *Cycle Catch*			
1968	885,870	920,092	1,805,962
1964	508,087	514,548	1,022,635
1960	1,198,969	1,255,195	2,454,164
1956	906,872	894,836	1,801,708
1952	1,113,475	1,154,383	2,267,858
1948	1,089,091	752,691	1,841,782
1944	435,443	1,003,826	1,439,269
1940	654,091	1,033,000	1,687,091
1936	453,025	2,126,074	2,579,099
1932	853,406	733,735	1,587,141
1928	630,457	311,226	941,683
1924	772,056	442,250	1,214,306
1920	677,690	532,039	1,209,729
1916	909,425	376,891	1,286,316
1912	2,005,869	1,357,425	3,363,294
1908	1,879,268	870,612	2,749,880
1904	1,506,137	892,934	2,399,071

* Includes 1,356 cases packed in Canada from sockeye caught in the United States.
** Includes 605 cases packed in Canada from sockeye caught in the United States.

TABLE III

DAILY CATCH OF SOCKEYE, 1956-1960-1964-1968 FROM UNITED STATES CONVENTION WATERS

	JULY				AUGUST				SEPTEMBER			
Date	1956	1960	1964	1968	1956	1960	1964	1968	1956	1960	1964	1968
1					59,168	117,041		95,135		3,777	378	
2	4,286			749	41,245	54,285					377	3,109
3	3,885			223		45,840	79,585		1,418			2,239
4	2,365			24		45,845	73,612		605			1,796
5	1,038						59,668	3,291	500	1,784		1,076
6					141,861			69,286	454	1,524		
7					98,859	194,605		68,089	146	1,295		
8		CLOSED	CLOSED	CLOSED		181,344		50,987		614	163	
9	2,429					126,087		57,251			152	772
10	1,803					96,389			78		83	702
11	2,189					65,882			58			146
12	1,423					42,416		82,039	33	CLOSED		143
13			3,118		24,347		25,336	24,597	119			
14			1,463	28	21,450			3,519	100		314	
15				2,662	12,509			357			48	
16	4,677			4,530	9,102						104	46
17	8,146			5,079			15,456		43		143	88
18	12,101	6,574				CLOSED	12,122		146			83
19	15,053	6,329					5,160	12,075	49	50		59
20		6,823	6,956		13,151			9,103	23	130		
21		7,550	8,672	2,170	8,831			3,314	37	56	50	
22			16,773	44,615	4,955			35		38	49	
23	78,518			40,911	2,252						61	108
24	59,695			39,630			5,773		3		13	24
25	39,052	78,450		44,582			1,845		3	CLOSED		14
26	31,635	38,405					1,205	3,182	4			10
27		33,335	79,632		651			4,458	5			
28		32,087	54,204		727			2,172	5		22	
29			53,412	15,711	389	3,587		33			6	
30	113,200			96,552	524	2,064					4	20
31	70,572			86,860		3,024	681					
Totals	452,067	209,553	224,230	384,326	440,021	978,409	280,443	488,923	3,830	9,268	1,967	10,435
Troll and outside seine		142	165	90	3,816	851	113	66	34			
Monthly Totals	452,067	209,695	224,395	384,416	443,837	979,260	280,556	488,989	3,864	9,268	1,967	10,435
June, Oct. & Nov. Totals									7,104	746	1,169	2,030
Season Totals									906,872	1,198,969	508,087	885,870

