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

1981

COMMISSIONERS

WILLIAM G. SALETIC
HERBERT A. LARKINS
ROLLAND A. SCHMITTEN
ALVIN W. DIXON
C. WAYNE SHINNERS
MICHAEL W. C. FORREST

NEW WESTMINSTER
CANADA
1982

INTERNATIONAL PACIFIC SALMON FISHERIES COMMISSION

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

CANADA

William A. Found	1937-1939
A. L. Hager	1937-1948
Senator Thomas Reid	1937-1967
A. J. Whitmore	1939-1966
	1968-1969
Olof Hanson	1948-1952
H. R. MacMillan. C.B.E.. D.Sc.	1952-1956
F. D. Mathers	1956-1960
W. R. Hourston	1960-1981
Richard Nelson	1966-1976
Roderick Haig-Brown	1970-1976
Richard A. Simmonds	1976-1980
Alvin W. Dixon	1978-
C. Wayne Shinners	1981-
Michael W. C. Forrest	1981-

UNITED STATES

Edward W. Allen	1937-1951
	1957-1957
B. M. Brennan	1937-1942
Charles E. Jackson	1937-1946
Fred J. Foster	1943-1947
Milo Moore	1946-1949
	1957-1961
Albert M. Day	1947-1954
Alvin Anderson	1949-1950
Robert J. Schoettler	1951-1957
Elton B. Jones	1951-1957
Arnie J. Suomela	1954-1961
DeWitt Gilbert	1957-1974
George C. Starlund	1961-1966
Clarence F. Pautzke	1961-1969
Thor C. Tollefson	1966-1975
Charles H. Meacham	1969-1970
Donald R. Johnson	1971-1980
William G. Saletic	1974-
Donald W. Moos	1975-1977
Gordon Sandison	1977-1980
Herbert A. Larkins	1980-
Rolland A. Schmitten	1981-

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Director — A. C. Cooper
Assistant Director — J. F. Roos

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REPORT OF THE INTERNATIONAL PACIFIC SALMON FISHERIES COMMISSION FOR THE YEAR 1981

The 1981 Fraser River sockeye run is the same cycle as the huge dominant cycle runs in the 1905-09-13 period during development of the commercial fishery and before the Hell's Gate slide. The sockeye run in 1981 was approximately 7.7 million fish and was possibly the largest on this cycle since 1913. The 26.7 million total runs for the years 1978-81 was 65.1% of the four year average of 41.0 million during the period 1894-1916 and was more than twice the average four year total of 12.2 million in the period 1917-49. The 1981 Fraser pink salmon run of 18.4 million was probably the largest since 1913 and was about 66% of the estimated historical abundance prior to 1913. These achievements are the results of fishway construction by the Commission to remove obstructions to the migration of the fish and management of the fisheries to secure the necessary increased numbers of spawners for the various races. The Commission has also constructed six spawning and incubation channels to assist restoration of some runs, but these facilities accounted for only 5.1% of the adult sockeye production in the years 1978-81 and 6.8% of the pink salmon production in 1981. Thus, most of the production is from natural spawning grounds, and it is now anticipated that these spawning grounds can produce most of the additional increase needed to reach historic abundance.

The increase in abundance of these stocks provides additional harvest for fishermen, but it also requires strict regulatory control to obtain the needed larger escapements. During the years 1978-81 an average of 71.5% of the total run was taken in all commercial fisheries. In the years 1910-13 it is estimated that the fisheries harvested an average of about 86% of the annual runs using the minimum escapement estimates for that period. Thus, Commission management practices combined with those in non-Convention Waters fisheries in recent years have actually been more restrictive as compared with the fisheries in the early 1900's.

The historic fishery for Fraser River sockeye was concentrated in the lower Fraser River and the adjacent portion of Georgia Strait and the area from Point Roberts to Salmon Banks in United States waters. Thus, the sockeye fishery was very concentrated on the Fraser River stock and in inshore waters. As a result of private incentive and various government policies, numerous changes in the fisheries have occurred over the years and Fraser River sockeye and pink salmon are now also harvested by net fisheries in Juan de Fuca Strait, Johnstone Strait, by troll fisheries off the west coast of Vancouver Island and the State of Washington, and sometimes by net fisheries in coastal waters of British Columbia north of Vancouver Island. Many of these additional fisheries intercept fish before they reach Convention Waters where the Commission has management responsibility. In 1981, 43.9% of the Fraser sockeye run and 33.8% of the Fraser pink run was caught before the fish reached Convention Waters. In addition, the west coast troll fishery takes place in Convention Waters, and in waters to the north and south because of differing jurisdictional priorities, unified regulation of this fishery has not been possible. Therefore, the Commission has not been able to exercise independent control in this part of Convention Waters.

The expansion of the movement of fishing vessels to locations beyond the historic fishing areas for Fraser sockeye and pinks also involves fisheries for other species of salmon and stocks from other river systems. Under these circumstances, in the areas beyond Convention Waters the governments sometimes have conflicting management choices for regulation of the fisheries. From the standpoint of management of the Fraser River sockeye and pink salmon, the allowable harvest of these stocks could be obtained readily within Convention Waters. If fisheries beyond Convention Waters for other species or other stocks harvest Fraser sockeye or pinks to the disadvantage of these other stocks or species, it is unreasonable to attribute the problem to the increased production of Fraser sockeye and pinks or to exclusively blame inshore net fisheries. The solution to the problem definitely is not further restrictions on the net fisheries in Convention Waters. The Commission has in recent years adjusted its regulations in Areas 17 and 18 of Canadian waters in recognition of the desirability of affording protection to local stocks. Further substantial changes in gear-area regulations could only be made with the support of the Canadian Government.

COMMISSION MEETINGS

The International Pacific Salmon Fisheries Commission held sixteen formal and twenty-five telephone meetings during 1981 with the approved minutes of the meetings being submitted to the Governments of Canada and the United States.

Mr. C. W. Shinners and Mr. M. W. Forrest were appointed Commissioners early in 1981 representing Canada. Mr. Gordon Sandison resigned and Mr. R. A. Schmitten was appointed as United States Commissioner.

On May 15 the Commission approved the appointment of Mr. W. Kimzey to the Advisory Committee representing United States Troll Fishermen. At its meeting of July 17, the Commission received a copy of Protocol amending the Convention to increase the membership of the Advisory Committee to seven from each country. On July 24 the Commission approved the appointment of Mr. C. Peterson to the Advisory Committee representing United States Native Indian Fishermen. At its December 11 meeting the Commission approved the appointment of Mr. D. Guerin to the Advisory Committee representing Canadian Native Indian Fishermen.

The membership of the Advisory Committee for 1981 was as follows:

Canada	*United States*
J. Brajcich Purse Seine Fishermen	W. Green Purse Seine Fishermen
B. Fraser Salmon Processors	J. Lind Salmon Processors
F. Nishii Gill Net Fishermen	R. Christensen Gill Net Fishermen
N. Carr Purse Seine Crew Members	T. Philpott Reef Net Fishermen
J. Makowichuk Troll Fishermen	G. Simmons (to May 14) W. Kimzey (from May 15) Troll Fishermen
A. Downs Sports Fishermen	E. Engman Sports Fishermen
D. Guerin (from Dec. 11) Native Indian Fishermen	C. Peterson (from July 24) Native Indian Fishermen

The first meeting of 1981 was held January 30, with Mr. Gordon Sandison serving as Chairman and Mr. W. R. Hourston as Vice Chairman continuing to serve as Canadian Commissioner until a third Canadian Commissioner was appointed. Mr. C. W. Shinners was present as new Canadian Commissioner. The Commission met with its Advisory Committee regarding tentative recommendations for regulatory control of the 1981 sockeye and pink salmon fishery in Convention Waters, as submitted to the Committee on December 12, 1980. The Commission delayed decision on regulations pending further examination of the proposals by Canada Department of Fisheries and Oceans for the conservation of chinook salmon.

On February 6, after certain revisions, the Commission approved the 1981 recommended regulations for submission to the two national governments.

At its meeting of May 15 it was announced that Mr. W. G. Saletic would serve as Chairman for the balance of Mr. Sandison's term and Mr. A. W. Dixon as Vice Chairman and Secretary. Mr. M. W. Forrest was present as the new Canadian Commissioner and Mr. R. A. Schmitten as United States Commissioner. The Commission approved a revised buget for 1981-82 and the budget request for fiscal year 1982-83. A draft of the 1980 Annual Report was approved and other administrative matters were discussed. The Commission reviewed correspondence from Canada Department of Fisheries and Oceans regarding revision of proposed closures for Area 29D, and discussed a request from United States authorities requesting coordination of troll fishing regulations in United States Territorial waters and High Seas within Convention Waters. The Commission approved revision of the regulations approved February 6 and the addition of a troll regulation in United States waters.

During the period June 26 to October 8 inclusive, the Commission held eleven formal and twenty-five telephone meetings for adjustment of fishing regulations to achieve the desired escapement and, as nearly as practicable, equitable division of the allowable catch of Fraser River sockeye and pink salmon. On August 28 the Commission, accompanied by members of the Advisory Committee, inspected the sockeye spawning in the Horsefly River system.

The Commission met December 4 to review the Annual Meeting presentation. The sixteenth and final formal meeting of the year was held on December 11 in Richmond, British Columbia, when the Commission held its Annual Meeting with its Advisory Committee and approximately 350 representatives of industry, government and press. A review of events during the 1981 sockeye and pink salmon season was presented by the Chairman. The catch and escapement statistics were also given by the staff. Prospects for the 1982 fishing season were reviewed and tentative regulations for the 1982 fishery were proposed for consideration by industry and their representatives on the Commission Advisory Committee.

1981 REGULATIONS

Recommendations for regulations governing the 1981 sockeye and pink salmon fishery in Convention Waters were adopted at a meeting of the Commission held February 6, 1981 and were submitted to the two national governments for approval on February 26, 1981. On March 31, 1981 the United States Government informed the Commission that its recommended 1981 regulations were approved with the exception that certain Treaty Indians were excluded and would be regulated under separate United States regulations. The National Marine Fisheries Service was designated as the enforcing agency in cooperation with other federal agencies. The recommendations for Canadian Convention Waters were implemented during the fishing season under the Fisheries Act, Pacific Commercial Salmon Fishery Regulations and subsequently by Order-in-Council dated September 30, 1981.

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 of 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 Canadian Government that, in the interests of such fisheries, the following Fraser River Sockeye and Pink Salmon Fishery Regulations for Convention Waters for the season of 1981 be adopted by Order-in-Council pursuant to Section 34 of the Fisheries Act, namely:

1. (1) No person shall fish for sockeye or pink salmon in the waters of the southerly portion of District No. 3 in that portion of Area 20 lying westerly of a line drawn true south from Sheringham Point Lighthouse to the International Boundary from the 21st day of June, 1981 to the 18th day of July, 1981, both dates inclusive.

(2) No person shall fish for sockeye or pink salmon with purse seines in the waters described in subsection (1) of this section from the 19th day of July, 1981 to the 12th day of September, 1981, both dates inclusive, except from half past six o'clock in the forenoon to half past six o'clock in the afternoon of Monday and Tuesday of each week.

(3) No person shall fish for sockeye or pink salmon with gill nets in the waters described in subsection (1) of this section from the 19th day of July, 1981 to the 12th day of September, 1981, both dates inclusive, except from half past six o'clock in the afternoon of Monday to half past six o'clock in the forenoon of Tuesday and from half past six o'clock in the afternoon of Tuesday to half past six o'clock in the forenoon of Wednesday of each week.

(4) No person shall troll commercially for sockeye or pink salmon in the waters described in subsection (1) of this section from the 19th day of July, 1981 to the 12th day of September, 1981, both dates inclusive, except at times that net fishing may be permitted within that area.

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

(1) From the 21st day of June, 1981 to the 27th day of June, 1981, both dates inclusive; and

(2) From the 28th day of June, 1981 to the 8th day of August, 1981, both dates inclusive, except from eight o'clock in the forenoon of Monday to eight o'clock in the forenoon of Tuesday of each week; and

(3) From the 9th day of August, 1981 to the 3rd day of October, 1981, both dates inclusive.

3. No person shall troll commercially for sockeye or pink salmon in that portion of the waters described in section 2 lying easterly of a straight line from Thrasher Rock Light to Salamanca Point on the southerly end of Galiano Island, thence in a straight line to East Point on Saturna Island, thence due south to the International Boundary:

(1) From the 9th day of August, 1981 to the 19th day of September, 1981, both dates inclusive, except from eight o'clock in the forenoon of Monday to eight o'clock in the forenoon of Tuesday of each week; and

(2) From the 20th day of September, 1981 to the 3rd day of October, 1981, both dates inclusive.

4. No person shall fish for sockeye or pink salmon with gill nets in District No. 1:

(1) From the 21st day of June, 1981 to the 27th day of June, 1981, both dates inclusive; and

(2) From the 28th day of June, 1981 to the 11th day of July, 1981, both dates inclusive, except from eight o'clock in the forenoon of Monday to eight o'clock in the forenoon of Tuesday of each week; and

(3) From the 12th day of July, 1981 to the 18th day of July, 1981, both dates inclusive, except from eight o'clock in the forenoon of Monday to eight o'clock in the forenoon of Tuesday, in those waters lying westerly of a line projected from Point Grey to the westerly end of the North Arm Jetty, thence to Sand Heads Light, thence to Canoe Pass Buoy, thence to the light on the westerly end of Tsawwassen Causeway and thence to the Point Roberts Light in the State of Washington; and

(4) From the 19th day of July, 1981 to the 5th day of September, 1981, both dates inclusive, except from eight o'clock in the forenoon of Monday to eight o'clock in the forenoon of Tuesday of each week; and

(5) From the 6th day of September, 1981 to the 19th day of September, 1981, both dates inclusive, except from eight o'clock in the forenoon of Monday to eight o'clock in the forenoon of Tuesday of each week, in those waters lying westerly of a line projected from Point Grey to the westerly end of the North Arm Jetty, thence to Sand Heads Light, thence southerly approximately 1.93 km (1.2 miles) to the Roberts Bank Horn (#309), and thence in a straight line to Georgina Point Light at Active Pass; and

(6) From the 20th day of September, 1981 to the 10th day of October, 1981, both dates inclusive.

5. No person shall troll commercially for sockeye or pink salmon in those waters described in section 4 from the 9th day of August, 1981 to the 10th day of October, 1981, both dates inclusive, except at times that net fishing 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 of 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 United States Government that regulations to the following effect, in the interests of such fisheries in Convention Waters, be adopted for the year 1981, and that an approved copy of said regulations be forwarded to the Director of Fisheries of the State of Washington for implementation 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 with nets from the 21st day of June, 1981 to the 27th day of June, 1981, both dates inclusive.

2. (1) No person shall fish for sockeye or pink salmon with purse seines in Puget Sound Salmon Management and Catch Reporting Areas 4B, 5 and 6C:

(a) From the 28th day of June, 1981 to the 4th day of July, 1981, and from the 12th day of July, 1981 to the 15th day of August, 1981, all dates inclusive, except from five o'clock in the forenoon to half past nine o'clock in the afternoon of Monday of each week; and

(b) From the 5th day of July, 1981 to the 11th day of July, 1981, both dates inclusive, except from five o'clock in the forenoon to half past nine o'clock in the afternoon of Tuesday; and

(c) From the 16th day of August, 1981 to the 12th day of September, 1981, both dates inclusive, except from five o'clock in the forenoon to nine o'clock in the afternoon of Monday of each week.

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

(a) From the 28th day of June, 1981 to the 18th day of July, 1981; from the 26th day of July, 1981 to the 1st day of August, 1981; and from the 9th day of August, 1981 to the 15th day of August, 1981, all dates inclusive, except from seven o'clock in the afternoon of Monday to half past nine o'clock in the forenoon of Tuesday of each week; and

(b) From the 19th day of July, 1981 to the 25th day of July, 1981, and from the 2nd day of August, 1981 to the 8th day of August, 1981, all dates inclusive, except from seven o'clock in the afternoon of Sunday to half past nine o'clock in the forenoon of Monday of each week; and

(c) From the 16th day of August, 1981 to the 22nd day of August, 1981, and from the 30th day of August, 1981 to the 5th day of September, 1981, all dates inclusive, except from six o'clock in the afternoon of Sunday to nine o'clock in the forenoon of Monday of each week; and

(d) From the 23rd day of August, 1981 to the 29th day of August, 1981, and from the 6th day of September, 1981 to the 12th day of September, 1981, all dates inclusive, except from six o'clock in the afternoon of Monday to nine o'clock in the forenoon of Tuesday of each week.

(3) No person shall fish for sockeye or pink salmon with commercial trolling gear in the waters described in subsection (1) of this section from the 28th day of June, 1981 to the 12th day of September, 1981, both dates inclusive, except from Monday through Friday of each week on those days when purse seine fishing is permitted within that area.

