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

1985

COMMISSIONERS

C. WAYNE SHINNERS
MICHAEL W.C. FORREST
DAVID C. SCHUTZ
ROLLAND A. SCHMITTEN
TED A. SMITS
EDWARD P. MANARY

NEW WESTMINSTER
CANADA
1986

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	1978-1984
C. Wayne Shinners	1981-1985
Michael W.C. Forrest	1981-1985
David C. Schutz	1984-1985

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	1974-1983
Donald W. Moos	1975-1977
Gordon Sandison	1977-1980
Herbert A. Larkins	1980-1983
Rolland A. Schmitten	1981-1985
Ted A. Smits	1983-1985
Thomas E. Kruse, Ph.D	1984-1984
William R. Wilkerson	1985-1985
Edward P. Manary	1985-1985

DIRECTOR OF INVESTIGATIONS

W. F. Thompson, Ph.D	1937-1942
B. M. Brennan	1943-1949
Loyd A. Royal	1951-1970
A. C. Cooper	1971-1981
John F. Roos	1982-1985

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SALMON COMMISSION

FOREWARD

The Government of the United States of America and the Government of Canada concluded approximately fifteen years of negotiations with the ratification of the Pacific Salmon Treaty on March 18, 1985. The new Treaty stipulated that the International Pacific Salmon Fisheries Commission would, for 1985 only, continue to allocate the catch of Fraser River sockeye and pink salmon between the fishermen of the two countries in the Convention Area. The Commission fulfilled this obligation for both species on the basis of the new sharing arrangement agreed to by the two Parties. In addition, the Commission continued all other investigations historically performed in the Convention Waters fishing areas and in the Fraser River watershed. The work of the International Pacific Salmon Fisheries Commission, which commenced in 1937, was terminated on December 31, 1985, thus completing almost fifty years of dedicated service to the resource, the two Parties and the fishing industries of both countries. The Fraser River sockeye and pink salmon stocks were restored to high levels of abundance, in contrast to the depleted condition of the runs when the Commission assumed responsibility for these two species.

REPORT OF THE INTERNATIONAL PACIFIC SALMON FISHERIES COMMISSION FOR THE YEAR 1985

The commercial fisheries for Fraser River sockeye salmon began in the 1870's and reached their peak in 1913 with a commercial catch of about 31,000,000 fish. At the turn of the century, the annual runs averaged about 10,000,000 sockeye. During the period 1911 to 1914, railroad construction in the Fraser Canyon at Hell's Gate caused a large slide and deposited great amounts of rock into the river. In the years following the record run of about 40,000,000 sockeye in 1913, the annual returns declined dramatically to less than one third former levels.

As early as 1892, Canada and the United States began to consult with each other over management problems pertaining to the Fraser sockeye salmon resource. There was general recognition that successful management would require a unified system, not independent control by each of the two Parties. When the runs declined precipitously following the 1913 disaster at Hell's Gate, the need for cooperative management and restoration became much more evident and urgent.

The Sockeye Salmon Fisheries Convention was signed on May 26, 1930, but ratifications were not exchanged until July 28, 1937, after agreements were reached on certain understandings.

The Commission was required to conduct eight years of research before it could regulate the fisheries starting in 1946. During these eight years, it began systematic investigations in both freshwater and marine areas. Sockeye were tagged at sea to determine migratory timing and racial identification of the stocks. Extensive tagging and recovery programs were conducted at Hell's Gate at all water levels to determine passage capabilities under varying flow conditions. These studies proved conclusively that the primary problem relating to depletion of the stocks was poor passage conditions in the Fraser River. Also, enumeration programs were initiated at the various spawning grounds. Indisputable scientific facts were required if solutions to the complex problems were to be achieved.

These studies established that fishways were required at various locations to ensure successful and undelayed upstream passage. The basis for specific management of the various races of sockeye salmon was also developed from these early investigations. After the scientific facts were established, the Commission moved quickly with the construction of 17 fishways starting at Hell's Gate in 1944. Beginning in 1945, various stocks responded rapidly to the improvement in upstream passage to their spawning grounds. Also, extensive closures imposed on the commercial fisheries for several years starting in 1946 provided increased numbers of spawners for many severely depleted races.

A protocol in 1957 amended the original Sockeye Salmon Fisheries Convention and provided for the conservation of the pink salmon resource of the Fraser River system. Thus, the responsibilities of the International Pacific Salmon Fisheries Commission were extended to include the management of this species. As a result of the migration block at Hell's Gate, pink salmon were unable to reach the large spawning grounds in the Thompson River and Seton Creek areas from 1913 until the fishways reestablished migratory access in 1945. The former large runs (probably in excess of 20,000,000) had by 1959-1961 declined to an average of about 4,000,000 fish.

Following the construction of fishways, the Commission launched intensive investigations into the factors affecting survival at various stages of sockeye and pink salmon life cycles. Also, a research station was established at Cultus Lake to determine and establish water quality standards required by the salmon and necessary to protect the stocks. Results of scientific investigations developed an understanding of the cyclic dominance characteristic requirements of the stocks and the basis for determination of optimum escapements. These studies also led to the construction of six artificial spawning channels where spawning grounds had been degraded or where limited spawning area was available. Critical to the increase in the stocks was the maintenance of high water-quality standards established from research studies carried out at the Sweltzer Creek field station at Cultus Lake.

During the tenure of the International Pacific Salmon Fisheries Commission, many various proposals were put forth by other user groups involving water diversion projects at such locations as in the Nechako watershed, Chilko Lake and in the Shuswap Lake area. One such project, the Kemano diversion, did proceed. This development has adversely impacted the sockeye stocks. In addition, B.C. Hydro authorities repeatedly examined the possibility of damming the Fraser River. Fortunately for the fish and fisheries, the only project that proceeded was a low level dam at the outlet of Seton Creek. While this project has adversely impacted the stocks, two spawning channels for

pink salmon were constructed to offset the effects of the dam and a fishway provided upstream passage of the Gates Creek and Portage Creek sockeye runs. Further provisions are required for full protection of the young downstream migrants.

The sockeye stocks have responded positively and dramatically to the Commission's research and management programs. The average annual sockeye run during the last four years (1982-1985) has been about 9,700,000 or near the estimated average return prior to the Hell's Gate slide. Dramatic improvement in depleted and almost extinct stocks has taken place. The most notable example is the Horsefly River race in the Quesnel Lake system. This race had declined from a total run estimated at about 10,000,000 fish in 1913 to only about 5,000 fish in 1941. The actual spawning escapement in 1941 was only 1,000 fish. By 1985 this system rebounded to produce a return in excess of 9,500,000 sockeye with escapement of over 1,300,000 fish. The total return of all stocks in 1985 produced 13,879,000 sockeye, the largest return on the cycle since 1913.