TABLE IV
DAILY CATCH OF SOCKEYE, 1956-1960-1964-1968 FROM CANADIAN CONVENTION WATERS

	JULY				AUGUST				SEPTEMBER			
Date	1956	1960	1964	1968	1956	1960	1964	1968	1956	1960	1964	1968
1				875	54,068					760	1,684	
2				1,761	25,441	47,301					103	1,823
3	8,554			2,481		194,327	114,881					5,017
4	4,731	7,347					42,299		4,403			655
5	6,501	6,170	CLOSED				22,772	233,366	1,448	491		584
6		4,544						57,248		222		
7				CLOSED						71	2,491	
8					154,050	108,471					664	
9					78,176	208,985					23	748
10	4,773					87,843						3,800
11	2,782	8,358				34,455			584			206
12	2,474	4,686					102,832	88,114	260	1,402		
13		4,341	2,441				28,793	25,694		464		
14					53,080			2,774		32	9	
15				3,565	15,765			83,013			9	
16				2,078		96,388						39
17	7,570					45,676	35,135					2,360
18	7,067	11,420				56,111	15,025			CLOSED		13
19	9,459	14,424					5,341	49,457	6,916			
20		24,164	6,922					4,318	2,753			
21			8,331		17,444			3,426			1,393	
22				29,390	5,804	53,752						
23				24,249		17,274					1	1,614
24	57,027						20,527		1,383		1	610
25	22,609	84,939					7,093		193		3	
26	29,237	51,124					953	698	94			
27		60,451	49,543					518	29			
28			13,561		6,907			10,970		614		
29			12,826	160,129	2,863	2,292				185	0	
30				44,117		806					0	2,269
31	181,981			28,164		885	4,927					
Totals	344,765	281,968	93,624	296,809	413,598	954,566	400,578	559,596	18,063	4,241	6,381	19,738
Troll and outside seine	91	670	1,775	25,627	111,659	2,092	1,637	10,841	57	109	15	107
Spring salmon gill nets			675	268		253			220	268	565	
Monthly Totals	344,856	282,638	96,074	322,704	525,257	956,911	402,215	570,437	18,340	4,618	6,961	19,845
June, Oct. & Nov. Totals									6,383	11,028	9,298	7,106
Season Totals									894,836	1,255,195	514,548	920,092

TABLE V
THE INDIAN CATCHES OF SOCKEYE SALMON BY DISTRICTS AND THE VARIOUS AREAS WITHIN THESE DISTRICTS, 1964, 1968

	1964		1968	
District and Area	*Catch*	*No. of Fishermen**	*Catch*	*No. of Fishermen**
HARRISON-BIRKENHEAD				
Skookumchuck and Douglas	1,460	13	500	10
Birkenhead River and Lillooet Lake	5,800	37	5,763	25
Harrison and Chehalis	800	42	400	12
TOTALS	8,060	92	6,663	47
LOWER FRASER				
Coquitlam to Chilliwack	21,150	105	8,670	66
Chilliwack to Hope	20,875	114	8,546	59
Vedder River and Vicinity	700	18	Included in Coquitlam to Chilliwack	
TOTALS	42,725	237	17,216	125
CANYON				
Hope to Lytton	58,450	172	44,913	312
TOTALS	58,450	172	44,913	312
LYTTON-LILLOOET				
Lytton to Lillooet	5,194	36	8,860	36
TOTALS	5,194	36	8,860	36
BRIDGE RIVER RAPIDS				
Rapids to Churn Creek	15,706	108	22,970	242
TOTALS	15,706	108	22,970	242
CHILCOTIN				
Farwell Canyon	203	10	7,445	
Hances Canyon	3,324	11	990	
Alexis Creek	927	24	2,540	
Siwash Bridge	1,762	15	3,180	
Keighley Holes	558	5	2,575	
TOTALS	6,774	65	16,730	100
UPPER FRASER				
Shelley	36	11	131	
Churn Creek to Chimney Creek	3,950	60	1,800	
Soda Creek	425	16	525	
Quesnel	300	11	300	
TOTALS	4,711	98	2,756	148
NECHAKO				
Nautley Reserve	1,257	15	1,594	
Stella Reserve	791	18	1,126	
TOTALS	2,048	33	2,720	38
STUART				
Fort St. James	224	50	92	37
Tachie, Trembleur and Takla Villages	287	82	122	42
TOTALS	511	132	214	79
THOMPSON				
North Thompson River	395	26	260	41
South Thompson River	200	109	—	114
Thompson River	200	168	700	38
TOTALS	795	303	960	193
GRAND TOTALS	144,974		124,002	

*Number of permits issued to Indians in district.
The Indian catch statistics detailed above are obtained principally from the Protection Officers of the Department of Fisheries of Canada. These officers control the taking of sockeye for food by the Indian population residing throughout the Fraser River watershed.