3. (1) No person shall fish for sockeye or pink salmon with purse seines in Puget Sound Salmon Management and Catch Reporting Areas 6, 6A, 7, 7A and 7D:

(a) From the 28th day of June, 1981 to the 4th day of July, 1981, and from the 12th day of July, 1981 to the 15th day of August, 1981, all dates inclusive, except from five o'clock in the forenoon to half past nine o'clock in the afternoon of Monday of each week; and

(b) From the 5th day of July, 1981 to the 11th day of July, 1981, both dates inclusive, except from five o'clock in the forenoon to half past nine o'clock in the afternoon of Tuesday; and

(c) From the 16th day of August, 1981 to the 19th day of September, 1981, both dates inclusive, except from five o'clock in the forenoon to nine o'clock in the afternoon of Monday of each week.

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

(a) From the 28th day of June, 1981 to the 4th day of July, 1981; from the 12th day of July, 1981 to the 18th day of July, 1981; from the 26th day of July, 1981 to the 1st day of August, 1981; and from the 9th day of August, 1981 to the 15th day of August, 1981, all dates inclusive, except from six o'clock in the forenoon to nine o'clock in the afternoon of Sunday of each week; and

(b) From the 5th day of July, 1981 to the 11th day of July, 1981, both dates inclusive, except from nine o'clock in the forenoon to half past nine o'clock in the afternoon of Monday; and

(c) From the 19th day of July, 1981 to the 25th day of July, 1981, and from the 2nd day of August, 1981 to the 8th day of August, 1981, all dates inclusive, except from nine o'clock in the forenoon to half past nine o'clock in the afternoon of Sunday of each week; and

(d) From the 16th day of August, 1981 to the 22nd day of August, 1981; from the 30th day of August, 1981 to the 5th day of September, 1981; and from the 13th day of September, 1981 to the 19th day of September, 1981, all dates inclusive, except from nine o'clock in the forenoon to nine o'clock in the afternoon of Sunday of each week; and

(e) From the 23rd day of August, 1981 to the 29th day of August, 1981, and from the 6th day of September, 1981 to the 12th day of September, 1981, all dates inclusive, except from half past five o'clock in the forenoon to nine o'clock in the afternoon of Sunday of each week.

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

(a) From the 28th day of June, 1981 to the 18th day of July, 1981; from the 26th day of July, 1981 to the 1st day of August, 1981; and from the 9th day of August, 1981 to the 15th day of August, 1981, all dates inclusive, except from seven o'clock in the afternoon of Monday to half past nine o'clock in the forenoon of Tuesday of each week; and

(b) From the 19th day of July, 1981 to the 25th day of July, 1981, and from the 2nd day of August, 1981 to the 8th day of August, 1981, all dates inclusive, except from seven o'clock in the afternoon of Sunday to half past nine o'clock in the forenoon of Monday of each week; and

(c) From the 16th day of August, 1981 to the 22nd day of August, 1981; from the 30th day of August, 1981 to the 5th day of September, 1981; and from the 13th day of September, 1981 to the 19th day of September, 1981, all dates inclusive, except from six o'clock in the afternoon of Sunday to nine o'clock in the forenoon of Monday of each week; and

(d) From the 23rd day of August, 1981 to the 29th day of August, 1981, and from the 6th day of September, 1981 to the 12th day of September, 1981, all dates inclusive, except from six o'clock in the afternoon of Monday to nine o'clock in the forenoon of Tuesday of each week.

4. (1) No person shall fish for sockeye or pink salmon with nets in that portion of the waters described in subsection (1) of section 3 lying northerly and westerly of a straight line drawn from Iwersen's Dock on Point Roberts in the State of Washington to Georgina Point Light at the entrance to Active Pass in the Province of British Columbia from the 30th day of August, 1981 to the 5th day of September, 1981, and from the 20th day of September, 1981 to the 3rd day of October, 1981, all dates inclusive.

(2) No person shall fish for sockeye or pink salmon with nets in that portion of the waters described in subsection (1) of section 3 lying westerly of a straight line drawn from the low water range marker in Boundary Bay on the International Boundary through the east tip of Point Roberts in the State of Washington to the East Point Light on Saturna Island in the Province of British Columbia from the 6th day of September, 1981 to the 19th day of September, 1981, both dates inclusive.

5. The foregoing recommended regulations shall not apply to the following waters:

(1) Puget Sound Salmon Management and Catch Reporting Areas as follows:

(a) Areas 6B, 6D and 7C.

(b) Commencing June 28, 1981, Area 7B.

(2) 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 Orders

In order to provide for adequate racial escapement of Fraser River sockeye and pink salmon and for an equitable share of the season's catch by fishermen of the United States and Canada, the approved regulations as detailed above were later adjusted by the Commission as follows:

May 15, 1981 — In view of the Canadian Government's revision of measures for the conservation of chinook salmon the Commission approved the following changes in regulations: 1) That Area 20 of Canadian Convention Waters not open as scheduled for the week commencing July 19 but open July 27 for one day of fishing and August 3 for one day of fishing. 2) That District No. 1 of Canadian Convention Waters open July 13 for 24 hours of fishing. 3) That United States Convention Waters not open as scheduled for the week commencing June 28. 4) That the scheduled opening in United States Convention Waters for the week commencing July 5 be advanced 24 hours for one day of fishing on July 6. 5) That United States Convention Waters regulation shall not apply to Puget Sound Salmon Management and Catch Reporting Area 7B commencing July 5.

In the interest of consistency with regulations promulgated by the United States regarding troll fishing, the Commission approved the following regulations for United States Waters: "no person shall fish for sockeye or pink salmon by commercial trolling gear in that portion of Convention Waters westerly of a straight line drawn from Tatoosh Island Lighthouse in the State of Washington to Bonilla Point in the Province of British Columbia comprising the Territorial waters of the United States and those High Seas waters contained in the United States Fishery Conservation Zone from the first day of June, 1981 to the 14th day of July, 1981, both dates inclusive."

June 26, 1981 — In order to secure escapement of Early Stuart sockeye and because of low abundance, the Commission cancelled the scheduled opening in District No. 1 and Areas 17 and 18 of Canadian Convention Waters for the week commencing June 28.

June 30, 1981 — In the interest of harvesting Early Stuart sockeye the Commission approved opening District No. 1 and Areas 17 and 18 of Canadian Convention Waters for 24 hours of fishing on July 2.

July 2, 1981 — In order to secure escapement of Early Stuart sockeye the Commission cancelled the scheduled opening in District No. 1 and Areas 17 and 18 of Canadian Convention Waters for the week commencing July 5.

July 6, 1981 — In the interest of harvesting Early Stuart sockeye the Commission approved opening District No. 1 and Areas 17 and 18 of Canadian Convention Waters for 24 hours of fishing on July 7.

July 10, 1981 — In the interest of harvesting Early Stuart sockeye the Commission approved that scheduled openings in United States Convention Waters and in District No. 1 and Areas 17 and 18 of Canadian Convention Waters for the week commencing July 12 be advanced 24 hours for one day of fishing.

July 31, 1981 — In the interest of escapement of early summer sockeye races the Commission approved the following regulatory changes: 1) That fishing in all Convention Waters not open as scheduled for the week commencing August 2. 2) That the Commission reassume control of Area 7B of United States Convention Waters effective 12:01 a.m. August 2 and that the waters of Area 7B remain closed except for nets with a minimum of 7½ inch mesh under regulation by the Director of Washington State Department of Fisheries.

August 2, 1981 — In the interest of harvesting Horsefly River sockeye the Commission approved the following regulatory changes: 1) That United States Convention Waters open for two days of fishing on August 4. 2) That Area 20 of Canadian Convention Waters open August 4 for one day of fishing. 3) That District No. 1 and Areas 17 and 18 of Canadian Convention Waters open for 24 hours of fishing at 6:00 p.m. August 3.

August 4, 1981 — In the interest of division of catch the Commission approved the following regulatory changes: 1) That fishing in United States Convention Waters be extended 24 hours making a total of 3 days for the current week. 2) That commencing 12:00 noon August 4, Area 7B of United States Convention Waters open for fishing at the same times as other United States Convention Waters.

August 6, 1981 — In the interest of harvesting Horsefly River sockeye the Commission approved opening District No. 1 and Areas 17 and 18 of Canadian Convention Waters on August 7 for 24 hours of fishing.

August 7, 1981 — In the interest of harvesting Horsefly River sockeye and division of catch the Commission approved the following regulatory changes for the week commencing August 9: 1) That Canadian Convention Waters not open as scheduled. 2) That United States Convention Waters opening be advanced 24 hours for two days of fishing. 3) That Area 7B of United States Convention Waters be closed except for nets with a minimum of 7½ inch mesh under regulation by the Director of Washington State Department of Fisheries effective 9:30 a.m. August 11.

August 10, 1981 — In the interest of division of catch and the harvest of Horsefly River sockeye the Commission approved the following regulatory changes: 1) That fishing in United States Convention Waters be extended 24 hours making a total of three days fishing for the current week. 2) That Area 20 of Canadian Convention Waters open August 12 for one day of fishing. 3) That District No. 1 of Canadian Convention Waters open August 11 for 24 hours of fishing.

August 12, 1981 — In the interest of division of catch and harvesting pink salmon the Commission approved a one day extension of fishing in Area 20 of Canadian Convention Waters, making a total of two days fishing for the current week.

August 14, 1981 — In the interest of harvesting pink salmon and obtaining Horsefly escapement, the Commission approved the following regulatory changes for the week commencing August 16: 1) That Area 20 of Canadian Convention Waters opening be delayed 24 hours for one day of fishing. 2) That United States Convention Waters opening be delayed 24 hours for one day of fishing. 3) That District No. 1 not open as scheduled.

August 17, 1981 — In the interest of division of catch and harvesting Horsefly River sockeye, the Commission approved opening District No. 1 of Canadian Convention Waters on August 19 for 24 hours.

August 18, 1981 — In the interest of harvesting pink salmon the Commission approved a one day extension in United States Convention Waters and Area 20 of Canadian Convention Waters making a total of two days fishing in each area for the current week.

August 21, 1981 — In the interest of division of catch the Commission approved a 24 hour delay of the scheduled opening in United States Convention Waters for the week commencing August 23.

August 25, 1981 — In the interest of harvesting pink salmon the Commission approved the following regulatory changes: 1) That fishing time in Area 20 of Canadian Convention Waters be extended one day making a total of three days fishing in the current period. 2) That fishing in United States Convention Waters be extended one day making a total of two days fishing in the current week.

August 27, 1981 — In the interest of harvesting pink salmon and division of catch the Commission approved the following regulatory changes: 1) That Area 20 of Canadian Convention Waters reopen August 29 for two days of fishing. 2) That the scheduled opening of United States Convention Waters for the week commencing August 30 be advanced 24 hours for one day of fishing.

August 30, 1981 — In the interest of harvesting pink salmon the Commission approved fishing in Area 20 of Canadian Convention Waters for one day on August 31 making a total of three days fishing in the current period and the scheduled fishery for Area 20 on September 1 would be cancelled.

August 31, 1981 — In the interest of division of catch and the harvest of pink salmon the Commission approved reopening United States Convention Waters on September 2 for one day of fishing.

September 4, 1981 — In view of low abundance of sockeye and pink salmon the Commission approved relinquishing regulatory control of Area 7B of United States Convention Waters effective 12:01 a.m. September 5. In the interest of harvesting pink salmon and division of catch the Commission approved the following regulatory changes for the week commencing September 6: 1) That fishing in Area 20 of Canadian Convention Waters be advanced 24 hours for two days of fishing. 2) That fishing in District No. 1 of Canadian Convention Waters be delayed 24 hours. 3) That United States Convention Waters not open as scheduled.

September 7, 1981 — In the interest of harvesting pink salmon the Commission approved the following regulatory changes: 1) That fishing in Area 20 of Canadian Convention Waters be extended by two days for a total of four days for the current week. 2) That United States Convention Waters open September 8 for one day of fishing.

September 9, 1981 — In the interest of harvest of pink salmon the Commission approved that District No. 1 of Canadian Convention Waters open September 10 for 24 hours fishing westerly of the Georgina Point Light Line.

September 11, 1981 — In the interest of division of catch the Commission approved the following regulatory changes for the week commencing September 13: 1) That the scheduled opening of United States Convention Waters be advanced 24 hours for two days fishing. 2) That District No. 1 of Canadian Convention Waters open as scheduled September 14 for 24 hours of fishing westerly of the "Blue Line".

September 15, 1981 — In the interest of division of catch the Commission approved reopening on September 17 those

United States Convention Waters lying southerly and easterly of a line projected from West Point Roberts Light to East Point Light on Saturna Island for two days of fishing.

September 18, 1981 — In view of continued presence of pink salmon the Commission extended regulatory control in Areas 7, 7A and 7D of United States Convention Waters and approved opening that area southerly and easterly of the Iwersen's Dock Line on September 22 for two days of fishing.

September 25, 1981 — Due to the declining numbers of pink salmon the Commission relinquished regulatory control of remaining Untied States Convention Waters effective 12:01 a.m. September 27.

The Commission relinquished regulatory control of the remaining Convention Waters effective October 11 as scheduled, thus completing the Commission's regulatory obligations for Convention Waters for the 1981 season.

SOCKEYE SALMON REPORT

The Fishery

The total 1981 Fraser River sockeye run was estimated at 7,712,000 fish compared to a preseason forecast of 6,000,000. The total return was the largest on the cycle since at least 1917 and possibly 1913. The run on this cycle has increased from only 2,202,000 sockeye in 1945, the year Hell's Gate fishways were constructed. The number of Fraser sockeye entering Convention Waters was 4,329,000 fish, of which, 2,445,000 (56.5%) were caught commercially, 441,000 (10.2%) were taken by the Indian fishery in the Fraser River watershed, and 1,443,000 (33.3%) were recorded on the spawning grounds (see Tables I to VI in Appendix). An estimated 9,000 non-Fraser sockeye, mainly from the run to Lake Washington in Washington State, were also caught in Convention Waters. The estimated catches of Fraser River sockeye in non-Convention Waters in Johnstone Strait and northern Strait of Georgia and in coastal waters north of Convention Waters were 3,232,000 and 151,000, respectively. The non-Convention Waters catch of Fraser sockeye migrating through Johnstone Strait was 41.9% of the total run, compared with 13.2% in 1977, the preceding cycle year.

The total 1981 Convention Waters catch of sockeye was 2,454,139 fish, the lowest catch on the cycle since 1965. The low catch in 1981 was the result of another year in which a high percentage of the total Fraser sockeye run migrated through Johnstone Strait. In 1978 an estimated 57% of the run came through Johnstone Strait, followed by 30% in 1979, 70% in 1980 and an estimated 67% in 1981.

The migration pattern of Fraser sockeye in 1981 had a significant impact on the Convention Waters catch. The total catch of Fraser sockeye in all areas of 5,809,000 (Table 1) was the largest

TABLE 1. 1981 Cycle Fraser sockeye commercial catch.

Year	Convention	Non-Convention	Total Catch	Percent of Total Catch outside Convention Waters
1953	4,022,000	422,000	4,444,000	9.5
1957	3,042,000	596,000	3,638,000	16.4
1961	2,735,000	583,000	3,318,000	17.6
1965	2,062,000	125,000	2,187,000	5.7
1969	3,241,000	477,000	3,718,000	12.8
1973	5,127,000	407,000	5,534,000	7.4
1977	3,658,000	763,000	4,421,000	17.3
1981	2,445,000	3,364,000	5,809,000	57.9

for the cycle since 1917. The northern migration resulted in the largest catch (3,364,000) on the cycle taken outside Convention Waters. For cycle years 1953 through 1977 an average of only 12.4% of the annual total Fraser catch was made outside Convention Waters but in 1981 it reached a record 57.9%. In 1978 about 42.5% of the total Fraser run was caught outside Convention Waters followed by 20.9% in 1979, 37.8% in 1980.

The preseason forecast for total Convention Waters catch in 1981 was 3,400,000 sockeye. If an average migration rate via Juan de Fuca Strait had existed in 1981, about 64.7% (mean of cycle years 1953-1977) of the total run or about 5,000,000 sockeye would have been caught in Convention Waters. The catch in Convention Waters in 1981 formed only 31.7% of the total run, the lowest percentage for any year (Table 2).

TABLE 2. Total Fraser run and percent caught in Convention Waters.

Year	Total Run	Convention Catch	Percent of Run caught in Convention Waters
1953	5,847,000	4,022,000	68.8
1957	5,397,000	3,042,000	56.4
1961	4,706,000	2,735,000	58.1
1965	3,106,000	2,062,000	65.3
1969	4,884,000	3,241,000	66.4
1973	6,877,000	5,127,000	74.6
1977	5,780,000	3,658,000	63.3
1981	7,712,000	2,445,000	31.7

Within Convention Waters, Canadian fishermen caught 1,159,653 sockeye (47.25%) and United States fishermen caught 1,294,486 sockeye (52.75%) (Appendix Tables I and II).