The once famous Upper Adams River sockeye run was exterminated by the effects of Hell's Gate and a splash dam on the Lower Adams River. A self-sustaining population has now been established in the Upper Adams River following many years of rehabilitation efforts. In 1984, the escapement increased dramatically to 3,500 fish. It appears that the potential now exists to again realize and experience the "millions" of early run sockeye that once were produced in the Adams River system.

Other sockeye stocks also have produced modern day record returns. The Early Stuart run in the 1970's reached a record level of more than 1,300,000 fish. The Lower Shuswap run in 1982 of 1,600,000 was probably the largest since 1913. More than 4,000,000 Chilko sockeye returned in 1984, the largest run on record. Many of the stocks previously mentioned, in addition to other races, have the potential for much greater production and it is reasonable to expect that even greater returns can be realized.

The present status of the Fraser pink salmon stocks is equally impressive compared with sockeye. With increased emphasis placed on obtaining larger escapements, significant improvement in production has taken place. Escapements in the 1960's were in the one to two million range, whereas in the last two cycle years (1983-1985) the escapement has averaged 5,500,000 fish. The total run in 1985 was 18,864,000 pink salmon, probably the largest run since 1913. The average Fraser pink salmon run for the last four cycles (1979-1985) has been 16,800,000 fish. It is believed that pink salmon potential returns in future years should increase above the 20,000,000 level. Of course, the vagaries of nature will continue to have both beneficial and detrimental impact on the yearly returns depending on environmental conditions.

One of the major reasons for the present day excellent status of the stocks is that unimpeded access to the spawning grounds has been reestablished. Also, good water quality in the migration paths of the Fraser River and its tributaries has been maintained as well as in the spawning areas. Scientific management controlling harvests and ensuring escapement goals has also been instrumental in the restoration of the runs.

The signing of the new Pacific Salmon Treaty on March 18, 1985, caused the termination of the International Pacific Salmon Fisheries Commission on December 31, 1985. The achievements of the IPSFC are a matter of record and will be reported in detail at a later time[1]. Without doubt, the International Pacific Salmon Fisheries Commission was faithful in its commitment to both Parties in fulfilling its mandate covering the protection, preservation and extension of the resource. The sockeye and pink salmon resources now are in a condition comparable to that of the pre-Hell's Gate period, more than 70 years ago. The Commission successfully performed a task where others failed. Management control and responsibility for the Fraser River sockeye and pink salmon resource has for the most part been returned to the Canadian Government.

1 - A comprehensive History of the IPSFC will be published at a later date.

COMMISSION MEETINGS

The International Pacific Salmon Fisheries Commission held eighteen formal and seventeen telephone conference meetings during 1985. The minutes of the meetings have been submitted to the Governments of Canada and the United States.

On April 3, Mr. W. R. Wilkerson, Director, Washington State Department of Fisheries, attended the meeting as a newly appointed Commissioner representing the United States. In June, Mr. E. P. Manary was appointed as a Commissioner replacing Mr. W. R. Wilkerson. On September 13, Mr. T. A. Smits announced his resignation as a United States Commissioner.

On April 3, the Commission approved the Advisory Committee reappointment of Mr. Brian Fraser representing Canadian Salmon Processors and the appointments of Mr. Larry Wick representing Canadian Purse Seine Fishermen and Mr. Jay Lind representing United States Salmon Processors.

The membership of the Advisory Committee for 1985 was as follows:

Canada	*United States*
J. Brajcich (to April 2) L. Wick (from April 3) Purse Seine Fishermen	V. Barcott Purse Seine Fishermen
B. Fraser Salmon Processors	J. Theodore (to April 2) J. Lind (from April 3) Salmon Processors
F. Nishii Gill Net Fishermen	B. Suggs Gill Net Fishermen
N. Carr Purse Seine Crew Members	T. Philpott Reef Net Fishermen
B. Fahey Troll Fishermen	M. Davis Troll Fishermen
	E. Engman Sport Fishermen
Sport Fishermen	
S. Douglas Native Indian Fishermen	C. Peterson Native Indian Fishermen

The first meeting of 1985 was held on February 1 with Mr. R. A. Schmitten serving as Chairman and Mr. M. W. C. Forrest serving as Vice Chairman and Secretary. The Commission discussed the administrative and financial matters for termination of the I.P.S.F.C. The Commission staff met with Commissioners and government officials regarding the transfer of staff to the Pacific Salmon Commission and Canada Department of Fisheries and Oceans.

On April 3 the Commission met and approved a draft of the 1984 Annual Report and discussed other administrative matters.

The Commission met on May 3 with its Advisory Committee regarding tentative recommended regulations for regulatory control of the 1985 sockeye and pink salmon fishery in the Fraser River Panel Area. After certain revisions, the Commission approved the recommended regulations for submission to the two governments.

At its meeting on June 14 the Commission received reports on regulatory concerns which had arisen since the approval of regulations and approved the alternation of first starts by United States gill nets and purse seines. The Commission was appraised of a potential blockage to migration at Little Hell's Gate in the Fraser Canyon caused by CNR blasting rock for twin tracking and of Alcan's position on providing water flows in the Nechako River.

During the period June 28 through October 18, the Commission held twelve formal and fifteen telephone conference meetings for adjustments of fishing regulations to achieve the desired escapement and, as nearly as practicable, the mandated allocation of the allowable

catch of Fraser River sockeye and pink salmon under the Pacific Salmon Treaty. On September 6 the Commission and Advisory Committee inspected the Horsefly River spawning grounds.

The Commission met November 27 to review the Annual Meeting presentation. The eighteenth and final formal meeting of the year was held on December 6 in Richmond, British Columbia, when the Commission held its Annual Meeting with its Advisory Committee and approximately 220 representatives of industry, government and press.

1985 REGULATIONS

Recommendations for regulations governing the 1985 sockeye and pink salmon fisheries in the Fraser River Panel Area were adopted at a meeting of the Commission held May 3 and were submitted to the two national governments for approval on May 10, 1985. On June 24, 1985 the United States Government informed the Commission that its recommended 1985 regulations were approved with the exception that certain Treaty Indian fisheries were excluded and would be regulated under separate regulations promulgated by the United States Department of Interior. The National Marine Fisheries Service was designated to enforce Commission regulations in United States Waters in cooperation with other United States agencies. The recommendations for Canadian Waters were implemented during the fishing season under the Fisheries Act, Pacific Commercial Salmon Fishery Regulations.

The recommendations of the Commission for fishing regulations were as follows:

Canadian Fraser River Panel Area Waters:

"Pursuant to the Pacific Salmon Treaty between the United States of America and Canada, signed at Ottawa on January 28, 1985, the International Pacific Salmon Fisheries Commission hereby recommends to the Canadian Government that, in the interests of the fisheries for Fraser River sockeye and pink salmon, the following fishery regulations for Convention Waters (Fraser River Panel Area Waters) for the season of 1985 be adopted and made effective by Public Notice under the Pacific Commercial Salmon Fishery Regulations, namely:

1. No person shall retain pink salmon taken by commercial trolling gear in the 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 from the 15th day of June, 1985 to the 3rd day of August, 1985 and from the 8th day of September, 1985 to the 14th day of September, 1985, all dates inclusive.