TABLE VI
SUMMARY OF THE SOCKEYE ESCAPEMENT TO THE FRASER RIVER SPAWNING AREAS, 1956, 1960, 1964, 1968

District and Streams	1968 Period of Peak Spawning	Estimated Number of Sockeye 1956	1960	1964	1968	Jacks	Sex Ratio Males 4-5 yr.	Females 4-5 yr.
LOWER FRASER								
Cultus Lake	Nov. 20-26	14,133	17,689	11,143	25,736	422	10,439	14,875
Upper Pitt River	Sept. 3-10	32,258	24,511	13,804	16,988	0	8,760	8,228
Widgeon Slough	Oct. 28-31	1,000	400	667	1,552	0	766	786
HARRISON								
Bear Creek	——	—	189	41	—	—	—	—
Big Silver Creek	Sept. 8-10	6,187	4,522	3,926	1,090	0	545	545
Harrison River	Nov. 14-19	3,184	17,279	2,202	5,391	12	2,518	2,861
Weaver Creek	Oct. 10-14	8,472	7,042	1,370	4,516	717	1,479	2,320
LILLOOET								
Birkenhead River	Sept. 22-24	57,899	38,916	69,939	83,907	25,803	17,128	40,976
SETON-ANDERSON								
Gates Creek	Aug. 25-31	9,059	5,449	19,971	10,289	176	4,265	5,848
SOUTH THOMPSON								
Seymour River	Aug. 25-28	2,684	3,047	2,784	3,870	119	1,657	2,094
Lower Adams River	Oct. 15-18	7,512	2,152	796	3,983	312	803	2,868
Little River	——	661	66	0	0	0	0	0
Scotch Creek	——	163	11	0	126	126	0	0
South Thompson River	——	0	0	0	0	0	0	0
Upper Adams River	——	0	Present	162	—	—	—	—
Momich River	Aug. 25-28	—	1,000	823	617	0	177	440
NORTH THOMPSON								
Raft River	Aug. 23-31	9,582	5,553	5,500	10,697	32	5,756	4,909
Barriere River	Aug. 26-30	—	23	85	275	0	137	138
Fennell Creek	Aug. 21-24	—	0	146	954	0	229	725
North Thompson River	——	—	—	38	—	—	—	—
CHILCOTIN								
Chilko River	Sept. 23-27	647,479	420,746	238,601	414,446	584	173,238	240,624
Taseko Lake	——	1,995	2,524	433	—	—	—	—
QUESNEL								
Horsefly River	Sept. 3-8	2,944	3,087	19,800	5,686	4,996	345	345
Mitchell River	Sept. 5-8	14	5	169	4	0	2	2
Little Horsefly River	Sept. 20-25	—	23	355	73	68	2	3
NECHAKO								
Endako River	Sept. 1-3	18	0	7	18	0	9	9
Nadina River (Early)	Aug. 20-26	1,311	1,566	1,397	902	0	406	496
(Late)	Sept. 12-15		157	232	1,496	247	574	675
Nithi River	Aug. 20-25	36	31	13	20	0	10	10
Ormonde Creek	Aug. 25-28	331	158	180	81	0	40	41
Stellako River	Sept. 22-26	38,459	38,884	31,047	30,420	52	14,952	15,416
STUART								
Early Runs								
Driftwood River	——	50	34	2	—	—	—	—
Forfar Creek	Aug. 10-12	5,497	1,755	27	149	4	63	82
Gluske Creek	Aug. 9-10	4,619	2,138	218	18	1	7	10
Kynoch Creek	Aug. 8-12	9,535	4,154	1,147	833	24	351	458
Narrows Creek	Aug. 9-10	697	598	22	41	5	18	18
Rossette Creek	Aug. 5-7	3,863	4,558	952	518	29	168	321
Shale Creek	——	185	139	27	0	0	0	0
Misc. Streams	Aug. 8-10	711	1,196	26	28	2	12	14
Late Runs								
Kazchek Creek	Sept. 12-15	223	5	0	33	4	14	15
Middle River	Sept. 15-20	500	1,056	743	288	63	112	113
Tachie River	Sept. 18-22	600	1,687	1,157	149	14	67	68
Sakeniche River	——	131	0	0	0	0	0	0
NORTHEAST								
Upper Bowron River	Sept. 1-5	6,996	7,620	1,500	3,634	23	1,805	1,806
TOTALS*		878,988	619,970	431,452	629,337	33,933	247,050	348,354

*Totals include small numbers of fish in small tributaries not listed in the table.