In Canadian Convention Waters, 307,732 sockeye (26.5%) were taken in the waters westerly of William Head, while 851,921 sockeye (73.5%) were caught easterly of William Head, almost all of which were taken in the Fraser River area. The catch and percentage of total catch made in the western area in 1981 was the lowest on the cycle since 1965. The troll fishery catch (16,551) in Convention Waters along the west coast of Vancouver Island was the lowest on the cycle since 1965 and formed only 1.4% of the total catch. The purse seine catch of 180,706 sockeye was the lowest catch and percentage (15.6%) taken by this gear since cycle year 1965. The low net fishery catch in Area 20 and low troll catch in Areas 21-24 were related to the low percentage of the run migrating toward and through Juan de Fuca Strait. Gill nets took 948,312 (81.8%) sockeye, the lowest number on the cycle since 1965 but the highest percentage since 1965.

In United States waters, the purse seine catch of 616,846 sockeye (47.7%) was the lowest on the cycle since 1945. The gill net catch of 652,674 (50.4%) sockeye was the lowest on the cycle since 1969. Reef nets caught only 24,856 sockeye (1.9%), the lowest catch and percentage for the cycle year. The proportion of the total run available to United States fishermen was reduced greatly compared with previous cycles because the majority of the sockeye run migrated through Johnstone Strait.

Fishing effort (total units fishing) during the peak of the sockeye and pink salmon runs decreased compared with the previous cycle year in all Convention Waters (Table 3) for all types of gear. Movement of gear to Canadian waters north of the Convention area occurred because of the northerly approach of Fraser sockeye. Fisheries in Alaska attracted many United States fishermen, thus, reducing the gear in Puget Sound.

TABLE 3. Fishing units operating in Convention Waters.

	Year	Purse Seine	Gill Net	Reef Net	Total
			SOCKEYE		
Canada	1977	110	980	—	1,090
	1981	54	737	—	791
United States	1977	212	1,021	53	1,286
	1981	171	867	43	1,081
			PINKS		
Canada	1979	184	661	—	845
	1981	155	525	—	680
United States	1979	327	768	52	1,147
	1981	310	500	47	857

The total catch by Treaty Indians in United States Convention Waters under United States Government regulations was approximately 371,000 sockeye. This catch was made during periods when the waters were closed under Commission regulations. Commission regulations in 1981 authorized a total of 23 separate fishing periods in Areas 6, 6A, 7, 7A and 7D. Treaty Indians of certain tribes were given fishing privileges for an extra 33 gill net and 31 purse seine separate fishing periods. In areas 4B, 5 and 6C, Commission regulations specified 17 separate fishing periods and the United States granted 43 additional fishing periods for certain Treaty Indians.

The Early Stuart race is the first run of the season and is dominant on the 1977-1981 cycle. A return of 1,100,000 sockeye had been predicted but the actual return was only 740,000 fish, the lowest on the cycle since 1969. The returns in 1977 and 1973 were about 1,350,000 sockeye, possibly the largest ever to the system. In 1973 the escapement was 301,000 spawners which was the desired goal in 1977 as well. Because of intensive fishing by Indian fisheries in both countries the net escapement reaching the spawning grounds in 1977 was only 118,000 sockeye. In 1981, Treaty Indian fishermen in United States Convention Waters caught about 140,000 Early Stuart sockeye on their extra days of fishing. Thus, about 38% of their total catch made during Commission closed periods consisted of Early Stuart sockeye whereas this race formed only about 10% of the total Fraser run. In addition, Indian fishermen in the Fraser River watershed took a record 140,000 Early Stuart sockeye before the fish reached the spawning grounds. The combined effect of all fisheries was an escapement in 1981 of 129,000 sockeye, only 10% larger than in 1977.

Total Early Stuart production in 1981 was reduced in part because of the catch taken in 1977 outside Commission regulations. The potential for the 1985 return has been reduced because of excessive fishing in 1981.

The Late Stuart population is also dominant on the 1981 cycle and a very satisfactory return took place. The total return of these sockeye was approximately 1,370,000 fish compared to the brood year run of only 602,000 fish.

The outstanding feature of the 1981 season was the excellent return of sockeye from the Quesnel Lake area composed primarily of the Horsefly River, McKinley Creek and Mitchell River runs. The total return in 1981 was approximately 4,060,000 sockeye compared with 2,154,000 fish in the brood year. The 1981 return was possibly the largest since 1913. The run to this system has increased from only 4,400 fish in 1941 to the large return this year (Figure 1). Over the long term continued increased production is anticipated from this system since escapements in recent years have continued to spread into the lower reaches of the Horsefly River where a large spawning area exists.

The timing of the runs were in general later than average with the peak of the Horsefly run the latest on record.

The average weight of 4-year-old sockeye was 5.5 pounds, slightly below the long term average of about 5.7 pounds.

Escapement

The net escapement of 1,442,675 sockeye represented 33.3% of the 1981 Fraser run to Convention Waters and 18.7% of the total Fraser run. The total escapement was the largest on the cycle since 1957 when an escapement of 1,662,011 was obtained. Distribution of the escapement among the various races was reasonably good.

Effort was again directed toward increasing the Early Stuart escapement especially on this the dominant cycle. The total run was about 360,000 less than predicted and in spite of limited fishing under Commission regulations, substantial improvement in escapement was not achieved. The estimated escapement of 335,000 Early Stuart sockeye past Mission, B.C., as determined from echo sounding, was not sufficient to provide the required escapement goal of at least 200,000 sockeye to the spawning grounds. The enumerated escapement of 129,498 was only slightly better than in 1977 when an escapement of 118,017 was recorded. The continuing problem of securing the required escapement of this race is discouraging and is affecting adversely the potential production that could be realized from this important spawning stock. In future, it will require the cooperative effort of each agency that has been involved with apportioning catch of Early Stuart sockeye in the various fisheries to provide the necessary restrictions needed to ensure that escapement requirements are met.

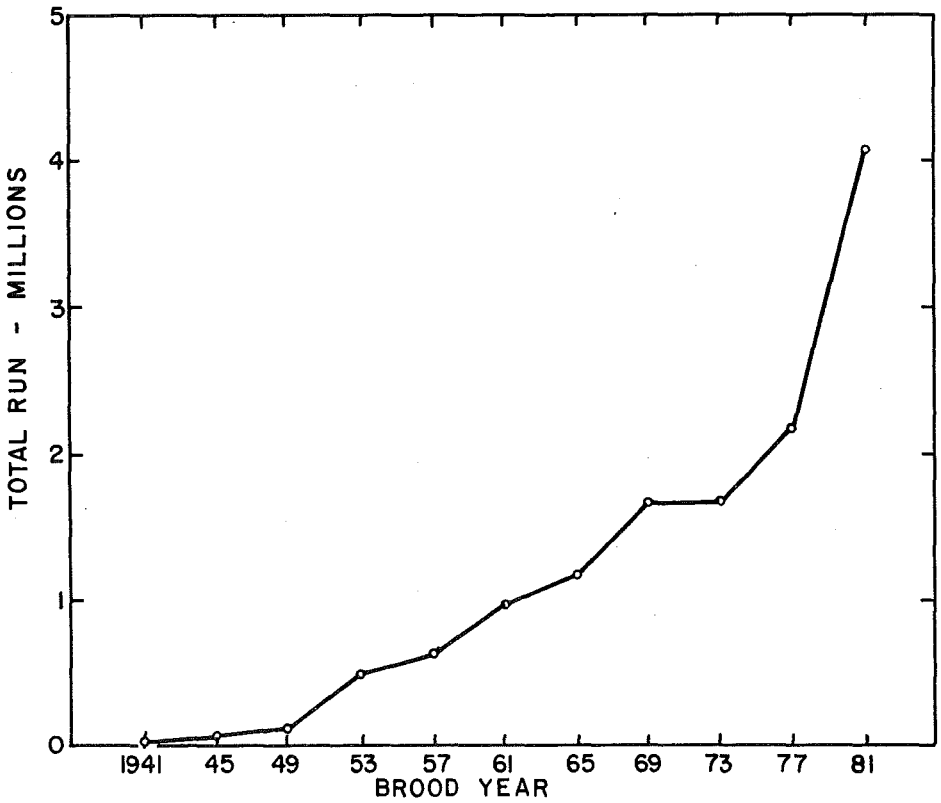

FIGURE 1. Total Quesnel system sockeye runs, 1941-1981 cycle.

Contrasted to the below desired escapement to Early Stuart spawning streams, the escapement of Late Stuart sockeye was much higher than in the brood year. Spawning populations in Middle River, Tachie River, Kuzkwa Creek and other smaller spawning areas totaled 249,699 sockeye, an increase of 103,070 fish (70.3%) over 1977 levels. An excellent distribution of spawners between the various spawning areas was also recorded.

The Quesnel Lake system escapement of 748,652 was probably the largest escapement since 1909 when an estimated 4,000,000 fish passed the dam at the outlet of Quesnel Lake. In 1941, ten cycles ago, the total escapement into the Quesnel system was less than 1,000 spawners and if the Hell's Gate fishways had not been completed in 1945, it is possible the Horsefly run would have been exterminated. The vast majority of the 1981 escapement spawned in the Horsefly River and tributary creeks (677,391). The upper Horsefly area escapement increased from 398,000 in 1977 to 558,000 in 1981, a 40.2% increase. One of the significant features of the Horsefly River escapement was the continued expansion into the lower Horsefly River spawning grounds (Table 4). A dramatic increase in escapement occurred in 1977 when 75,100 sockeye spawned in the lower area which comprised 15.9% of the total escapement into the Horsefly River. In 1981 the number of fish in the lower area increased by 59.4% to 119,700 fish, or 17.7% of the total Horsefly River escapement. Mitchell River is tributary to the northern end of Quesnel Lake. The escapement into this river has increased each cycle year since observations started in 1941 when only 41 spawners were observed. The escapement in 1981 was a record 66,106 fish, additional evidence of the remarkable resiliency of sockeye salmon.

TABLE 4. Horsefly River area spawners.

Year	Total Horsefly River	Lower Area	% in Lower Area
1941	918		
1945	4,441		
1949	30,000		
1953	105,440	300	0.3
1957	220,952	400	0.2
1961	295,705	2,800	1.0
1965	359,232	10,000	3.9
1969	269,987	13,400	5.0
1973	253,384	8,700	3.4
1977	473,008	75,100	15.9
1981	677,389	119,700	17.7

The Bowron River escapement of 1,170 sockeye was the lowest for any year since 1941. The Early Nadina River escapement of only 821 sockeye continued the decline on this cycle from the 30,000 fish recorded in 1957. The 1981 escapement was the lowest on the cycle since 1945. The Late Nadina escapement increased by about 2,000 sockeye compared with the brood year to a total of 18,916 spawners, the largest escapement on the cycle since 1969. The escapement into the spawning channel was 17,892 fish, the largest number to date on the cycle. The escapement to Stellako River has been declining on this cycle also. The escapement of 22,021 spawners in 1981 was the lowest on the cycle since 1945 and was approximately 1,400 less than in the brood year. While the Early Nadina and Stellako populations showed declines in escapement compared with the brood year by 43.5% and 6.1%, respectively, the spawning channel-assisted Late Nadina run increased by 12.0%. The Nadina River runs formerly were dominant on the 1981 cycle and the escapement in 1957 was 59,000 sockeye to the Early and Late runs combined, whereas the Stellako River run was dominant on the 1982 cycle. Record escapements in 1979 of about

290,000 sockeye to the Stellako River and 56,000 fish to the Late Nadina spawning area were associated with continued increased production on that cycle since 1971. These data suggest that dominance of those races is now established on the 1979 cycle.

The Upper Pitt River escapement of 25,327 spawners was the fourth largest in the 25-year period, 1957-1981 and were mostly five-year-olds. Escapements have averaged 27,000 fish the past 8 years compared with an average of 14,400 from 1957 to 1973. This increase in escapement and proportionally, the catch, is attributable to the spawning channel. The escapement to Seymour River of 11,529 sockeye showed an increase of 95% compared with the brood year and was the largest number of spawners on the cycle since 1957. The Scotch Creek run continued to increase and the record escapement of 18,952 sockeye was a 39% increase over the brood year escapement. In just five cycles, this race has increased in escapement from only 598 sockeye in 1961. The Gates Creek escapement increased by 66.5% compared with the brood year going from 2,889 four years ago to 4,809 this year. This was the largest escapement on record for the cycle. Of the total, 3,988 sockeye entered the spawning channel. The escapement to Raft River increased just slightly compared with the brood year to 873 spawners. However, this level of escapement is considerably less than desired. The Chilko River escapement of 35,909 spawners decreased 33.9% from the brood year. The 1981 spawning was the lowest recorded on the cycle and the lowest of any year since 1950 when the escapement was 26,447. While the escapement in 1981 was disappointing, escapements of about this level (40,000) did occur in both 1961 and 1965 followed by increased escapements on subsequent cycle years.

Escapement into Fennell Creek in the North Thompson system increased substantially in 1981 going from 355 fish in the brood year to 2,113 sockeye in 1981. This population has increased from only 52 sockeye in cycle year 1969 to the present record level for the cycle.

The Birkenhead River escapement of 65,495 sockeye was satisfactory and a definite improvement over the brood year escapement of 43,000 spawners.

Late run escapements to Lower Adams River, Lower Shuswap River, Portage Creek and Weaver Creek were below brood year levels, but the Weaver Creek channel was filled to the desired capacity with 19,600 sockeye. The Weaver Creek run was affected by severe flooding in the fall of 1977. The Harrison River and Cultus Lake populations increased over the brood year. In those areas where reduction in escapement was noted, the level of escapements provides an adequate potential for the 1985 return.

One of the highlights of the season was the relatively low prespawning mortality that was recorded for several important races. The prespawning loss of female sockeye at Horsefly River was only 18.5% in 1981 compared to 40.3% loss in 1977. At Gates Creek there was about 50% loss in creek spawners but only 23% loss in channel spawners. Early Stuart sockeye had a 10.7% loss compared with an average 26.3% prespawning mortality in the previous 4 years. All other major races experienced high success of spawning and the number of effective female spawners (653,000) was 62.0% higher than in 1977 and was the largest since 1957.

In 1972, the Commission began studying the use of acoustics to estimate adult sockeye migrating up the Fraser River. Daily echo sounding estimates of escapement have been obtained since 1974, supplementing the traditional test fishing catch per unit of effort data. The procedure employs a boat mounted echo sounder run repeatedly across the river at Mission for target abundance data and periodic stationary sounding to obtain rate of travel information. In 1981, echo sounding from June 24 to September 13 gave an accumulated escapement of 2,078,000 sockeye migrating past Mission. Escapements to individual spawning grounds plus the recorded Indian fishery catch upstream of Mission totaled 1,749,000 sockeye leaving a discrepancy of 329,000 fish (15.8% of the estimate). This was the largest difference between estimated and accounted totals experienced to date. While the echo sounding procedures do not detect all fish, the data suggest that many fish were not accounted for upstream.

The Indian subsistence catch in the Fraser River watershed was 441,000, the largest on record. The estimated catch for 1981 was about 196,000 larger than that recorded in 1977. It is apparent that the Commission must have not only the current in-season appraisal of the removals made by this fishery but must also anticipate correctly the exploitation rate that will take place in order to ensure adequate escapement of each race. For example, in 1981 the Fraser River Indian fishery catch of one race (Early Stuart) was 32.2% of the total catch of all summer run races, whereas this race formed only 16.1% of the total escapement of these races. In future, management of the various Indian fisheries throughout the Fraser watershed should take into account the specific escapement requirements of each race.

PINK SALMON REPORT

The Fishery

The total 1981 Fraser River pink salmon run was estimated at 18,400,000 fish, double the predicted 9,000,000 return. The total return was the largest under Commission management which started in 1957 and was probably the largest since 1913. Examination of historical data indicates that even further expansion of total production is possible.

The total number of fry produced by the 1979 escapement was 342,000,000 (Table 5), the second largest on record. These fry had a marine survival of 5.4%, exceeding the previous record survival of 5.0% observed for the 1971 run. The benefit of a large fry migration associated with above average marine survival is demonstrated by the 1981 adult return. With the 1961-1975 brood years average fry production of 244,000,000 and using the 5.4% marine survival rate for 1981, the return would have been 13,200,000 pink salmon and using the average of 2.9% marine survival for all years through 1979 return, a run of only 7,100,000 pink salmon would have occurred in 1981.

TABLE 5. Fraser River pink salmon production. (Fry production data not available prior to 1961).

	Brood Year									
	1961	**1963**	**1965**	**1967**	**1969**	**1971**	**1973**	**1975**	**1977**	**1979**
Total Spawners (millions)	1.094	1.953	1.191	1.831	1.529	1.804	1.754	1.367	2.388	3.561
Female Spawners (millions)	.654	1.217	.692	1.015	.961	1.103	1.015	.806	1.421	2.113
Potential Egg Deposition (billions)	1.569	2.435	1.488	2.132	2.018	1.923	1.865	1.493	2.960	3.787
Fry Production (millions)	143.6	284.2	274.0	237.6	195.6	245.0	292.4	279.2	473.3	341.5
Adult Return Catch + Escapement (millions)	5.326	2.271	12.850	3.849	9.707	6.753	4.867	8.173	14.100	18.400
Freshwater Survival	9.2%	11.7%	18.4%	11.1%	9.7%	12.7%	15.7%	18.7%	16.0%	9.0%
Marine Survival	3.7%	0.8%	4.7%	1.6%	5.0%	2.8%	1.7%	2.9%	3.0%	5.4%

The total number of pink salmon entering Convention Waters in 1981 was estimated to be 13,091,000 fish (Table 6) compared to 12,951,000 in the brood year. Fraser River pink salmon formed 93.5% of the total in 1981. The harvest of 292,000 United States pink salmon stocks in

Convention Waters constituted 39.5% of the United States run to Convention Waters, whereas 62.9% of the Fraser run to Convention Waters was harvested.