2. (1) No person shall fish for sockeye or pink salmon with nets in Pacific Fishery Management Area 20[1], 3 and 4 from the 23rd day of June, 1985 to the 20th day of July, 1985 and from the 8th day of September, 1985 to the 14th day of September, 1985, all 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:

(a) From the 21st day of July, 1985 to the 27th day of July, 1985, 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

(b) From the 28th day of July, 1985 to the 10th day of August, 1985 and from the 18th day of August, 1985 to the 24th day of August, 1985, all dates inclusive, except from half past six o'clock in the forenoon to half past six o'clock in the afternoon of Monday, Tuesday and Wednesday of each week; and

(c) From the 11th day of August, 1985 to the 17th day of August, 1985, 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; and

(d) From the 25th day of August, 1985 to the 31st day of August, 1985, both dates inclusive, except from seven o'clock in the forenoon to seven o'clock in the afternoon of Monday, Tuesday and Wednesday; and

(e) From the 1st day of September, 1985 to the 7th day of September, 1985, both dates inclusive, except from seven o'clock in the forenoon to seven o'clock in the afternoon of Monday and Tuesday.

(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 21st day of July, 1985 to the 27th day of July, 1985, 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

(b) From the 28th day of July, 1985 to the 10th day of August, 1985 and from the 18th day of August, 1985 to the 24th day of August, 1985, all 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 and from half past six o'clock in the afternoon of Wednesday to half past six o'clock in the forenoon of Thursday of each week; and

(c) From the 11th day of August, 1985 to the 17th day of August, 1985, 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; and

(d) From the 25th day of August, 1985 to the 31st day of August, 1985, both dates inclusive, except from seven o'clock in the afternoon of Monday to seven o'clock in the forenoon of Tuesday and from seven o'clock in the afternoon of Tuesday to seven o'clock in the forenoon of Wednesday and from seven o'clock in the afternoon of Wednesday to seven o'clock in the forenoon of Thursday; and

(e) From the 1st day of September, 1985 to the 7th day of September, 1985, both dates inclusive, except from seven o'clock in the afternoon of Monday to seven o'clock in the forenoon of Tuesday and from seven o'clock in the afternoon of Tuesday to seven o'clock in the forenoon of Wednesday.

(4) No person shall troll commercially for sockeye or pink salmon in the waters described in subsection (1) of this section from the 21st day of July, 1985 to the 14th day of September, 1985, both dates inclusive, except at times that net fishing may be permitted within that area.

3. (1) No person shall fish for sockeye or pink salmon with nets in Pacific Fishery Management Areas 17 and 18 from the 23rd day of June, 1985 to the 28th day of September, 1985, both dates inclusive.

(2) No person shall troll commercially for sockeye or pink salmon in Pacific Fishery Management Area 18-1 from the 11th day of August, 1985 to the 28th day of September, 1985, both dates inclusive.

4. (1) No person shall fish for sockeye or pink salmon with purse seines in Pacific Fishery Management Area 29-1 to 7 and 9 to 17.

(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 23rd day of June, 1985 to the 29th day of June, 1985; from the 25th day of August, 1985 to the 7th day of September, 1985; and from the 22nd day of September, 1985 to the 12th day of October, 1985, all dates inclusive; and

(b) From the 30th day of June, 1985 to the 20th day of July, 1985 and from the 11th day of August, 1985 to the 24th day of August, 1985, all 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

(c) From the 21st day of July, 1985 to the 10th day of August, 1985, both dates inclusive, except from eight o'clock in the forenoon of Monday to eight o'clock in the forenoon of Tuesday and from eight o'clock in the forenoon of Wednesday to eight o'clock in the forenoon of Thursday of each week.

(3) No person shall troll commercially for sockeye or pink salmon in the waters described in subsection (1) of this section from the 22nd day of September, 1985 to the 12th day of October, 1985, both dates inclusive.

5. (1) No person shall fish for sockeye or pink salmon with gill nets in Pacific Management Area 29-1 to 6 from the 8th day of September, 1985 to the 21st day of September, 1985, 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.

(2) No person shall troll commercially for sockeye or pink salmon in the waters described in subsection (1) of this section:

(a) From the 11th day of August, 1985 to the 31st day of August, 1985 and from the 15th day of September, 1985 to the 21st day of September, 1985, all dates inclusive, except at times that net fishing may be permitted within that area; and

(b) From the 1st day of September, 1985 to the 14th day of September, 1985, both dates inclusive, except from eight o'clock in the forenoon of Monday to eight o'clock in the afternoon of Friday of each week.

6. (1) No person shall fish for sockeye or pink salmon with gill nets in Pacific Management Area 29-7 and 9 to 17 from the 8th day of September, 1985 to the 21st day of September, 1985, both dates inclusive.

(2) No person shall troll commercially for sockeye or pink salmon in the waters described in subsection (1) of this section from the 11th day of August, 1985 to the 21st day of September, 1985, both dates inclusive.

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

United States Fraser River Panel Area Waters:

"Pursuant to the Pacific Salmon Treaty between the United States of America and Canada, signed at Ottawa on the 28th day of January, 1985, the International Pacific Salmon Fisheries Commission hereby recommends to the United States Government that, in the interests of the fisheries for Fraser River sockeye and pink salmon, the following regula-

tions for Convention Waters (Fraser River Panel Area Waters) for the season of 1985 be adopted and that said regulations be forwarded to the Secretary of Commerce for implementation as federal regulations by the National Marine Fisheries Service, and to the Director of Fisheries of the State of Washington for implementation as law of the State of Washington, namely:

1. (1) No person shall retain pink salmon taken by commercial trolling gear in those 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 from the 15th day of June, 1985 to the 14th day of July, 1985, both dates inclusive.

(2) Regulatory control of the waters described in subsection (1) of this section shall be relinquished effective 12:01 a.m. September 15, 1985.

2. (1) No person shall fish for sockeye or pink salmon with nets in Puget Sound Salmon Management and Catch Reporting Areas 4B, 5, 6 and 6C from the 23rd day of June, 1985 to the 20th day of July, 1985; from the 11th day of August, 1985 to the 17th day of August, 1985 and from the 25th day of August, 1985 to the 14th day of September, 1985, all 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:

(a) From the 21st day of July, 1985 to the 10th day of August, 1985, both dates inclusive, except from five o'clock in the forenoon to half past nine o'clock in the afternoon of Tuesday of each week; and

(b) From the 18th day of August, 1985 to the 24th day of August, 1985, both dates inclusive, except from five o'clock in the forenoon to nine o'clock in the afternoon of Tuesday and Wednesday.