TABLE VII
DAILY CATCH OF SOCKEYE, 1953-1957-1961-1965 FROM UNITED STATES CONVENTION WATERS

	JULY				AUGUST				SEPTEMBER			
Date	1953	1957	1961	1965	1953	1957	1961	1965	1953	1957	1961	1965
1	24,386	10,165					128,699		1,307			
2	32,371	11,833					75,733	3,137	1,050	7,288		
3	39,812	13,977	47,926					1,445	1,027	25,515		
4			43,037		53,277			52,146	2,944	19,653		
5			28,585	26,335	50,531	247,511		65,290				
6	48,620			21,773	24,955	135,265			1,104			
7	69,419				24,647				780			932
8	54,566	42,804							757			358
9	57,159	57,639						55,149	892	1,852	CLOSED	181
10	31,169	23,464	143,287		35,819		82,844	30,297	509	3,333		
11			89,786		31,244			14,893	604	4,583		
12				20,836	21,641	169,312				1,451		
13	15,334			15,456	18,034	121,946			423	5		62
14	26,643				16,328	71,364			331			16
15	33,817	39,662					18,748		339			0
16	35,230	37,687					5,241	13,584	228	109		0
17	21,961	33,138	49,754		18,173			8,584	637	610		
18			43,233		14,384				17	170	22	
19			34,815	43,747	16,544	49,619					10	
20				74,983	8,017	45,223			60		6	20
21	175,068			84,674	14,939	28,689	11,491		22			23
22	109,925	95,124				27,606	6,038		5			57
23	165,742	78,735							8	24		40
24		52,762	199,232		14,521				9	29		
25			117,345		8,796			7,728		8	11	
26			73,843		6,949	22,237	CLOSED	3,863			33	
27	213,804				7,891	16,538			1		10	43
28	147,109			262,812	6,569	12,724						9
29	77,777	63,287		172,566		7,420						10
30	90,768	61,061			2,574				11			0
31		46,297	161,484		2,860							
Totals	1,470,680	667,635	1,032,327	723,182	398,693	955,454	328,794	256,116	13,065	64,630	92	1,751
Troll and outside seine	31,396		750	104	38,496		380	46	60			1
Monthly Totals	1,502,076	667,635	1,033,077	723,286	437,189	955,454	329,174	256,162	13,125	64,630	92	1,752
June, Oct. & Nov. Totals									80,047	1,546	16,049	44,918
Season Totals									2,032,437	1,689,265	1,378,392	1,026,118

TABLE VIII

DAILY CATCH OF SOCKEYE, 1953-1957-1961-1965 FROM CANADIAN CONVENTION WATERS

	JULY				AUGUST				SEPTEMBER			
Date	1953	1957	1961	1965	1953	1957	1961	1965	1953	1957	1961	1965
1	33,417	19				36,393	109,677		4,397			
2	36,323	274						206,017	4,038	9,419		
3	2,287	1,658	36,879		91,326			79,921	4,797	4,956		
4		1,157	7,930		54,086			29,092	246	3,328		
5				35,176	48,611	83,204				1,920	53	
6	72,602			8,184	38,493	138,428				1,619	18	
7	36,926				6,820	52,297			6,321			133
8	22,165	68							5,136			106
9	27,665						28,636	20,830	6,556	67		59
10	2,500	4,529	109,597		20,889		23,368	63,820	7,067	11,153		
11		67	27,730		60,670			24,820	89	6,060		
12			34,089	19,440	37,370	37,115				3,340	7	
13	28,227		46,966	5,750	36,956	104,138	52,261			1,833	4	27
14	16,936				19,232	81,215	18,609		32			10
15	21,295					85,221	21,972		14			9
16	24,817	31,184					7,407	9,770	14,700	2,753		11
17	4,809	17,143	86,946		31,843			26,163	8,126	4,224		
18		17,281	44,527		13,370			4,618	2	2,102		
19				73,372	10,734	24,722				763	2	
20	93,156			22,946	13,397	62,386				924	3	4,335
21	128,664			13,577	7,066	40,463	17,815				2	8
22	112,022	72,300				31,909	5,898					3
23	87,223	82,253										
24		53,025	217,241		10,945					1		
25		20,679	153,593		4,916			6,790				
26			98,121		2,929	25,088		1,481			11	
27	40,629			179,102	4,860	12,623						18
28	249,362			69,415	1,024	9,799	5,630				1	3
29	130,898	13,254		76,955		1,836	1,831					3,182
30	140,486	83,664		10,080				4,562				
31	7,932	75,599	179,254		6,869							
Totals	1,320,341	474,154	1,042,873	513,997	522,406	826,837	293,104	477,884	61,521	54,462	101	7,904
Troll and outside seine		662	4,976	6,687	474	1,001	2,363	2,183		37	4,236	50
Spring salmon gill nets									212		625	569
Monthly Totals	1,320,341	474,816	1,047,849	520,684	522,880	827,838	295,467	480,067	61,733	54,499	4,962	8,523
June, Oct. & Nov. Totals									87,389	3,607	8,821	29,921
Season Totals									1,992,343	1,360,760	1,357,099	1,039,195