TABLE 6. Calculated catches and percentage harvest from pink salmon runs entering Convention Waters in 1981.

	Source of Run			
	United States	Fraser River	Canada Non-Fraser	Total
Total entering Convention Area	739,000	12,236,000	115,000	13,091,000
Catch in Canadian Convention Waters Westerly of William Head	244,000	3,557,000	38,000	3,839,000
Easterly of William Head		348,000		348,000
Total	244,000	3,905,000	38,000	4,187,000
Percent Harvest	33.02	31.91		
Catch in United States Convention Waters	48,000	3,787,000	41,000	3,876,000
Percent Harvest	6.50	30.95		
Total Catch in Convention Area	292,000	7,692,000	79,000	8,063,000
Percent Harvest	39.51	62.86		

The 1981 catch in Convention Waters was 8,063,424 pink salmon compared with 8,177,628 in 1979 (Appendix Table XI). The division of catch was Canada 4,187,853 (51.94%), and the United States 3,875,571 (48.06%).

The total troll catch of pink salmon of all stocks off the Washington and Vancouver Island coasts was estimated at 2,886,000 fish in 1981 (Table 7). In the previous cycle years (1977 and 1979), the coastal troll catch had reached 2,031,000 and 3,744,000 fish, respectively. Not only did the total 1981 catch in this fishery decline by 858,000 fish relative to 1979, but also the percentage which this catch formed of the combined coastal troll and Convention net fishery catch declined to 29.5% compared with 39.6% and 37.0% in 1977 and 1979.

TABLE 7. Pink salmon catches inside and outside of Bonilla Point Line.

Year	Convention Waters Inside Catch	Washington-B.C. Coastal Troll Catch (Grays Hrbr.-A.27)	Troll Catch % of Inside plus Coastal Catch
1957	5,205,000	278,000	5.08
1959	4,378,000	497,000	10.20
1961	936,000	220,000	19.02
1963	7,749,000	1,212,000	13.52
1965	1,004,000	217,000	17.79
1967	6,870,000	1,709,000	19.92
1969	1,553,000	568,000	26.77
1971	4,075,000	989,000	19.53
1973	3,856,000	869,000	18.39
1975	2,263,000	686,000	23.26
1977	3,098,000	2,031,000	39.60
1979	6,367,000	3,744,000	37.03
1981	6,902,000	2,886,000	29.48

The catch distribution in Canadian Convention Waters showed that 91.7% of total catch was made westerly of William Head, a slight decline from the 97.7% catch recorded in this area in 1979. In all of Canadian Convention Waters, trollers took 1,045,791 pink salmon (25.0%) about 500,000 fewer than in 1979 and a reduction in percentage from 37.4% in the brood year. The catch of 2,794,078 pinks by purse seines was the largest since 1963 as was the percentage (66.7%). The gill net catch of 347,984 (8.3%) was more than three times larger than in the brood year.

In United States Convention Waters, purse seines caught 3,310,281 pink salmon (85.4%), almost equal to the large catch made in 1979 (3,354,000) and the percentage taken was the highest since 1955 (86.2%). The catch by gill nets was 308,649 (8.0%) compared with 389,000 (9.6%) in 1979. The reef net catch increased to 80,148 (2.1%) in 1981 from 42,771 (1.1%) in 1979 and was the largest catch for this gear since 1973 (102,000). The percentage taken by reef nets was the highest since 1975 (4.4%). The coastal troll catch declined to 176,493 (4.6%) partly as a result of Washington State Department of Fisheries possession restrictions on pink salmon imposed near the peak of the pink salmon season. Included in the United States total catch of 3,875,571 pink salmon are 838,000 fish (21.6%) caught by Treaty Indians fishing under United States Government regulations.

There are three basic methods used in season to estimate the size of the Fraser pink salmon run; the relative number of pink salmon taken in the coastal troll fishery, the average weight of pink salmon, and the maximum two-day mean catch per purse seine taken near the peak of the run in the Canadian Area 20 fishery. Using troll landings alone, the 1981 Fraser run, because of the significant decline in total catch by trollers, was indicated to be below the 1979 run size of 14,100,000. However, troll regulations imposed in 1981 as well as the availability of fish to the gear and other factors may have had an impact on catch. The fish were small in 1981 (4.9 pounds) just slightly larger than in 1979 (4.8 pounds) and this data suggested a run from 13,000,000 to 15,000,000. Purse seine catch information from the commercial fishery in Area 20 indicated a return of about 15,000,000. Catch information during the season in Area 20 must be interpreted in light of catches made in the non-Convention Waters fisheries of Johnstone Strait to accurately evaluate run size. From 1959 through 1979 the annual percentage of the total Fraser pink salmon run migrating through Johnstone Strait has varied from a low of 22.2% in 1973 to a high of 41.5% in 1971, with the average at 28.0%. In 1981 the diversion rate is estimated at 32.9%, slightly above average. Thus, all the in-season indicators of Fraser pink salmon pointed to a total run at least 3,000,000 less than the actual. Purse seine catches in Area 20 also consist of non-Fraser pink salmon stocks. Below average returns to rivers in Washington State and in northern Georgia Strait contributed to the underestimation. However, subsequent evaluation of the numbers of pink salmon delaying in Georgia Strait off the mouth of the Fraser River based on analysis of catches in adjacent fisheries, suggested a total run near the actual.

Escapement

Fraser pink salmon are harvested primarily by the coastal troll fishery and net fisheries operating in Juan de Fuca Strait and Puget Sound and in Johnstone Strait. Those fish escaping capture enter Georgia Strait but delay off the mouth of the Fraser River before proceeding upstream to spawn. As a consequence of this delay the commercial harvest is virtually complete by the commencement of upstream migration. Regulation of the fishery to obtain an escapement goal, therefore, depends upon accurate estimation of the cumulative escapement into Georgia Strait through the period of commercial fishing. Methods have been devised to make in-season estimates of cumulative escapement.

By using the number of days fishing in Area 20, United States waters and in Johnstone Strait and the associated calculated purse seine equivalents, the relative efficiency of the fisheries can be estimated based on several previous years' data. Applying the exploitation rate estimate to the current year's catches in these areas gives an estimate of the numbers of pink salmon escaping

these fisheries during the current season. The in-season estimates indicated a net pink salmon escapement about 100,000 more than that realized. Post-season review of the final data indicated that the catch in Johnstone Strait was larger than estimated in season by about 700,000 fish but that an offsetting higher exploitation rate gave escapement estimates comparable to those made in season.

The 1981 escapement of pink salmon to the Fraser River spawning areas was 4,488,336 fish (Appendix Table XIV), or about 24.3% of the total run. In addition, an estimated 56,202 pinks were caught in the Fraser River Indian fishery making a total gross escapement of 4,544,538, the largest escapement back to 1957 when enumeration started. The total run reaching Convention Waters was 12,236,000 and 36.7% reached the spawning grounds. It is possible that the 1981 escapement reaching the spawning grounds was the largest since 1911.

The escapement of Early run pink salmon was 4,097,269, the largest on record. The 1981 escapement exceeded the previous maximum recorded in 1979 by about 942,000 fish. The Thompson River escapement of 1,162,754 was the largest on record exceeding the previous largest escapement of 972,941 fish in 1977. The Seton Creek escapement was 563,641 spawners compared with the brood year escapement of 593,962. The two spawning channels accommodated 44,248 pink salmon in 1981.

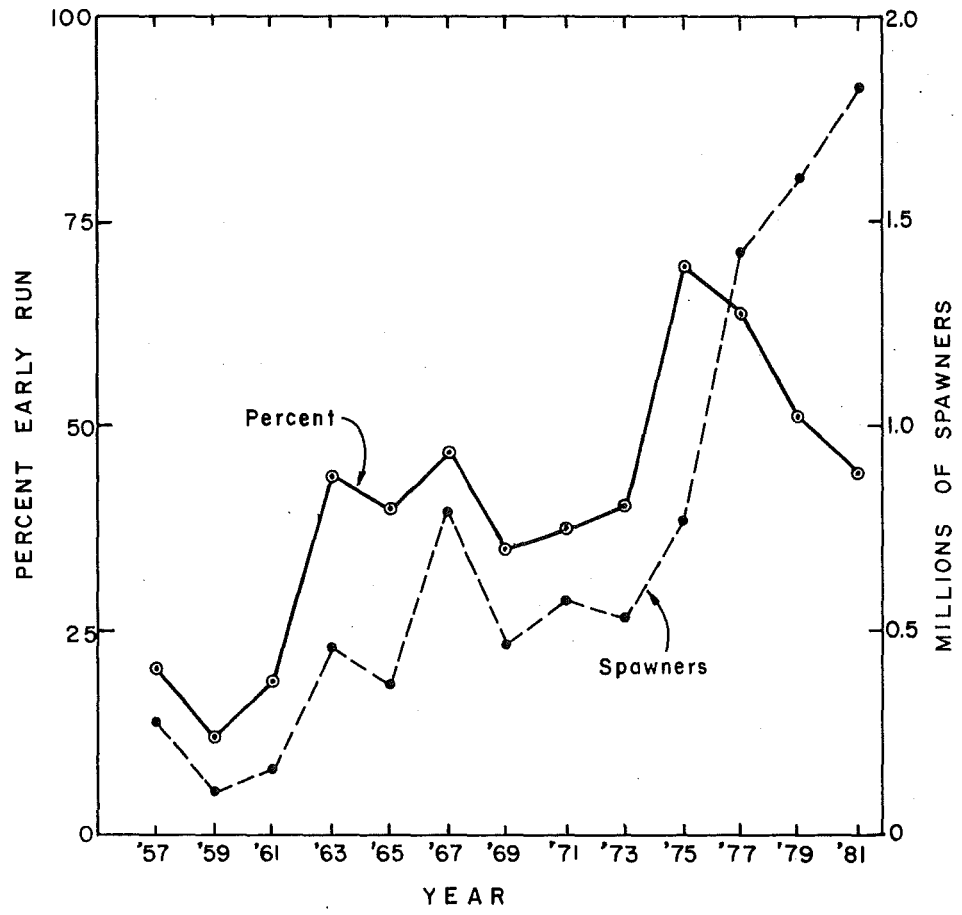

FIGURE 2. Percent of total Early run escapement spawning above Hell's Gate and number of spawners.

The percentage of the Early run escapement spawning above Hell's Gate increased steadily from about 20% in the late 1950's (Figure 2) to a maximum of 70% in 1975 followed by a sharp decline in each succeeding year to about 45% in 1981. The declining percentage as shown has been associated with the years (1977, 1979 and 1981) of largest escapement above Hell's Gate of 1,418,000, 1,609,000 and 1,828,000 in the respective years.

Visual observations in the Fraser River canyon during upstream migration showed that fish were congested in the Saddle Rock area and congestion was also observed below the fishways at Hell's Gate. Possibly because of the large numbers of fish, low water levels and slower travel rates, a significant proportion of pink salmon that eventually did pass Hell's Gate were extended in their migration but no adverse effects were detected at any of the spawning areas as success of spawning was normal.

The other major segment of the Early run spawns in the Fraser River below Hope and the escapement of 2,252,368 pink salmon to this area was the largest on record. The previous largest escapement was in the brood year when 1,521,856 fish spawned in that area.

The total Late run escapement of 391,067 was slightly below the brood year level of 405,709. Thus, whereas the total Early run escapement in 1981 increased by about 29.9% compared with the brood year, the Late run escapement decreased by 3.6%. The Harrison River escapement of 314,519 was the largest since 1963 and about 45,000 larger than in 1979. The escapement to the Chilliwack-Vedder River was 68,601 or about 55,000 less than in 1979.

Total Early run escapements have increased by 277% from 1975 to 1981 whereas the Late run escapement has increased by only 40% during the same period. It is quite apparent that the large returns in recent years have come from the Early run stock. Spawning and incubation conditions are generally favorable for the Early run and the Late run is subjected to frequent floods.

Stocks of pink salmon destined for areas other than the Fraser River are also found in Convention Waters. The escapements into Canada non-Fraser rivers located north of the Fraser River showed improvement but escapement to Puget Sound rivers in Washington State showed a substantial reduction compared with the brood year (1979) (Appendix Table XV).

The migratory behavior of Fraser pink salmon in the river differs somewhat from sockeye and reliable estimates of escapements have yet to be achieved by echo sounding techniques. Pink salmon exhibit more shore and surface orientation. The echo sounding data gathered in 1979 using a boat transecting mode of operation greatly underestimated the pink salmon escapement, possibly due to avoidance of the boat by the migrating fish. During the 1981 pink salmon migration, the Commission collected all target abundance data using two down looking transducers operated in stationary modes thereby reducing the local disturbance of the boat and hopefully reducing potential avoidance problems. The record escapement of 4,545,000 pink salmon was enumerated during upstream migration between September 2 and October 3. Echo sounding gave an in-season estimate of 5,533,000 pink salmon to October 3. Considering that some additional escapement occurred after this date, the estimate was about 30% high. The major difficulties appeared to be associated with the extremely high target densities which occurred for several days at the peak of migration. Improved echo sounding equipment and data handling techniques are required in order to reduce these estimation errors.

SPAWNING CHANNEL OPERATIONS

Fry production from the 1980 spawning of sockeye at channels operated by the Commission totaled 70 million (Table 8). At Upper Pitt the fry output was again above average and

TABLE 8. Sockeye fry production from the 1980 brood at spawning and incubation channels.

Site	Egg Deposition	Fry Produced	Percent Survival
Upper Pitt	4,863,000*	3,908,000	80.4
Weaver Creek	94,722,000	52,603,000	55.5
Gates Creek	29,723,000	11,469,000	38.6
Nadina River	4,918,000	1,962,000	39.9

*eggs taken

was the third largest from the incubation channel. At Weaver Creek the channel fry output was the second largest on the cycle and also for all years. This production came from a record high density of sockeye spawners in the channel (1.31 females per sq. yd.) and still does not show much effect of density of spawners on fry output (Figure 3). At Gates Creek the channel fry output was also the second largest on the cycle and for all years. This production came from the highest density of spawners yet obtained in the channel (0.95 females per sq. yd.), but egg to fry survival was the lowest of any year. Sampling of the dead eggs after completion of emergence of the fry indicated that the mortality occurred at an advanced eyed stage, and an extreme freshet in late September 1980 was indicated as the probable cause. Egg losses were greatest at the upper end of the channel where the heaviest spawning occurred. This section of the channel is most affected by silt in the water supply due to the filtering action of the gravel. It was concluded that the combination of siltation and high density of spawners was responsible for the low survival. At Nadina River the fry output was the largest yet for this cycle year. The egg to fry survival of 39.9% was well below the average of 64% for the seven preceding years. The low survival could not be attributed to density of spawners because of the small spawning population of only 1,632 spawners. Detailed examination of the channel after completion of fry emergence showed few dead eggs remaining and no reason for the low survival was found.

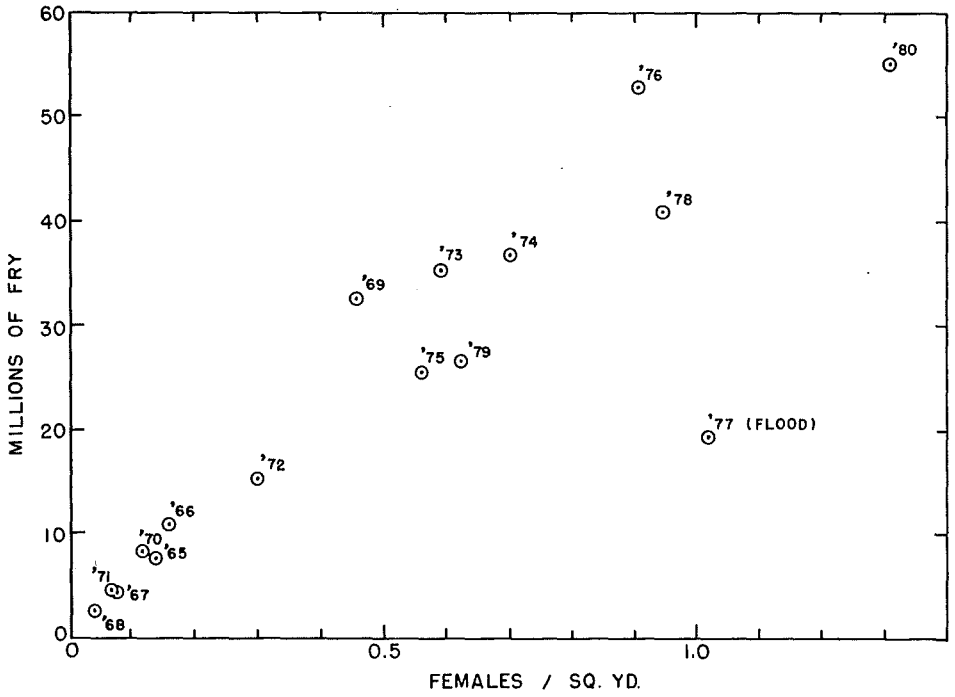

FIGURE 3. Relation between density of female sockeye spawners and fry production at Weaver Creek spawning channel.