(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 21st day of July, 1985 to the 27th day of July, 1985 and from the 4th day of August, 1985 to the 10th day of August, 1985, all dates inclusive, except from seven o'clock in the afternoon of Tuesday to half past nine o'clock in the forenoon of Wednesday of each week; and

(b) From the 28th day of July, 1985 to the 3rd day of August, 1985, both dates inclusive, except from seven o'clock in the afternoon of Monday to half past nine o'clock in the forenoon of Tuesday; and

(c) From the 18th day of August, 1985 to the 24th day of August, 1985, both dates inclusive, except from six o'clock in the afternoon of Tuesday to nine o'clock in the forenoon of Wednesday and from six o'clock in the afternoon of Wednesday to nine o'clock in the forenoon of Thursday.

3. No person shall fish for sockeye or pink salmon with nets in Puget Sound Salmon Management and Catch Reporting Area 6A from the 23rd day of June, 1985 to the 14th day of September, 1985, both dates inclusive.

4. (1) No person shall fish commercially for sockeye or pink salmon in Puget Sound Salmon Management and Catch Reporting Areas 7 and 7A from the 23rd day of June, 1985 to the 20th day of July, 1985; from the 11th day of August, 1985 to the 17th day of August, 1985 and from the 15th day of September, 1985 to the 21st day of September, 1985, all 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:

(a) From the 21st day of July, 1985 to the 10th day of August, 1985, both dates inclusive, except from five o'clock in the forenoon to half past nine o'clock in the afternoon of Tuesday of each week; and

(b) From the 18th day of August, 1985 to the 14th day of September, 1985, both dates inclusive, except from five o'clock in the forenoon to nine o'clock in the afternoon of Tuesday and Wednesday 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 21st day of July, 1985 to the 27th day of July, 1985 and from the 4th day of August, 1985 to the 10th day of August, 1985, all dates inclusive, except from seven o'clock in the afternoon of Tuesday to half past nine o'clock in the forenoon of Wednesday of each week; and

(b) From the 28th day of July, 1985 to the 3rd day of August, 1985, both dates inclusive, except from seven o'clock in the afternoon of Monday to half past nine o'clock in the forenoon of Tuesday; and

(c) From the 18th day of August, 1985 to the 24th day of August, 1985 and from the 1st day of September, 1985 to the 7th day of September, 1985, all dates inclusive, except from six o'clock in the afternoon of Tuesday to nine o'clock in the forenoon of Wednesday and from six o'clock in the afternoon of Wednesday to nine o'clock in the forenoon of Thursday of each week; and

(d) From the 25th day of August, 1985 to the 31st day of August, 1985 and from the 8th day of September, 1985 to the 14th day of September, 1985, all dates inclusive, except from six o'clock in the afternoon of Monday to nine o'clock in the forenoon of Tuesday and from six o'clock in the afternoon of Tuesday to nine o'clock in the forenoon of Wednesday of each week.

(4) 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 21st day of July, 1985 to the 27th day of July, 1985 and from the 4th day of August, 1985 to the 10th day of August, 1985, all dates inclusive, except from half past seven o'clock in the forenoon to half past nine o'clock in the afternoon of Monday of each week; and

(b) From the 28th day of July, 1985 to the 3rd day of August, 1985, both dates inclusive, except from half past six o'clock in the forenoon to eight o'clock in the afternoon of Monday; and

(c) From the 18th day of August, 1985 to the 24th day of August, 1985 and from the 1st day of September, 1985 to the 7th day of September, 1985, all dates inclusive, except from six o'clock in the forenoon to nine o'clock in the afternoon of Monday and from five o'clock in the forenoon to nine o'clock in the afternoon of Tuesday of each week; and

(d) From the 25th day of August, 1985 to the 31st day of August, 1985 and from the 8th day of September, 1985 to the 14th day of September, 1985, all dates inclusive, except from half past five o'clock in the forenoon to six o'clock in the afternoon of Monday and from five o'clock in the forenoon to nine o'clock in the afternoon of Tuesday of each week.

5. No person shall fish for sockeye or pink salmon in Puget Sound Salmon Management and Catch Reporting Area 7B, except for those sockeye and pink salmon taken in nets having mesh not less than 7 inches as authorized for the taking of chinook salmon by the Director of Fisheries of the State of Washington, from the 23rd day of June, 1985 to the 20th day of July, 1985, both dates inclusive.

6. No person shall fish commercially for sockeye or pink salmon in Puget Sound Salmon Management and Catch Reporting Area 7D from the 23rd day of June, 1985 to the 20th day of July, 1985, both dates inclusive.

7. (1) No person shall fish commercially for sockeye or pink salmon in that portion of the waters described in subsection (1) of section 4 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 25th day of August, 1985 to the 31st day of August, 1985, both dates inclusive.

(2) No person shall fish commercially for sockeye or pink salmon in that portion of the waters described in subsection (1) of section 4 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 1st day of September, 1985 to the 28th day of September, 1985, both dates inclusive.

8. The following Convention Waters (Fraser River Panel Area Waters) are excluded:

(1) Puget Sound Salmon Management and Catch Reporting Areas 6B, 6D and 7C.

(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 to achieve the mandated sharing of the fish by fishermen of the United States and Canada, the approved regulations were adjusted by the Commission as follows:

June 28, 1985 - In order to secure escapement from a small Early Stuart sockeye run, the Commission cancelled the scheduled opening in Area 29 of Canadian Waters for the week commencing June 30.

July 5, 1985 - For the conservation of the Early Stuart sockeye, the Commission cancelled the scheduled opening in Area 29 of Canadian Waters for the week commencing July 7. The Commission also approved the following regulatory changes: 1) That reef net fishing in United States Waters each week would be advanced by one day from the preseason schedule; 2) That retention of pink salmon by trollers westerly of the Bonilla-Tatoosh Line be permitted after July 10; 3) That Area 29-2 to 5 open for trolling from July 20 to August 10.

July 12, 1985 - Due to the low abundance of Early Stuart sockeye, the Commission cancelled the scheduled opening in Area 29 of Canadian Waters for the week commencing July 14.

July 19, 1985 - In the interest of obtaining additional escapement of Early Stuart sockeye, the Commission approved the following regulatory changes: 1) That Area 20-1, 3 and 4 of Canadian Waters and United States Waters not open as scheduled for the week commencing July 21; 2) That Area 29 of Canadian Waters open as scheduled but for 1 day of fishing only.

August 2, 1985 - In order to harvest Horsefly sockeye in United States Waters, the Commission approved 2 days fishing for the week commencing August 4.

August 9, 1985 - For the harvest of Horsefly sockeye in United States Waters, the Commission approved an August 13 opening for 1 day of fishing.