Strike Relief Fishing

CLOSED

TABLE IX
SUMMARY OF THE SOCKEYE ESCAPEMENT TO THE FRASER RIVER SPAWNING AREAS, 1953, 1957, 1961, 1965

District and Streams	1965 Period of Peak Spawning	Estimated Number of Sockeye				Jacks	Sex Ratio	
		1953	1957	1961	1965		Males 4-5 yr.	Female 4-5 yr.
LOWER FRASER								
Cultus Lake	Nov. 24-30	13,000	20,647	15,428	2,532	77	832	1,62
Upper Pitt River	Sept. 7-10	18,693	12,338	11,162	6,981	15	3,515	3,45
Widgeon Slough	Nov. 1-7	1,518	1,200	1,293	275	0	113	16
HARRISON								
Big Silver Creek	Sept. 22-26	432	389	398	596	0	238	35
Harrison River	Nov. 10-20	21,328	3,812	42,778	15,034	0	7,239	7,79
Weaver Creek	Oct. 8-25	9,530	20,887	4,383	11,162	51	4,560	6,55
Misc. Streams	Sept. 22-26	86	——	11	50	0	20	3
LILLOOET								
Birkenhead River	Sept. 16-23	53,111	24,168	49,627	30,008	13,778	5,587	10,64
SETON-ANDERSON								
Gates Creek	Aug. 24-27	78	1,112	252	1,679	37	577	1,06
Portage Creek	Oct. 26-31	200	470	527	2,108	1,127	392	58
SOUTH THOMPSON								
Seymour River	Aug. 27-28	5,947	14,095	5,822	6,954	865	3,341	2,74
Scotch Creek	Aug. 23-30	1,364	2,354	598	1,910	0	1,074	83
Lower Adams River	Oct. 15-21	177,000	257,614	57,796	55,041	53,466	532	1,04
Little River	Oct. 18-24	32,118	34,964	8,253	3,236	3,088	50	9
South Thompson River	Oct. 20-24	12,614	14,645	254	192	120	37	3
Misc. Streams	——	——	——	——	1,022	730	117	17
NORTH THOMPSON								
Raft River	Aug. 30-Sept. 1	8,242	7,264	7,301	6,624	0	2,538	4,08
Barriere River	Aug. 30-Sept. 7	——	38	335	104	0	52	5
North Thompson River	——	——	——	225	Present	——	——	——
CHILCOTIN								
Chilko River	Sept. 24-27	197,660	140,765	40,315	39,902	4,567	12,294	23,04
Taseko Lake	——	4,422	3,667	80	Present	——	——	——
QUESNEL								
Horsefly River	Aug. 29-Sept. 3	105,218	226,378	295,705	359,232	10	164,408	194,81
Mitchell River	Sept. 5-10	2,344	2,677	6,601	5,335	0	2,442	2,89
NECHAKO								
Endako River	——	605	110	0	2	0	1	
Nadina River (Early)	Aug. 28-Sept. 1	38,574	30,000	18,885	3,884	0	1,840	2,04
(Late)	Sept. 18-23		29,146	17,544	11,293	0	5,658	5,63
Nithi River	Aug. 28-Sept. 2	1,208	1,186	146	34	0	17	1
Ormonde Creek	——	956	450	0	0	0	0	
Stellako River	Sept. 27-30	45,057	38,922	47,241	39,418	33	18,301	21,08
STUART								
Early Runs								
Ankwil Creek	Aug. 6-10	5,913	8,285	18,468	2,806	0	957	1,84
Bivouac Creek	Aug. 2-6	8,994	9,464	997	401	0	252	14
Driftwood River	Aug. 8-12	8,655	45,567	81,617	4,221	0	1,850	2,37
Dust Creek	Aug. 5-8	16,891	14,827	10,870	1,584	0	649	93
Felix Creek	Aug. 2-6	805	7,081	3,082	1,404	0	508	89
15 Mile Creek	Aug. 6-10	794	511	922	74	0	26	4
5 Mile Creek	Aug. 6-10	2,632	3,821	731	40	0	14	2
Forfar Creek	Aug. 2-6	18,054	17,975	13,599	2,221	0	784	1,43
Forsythe Creek	Aug. 6-10	4,500	6,385	5,836	553	0	212	34
Frypan Creek	Aug. 6-10	4,566	3,890	10,595	275	0	90	18
Gluske Creek	Aug. 2-6	16,074	21,899	5,652	2,200	0	859	1,34
Kynoch Creek	Aug. 2-6	16,676	13,473	16,170	2,885	0	1,231	1,65
Leo Creek	Aug. 2-6	6,361	10,620	1,624	121	0	44	7
Narrows Creek	Aug. 5-8	20,604	16,184	7,897	1,377	0	565	81
Paula Creek	Aug. 2-5	1,406	7,918	1,400	79	0	29	5
Rossette Creek	Aug. 2-6	6,355	7,087	4,993	1,165	0	422	74
Sakeniche River	Aug. 2-6	3,382	6,340	5,278	4	0	2	
Sandpoint Creek	Aug. 2-6	2,092	20,914	3,523	706	0	262	44
Shale Creek	Aug. 6-10	3,809	1,606	2,392	79	0	28	5
25 Mile Creek	Aug. 5-8	2,167	724	1,663	229	0	80	14
Misc. Streams	Aug. 5-8	3,392	10,462	3,911	621	0	211	41
Late Runs								
Kazchek Creek	Sept. 8-12	7,903	19,582	15,676	3,292	0	1,623	1,66
Kuzkwa Creek	Sept. 14-18	3,686	50,006	39,245	10,000	0	4,369	5,63
Middle River	Sept. 12-18	235,572	332,098	177,516	139,186	0	55,804	83,38
Pinchi Creek	——	72	6,390	527	Present	——	——	——
Sakeniche River	Sept. 8-12	104	592	1,094	11	0	5	
Tachie River	Sept. 14-20	107,506	118,252	177,047	62,469	15	22,418	40,03
NORTHEAST								
Upper Bowron River	——	13,517	12,069	7,460	2,660	1	1,197	1,46
TOTALS*		1,274,346	1,663,320	1,253,012	845,418	77,980	330,334	437,10