The total Pitt River sockeye return in 1981 was estimated at 101,000, of which 23,000 were produced by the incubation channel (Figure 4). The low production for both the 1980 and 1981 returns is probably attributable to poor survival of 4- and 5-year-old fish related to the large fry output from the 1976 brood. The total Weaver Creek sockeye return in 1981 was estimated at 162,000, of which 158,000 were produced by the spawning channel (Figure 5). This was the return from the brood year (1977) that was severely affected by a fall flood in Weaver Creek, otherwise the return would have been greater. The total Gates Creek sockeye return in 1981 was estimated at 21,900 of which 19,500 were produced by the channel. This is about double the production on the previous cycle year for this off cycle year. The total Late Nadina River sockeye return in 1981 was estimated at 148,000, of which 146,000 were produced by the channel. This is about 1.8 times larger than the return on the previous cycle and the second largest return so far from the channel.

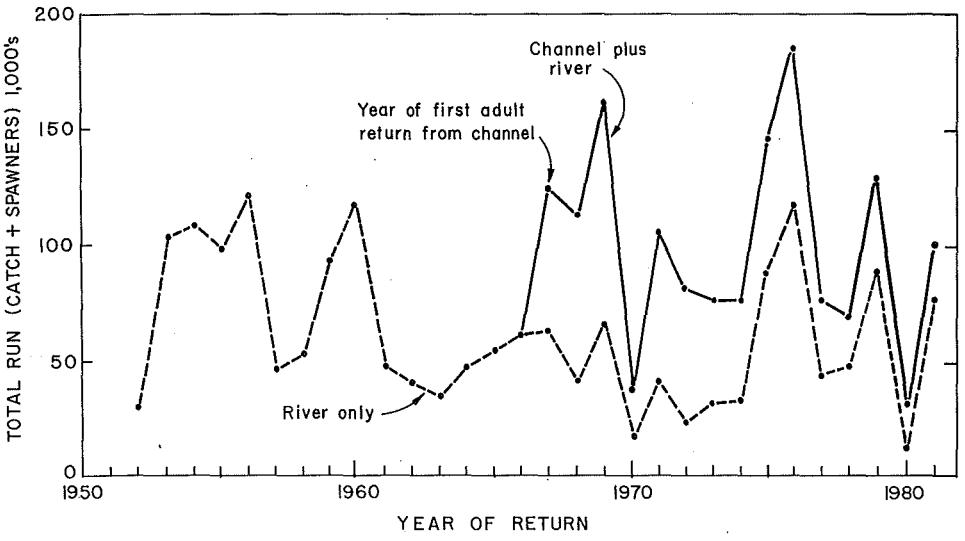

FIGURE 4. Sockeye production from Pitt River and Pitt River incubation channel, 1952-1981.

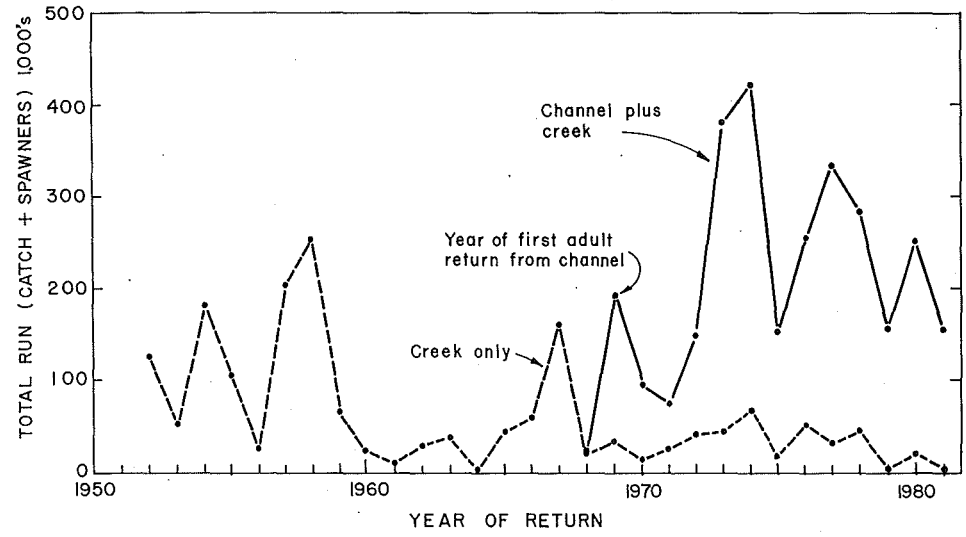

FIGURE 5. Sockeye production from Weaver Creek and Weaver Creek channel, 1952-1981.

In the fall of 1981, 4,563,000 eggs were taken at Upper Pitt River for the incubation channel. At Weaver Creek the number of sockeye spawners was restricted to 18,715 adults to obtain a combined channel and creek fry output believed to approximate the optimum for the rearing area utilized in Harrison Lake. Further clarification of the factors affecting the freshwater survival of Weaver Creek and Pitt River fry is needed. At Gates Creek channel there were 3,896 adult spawners, compared to 1,531 in 1977. The spawners were confined to the lower half of the channel to avoid the silted area at the upper end of the channel. At Nadina River channel, there were 17,888 adult spawners, compared to 16,286 on the previous cycle. The channel was divided into two halves and spawners were about equally divided in the two sections. This was done to avoid the congestion of spawners that usually occurs at the upstream end of the channel.

RESEARCH

The start of an investigation into the possible advantages of bypassing Gates Creek sockeye fry past Anderson Lake into Seton Lake was mentioned in the 1978 Annual Report. Adults of the marked fry returned in 1981 and the comparative survival of the two groups of marked fry indicates a survival disadvantage in bypassing Anderson Lake. This agrees with previous conclusions based on the relative survival of jack sockeye that returned last year.

Research into the lacustrine biology of sockeye salmon continued in 1981. The primary emphasis in hydroacoustic surveys in 1981 was given to Cultus Lake. This emphasis was based upon the need for evaluation of the statistical parameters affecting the results generated by the hydroacoustic system as well as implementation of an on board digital echo integrator. The objective is to simplify data processing through automation.

Other lake systems sampled hydroacoustically during the year included Takla, Trembleur, Stuart, Pitt, Quesnel, Seton and Harrison Lakes. The analysis procedure will continue as in the past on these lake systems.

The hydroacoustic system used is dependent upon the evaluation of recorded echo returns in conjunction with echo integration. Steps have been initiated in 1981 to simplify the estimation procedure by direct in-field scaling of the integrated results. This requires collecting information on target strength of the target species as well as other abundant resident species. The in-field integration of echoes on several lake systems was undertaken and proved to be feasible using a microprocessor-based integrator. Steps also have been taken to link this equipment to a general purpose microcomputer such that peripheral processing might be conducted without the need for data conversion. Refinement of this process will constitute a major gain in data handling capabilities in the future.

Plankton surveys were carried out simultaneously with the acoustic surveys. These included Clarke-Bumpus tows for stratified species identification, Wisconsin hauls for standing crop analysis and conductivities, transparencies and temperature profiles. Additional plankton surveys were carried out on Chilko, Fraser and Francois Lakes.

A program was carried out to test the effectiveness of freeze-dried plankton as a diet for newly emerged sockeye fry. Fry were fed a commercially prepared diet as a control. Fish were fed for six weeks at a temperature of 5.5 degrees C. The plankton-fed fish fed more vigorously and were significantly larger at the end of six weeks. It was concluded that fresh freeze-dried plankton is an excellent starter diet for sockeye.

The program to restore the Upper Adams sockeye population reported in the 1980 Annual Report continued in 1981. In the spring of 1981, 380,000 fry were transferred in three lots to floating rearing ponds in Adams Lake at the mouth of the Upper Adams River. These fry were reared for a mean of 31 days ranging from 40 days for the first lot to 18 days for the last group. The rearing had to be terminated earlier than planned because of problems with the quality of

the food supply. In spite of this 334,079 fry imprinted on Upper Adams River water were released to Adams Lake on June 1, 1981. Adult returns are expected in 1984 and an assessment of this program will be made at that time.

Tests started in 1980 and referenced in the Annual Report of that year, have shown that DCAF, a fluorescein compound, appears to be an effective agent for marking sockeye salmon fry. Fry fed a diet mixed with DCAF solution for one week had green fluorescence present in their scales when sampled two months later. After eight months the fluorescence was somewhat weaker, but still detectable. Mortalities in both a control group and the group fed DCAF were extremely low with no difference between groups. Examination of DCAF marked scales requires fluorescence microscopy capability which may make it impractical for some tests, however, it does appear to be an effective marking technique for sockeye fry.

The much higher than predicted marine survival of the 1979 brood pink salmon fry shows the multi-factor method used in making the prediction is inadequate. Preliminary review after the 1981 pink salmon run was complete suggests a single factor method using data from a number of points in the vicinity of S.W. Vancouver Island should be given more consideration.

Mid-ocean sea surface temperatures again worked well in 1981 to predict trends in the return timing of Fraser sockeye. The prediction was almost exactly correct for the Early Stuart sockeye return which showed an average timing. The prediction for Horsefly sockeye was for the latest ever return by a day or so and the actual return was the latest by 5-6 days. It was difficult to compare predictions made for returns via the normal Juan de Fuca Strait route with actual timing in 1981, as most of the Horsefly sockeye returned via Johnstone Strait. Fraser pinks returned a little earlier than predicted. Before the 1981 season, winter sea surface coastal transport and early summer coastal sea surface temperatures indicated the strong possibility that a large proportion (greater than 50%) of the Fraser River sockeye would return via Johnstone Strait. The actual Johnstone Strait percentage in 1981 was 69% and so the general usefulness of these two preseason environmental indications (at least in years of extreme values) was evident. However, the considerable weekly variation in sockeye diversion percentage proved to be surprisingly unpredictable by any pre- or in-season environmental indicator. The first attempt at predicting the Johnstone Strait diversion of Fraser pinks using winter rainfall and sea surface transport indicated a diversion of 25% and the actual diversion was 33%.

ENVIRONMENT PROTECTION

Quesnel River Pulp Company commenced operation of a thermomechanical pulp mill at Quesnel in November. Effluent treatment consists of sedimentation to reduce suspended solids followed by 5-day treatment in an aerated lagoon to reduce toxicity. Effluent is discharged to the Fraser River through a diffuser. The discharge permit issued by the B.C. Waste Management Branch specifies Level A Objectives which means that at least 50 percent of fish must survive a 96 hour bioassay of undiluted effluent.

Several samples of effluent from Cariboo Pulp and Paper, also at Quesnel, failed to meet detoxification criteria. Upsets in the pulp mill causing extra loading on the aerated lagoon were apparently partly responsible for poor performance. Temporary measures were taken to assist the treatment system to process the extra load. Although reported to be under study, a long-term permanent solution to the problem of sub-standard treatment had yet to be announced.

Effluents from two bleached kraft pulp mills at Prince George are pretreated, combined and detoxified in a 245 million U.S. gallon (927,000 cu m) aerated lagoon providing about 4.3 days treatment time before discharge to the Fraser River via a surge pond connected to a multi-port diffuser. On December 28 about 75 feet (23 m) of dyke enclosing the aerated lagoon was washed out

near the outlet when the dyke was overtopped. About 120 million U.S. gallons (454,000 cu m) of effluent and 71,000 cu yds (54,000 cu m) of sand-silt soil were lost to the Fraser River. Although it was evident that the dyke was overtopped owing to a restriction somewhere in the discharge system, the exact cause was not determined. Both mills were shut down on December 25 and 26 and start-up procedures commenced on December 27. Thus, most of the effluent in the aerated lagoon would have had several days treatment before the dyke was breached. Prince George Pulp and Paper ceased operating when the breach occurred but Intercontinental Pulp and Paper continued operating, using the 24 hour pretreatment lagoon. Dyke restoration was sufficient to prevent drainage to the river by December 30 and the dyke was brought to its original elevation on January 1. The aerated lagoon was returned to service January 2, 1982, when both mills began operation. Sand-silt washed into the Fraser when the dyke breached was deposited around the diffuser. Regulatory agencies approved a plan to remove this material and use it to repair gullies eroded in the riverbank by the effluent.

Northwood Pulp and Timber Company is doubling their kraft pulping and bleaching capacity at Prince George. A second aerated treatment lagoon will be constructed adjacent to the existing one. By reducing wastewater discharge per unit of production and adding the second treatment lagoon, treatment time is expected to equal eight days.

The Weldwood plywood mill in Quesnel applied to the Waste Management Branch to discharge nine million gallons of log pond water to the Fraser River following treatment with activated charcoal. The application was made because it appeared water in the log pond would overtop the dykes separating the pond from the river. Normally, excess water was lost by exfiltration through the dykes but these had sealed. Laboratory tests conducted by a consultant indicated the proposed treatment would detoxify the pond waters. After hearing recommendations developed jointly by the Environmental Protection Service, Canada Department of Fisheries and Oceans and the Commission, the Waste Management Branch authorized three discharge periods of treated effluent to be completed before April 15, 1981. Prior to each discharge a sample of activated charcoal treated wastewater was bioassayed by the consultant and detoxification was confirmed.

Commission staff continued a cooperative study with the Chemistry Department, University of British Columbia, to define the metabolic processes by which resin acids in pulp mill wastes are detoxified by selected microorganisms. The studies identified the metabolites formed when dehydroabietic and isopimaric resin acids were metabolised by the fungi *Mortierella isabellina.* Bioassays of metabolites using *Daphnia pulex* demonstrated a large decrease in acute toxicity when compared to the parent resin acids. The project is continuing with emphasis on detoxification of chlorinated resin acids.

Eurasian water milfoil *(Myriophyllum spicatum),* the nuisance weed which has invaded lakes in Washington and British Columbia, was discovered in the Salmon Arm area of Shuswap Lake this summer by the B.C. Aquatic Studies Branch as part of a surveillance program. According to surveys, Cultus Lake is the only other sockeye rearing lake in the Fraser River basin containing milfoil. At Cultus Lake, diver dredging, bottom barriers made of burlap or fiberglass and floating rotovators have been used to control growths under a program sponsored by the B.C. Ministry of Environment and local governments. A proposal to use the herbicide 2,4-D in selected areas of Cultus Lake in 1981 was withdrawn.

Initially, milfoil in Shuswap Lake was discovered in three patches totaling 15 acres (6 ha) at Sandy Point and Captains Cove in Salmon Arm and at Sicamous Narrows where Mara Lake joins Shuswap Lake. In an emergency program initiated by the Aquatic Studies Branch of the Ministry of Environment, some milfoil was removed by diver dredging while other plants were covered with bottom barriers. In a subsequent survey, single milfoil plants were observed at six additional sites in Salmon Arm. Thus, although milfoil was widespread in Salmon Arm, the infestations were considered sparse.

So far milfoil has not affected sockeye adversely in Cultus Lake but it has the potential to overgrow beach spawning areas in Cultus and Shuswap Lakes unless controlled. Heavy growths of milfoil at Sicamous Narrows might also interfere with migration of juvenile sockeye from Mara to Shuswap Lake. The Commission keeps abreast of infestation and control measures concerning milfoil through its representation on the Aquatic Weed Advisory Committee.

Public hearings were held by the Pollution Control Board in 1980 concerning discharges of municipal sewage to the Fraser River estuary. The Commission cooperated with Canada Department of Fisheries and Oceans and Environmental Protection Service in preparing briefs and presenting testimony. The Board announced its conclusions in late 1980 and if their recommendations are followed the sequence of events would be:

a) An immediate start on upgrading the Iona Island treatment plant to meet Level AA Objectives for embayed marine discharges.

b) The effluents from Annacis Island and Lulu Island treatment plants would meet Level AA Objectives for river discharge by 1990.

Subsequent to the findings of the Pollution Control Board, charges were brought against the Greater Vancouver Sewerage and Drainage District (GVSDD) by the province on four counts relating to the discharge from Iona Island sewage treatment plant. In Provincial Court, April 3, 1981, the Court ordered a suspended sentence for two years and specified that a study group composed of federal, provincial and GVSDD representatives examine and recommend on the options available and the costs and benefits of improving the quality and location of the Iona discharge. The foregoing condition was also imposed as a consequence of a later charge under the Fisheries Act pertaining to the Iona discharge brought against the GVSDD by the B.C. Union of Indian Chiefs. A member of the Commission's staff was subpoened to present testimony concerning the toxicity of chlorinated primary sewage to aquatic life. Alternatives to be considered by the Study Group for the Iona discharge included secondary treatment and extension of the outfall into deep water off Sturgeon Bank. The Commission is cooperating with Canada Department of Fisheries and Oceans in reviewing and commenting on the alternatives.