August 13, 1985 - For the additional harvest of Horsefly sockeye in Area 20 of Canadian Waters, the Commission approved a 1 day extension, making a total of 3 days for the week.

August 16, 1985 - The Commission required additional Horsefly escapement and approved the following regulatory changes: 1) That Area 20-1, 3 and 4 of Canadian Waters open as scheduled but for only 1 day of fishing; 2) That Area 29 of Canadian Waters opening be advanced 24 hours for 1 day of fishing; 3) That United States Waters not open as scheduled for the week commencing August 18.

August 19, 1985 - In order to harvest Horsefly sockeye, the Commission reopened Area 29 of Canadian Waters for gill nets on August 21 for 1 day of fishing and Area 29-1 to 4 and 6 of Canadian Waters to trolling August 22 for 1 day.

August 23, 1985 - For the harvest of Horsefly sockeye, the Commission approved the following regulatory changes: 1) That Area 20-1, 3 and 4 of Canadian Waters open as scheduled but for 2 days of fishing; 2) That Area 29 of Canadian Waters open August 25 for 1 day of fishing; 3) That United States Waters open for 1 day of fishing with purse seines starting first on August 26 and the Iwersen's Dock Line would not be in effect.

August 26, 1985 - In the interest of additional harvest of Horsefly sockeye, the Commission reopened Area 29 of Canadian Waters to gill nets August 28 for 1 day of fishing and Area 29-1 to 4 and 6 of Canadian Waters to trolling August 29 for 24 hours.

August 27, 1985 - For harvest and allocation of catch, the Commission reopened United States Waters on August 28 for 1 day of fishing making a total of 2 days for the week.

August 30, 1985 - Due to the lateness of the pink salmon run and for the protection of sockeye, the Commission approved the following regulatory changes: 1) That Area 29-1 to 4 and 6 of Canadian Waters not open as scheduled; 2) That the Iwersen's Dock Line in United States Waters be in effect.

September 5, 1985 - For the harvest of pink salmon and Horsefly sockeye the Commission approved the following regulatory changes: 1) That Area 20-1, 3 and 4 of Canadian Waters open September 9 for 2 days of fishing; 2) That Area 29-1 to 7 and 9 to 17 of Canadian Waters open to gill nets September 6 for 12 hours; 3) That Area 29-1 to 4 and 6 of Canadian Waters open to trolling September 7 for 2 days; 4) That Area 29-1 to 4 and 6 of Canadian Waters open September 10 for trolling for 4.5 days of fishing; 5) That fishing in Areas 7 and 7A of United States Waters, scheduled to open for one day on September 10, be advanced 24 hours but that the second day on September 11 be unchanged. The East Point Light Line would be in effect.

September 10, 1985 - Due to the rapid decline of pink salmon abundance, the Commission cancelled the opening in United States Waters for September 11.

September 12, 1985 - The Commission approved Area 29-1 to 4 and 6 of Canadian Waters be closed to trolling effective 8:00 p.m. September 12 and that retention of pink salmon in Areas 17, 18 and 29-5 be prohibited effective 8:00 p.m. September 12.

September 13, 1985 - The Commission extended regulatory control of Area 20 of Canadian Waters and the area remained closed to fishing.

September 17, 1985 - Due to declining numbers of pink salmon in Area 20 of Canadian Waters, the Commission relinquished regulatory control effective 12:01 a.m. September 18.

October 8, 1985 - In the interest of additional pink salmon harvest, the Commission opened Area 29-1 to 7 and 9 to 17 of Canadian Waters for gill nets for 12 hours of fishing on October 9. Regulatory control of Area 29 of Canadian Waters was extended beyond the scheduled date of relinquishment.

The Commission relinquished regulatory control of the remaining Fraser River Panel Area Waters effective October 20, thus completing the Commission's regulatory obligations for the 1985 season.

SOCKEYE SALMON REPORT

The Fishery

The Fraser River sockeye run in 1985 totaled 13,879,000 fish, 54% more than the forecast of 9,000,000 fish. Commercial fishermen harvested 11,295,000 (81.4% of the total run) Fraser River sockeye in all fisheries. Canadian Indian subsistence fishermen caught 442,000 sockeye, primarily in the Fraser River. The recreational catch was estimated at 2,500 fish and an escapement of 2,139,000 sockeye reached the spawning grounds (Tables I to VI in Appendix). Both total run and commercial catch were the largest on the cycle since 1913. The run exceeded the 1981 brood year return by over 6,000,000 sockeye (79%) (Table 1). The 1985 Fraser River sockeye run was the third largest and the catch was the second largest for all years since 1913.

TABLE 1. Total Fraser sockeye returns on the 1985 cycle.

Year	Total Run
1953	5,854,000
1957	5,401,000
1961	4,714,000
1965	3,167,000
1969	4,941,000
1973	6,878,000
1977	5,779,000
1981	7,741,000
1985	13,879,000

Allocation of the 1985 Fraser River sockeye harvest under the terms of the Pacific Salmon Treaty included the catch taken by fishermen of Canada and the United States in all areas. Sharing of the catch was to follow a Treaty defined allocation with the United States receiving 1,780,000 (minus 50,000 fish) of the preseason forecast of 6,600,000 Total Allowable Catch (TAC). Because of the larger run, catch by United States fishermen was 2,933,000 fish (26.0%), and the commercial catch in Canada reached 8,362,000 sockeye (74.0%) (Table 2).

TABLE 2. 1985 Fraser River sockeye commercial catch.

		Catch	%
CANADA			
Fraser River Panel Area		4,673,000	41.4
Non-Panel Areas		3,689,000	32.6
	Total	8,362,000	74.0
UNITED STATES			
Fraser River Panel Area		2,923,000	25.9
Non-Panel Areas		10,000	0.1
	Total	2,933,000	26.0
TOTAL COMMERCIAL CATCH		11,295,000	100.0

In-season adjustments of the escapement goal approved by Canada increased the net escapement above the preseason goal of 2,000,000 fish. The additional escapement was included in the TAC for computation of the United States allocation. In addition, the Canadian Indian subsistence fishery catch in excess of 400,000 fish was included in Canada's catch total. Inclusion of recreational fishery catch (2,500), Indian catch in excess of 400,000 fish (42,000) and net escapement over 2,000,000 fish (138,600) increased the Total Allowable Catch to 11,479,000 Fraser sockeye and United States share to 3,046,000 Fraser sockeye as follows:

Actual Total Run	13,879,000
Net Escapement (for computation)	-2,000,000
Total Catch (for computation)	11,879,000
Fraser River Indian Food Fishery Exemption	-400,000
Total Allowable Catch (for computation)	11,479,000
United States Allocation:	
(1,780,000/6,600,000) x 11,479,000 =	*3,096,000* (rounded)
Less 50,000 fish	-50,000
Allocation computation	3,046,000

The 1985 United States catch in all areas is estimated at 2,933,000 Fraser sockeye. Annex IV, Chapter 4, 1(b) of the Pacific Salmon Treaty states that "--- if management measures fail to achieve such sockeye and pink catches, any difference shall be compensated by adjustments to the Fraser fishery in subsequent years;". The difference (113,000) between the treaty-defined share and the actual catch taken by the United States in 1985 would be compensated in following years.