*Totals include small numbers of fish in small tributaries not listed in the table.

TABLE X
DAILY CATCH OF PINKS, 1961-1963-1965-1967 FROM UNITED STATES CONVENTION WATERS

	JULY				AUGUST				SEPTEMBER			
Date	1961	1963	1965	1967	1961	1963	1965	1967	1961	1963	1965	1967
1					34,070	52,307		7,164				145,934
2					27,621	48,241	2,533	8,084		386,713		
3	34						1,312			215,316		
4	61						6,736			75,268		
5	38		84			68,013	15,117			61,129		362,417
6			124			52,218		199				261,626
7						40,441		6,635	CLOSED		108,690	144,223
8						30,906		10,666			68,470	
9				2			14,502			103,803	27,983	
10	494	CLOSED		29	64,389		11,818			193,448		
11	398			39			11,865			188,781		157,616
12			674			102,743						149,560
13			483			98,389		24,236			13,716	124,201
14						84,776		41,126			4,316	89,874
15					45,358			45,622			109	
16				10	21,451		29,700	53,414			46	
17	6,592			322			26,038					
18	8,234			209					4,023	91,403		96,316
19	12,592		1,729			173,834			1,790	24,221		48,221
20			2,504			166,400			1,265		6,185	39,802
21			2,272		72,620	181,808		133,050			2,036	17,651
22		7,831			51,641			191,662			2,099	
23		19,156		275				140,804		26	2,402	
24	25,288	17,490		6,873				172,829		41		
25	20,603	35,819		6,010			60,960		540	23		943
26	18,595	27,844		5,622	CLOSED	427,506	46,508		463	14		769
27		22,440		5,952		349,273			76		940	323
28			3,799			263,222					530	
29		37,626	3,469			164,078		483,011			335	
30		44,316		3,897				366,854		12,753	180	
31	24,759	44,595		10,619				262,997				
Totals	117,688	257,117	15,138	39,859	317,150	2,304,155	227,089	1,948,353	8,157	1,352,939	238,037	1,639,476
Troll	20,449	133,114	21,986	48,377	40,671	327,235	53,630	132,751	1,683	20,550	1,832	9,297
Monthly Totals	138,137	390,231	37,124	88,236	357,821	2,631,390	280,719	2,081,104	9,840	1,373,489	239,869	1,648,773
June, Oct. & Nov. Totals									2,746	31,122	668	8,927
Season Totals									508,544	4,426,232	558,380	3,827,040