Chlorine residuals remaining in municipal sewage after disinfection are potentially toxic to aquatic life but can be removed by dechlorination. When commenting in 1978 on plans to upgrade the sewage treatment plant at Harrison Hot Springs to accommodate a greater sewage load it was recommended that dechlorination be adopted. Chlorine residuals are of special concern in this case because the effluent is discharged where Harrison River leaves the lake and this area is very important to sockeye and pink salmon. The Waste Management Branch has now directed that dechlorination be included in the treatment process.

Surveys were conducted in the Nechako River during 1981 to obtain additional data on reaeration coefficients. This information was needed in connection with studies of possible gas supersaturation in the river in the event of further reduction in flow in the Nechako River because of the Kemano Completion proposal under investigation by the Aluminum Company of Canada. Measurements of dissolved nitrogen in three river reaches from Cheslatta Falls to Vanderhoof were used to calculate reaeration coefficients since these determine the rates at which supersaturation is dissipated due to river turbulence. Reaeration coefficients were combined with termperature predictions to calculate values for supersaturation throughout the Nechako River. The results of these analyses of supersaturation will form part of the Commission's assessment of the Alcan proposal.

B.C. Hydro and Power Authority issued an Environmental Impact Statement (EIS) concerning their proposal to develop a 2000 megawatt coal-fired power plant and mine in the Hat Creek area between the Thompson and Fraser Rivers. The gaseous emissions from burning coal contain oxides of sulfur and nitrogen which are projected to cause an increase in acid content of dry and wet deposition at points downwind. However, the technology is available to reduce

substantially the acid forming substances in gaseous emissions. The Commission is participating in an assessment of the Hat Creek project by a Federal Regional Screening and Coordinating Task Force. To assist in this assessment, the Commission and Canada Department of Fisheries and Oceans undertook a water sampling program to determine whether salmon-supporting water bodies downwind of Hat Creek may be sensitive to acid deposition. Samples are being collected on a seasonal basis with greatest emphasis on spring runoff since most of the acids deposited on snow throughout the winter are released during the early stages of snowmelt. Using the sensitivities of lakes and streams and a mathematical model of acid deposition from Hat Creek developed by Atmospheric Environment Service, the potential impact of gaseous emissions will be assessed.

A water quality monitoring program continued at Weaver Creek spawning channel to monitor incoming water from the Sakwi Creek and Weaver Lake basins. The amount of suspended sediment entering Sakwi Creek from the Hemlock Valley ski area decreased owing to reseeding and control of soil disturbance. The ski resort project is under a development plan administered by the B.C. Ministry of Lands, Parks and Housing. Through a referral process the Commission reviewed the proposed development plan and offered recommendations.

Silt-laden runoff from clay banks along the road to Hemlock Valley was the remaining major source of sediment in Sakwi Creek. In the past, rock filled gabions were placed to create retaining walls and embankments were reseeded by Department of Highways. Some changes in road alignment were made in 1981 to improve bank stability and reduce erosion. These projects have had a beneficial effect.

Water sampling continued in the Nadina River basin to monitor the effects of logging and road construction on suspended sediment loads. Through the Engineering Division, sources of sediment were identified and corrective action recommended during on-site inspections by a federal-provincial resource committee to correct conditions causing discharges of sediment from logging and road construction.

Bioassays using fish are specified by the Waste Management Branch to monitor detoxification of effluents. The Commission concurs with this concept since it provides a measurement of the safety of an effluent for aquatic life which chemical analyses alone cannot. However, various types of bioassays and procedures are possible, sometimes leading to conflicting interpretations. To overcome this problem a task force, including the Commission, was formed to develop guidelines and standard procedures for bioassays. The task force recommendations are expected in 1982.

ENGINEERING

In 1981, the Commission continued investigations into the potential impacts of Alcan's proposed expansion of the existing Nechako-Kemano hydroelectric development. In conjunction with the Canada Department of Fisheries and Oceans and the British Columbia Fish and Wildlife Branch, the Commission provided Alcan and its consultants with data for assessment of potential effects of the project, and participated in workshops to discuss various topics. The Commission is preparing a report to present its findings and recommendations which should be completed during 1982.

In 1981, Alcan agreed to continuation of the 1980 Supreme Court Order concerning flows in the Nechako River. The Commission participated in a cooperative program with the company and the Canada Department of Fisheries and Oceans to determine on a daily basis the volume of spill required to limit Nechako River mean daily temperatures to a maximum of 68°F. A practical method was developed for predicting river water temperatures on the basis of 5-day forecasts of meteorological data. This 5-day warning of impending high temperatures was required because of

the water travel time from the reservoir to the critical high temperature river reach immediately upstream from Stuart River.

As indicated in Figure 6 the program was reasonably effective in limiting the occurrence of high temperatures. During a period of very hot weather that occurred while Nadina sockeye were migrating, temperatures in the Nautley-Stuart reach exceeded 68°F for only 5 days. Furthermore,

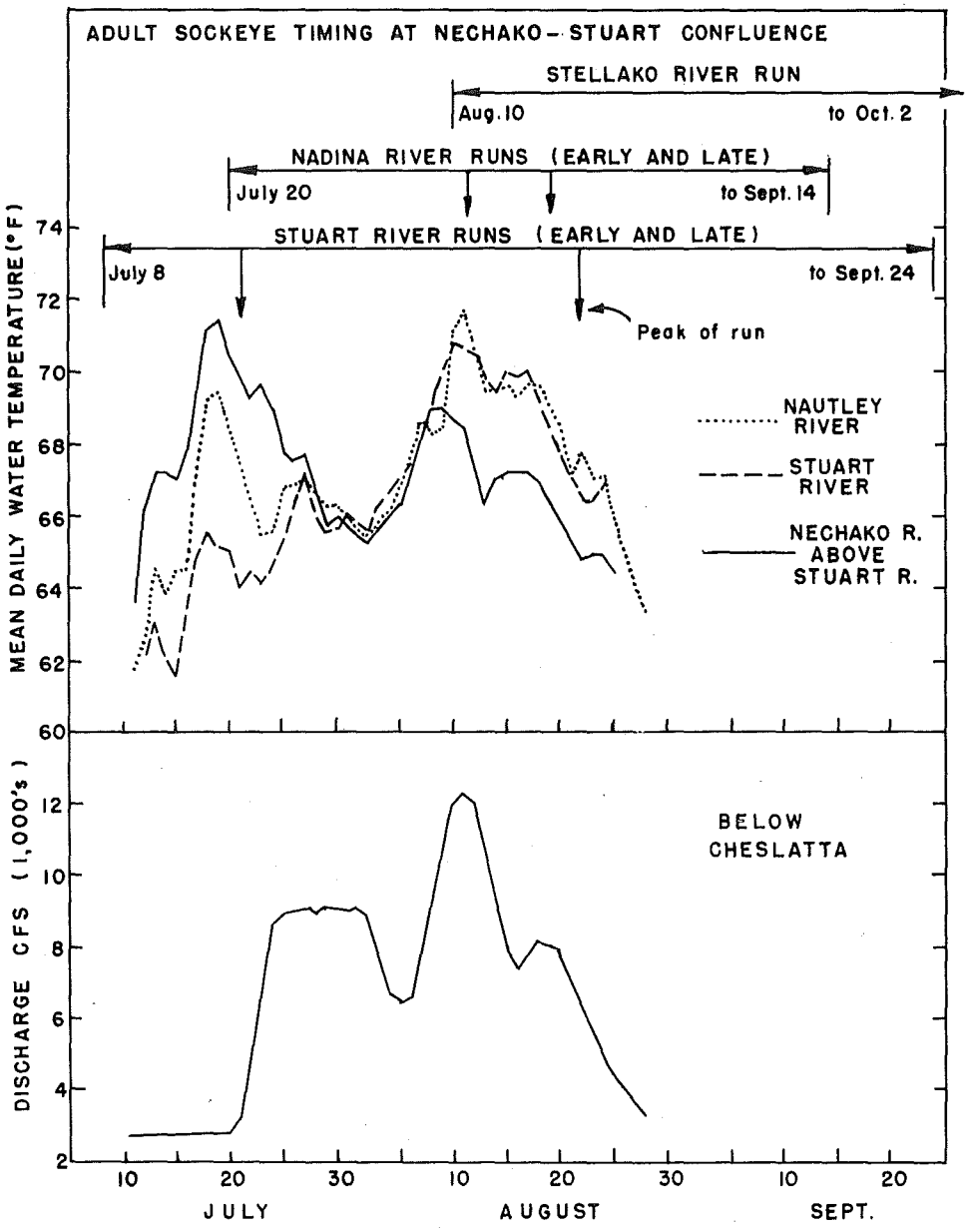

FIGURE 6. Mean daily Nechako temperatures in relation to sockeye timing and discharge from the Nechako reservoir in 1981.

the Nechako River temperatures exceeded the critical level by a maximum of only 1°F. This year, dead sockeye were reported in Stuart River during a period when the mean daily temperatures ranged between 69.4 and 70.8°F for 10 consecutive days.

Studies in cooperation with B.C. Hydro and Power Authority at the Seton Creek hydroelectric installation in 1981 confirmed that diversion of Cayoosh Creek to Seton Lake would solve the long-standing problem of delay and loss of adult sockeye in the powerhouse tailrace. On the basis of radiotelemetry studies of migration behavior and preference trough studies of the response of sockeye to various concentrations of foreign water, it was concluded that permanent facilities should be provided for diversion of Cayoosh water into Seton Lake to reduce the concentration of Cayoosh water in Seton Creek to a maximum of 20% during the Gates Creek run and 10% during the Portage Creek run. Studies of the downstream migration of sockeye smolts were also continued at the Seton Creek installation in 1981. In addition to determining the daily and seasonal timing of the migration, these studies again showed that virtually all of the smolts pass through the turbine in migrating from the lake and that it is not practical to alter the daily period of turbine operation to direct the fish toward the less harmful spillway exit at this plant. Sporadic turbine operation, by changing the Seton Lake outlet discharge, caused the fish to delay in the lake, which could have a serious adverse effect on their survival.

The Commission's participation in the Nadina Resource Committee was continued in 1981 in an effort to minimize adverse effects of logging and road building in the Nadina River watershed. The Commission has cooperated with the Canada Department of Fisheries and Oceans, the British Columbia Ministry of Forests, the British Columbia Fish and Wildlife Branch and the logging companies to review logging plans, monitor work in progress and record any changes in water quality. This cooperation appears to have minimized potential adverse effects of Nadina logging and the Commission has recommended that the same approach be used in other important sockeye producing areas in the northern part of the Fraser River watershed, where the spawning grounds are particularly susceptible to the adverse effects of logging.

Frequent meetings were held with engineering and environmental consultants concerning the proposal by Canadian National Railways to construct a second track through the Thompson and Fraser River canyons and the proposal by B.C. Hydro to build a water intake in Thompson River for the Hat Creek power project.

The frequency of occurrence of severe floods in Weaver Creek appears to have increased in recent years. Flooding damages the stream banks and the excessive watershed erosion causes bedload deposition in Weaver Creek, resulting in dispersal of the stream over a wide area. To maintain the stream in a single channel of sufficient depth to enable safe migration of fish to and from the spawning channel, it is necessary to excavate the streambed and rebuild the stream banks. A major flood occurred in January 1981 and excavation was required prior to fry emergence. Further work was required in September to obtain satisfactory conditions for migration of adult sockeye and to restore normal operation of the diversion structure for leading fish into the spawning channel, for diverting surplus fish past the channel and for diverting flow into the intakes on Sakwi and Weaver Creeks.

The McKinley Lake pipeline and dam were operated from August 20 until September 19 to improve temperatures for migration and spawning of the McKinley Creek sockeye population.

The Nadina spawning channel was cleaned in 1981, the last cleaning having been done in 1977. Excellent cleaning was accomplished by using a gradall to drag the air-water gravel cleaner through the channel. There was not sufficient flow available to permit cleaning the Weaver Creek spawning channel. The Pitt incubation channel was cleaned manually by hand digging and washing the gravel with a hand-held high-pressure waterjet. The Gates and Seton Creek channels did not require cleaning in 1981.

TABLE I

SOCKEYE CATCH BY GEAR

Gear		1969	1973	1977	1981
United States Convention Waters					
Purse Seines	Units	183	151	212	171
	Catch	991,598	1,410,499	822,995	616,846
	Percent	62.51	53.68	45.99	47.65
Gill Nets	Units	519	725	1,021	867
	Catch	517,650	1,075,698	899,757	652,674
	Percent	32.64	40.94	50.28	50.42
Reef Nets	Units	44	48	53	45
	Catch	76,570	140,921	65,984	24,856
	Percent	4.83	5.36	3.68	1.92
Troll	Catch	358	463	873	110
	Percent	0.02	0.02	0.05	0.01
TOTAL CATCH		1,586,176	2,627,581	1,789,609	1,294,486
Canadian Convention Waters					
Purse Seines	Units	89	129	110	54
	Catch	340,187	1,126,314	448,214	180,706
	Percent	20.30	43.67	22.74	15.58
Gill Nets	Units	1,082	1,178	980	737
	Catch	1,268,525	1,395,085	1,487,900	948,312
	Percent	75.71	54.10	75.48	81.78
Troll	Catch	66,824	57,571	35,039	30,635
	Percent	3.99	2.23	1.78	2.64
TOTAL CATCH		1,675,536	2,578,970	1,971,153	1,159,653

NOTE: Gear counts represent the maximum number of units delivering sockeye on a single day near the peak of the run.

TABLE II

CYCLIC LANDINGS OF SOCKEYE FROM CONVENTION WATERS

	United States	*Canada*	*Total*
1981			
Total Landings (No. Sockeye)	1,294,486	1,159,653	2,454,139
Share in Fish	52.75%	47.25%	
1946-1981			
Total Landings (No. Sockeye)	58,805,680	57,485,677	116,291,357
Share in Fish	50.57%	49.43%	
1981 *Cycle Catch*			
1981	1,294,486	1,159,653	2,454,139
1977	1,789,609	1,971,153	3,760,762
1973	2,627,581	2,578,970	5,206,551
1969	1,586,176	1,675,536	3,261,712
1965	1,026,118	1,039,195	2,065,313
1961	1,378,392	1,357,099	2,735,491
1957	1,689,265	1,360,760	3,050,025
1953	2,032,437	1,992,343	4,024,780
1949	1,056,792	1,020,799	2,077,591
1945	706,464	969,444	1,675,908
1941	1,558,554	2,116,723	3,675,277
1937	897,022	1,075,986	1,973,008
1933	1,724,127	726,309	2,450,436
1929	1,334,141	725,037	2,059,178
1925	1,375,012	453,704	1,828,716
1921	1,199,929	486,312	1,686,241
1917	5,005,609	1,877,792	6,883,401
1913	21,736,398	9,606,641	31,343,039
1909	13,664,988	7,261,486	20,926,474
1905	10,330,277	10,350,959	20,681,236
1901	13,694,032	12,065,999	25,760,031

TABLE III

DAILY CATCH OF SOCKEYE, 1969-1973-1977-1981 FROM UNITED STATES CONVENTION WATERS

	JULY				AUGUST				SEPTEMBER			
Date	**1969**	**1973**	**1977**	**1981**	**1969**	**1973**	**1977**	**1981**	**1969**	**1973**	**1977**	**1981**
1	6,906					242,792	14,338			12,031	13	711
2	4,731	110,423							4,142	7,085		5,719
3		80,632			122,566			5,110	3,683	3,912		269
4		75,761			77,758			57,906				
5			230,143	30,318	63,332			38,069			302	
6			98,478	67,273			12,777	42,319			15	
7	1,824		18,638	28,251			145,053	22,340				65
8	1,931		39,389	40,673		249,821	3,031	35,587	18			1,940
9	2,324	153,802					41,953	106,214	78	1,429		114
10		78,082					1,060	120,879	981	484		99
11		77,654		29,248	42,399			114,430	266	126		
12		60,972		31,465	18,044			42,651				30
13		47,993		9,305	15,558			26,427				1,122
14	16,173		119,339		12,433	102,899	2,723	11,207				709
15	9,948					39,203	61,433		191			2
16		85,708					31,546		30		18	30
17		40,820							2	49		172
18		43,260			17,370			41,587		22		65
19					23,237			39,773				
20				39,272		84,981		7,387			22	5
21	221,188			30,055		58,765	776	6,973			1	7
22	156,203			34,124		33,417	17,032		98		4	13
23	182,627	120,363				10,132	7,411		699			11
24		79,529	26,703				5,522		91	6		
25		69,739	386,882		19,605		82	37,029	41	9		
26			16,671		17,334		59	20,380			346	
27				143,894		30,423		1,808			226	
28	230,072					13,494		2,889			120	
29	201,102						92	6,545	1,004			
30	92,332	287,354	15,296				5,446	11,114	294			
31		279,495	241,105				1,414					
Totals	1,127,361	1,691,587	1,192,644	483,878	429,636	865,927	351,748	798,624	11,618	25,153	1,067	11,083
Troll	131	285	377	53	210	108	492	57	1	1	0	0
Monthly Totals	1,127,492	1,691,872	1,193,021	483,931	429,846	866,035	352,240	798,681	11,619	25,154	1,067	11,083
June & Oct. Totals									17,219	44,520	243,281	791
Season Totals									1,586,176	2,627,581	1,789,609	1,294,486