Canadian commercial catches of Fraser sockeye in the Fraser River Panel Area amounted to 4,673,000 Fraser sockeye (Table 2) and 1,000 sockeye of other stocks. Within the Panel Area, 2,762,000 sockeye were harvested in the Area 20 net fishery (Table 3). An additional 533,000 fish were taken in the coastal troll fishery, making the catch westerly of William Head 3,295,000 sockeye or 71% of the Canadian Fraser River Panel Area catch. Easterly of William Head, the catch amounted to 1,378,000 sockeye (29%), mainly taken by gill nets in Area 29. The total troll catch in the Area of 601,000 Fraser River sockeye was clearly the largest recorded on the cycle. In the brood year (1981), only 31,000 sockeye were taken in the same areas by trollers. Canadian catches of Fraser River sockeye in non-Panel Areas reached 3,689,000 fish, taken primarily in the Johnstone Strait net fishery and by trollers off the west coast of Vancouver Island.

Johnstone Strait net catches were 3,036,000 sockeye while trollers operating north of the Area along the west coast and in Johnstone Strait landed 605,000 Fraser sockeye. Fisheries in Areas 1 and 2W (Queen Charlotte Islands) accounted for an additional 83,000 fish.

Large catches in Johnstone Strait were the result of a higher-than-average migration of sockeye via the northern approach. An estimated 33% of all Fraser River sockeye approached the river from north of Vancouver Island in 1985, substantially lower than the 67% diversion observed in 1981 but above the long-term average of 24%.

TABLE 3. 1985 Canadian catch of Fraser River sockeye, Fraser River Panel Area only.

		Number	Percent
Areas 20, 121-124	Troll	533,000	11.4
Area 20	Purse Seine	2,285,000	48.9
	Gill Net	477,000	10.2
Westerly Area Total		3,295,000	70.5
Areas 17, 18, 29	Gill Net	1,310,000	28.0
	Troll	68,000	1.5
Easterly Area Total		1,378,000	29.5
Grand Total		4,673,000	100.0

Canada requested that the Commission implement the Minister's Advisory Council (MAC) recommendations for allocation of the Fraser sockeye catch in the Fraser Panel Area. The catch distribution of fish taken in all fisheries in the 1981 base year, were: troll, 2.4%, purse seine, 66.2% and gill nets, 32.1%. Final estimates of Canadian catch in 1985 by gear were as follows: troll, 14.4%, purse seines, 57.0%, and gill nets, 28.6% (Table 4). The most notable departure from past years occurred in the catch by trollers. The average share of the Canadian catch taken by this gear in the past three cycle years was 2.8%. Reasons for the larger catch taken in 1985 include increased directed effort by trollers, the large run and greater vulnerability of sockeye to improved troll gear and tactics. Commission regulated fisheries harvested only 50% of the Canadian catch, since regulations were promulgated only for net fisheries in Areas 20 and 29 and the inside troll fisheries. The Commission had no regulatory authority over the troll fishery on the west coast of Vancouver Island, where more than 1,000,000 sockeye were harvested. The responsibility for management of the troll fishery in that area was with the Canadian Government.

In the Fraser Panel Area, the catch of sockeye by gear was as follows: troll, 604,000 (12.9%), purse seine, 2,285,000 (48.9%), and gill nets, 1,789,000 (38.2%). The total catch of sockeye (all stocks) was 4,677,000.

United States Fraser River Panel Area fisheries yielded total catches of 2,925,000 sockeye including 1,800 fish of non-Fraser River stocks. There was no agreed upon catch allocation by gear in the United States fishery. Gill nets harvested 1,423,000 sockeye (48.7%), purse seines landed 1,404,000 (48.0%) and reef nets accounted for 96,000 fish (3.3%). The gill net catch was the largest taken by this gear in any year. Purse seine and reef net catches were the largest on the cycle since 1973. The catch of about 800,000 sockeye on August 13 was the largest single day's catch on record.

In addition to Panel Area catches, United States fishermen harvested 10,000 Fraser River sockeye in Alaska District 104.

As in other recent years starting in 1977, Treaty Indian fishermen in United States Waters fished outside the regulatory control of the Commission. The total net catch of sockeye taken by Treaty Indians under regulations promulgated by the United States Department of the Interior was 1,574,000 fish, or 53.9% of the total United States catch.

TABLE 4. 1985 Canadian catch of Fraser River sockeye by gear and area.

Gear		Catch	%
Troll			
Areas 101-111, 11, 12, 20, 121-127		1,074,000	12.8
Areas 13-16		64,000	0.8
Areas 17, 18, 29*		68,000	0.8
	Total	1,206,000	14.4
Purse Seine			
Areas 1-16		2,482,000	29.7
Area 20*		2,285,000	27.3
	Total	4,767,000	57.0
Gill Net			
Areas 1-16		602,000	7.2
Area 20*		477,000	5.7
Area 29*		1,310,000	15.7
	Total	2,389,000	28.6
	Total Catch	8,362,000	100.0

* Fraser River Panel Area fisheries regulated by the I.P.S.F.C.

Fishing times in Panel Area Waters for net gear increased only slightly over preseason expectations even though the actual return was much larger than forecast (Table 5).

TABLE 5. Numbers of days directed toward sockeye harvest in Fraser River Panel Area fisheries.

	Days in Preseason Schedule	Actual Days Fished
CANADA:		
Area 20	9	10
Area 29	11	11
UNITED STATES:	3*	4*

* Commission regulated fisheries.

The amount of fishing gear (nets) in Area fisheries during the sockeye fishing season increased in Canadian Area 20 due to a more normal proportion of fish migrating via Juan de Fuca Strait in 1985 compared with the brood year, 1981 (Table 6). The number of purse seines in United States fishing areas decreased while the number of gill nets increased slightly.

TABLE 6. Maximum number of fishing units operating in the Fraser River Panel Area near the peak of sockeye abundance.