TABLE XI

DAILY CATCH OF PINKS, 1961-1963-1965-1967 FROM CANADIAN CONVENTION WATERS

	JULY				AUGUST				SEPTEMBER			
Date	1961	1963	1965	1967	1961	1963	1965	1967	1961	1963	1965	1967
1					14,821			528				
2							10,495	474		67,539		
3	1						12,117			182,611		117,540
4	1	CLOSED				5,237	10,252			210,058		134,138
5						31,344			3,335	178,872		128,994
6			3			57,540		10,829	2,198			65,626
7			2			67,174		14,045			17,544	93,898
8				CLOSED		775		17,863			10,086	100,559
9					18,773		23,992	20,326		24,161	5,416	
10	4				22,031		24,346			131,138		
11	4						25,866			91,215		218,008
12	6		10			77,691			936			136,118
13	29	Strike	10		4,954	86,575			569		6,151	73,745
14		July 12			3,753	81,750		146,394			4,110	31,250
15		to			80,913	106,538		108,014			3,383	
16		Aug. 4			56,892		49,953	105,629		14,390	3,314	
17	13,807			8			43,342			8,865		
18	8,909			7			40,776					29,284
19			22	4		142,007			344			16,313
20			49			113,020			260		52,695	10,361
21			182		15,144	125,864		67,700	431		718	
22					39,029	372,486		150,862			383	54,442
23						187,652		168,186		71,976		
24	27,564			328								
25	22,427			266			81,419			5,651		10,133
26	18,841			308		12,340	37,969		89	1,790		6,294
27			353	454		419,589			30		317	4,998
28			147		5,480	243,875		210,531	22		163	
29			198		12,061	229,443		293,634			32,671	
30			70			220,827	5,307	239,917				
31	9,097			1,037				221,137				
Totals	100,690	0	1,046	2,412	273,851	2,581,727	365,834	1,776,069	8,214	988,266	136,951	1,231,701
Troll	26,208	100,316	14,990	99,288	34,659	214,245	51,148	663,415	20,038	106,578	7,378	197,605
Spring salmon gill nets									37,330	12,894	13,508	
Monthly Totals	126,898	100,316	16,036	101,700	308,510	2,795,972	416,982	2,439,484	65,582	1,107,738	157,837	1,429,306
June, Oct. & Nov. Totals									44,138	169,262	1,612	186,432
Season Totals									545,128	4,173,288	592,467	4,156,922

TABLE XII

SUMMARY OF THE PINK SALMON ESCAPEMENT TO THE FRASER RIVER SPAWNING AREAS

District and Streams	1967 *Period of Peak Spawning*	*Estimated Number of Pink Salmon* 1961	1963	1965	1967
EARLY RUNS					
LOWER FRASER					
Main Fraser	Oct. 1-10	549,400	516,831	543,757	785,797
HARRISON					
Chehalis River	Oct. 15-20	11,921	12,394	7,621	5,625
FRASER CANYON					
Coquihalla River	Oct. 10-16	7,316	14,971	3,845	3,045
Jones Creek	Oct. 10-15	5,088	3,500	3,000	3,162
Misc. Tributaries	Oct. 10-16	2,969	4,081	1,057	2,395
SETON-ANDERSON					
Seton Creek	Oct. 13-17	58,717	121,424	95,046	225,351
Portage Creek	Oct. 15-20	1,550	8,013	5,931	7,822
Bridge River	Oct 12-20	1,895	6,422	23,657	6,547
THOMPSON					
Thompson River & Tributaries	Oct. 5-15	69,411	285,243	233,100	450,487
TOTALS*		708,267	972,879	917,736	1,490,231
LATE RUNS					
LOWER FRASER					
Stave River	Oct. 20-23	3,994	910	226	276
HARRISON					
Harrison River	Oct. 15-22	186,137	645,476	69,213	64,576
Weaver Creek	Oct. 14-18	539	693	528	786
CHILLIWACK-VEDDER					
Chilliwack-Vedder River	Oct. 25-Nov. 1	188,555	317,750	193,911	252,585
Sweltzer Creek	Oct. 28-Nov. 3	6,224	15,215	8,908	19,586
TOTALS*		385,838	980,453	273,387	341,141
GRAND TOTALS		1,094,105	1,953,332	1,191,123	1,831,372

*Totals include small numbers of fish in small tributaries not listed in the table.