TABLE IV

DAILY CATCH OF SOCKEYE, 1969-1973-1977-1981 FROM CANADIAN CONVENTION WATERS

	JULY				AUGUST				SEPTEMBER			
Date	**1969**	**1973**	**1977**	**1981**	**1969**	**1973**	**1977**	**1981**	**1969**	**1973**	**1977**	**1981**
1	10,842					140,333	254,774		1,272	2,157	205	
2	10,654	77,811		49,795		108,960	49,889		709	1,489		
3		27,430						150,102		25,190		
4		16,248	216,751		178,581			46,535				
5			97,485		81,629						53	
6		Strike			51,902	264,462	170,652				19,158	1,697
7		July 6-		48,376		50,062	45,446	117,472	286			879
8		July 15				36,412	37,489		163		17,653	3,795
9	5,363	32,772				150,843	49,295		177	97		409
10						61,480	66,984		287	11,213		2,782
11					34,096			103,507		70		
12				35,688	62,362			16,493		37	25,675	
13			68,514		15,882	57,682		15,507				
14	22,096		22,076			138,703					26,723	3,595
15		26,786				105,299	96,228					
16		12,961					11,790					
17		8,966							45	7,972		
18		10,905			8,471			30,058	16	4		
19					4,830			171,135		7		
20			95,756	36,499	13,310	93,807						
21	96,953		31,816			26,584					9,328	
22	30,593					26,578	20,032	58,606				
23		243,444				11,668	2,928		15			
24		150,685					1,142	39,657	35	2,595		
25		112,045	351,221					11,337		22		
26			43,025		5,907			11,356		13,637		
27	368,974			130,992		31,894						
28	229,115					7,784						
29	160,326					11,313	5,771	6,412				
30	91,292	150,434			1,159			6,666	18			
31	79,400	215,403			1,160		369	26,643				
Totals	1,105,608	1,085,890	926,644	301,350	459,289	1,323,864	812,789	811,486	3,023	64,490	98,795	13,157
Troll	43,240	24,079	17,012	2,467	18,802	28,890	13,699	26,051	4,419	3,574	1,715	2,079
Spring Salmon Gill Nets	3,079								8,288	1,769	517	
Monthly Totals	1,151,927	1,109,969	943,656	303,817	478,091	1,352,754	826,488	837,537	15,730	69,833	101,027	15,236
June, Oct. & Nov. Totals									29,788	46,414	99,982	3,063
Season Totals									1,675,536	2,578,970	1,971,153	1,159,653

TABLE V

INDIAN CATCH OF SOCKEYE BY DISTRICT AND AREA, 1977 AND 1981

	1977		1981	
District and Area	*Catch*	*No. of Fishermen**	*Catch*	*No. of Fishermen**
HARRISON-BIRKENHEAD				
Birkenhead River and Lillooet Lake	14,050	1	5,000	1
TOTALS	14,050	1	5,000	1
LOWER FRASER				
Below Hope	69,252	424	98,291	492
TOTALS	69,252	424	98,291	492
MIDDLE FRASER				
Hope to Lytton	71,130	1,115	92,578	1,291
Lytton to Churn Creek	53,070		101,425	
TOTALS	124,200	1,115	194,003	1,291
CHILCOTIN				
Farwell Canyon to Siwash Bridge	7,321	88	31,350	95
Keighley Holes	1,144			
TOTALS	8,465	88	31,350	95
UPPER FRASER				
Churn Creek to Quesnel	12,589	199	71,660	205
Shelley	530	28	10,040	60
TOTALS	13,119	227	81,700	265
NECHAKO				
Nautley and Stella Reserves	5,698	55	11,187	61
TOTALS	5,698	55	11,187	61
STUART				
Fort St. James-Pinchi Village	4,874	52	8,933	2
Tachie, Takla & Trembleur Villages	5,410	67	10,750	2
TOTALS	10,284	119	19,683	4
THOMPSON				
Main Thompson	500	20	—	—
North Thompson	—	—	—	—
South Thompson	60	5	—	25
TOTALS	560	25	—	25
GRAND TOTALS	245,628**	2,054	441,214	2,234

*Number of permits issued to Indians in district.
**Does not include 900 fish taken in Area 20.

The Indian catch statistics detailed above are obtained from the Canada Department of Fisheries and Oceans. Their officers control the taking of sockeye by the Indian populations residing throughout the Fraser River watershed.

TABLE VI

SUMMARY OF THE SOCKEYE ESCAPEMENT TO THE FRASER RIVER SPAWNING AREAS, 1969, 1973, 1977, 1981

District and Streams	1981 Period of Peak Spawning	Estimated Number of Sockeye				Jacks	Sex Ratio Males 4-5 Yr.	Sex Ratio Females 4-5 Yr.
		1969	1973	1977	1981			
LOWER FRASER								
Cultus Lake	Nov. 15-20	6,739	858	353	1,159	903	112	144
Upper Pitt River	Sept. 10-14	25,084	11,928	13,887	25,327	0	11,355	13,972
Widgeon Slough	Oct. 29-Nov. 1	715	427	427	572	0	297	275
HARRISON								
Big Silver Creek	Sept. 18-21	85	270	349	173	0	73	100
Harrison River	Nov. 15-17	15,006	3,060	2,246	3,193	0	1,405	1,788
Weaver Creek	Oct. 10-16	41,857	27,807	22,105	24,138	851	10,161	13,126
Weaver Channel	Oct. 16-22	17,089	22,366	33,040	19,655	940	8,471	10,244
LILLOOET								
Birkenhead River	Sept. 23-30	64,527	139,295	43,139	65,495	16,472	20,576	28,447
SETON-ANDERSON								
Gates Creek	Aug. 25-Sept. 4	205	231	1,176	821	47	445	329
Gates Channel	Aug. 30-Sept. 3	676	668	1,713	3,988	92	1,631	2,265
Portage Creek	Nov. 1-6	1,040	4,272	7,974	6,086	231	2,858	2,997
SOUTH THOMPSON								
Seymour River	Aug. 28-Sept. 2	7,327	2,856	5,911	11,529	170	5,934	5,425
Scotch Creek	Aug. 28-31	3,395	6,235	13,586	18,952	0	11,340	7,612
Lower Adams River	Oct. 12-15	45,908	33,312	57,964	31,097	25,855	1,522	3,720
Little River	Oct. 15-18	6,842	6,689	8,684	8,169	7,231	478	460
South Thompson River	Oct. 3-6	630	545	432	182	161	11	10
Lower Shuswap River	Oct. 10-15	1,703	7,452	14,695	7,358	3,283	2,275	1,800
Misc. Streams	—	236	0	0	101	84	5	12
NORTH THOMPSON								
Raft River	Aug. 29-Sept. 2	5,593	2,729	648	873	58	417	398
Barriere River	—	40	22	16	0	0	0	0
Fennell Creek	Aug. 26-29	52	205	355	2,113	37	823	1,253
North Thompson River	—	—	—	1,372	0	0	0	0
CHILCOTIN								
Chilko River	Sept. 21-27	76,518	61,707	54,322	35,909	1,549	12,919	21,441
QUESNEL								
Horsefly River	Aug. 24-Sept. 7	270,027	253,388	473,008	677,389	31	316,399	360,959
Mitchell River	Sept. 14-17	8,939	24,673	42,396	66,106	0	27,620	38,486
NECHAKO								
Nadina River (Early)	Sept. 5-10	8,541	2,705	1,453	821	0	357	464
(Late)	Sept. 21-25	27,898	7,951	610	1,024	0	337	687
Nadina Channel	Sept. 19-23	—	8,786	16,286	17,892	4	7,329	10,559
Nithi River	Late Aug.	140	54	150	100	0	50	50
Stellako River	Sept. 29-Oct. 4	49,341	30,755	23,452	22,021	195	9,331	12,495
STUART								
Early Runs								
Ankwill Creek	Aug. 3-7	15,795	21,790	6,287	8,497	0	3,360	5,137
Bivouac Creek	Aug. 1-3	952	1,884	952	285	0	89	196
Driftwood River	Aug. 1-10	37,028	131,172	54,568	47,298	0	20,337	26,961
Dust Creek	Aug. 3-7	3,595	17,850	16,200	5,044	4	2,025	3,015
Felix Creek	Aug. 3-7	5,879	7,465	2,160	6,200	6	2,507	3,687
15 Mile Creek	Aug. 1-7	209	1,090	452	815	0	265	550
5 Mile Creek	Aug. 3-6	902	2,408	907	369	0	117	252
Forfar Creek	July 30-Aug. 4	9,922	18,924	3,628	12,228	9	5,508	6,711
Forsythe Creek	July 30-Aug. 2	2,248	10,907	3,677	2,386	0	964	1,422
Frypan Creek	July 30-Aug. 2	3,145	5,799	4,383	1,864	0	838	1,026
Gluske Creek	Aug. 2-6	4,660	19,450	4,646	10,741	0	4,438	6,303
Kynoch Creek	July 30-Aug. 6	12,380	22,485	5,893	13,452	5	5,684	7,763
Leo Creek	Aug. 4-7	571	1,390	646	78	0	26	52
Narrows Creek	July 29-Aug. 4	5,746	5,726	2,844	3,583	0	1,561	2,022
Paula Creek	Aug. 3-6	794	2,787	918	1,626	2	645	979
Rossette Creek	July 29-Aug. 4	1,566	4,156	2,261	8,018	15	3,273	4,730
Sakeniche River	—	691	4,175	288	6	0	0	6
Sandpoint Creek	July 29-Aug. 6	693	3,178	1,519	1,224	0	464	760
Shale Creek	Aug. 1-7	706	3,260	1,672	1,630	0	525	1,105
25 Mile Creek	July 31-Aug. 7	0	744	164	923	0	262	661
Misc. Streams	Aug. 1-6	2,336	14,013	3,952	3,231	0	1,304	1,897
Early Stuart Totals		(109,818)	(300,653)	(118,017)	(129,498)	(41)	(54,192)	(75,265)
Late Runs								
Kazchek Creek	Sept. 15-18	178	2,909	720	6,872	0	3,112	3,760
Kuzkwa Creek	Sept. 10-15	8,370	20,124	9,031	20,520	0	7,952	12,568
Middle River	Sept. 12-16	111,322	91,879	80,420	125,630	5	58,759	66,866
Pinchi Creek	Sept. 14-16	756	1,271	1,719	1,494	0	760	734
Tachie River	Sept. 19-24	86,431	97,445	54,282	94,050	200	47,740	46,110
Misc. Streams	Sept. 17-21	—	715	457	1,133	0	530	603
Late Stuart Totals		(207,057)	(214,343)	(146,629)	(249,699)	(205)	(118,853)	(130,641)
NORTHEAST								
Upper Bowron River	Aug. 28-31	3,872	4,700	2,500	1,170	0	533	637
TOTALS*		1,006,972	1,181,093	1,113,453	1,442,675	58,573	632,694	751,408

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

TABLE VII

DAILY CATCH OF SOCKEYE, 1966-1970-1974-1978 FROM UNITED STATES CONVENTION WATERS

	JULY				AUGUST				SEPTEMBER			
Date	**1966**	**1970**	**1974**	**1978**	**1966**	**1970**	**1974**	**1978**	**1966**	**1970**	**1974**	**1978**
1					131,250			57,144		31		
2					104,089					6		
3	C				104,338	79,718					55,431	
4	L				56,763	43,413						
5	O				73,479	35,355			8,986			
6	S								4,292			
7	E						234,490		9,196	549		
8	D				76,199		142,942		4,756	301		
9					66,840					671	12,421	
10					40,168	70,672				275	6,988	
11	2,317				45,066	55,718					5,044	36,666
12	1,968				51,407	59,364	105,239		3,262			11,759
13		4,133			26,894	67,530	139,059	33,751	980			5,670
14		1,716				48,662	103,232	77,453	1,686	11,940		
15			8,175		44,307		154,957	63,511	511	2,356		
16			1,776	2,124	43,556	67,087		17,125		1,373	11,730	
17				10,355	51,893	89,253				168	4,321	
18	6,902			8,379	22,143	94,580				1,722	1,450	22,278
19	6,154				17,494	73,372			8,131			8,135
20		14,399				52,020	310,026	16,556	11,012			3,014
21		10,630					216,732	354,173	12,804	792		
22		14,252	4,661		73,061		158,644	184,516	6,364	258		
23		9,783	3,997	6,245	94,884			163,430		2,634	1,442	
24				22,694				20,481		3,842	504	
25	28,951			15,825						802	262	2,030
26	34,784						308,214		145			3,080
27	41,679	47,077				234,354	238,166	48,944	186			5,341
28		33,591				91,263		138,993	33	1,305		
29		11,710	100,429						8	1,094		
30			75,587		11,044				30	923		
31			55,127	13,705	6,457	49						
Totals	122,755	147,291	249,752	79,327	1,141,332	1,162,410	2,111,701	1,176,077	72,382	31,042	99,593	97,973
Troll	75	57	133	286	287	365	87	48		1	1	
Monthly Totals	122,830	147,348	249,885	79,613	1,141,619	1,162,775	2,111,788	1,176,125	72,382	31,043	99,594	97,973
June & Oct. Totals									384	9,051	408	8,735
Season Totals									1,337,215	1,350,217	2,461,675	1,362,446

TABLE VIII

DAILY CATCH OF SOCKEYE, 1966-1970-1974-1978 FROM CANADIAN CONVENTION WATERS

	JULY				AUGUST				SEPTEMBER			
Date	**1966**	**1970**	**1974**	**1978**	**1966**	**1970**	**1974**	**1978**	**1966**	**1970**	**1974**	**1978**
1					227,815			47,145		933	13,378	
2			14,984		102,476			39,809		167,484	9,823	
3					44,215	84,815					79,914	
4	9,042				48,348	133,926						
5	9,990						64,383		438			108,180
6									6,858			
7					134,957		194,503		174	107		
8			29,177		81,319		180,367	71,632	105	5,627		
9			5,701		57,790					61	112,839	
10			9,000		76,573						1,271	32,682
11	9,714				55,376	231,605				8,248		
12	2,539				102,303	185,031			174	105		23,715
13		5,562							16	139	135,407	
14								87,122	511	239		
15			7,754	Strike	46,027		32,131					
16				July 16-19	45,504						1,405	
17				4,997	48,046	94,112					1,712	
18	8,073					103,304	147,866					3,633
19	5,050						113,219		760			
20		9,883					199,353		71			
21		5,225						216,090	903			
22			4,838		70,477			122,905				
23			3,328		48,119			124,712				
24				14,087								
25	40,159			6,736			34,766					
26	15,177						88,440		530			
27		71,450				27,577	33,882		56			
28		45,779				4,850	235,993	83,743	7,668	150,254		64,897
29		21,227	84,653									
30			94,877		1,689						26,041	
31			103,943		7,233	1,975						
Totals	99,744	159,126	358,255	25,820	1,197,267	867,195	1,324,903	793,158	18,264	333,197	381,790	233,107
Troll	2,603	11,353	49,208	9,251	18,950	134,009	368,553	214,652	35	51	7,814	6,103
Spring Salmon Gill Nets		1,025		2,142	2,970	5,222			3,810			
Monthly Totals	102,347	171,504	407,463	37,213	1,219,187	1,006,426	1,693,456	1,007,810	22,109	333,248	389,604	239,210
June, Oct. & Nov. Totals									6,511	30,593	9,496	32,882
Season Totals									1,350,154	1,541,771	2,500,019	1,317,115