	Year	Purse Seines	Gill Nets	Reef Nets	Total
CANADA:					
Area 20	1981	54	100	—	154
	1985	186	180	—	366
Area 29	1981	—	677	—	677
	1985	—	844	—	844
UNITED STATES:	1981	171	867	45	1083
	1985	164	916	39	1119

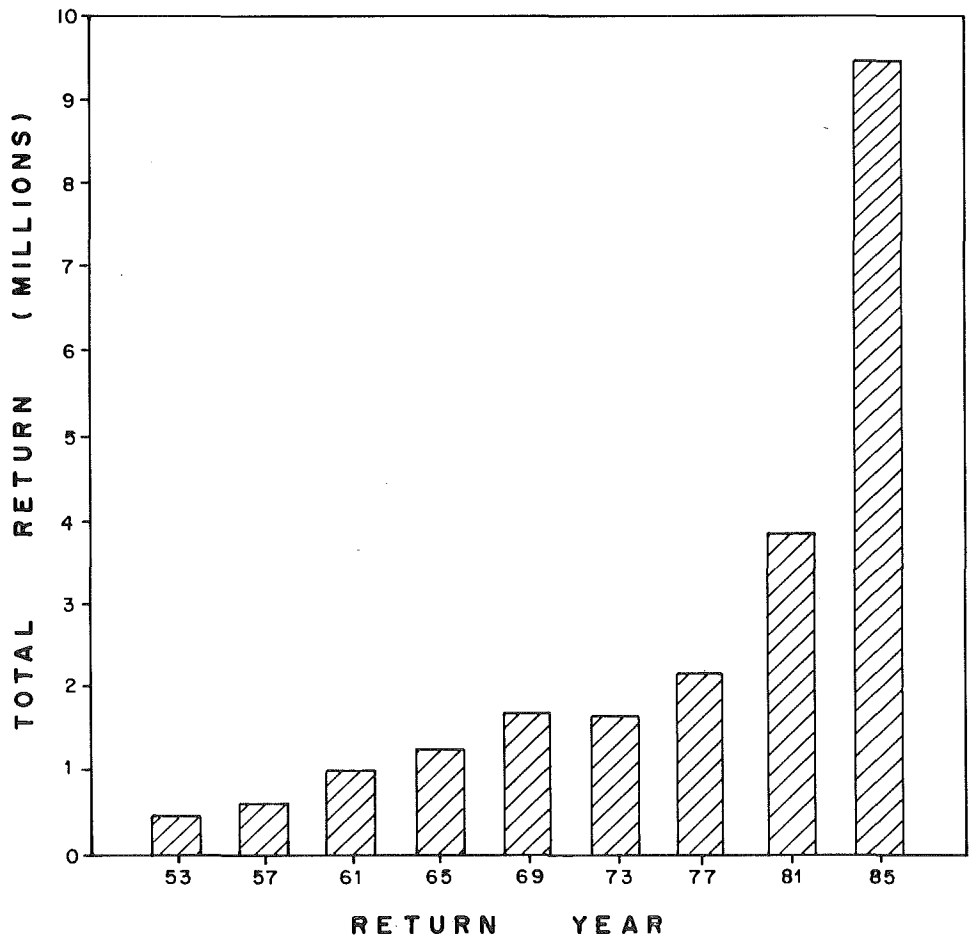


FIGURE 1. Total run of Quesnel area sockeye, 1953-1985 cycle.

Sockeye production in 1985 was dominated by the exceptional return of Quesnel Lake stocks, primarily to the Horsefly River. A total run of 9,554,000 fish of these stocks was recorded (Figure 1). This return was the largest to the Quesnel area since 1913. Rehabilitation of the Quesnel area stocks has been achieved through the combination of improved upstream access and escapement management from 1945 to the present. In 1941, at the point of minimum abundance, only 1,000 sockeye arrived at the Horsefly River spawning grounds (Table 7). The completion of the first Hell's Gate fishway in 1945 and severe restrictions on harvests by the commercial fishery improved the escapement to 105,000 spawners by 1953. This stock recovered gradually between 1953 and 1973 despite chronic prespawning losses of up to 60% of the female population. In 1977, the percentage of the Horsefly River run that utilized the lower portion of the river increased significantly (Table 7). These fish appeared to be later-timed migrants and occupied areas previously used by the historic (pre-1913) population. The commercial fisheries were adjusted by management in 1977 and 1981 to obtain larger total escapements and, in particular, to obtain proportionally more escapement of these later migrants. In addition, in recent cycle years, pre-spawning mortality losses have been low.

Increased escapements have produced larger juvenile populations and this has resulted in depressed growth rates in Quesnel Lake. Circuli in the freshwater growth zone of the scales of Quesnel Lake sockeye reflect this density-dependent growth effect and confirm that the large adult population observed in 1985 was the direct result of increased smolt production from the progressively larger spawning escapements.

TABLE 7. Horsefly River 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
1985	1,135,000	258,000	22.7

Late Stuart sockeye stocks exhibit cyclic dominance similar to Quesnel Lake sockeye. The excellent return of 1,978,000 fish in 1985 was probably the largest production since 1913. Juveniles produced by spawners in Middle River and its tributaries rear in Trembleur Lake while Tachie River fry migrate downstream to Stuart Lake. Normally, the Middle River population predominates in the return, as evidenced by larger escapements to that area. However, in 1985, the larger fraction of spawning adults was in the Tachie River. Freshwater growth of Tachie River sockeye in Stuart Lake was the lowest on record, confirming lake surveys that indicated a large population of juveniles in 1982 from the 1981 spawning.

It appears that Early Stuart eggs deposited in 1981 suffered during a very cold overwinter incubation period, thus reducing juvenile and adult production of this stock. The total return of 357,000 adults was the smallest since 1965. The rate of return was only 2.7 per brood-year spawner, the second lowest observed on the cycle.

Significant returns were recorded for Chilko and Stellako stocks where 5-year-old fish supplemented modest returns of 4-year-old sockeye. In total, 474,000 Chilko River 5-year-old fish from the 1980 spawning returned, adding to the record return in 1984 of 3,700,000 4-year-old adults. The total 1985 Chilko run of 688,000 adults (69% 5-year-olds) was the largest on the cycle since 1957. Stellako sockeye contributed 455,000 fish to the total run, and 219,000 (48%) were 5-year-olds.

In addition to the poor Early Stuart return, several other stocks were well below optimum production levels. A return of only 79,000 Late Nadina sockeye was a disappointment. The returns of 4-year-old sockeye to the Thompson River area stocks were generally low. Birkenhead River contributed only 144,000 adult sockeye, while the Pitt River return of 9,000 was very poor. Production from the latter two areas suffered from severe flooding during incubation of eggs deposited in both 1980 and 1981. The return of 237,000 adult sockeye to Weaver Creek was near the average.

Onshore arrivals were later than normal for most sockeye stocks, as was forecast using Gulf of Alaska sea surface temperature data. Adjustments of fishing schedules were necessary to accommodate the entry patterns, but were generally minor owing to the incorporation of the timing forecast in the preseason management plan.

The average weight of 4-year-old Fraser River sockeye in 1985 was 5.5 pounds, slightly lower than the long-term average. The record small size of jacks in 1984 and the small size of adults in 1985 are a continuation of the trend of reduced ocean growth observed for the last six years. Jack sockeye in 1985 were also below average in size.