TABLE IX

SUMMARY OF THE SOCKEYE ESCAPEMENT TO THE FRASER RIVER SPAWNING AREAS, 1966, 1970, 1974, 1978

District and Streams	1978 Period of Peak Spawning	Estimated Number of Sockeye			
		1966*	1970*	1974*	1978
LOWER FRASER					
Cultus Lake	Nov. 13-17	17,464	15,149	9,814	7,265
Upper Pitt River	Sept. 12-16	20,867	6,657	20,792	24,835
Widgeon Slough	Sept. 4-8	884	364	1,643	1,600
HARRISON					
Big Silver Creek	Sept. 25-27	329	261	837	1,253
Harrison River	Nov. 10-15	32,672	12,675	16,920	19,747
Weaver Creek	Oct. 27-Nov. 1	13,875	6,373	42,143	43,989
Weaver Channel	Oct. 17-22	6,541	4,723	24,664	32,248
LILLOOET					
Birkenhead River	Sept. 26-29	81,134	72,760	173,463	99,857
SETON-ANDERSON					
Gates Creek	Sept. 14-18	592	68	146	931
Gates Channel	Sept. 14-18	—	735	1,645	1,639
Portage Creek	Nov. 12-15	31,844	3,901	8,986	10,230
SOUTH THOMPSON					
Seymour River	Sept. 1-5	28,754	11,991	45,189	62,929
Eagle River	Sept. 13-17	288	23	263	189
Scotch Creek	Sept. 1-4	459	304	464	2,056
Anstey River	Aug. 30-Sept. 1	—	196	666	886
Upper Adams River	—	63	4	13	0
Lower Adams River	Oct. 22-25	1,197,336	1,297,990	889,613	1,493,473
Little River	Oct. 25-27	55,952	168,881	122,112	81,055
South Thompson River	Oct. 25-27	4,313	5,931	14,466	9,986
Lower Shuswap River	Oct. 19-20	24,629	29,074	86,396	187,167
Middle Shuswap River	Oct. 19-20	1,872	4,559	3,064	10,890
Misc. Late Runs	Oct. 25-27	38,378	50,389	41,882	117,832
NORTH THOMPSON					
Raft River	Sept. 5-8	6,250	4,474	2,396	2,500
Fennell Creek	Aug. 29-Sept. 2	—	9	243	675
North Thompson River	—	46	270	343	—
CHILCOTIN					
Chilko River	Sept. 26-29	226,702	145,049	128,131	151,835
Chilko Lake-South End	Sept. 10-15	—	0	14,464	7,339
QUESNEL					
Horsefly River	Sept. 4-10	1,607	1,350	4,459	7,287
Mitchell River	Sept. 15-18	142	23	—	1,237
NECHAKO					
Nadina River (Early)	—	83	78	0	0
(Late)	Sept. 20-23	1,784	3,939	2,930	227
Nadina Channel	Sept. 18-21	—	—	895	2,555
Stellako River	Sept. 24-30	101,684	45,876	41,473	60,421
STUART					
Early Runs					
Ankwill Creek	July 29-30	86	220	544	1,363
Bivouac Creek	July 29-30	0	0	40	157
Crow Creek	July 29-30	126	396	981	467
Driftwood River	July 31-Aug. 1	140	1,983	1,894	4,903
Dust Creek	July 29-30	178	963	934	657
Felix Creek	July 28-29	979	2,866	3,201	5,575
Fleming Creek	July 28-29	0	106	20	590
Forfar Creek	July 29-30	1,739	6,476	5,495	9,579
Forsythe Creek	July 29-30	67	187	270	381
Frypan Creek	July 29-30	58	130	362	448
Gluske Creek	July 29-30	1,876	5,702	5,548	4,295
Kynoch Creek	July 29-30	3,591	4,676	10,652	10,649
Leo Creek	July 29-30	0	41	32	34
Narrows Creek	July 31-Aug. 1	322	144	486	709
Paula Creek	July 28-29	0	565	2,059	1,604
Rossette Creek	July 29-30	1,645	7,664	5,675	7,452
Sakeniche River	July 30-31	2	0	51	123
Sandpoint Creek	July 29-30	0	358	599	493
Shale Creek	July 29-30	50	34	345	470
Misc. Streams	July 28-30	0	236	456	148
Early Stuart Totals	July 28-Aug. 1	(10,859)	(32,747)	(39,644)	(50,097)
Late Runs					
Kazchëk Creek	—	144	74	239	122
Kuzkwa Creek	Sept. 21	295	90	718	742
Middle River	Sept. 21-25	4,917	12,115	8,990	4,061
Pinchi Creek	Sept. 21	76	0	0	74
Tachie River	Sept. 21-25	3,600	2,776	4,680	8,028
Late Stuart Totals	Sept. 21-25	(9,032)	(15,055)	(14,627)	(13,027)
NORTHEAST					
Upper Bowron River	Aug. 27-30	2,480	1,341	1,850	3,150
TOTALS**		1,919,286	1,943,221	1,757,474	2,514,318

*Numbers for some populations are revised from the Annual Report for the respective years.
** Totals include small numbers of fish in small tributaries not listed in the table.

TABLE X

PINK SALMON CATCH BY GEAR

Gear		1975	1977	1979	1981
United States Convention Waters					
Purse Seines	Units	263	266	327	310
	Catch	978,042	1,777,767	3,354,044	3,310,281
	Percent	78.04	81.98	82.89	85.41
Gill Nets	Units	902	907	768	500
	Catch	196,726	197,178	388,723	308,649
	Percent	15.70	9.09	9.61	7.96
Reef Nets	Units	56	53	52	47
	Catch	55,223	30,069	42,771	80,148
	Percent	4.41	1.39	1.06	2.07
Troll	Catch	23,164	163,416	260,735	176,493
	Percent	1.85	7.54	6.44	4.55
TOTAL CATCH		1,253,155	2,168,430	4,046,273	3,875,571
Canadian Convention Waters					
Purse Seines	Units	116	111	184	155
	Catch	639,026	807,194	2,480,864	2,794,078
	Percent	50.88	38.89	60.05	66.72
Gill Nets	Units	926	913	661	625
	Catch	376,511	280,674	103,738	347,984
	Percent	29.98	13.52	2.51	8.31
Troll	Catch	240,353	987,610	1,546,753	1,045,791
	Percent	19.14	47.59	37.44	24.97
TOTAL CATCH		1,255,890	2,075,478	4,131,355	4,187,853

NOTE: Gear counts represent the maximum number of units delivering pinks on a single day near the peak of the run.

TABLE XI

CYCLIC LANDINGS OF PINK SALMON FROM CONVENTION WATERS

	United States	*Canada*	*Total*
1981			
Total Landings (No. of Pinks)	3,875,571	4,187,853	8,063,424
Share in Fish	48.06%	51.94%	
1957-1981			
Total Landings (No. of Pinks)	31,410,398	31,125,528	62,535,926
Share in Fish	50.23%	49.77%	
1981 *Cycle Catch*			
1981	3,875,571	4,187,853	8,063,424
1979	4,046,273	4,131,355	8,177,628
1977	2,168,430	2,075,478	4,243,908
1975	1,253,155	1,255,890	2,509,045
1973	2,224,924	2,060,679	4,285,603
1971	2,371,151	2,137,337	4,508,488
1969	945,797	861,505	1,807,302
1967	3,827,040	4,156,922	7,983,962
1965	558,380	592,467	1,150,847
1963	4,426,232	4,173,288	8,599,520
1961	508,544	545,128	1,053,672
1959	2,427,535	2,312,906	4,740,441
1957	2,777,366	2,634,720	5,412,086
1955	4,685,984	4,129,063	8,815,047
1953	4,951,429	4,142,117	9,093,546
1951	5,086,284	2,885,514	7,971,798
1949	6,235,400	3,189,662	9,425,062
1947	8,801,595	3,491,416	12,293,011
1945	5,458,890	1,279,849	6,738,739

TABLE XII

DAILY CATCH OF PINK SALMON, 1975-1977-1979-1981 FROM UNITED STATES CONVENTION WATERS

	JULY				AUGUST				SEPTEMBER			
Date	**1975**	**1977**	**1979**	**1981**	**1975**	**1977**	**1979**	**1981**	**1975**	**1977**	**1979**	**1981**
1						1,040				17,172		35,858
2									280,698			461,655
3								3,229			306,247	3,835
4								13,656		1,641	59,389	
5		220		32			14,791	11,571		152,848		
6		203		110		854	33,009	13,013		10,868		
7	307	71		23		8,841	34,056	4,538				18,918
8	308	189		91		109		6,772	53,910			471,496
9	324					8,300		18,899	32,018			40,374
10						644		21,083				36,505
11				200	19,933			26,709				4,353
12				666	16,127			12,446				24,795
13				164			42,539	10,487		219		105,752
14	1,066			256	23,762	1,796	132,837	11,252	146,806			53,736
15	840					46,828	113,410		132,744			6,130
16		1,776	4,266			70,333			57,264	5,344	12,762	7,113
17		409	925							55	70,785	35,350
18			1,608		55,608			165,098			3,790	11,586
19					52,909		7,602	177,216		36	1,620	1,462
20				2,609	53,815		476,678	88,850		2,042		337
21	8,328			2,325		23,559	478,797	79,974		1,623		4,793
22	5,047		5,203	4,100		446,813	95,190			995		7,447
23			13,237			246,590	345,863		12,387			3,024
24		2,163	8,198			275,569	60,371		4,707			
25		4,015				21,322	28,794	483,314				
26		1,363			137,643	20,728	548,344	498,424		743		
27				9,255	91,649		457,938	115,077		780		
28	12,707			3,202			35,947	136,034		243		
29	8,891					9,689	347,355	170,459	2,431			
30	7,998	422	12,529			360,684	15,619	273,423	866			
31	8,130	4,657	3,019			250,303	12,722					
Totals	53,946	15,488	48,985	23,033	451,446	1,794,002	3,281,862	2,341,524	723,831	194,609	454,593	1,334,519
Troll	7,881	40,202	34,918	35,736	11,946	118,162	224,700	139,418	956	4,394	2	479
Monthly Totals	61,827	55,690	83,903	58,769	463,392	1,912,164	3,506,562	2,480,942	724,787	199,003	454,595	1,334,998
June & Oct. Totals									3,149	1,573	1,213	862
Season Totals									1,253,155	2,168,430	4,046,273	3,875,571

TABLE XIII

DAILY CATCH OF PINK SALMON, 1975-1977-1979-1981 FROM CANADIAN CONVENTION WATERS

	JULY				AUGUST				SEPTEMBER			
Date	**1975**	**1977**	**1979**	**1981**	**1975**	**1977**	**1979**	**1981**	**1975**	**1977**	**1979**	**1981**
1						12,490			33,756	50,134		
2						5,713			61,793			
3								234				
4		75			470			5,331			49,036	
5					199				78,851	30,598		
6						1,433	75,235		74,730	108,270		248,776
7	50					23,843	499	758	50,627			150,069
8						20,702			58,485	69,472		121,764
9	11		66		186	24,390						52,801
10					70	693						48,062
11					165			747				
12					121		1,547	77,045		28,051		
13		172					119,176	101,425		1,279		
14	18						155,509		62,355	44,759		154,919
15						207,768			45,604			
16			165			116,168	2,886		33,961			
17									29,163		6,309	
18					6,347			93,787	58,966		3,678	
19					11,200			105,277		548		
20		173		260	9,559		317,597			126		
21	243	152			14,836		240,369			9,285		
22	130				9,634	37,831	98,272	4,006	45,221			
23			182			136,178	2,467		2,800			
24	Strike					55,838		226,658				
25	July 25-	4,633			96,884		623,102	293,375	10,910			
26	Aug. 24	120			85,765		384,563	237,385	14,358			
27	712			12,232	94,303		244,486					
28	382											
29						3,685		384,824	11,317			
30			175				257,934	432,006	508			
31						87,617		389,248				
Totals	1,546	5,325	588	12,492	329,739	734,349	2,523,642	2,352,106	659,047	342,522	59,023	776,391
Troll	72,114	274,529	129,511	123,278	56,040	604,639	1,297,321	667,981	99,598	45,067	35,543	249,699
Spring Salmon Gill Nets									14,358	3,527		
Monthly Totals	73,660	279,854	130,499	135,770	385,779	1,338,988	3,820,963	3,020,087	773,003	391,116	94,566	1,026,090
June & Oct. Totals									23,448	65,520	85,327	5,906
Season Totals									1,255,890	2,075,478	4,131,355	4,187,853

TABLE XIV

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

District and Streams	*1981 Period of Peak Spawning*	*Estimated Number of Pink Salmon* 1975	1977	1979	1981
EARLY RUNS					
LOWER FRASER					
Main Fraser	Oct. 7-14	315,049	775,016	1,521,856	2,252,368
FRASER CANYON					
Coquihalla River	Oct. 8-13	5,933	2,821	16,468	24,029
Jones Creek	Oct. 3-12	2,645	3,350	4,993	4,485
Misc. Tributaries	Oct. 1-13	948	3,687	4,149	14,720
SETON ANDERSON					
Seton Creek	Oct. 4-10	209,734	341,256	549,512	519,393
Upper Seton Channel	Oct. 12-16	7,995	11,122	9,956	10,402
Lower Seton Channel	Oct. 12-18	23,874	37,163	34,494	33,846
Portage Creek	Oct. 7-12	28,454	19,904	51,842	18,733
Bridge River	Oct. 10-13	10,803	25,800	65,759	43,940
Gates Creek	Oct. 16-18	—	96	1,277	88
THOMPSON					
Thompson River and Tributaries	Oct. 5-16	480,350	972,941	885,402	1,166,348
TOTALS*		1,085,985	2,193,156	3,154,945	4,097,269
LATE RUNS					
HARRISON					
Harrison River	Oct. 15-20	180,052	126,782	269,858	314,519
Chehalis River	Oct. 15-17	2,356	2,613	2,067	169
Weaver Creek	Oct. 16-20	411	2,397	117	1,006
Weaver Channel	Oct. 10-15	1,201	963	737	1,287
CHILLIWACK-VEDDER					
Chilliwack-Vedder River	Oct. 12-20	81,137	48,561	124,041	68,601
Sweltzer Creek	Oct. 23-26	16,121	5,093	8,889	5,213
TOTALS*		281,278	186,409	405,709	391,067
GRAND TOTALS*		1,367,263	2,387,811	3,560,654	4,488,336

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

TABLE XV

SUMMARY OF THE PINK SALMON ESCAPEMENTS TO UNITED STATES AND CANADIAN NON-FRASER RIVER SPAWNING AREAS*

United States Spawning Areas	**1975**	**1977**	**1979**	**1981**
Nooksack	36,000	25,000	31,400	15,000
Skagit	100,000	500,000	300,000	100,000
Stillaguamish	30,000	38,000	135,000	18,000
Snohomish	65,600	160,000	180,000	90,000
Puyallup	11,800	28,800	29,500	11,500
Dosewallips	5,500	16,800	17,400	1,700
Duckabush	4,500	12,300	16,200	2,300
Dungeness	24,500	35,500	50,000	2,900
Elwha	1,500	5,000	7,100	200
Miscellaneous	11,200	32,300	15,800	7,400
TOTALS	290,600	853,700	782,400	249,000
Canadian Non-Fraser Spawning Areas	**1975**	**1977**	**1979**	**1981**
Jervis Inlet	24,300	20,000	13,600	29,430
Howe Sound	105,500	2,000	4,700	13,975
Burrard Inlet	35,000	22,000	22,470	41,505
TOTALS	164,800	44,000	40,770	84,910

*These data were provided through the courtesy of the Washington State Department of Fisheries and the Canada Department of Fisheries and Oceans.

COMMISSION PUBLICATIONS, 1981

1. Annual Report of the International Pacific Salmon Fisheries Commission for 1980.

2. Bulletin XXII. 1980. Energy sources and expenditures in Fraser River sockeye salmon during their spawning migration by Philip Gilhousen.

STAFF PUBLICATIONS IN OTHER JOURNALS

1. Studies related to biological detoxification of kraft pulp mill effluent. I. The biodegradation of dehydroabietic acid with *Mortierella isabellina* by James P. Kutney, Mahatam Singh, Gary Hewitt, Phillip J. Salisbury, Brian R. Worth, James A. Servizi, Dennis W. Martens, and Robert W. Gordon. Can. Jour. of Chem. Vol. 59. No. 15. 1981.

2. Studies related to biological detoxification of kraft pulp mill effluent. II. The biotransformation of isopimaric acid with *Mortierella isabellina* by James P. Kutney, Mahatam Singh, Eugene Dimitriadis, Gary M. Hewitt, Phillip J. Salisbury, Brian R. Worth, James A. Servizi, Dennis W. Martens, and Robert W. Gordon. Can. Jour. of Chem. Vol. 59. No. 24. 1981.

3. Brief presented to British Columbia Pollution Board enquiry pertaining to the Annacis Island sewage treatment plant and municipal waste discharges into the Lower Fraser River by I. K. Birtwell, J. C. Davis, M. Hobbs, M. D. Nassichuk, M. Waldichuk and J. A. Servizi. Can. Industry Rept. of Fisheries and Aquatic Services. No. 126. 1981.

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George T. Brajcich	1956-1957
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John Brajcich	1973-

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Homer Stevens	1944-1949
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M. Guns	1969-1971
	1975-1979
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John Makowichuk	1979-

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Sports Fishermen

M. W. Black	1938-1961
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R. H. Wright	1965-1972
H. English	1972-1980
A. Downs	1980-

Native Indians

D. Guerin	1981-

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Salmon Processors

C. J. Collins	1938-1949
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Purse Seine Fishermen

L. Makovich	1938-1946
N. Mladinich	1946-1976
W. Green	1976-

Gill Net Fishermen

C. Karlson	1938-1958
J. F. Jurich	1946
J. Erisman	1958-1964
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Troll Fishermen

S. Leite	1938-1945
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C. J. Dando	1946-1948
A. Anderson	1948-1949
J. R. Brown	1949-1957
B. J. Johnson	1958-1962
F. Bullock	1962-1966
C. Mechals	1966-1972
F. Lowgren	1972-1973
G. D. Simmons	1973-1981
W. Kimzey	1981-

Reef Net Fishermen

J. R. Brown	1958-1974
G. H. Schuler	1974-1978
T. Philpott	1978-

Sports Fishermen

K. McLeod	1938-1953
H. Gray	1953-1972
E. Engman	1972-

Native Indians

C. Peterson	1981-

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