Escapement

Sockeye escapements for most races in the watershed were excellent. In total, 2,139,000 sockeye arrived in the spawning areas, an increase of 48% from the escapement of 1,443,000 spawners in 1981 (Appendix Table VI). Spawning was generally later than normal, related to late arrival of fish in coastal areas.

The Nechako watershed was an important area in 1985 with both the Early and Late Stuart dominant runs occurring on this cycle. Even though the Early Stuart sockeye total run was below expectations, the escapement of 235,000 spawners slightly exceeded the goal of 230,000, and was an 81% increase from the brood year. Spawning was concentrated in the Takla Lake tributaries with 94,000 spawners in Driftwood River and 42,000 additional fish in smaller streams tributary to the lake.

Late Stuart sockeye spawn primarily in Middle and Tachie Rivers between the large lakes in the system. Normally only about 10% of the run use tributary streams. The escapement of 275,000 sockeye was 10% more than observed in 1981, and was near the long term average escapement for this stock. The majority spawned in the Tachie River in 1985; this was contrary to typical years in which Middle River has been the primary spawning area. Tributary streams in the system were used by less than 2% of the spawners, compared with 12% in 1981. Loss of eggs deposited in these streams due to very cold temperatures during the winter of 1981-1982 may have reduced production in 1985.

In the Fraser Lake-Francois Lake watershed, the escapement of Nadina River sockeye was low. The Early Nadina escapement declined 98% to only 18 spawners. This cycle was formerly the dominant year for the Nadina runs; in 1957, 30,000 Early Nadina spawners were recorded. Late Nadina sockeye escapement was not as severely affected, but declined to 14,000 spawners from the brood year level of 19,000 fish. Over 12,000 of these fish entered the spawning channel. While the spawning channel has aided the Late Nadina sockeye run, the increased harvest rate on Horsefly sockeye that migrate through the fisheries at the same time was responsible, in part, for the lower Late Nadina sockeye escapement.

Stellako River sockeye are normally not abundant on the 1985 cycle. However, the

run did return in good numbers and 42,000 spawners represent a doubling of the escapement from the brood year level.

Bowron River sockeye increased from 1,200 spawners in 1981 to 6,400 in 1985. Better overall production and escapement have been observed in the past two years.

The outstanding feature of the 1985 escapement was the excellent return of 1,349,000 fish to the Quesnel system spawning areas. All spawning areas contained large numbers of fish. Since the recovery of the population from extremely low abundance in the 1940's, most Horsefly River spawners have utilized the upper river spawning grounds (Table 7). As recent as in 1973, 91% of all Horsefly area spawners were found there. This year, only 64% of the escapement utilized this area. However, the escapement of 762,000 spawners in the upper Horsefly River was the largest on record. The International Pacific Salmon Fisheries Commission recommended that sockeye be airlifted above the falls. Canada Department of Fisheries and Oceans successfully transported 32,000 sockeye above Horsefly Falls. Inaccessible spawning areas above the falls were probably used for the first time. This area and the lower Horsefly River have some of the largest underutilized sockeye spawning areas in the Fraser River watershed. McKinley Creek contained 83,000 spawning fish in the lower creek and 15,000 in the upper portion above McKinley Lake.

Lower Horsefly River spawning grounds were historically used by the very large runs prior to 1913. Hell's Gate obstructions between 1913 and 1945 decimated the portion of the Horsefly run using the lower river. Slow increases in the population have occurred in recent years. In 1981, 17.7% of the Horsefly escapement spawned there. In 1985, it is estimated that 258,000 sockeye spawned in the lower Horsefly River accounting for 22.7% of the area escapement. The Little Horsefly River held an additional 17,000 spawners. Mitchell River, which enters the north arm of Quesnel Lake, increased in population to 205,000 spawners, three times the brood year number.

In total, the Quesnel Lake streams contained as many sockeye as spawned in the entire Fraser watershed in 1981. Late timing and below average water temperature during migration and spawning resulted in a very high success of spawning (95%). This high success of spawning has not occurred on the cycle since 1957.

Chilko River sockeye escapements on this cycle have been depressed for many years. A large return of 5-year-old spawners augmented a small return of 4-year-old fish. In total, 71,000 adult sockeye and 15,000 jacks utilized the Chilko River area. This was more than double the 1981 escapement and was the largest adult population on the cycle since 1969.

In the Seton-Anderson system, the Gates Creek spawning channel and adjacent stream accommodated 5,800 spawners, unchanged from the brood year. Only 2,100 Portage Creek spawners arrived in 1985, a decrease from 6,100 fish in 1981.

The adult escapements to Thompson River watershed areas were lower than observed in recent cycle years. The Seymour River population declined 40% to 6,400 spawners. Scotch Creek sockeye have been dominant on the 1985 cycle but escapement declined severely from 19,000 in 1981 to 3,400 spawners in 1985. The escapement of 83 fish to the Upper Adams River where few fish had spawned in 1981 was very encouraging. The majority of these were 5-year-olds of the very successful 1980 brood. Early runs into the North Thompson River include Fennell Creek, which declined 23% to 1,600 spawners, and Raft River where 3,600 fish arrived, a four-fold increase over 1981. In these latter two areas, 5-year-old fish also predominated in the return.

Late timed sockeye spawn in the Lower Adams River, Little River and Lower Shuswap River. Adult runs were small with only 400 fish at Adams and 800 arriving in the Lower Shuswap. Jack sockeye, 3-year-old forerunners of the 1986 dominant cycle return, brought the total populations to 12,000 in the Adams area and 3,100 in the Lower Shuswap. This jack escapement to Adams River, however, was the lowest for a year immediately prior to a dominant cycle since 1941.

In the Lower Fraser watershed, the Birkenhead run was depleted by the impacts of flooding during egg incubation in both 1980 and 1981. The total spawning population was 37,600 fish, but only 11,900 of these were adults, down 75% from the 1981 escapement. Upper Pitt River sockeye showed a similar drastic reduction in escapement, declining from 25,300 in 1981 to only 3,600 fish this fall. The Weaver Creek sockeye escapement into the spawning channel and adjacent stream was 39,500 fish, 13% lower than 1981. Of these, 21,800 entered the channel. The 1985 run was produced almost exclusively in the channel as flooding in Weaver Creek in 1981 destroyed most of the wild eggs. Without the channel, a decline similar to those observed at Pitt and Birkenhead Rivers could have been expected since Weaver Creek is even more severely impacted by fall floods. Harrison River sockeye escapement was only 5,100 spawners.

Prespawning mortalities were low at all those streams which have been subject to chronic losses such as Horsefly River. Late arrival of the fish and low water temperatures combined to reduce stress and resulted in about 95% of the females successfully depositing eggs.

In-season acoustic monitoring of the sockeye escapement at Mission, B.C. provides estimates of daily escapement. The 1985 escapement past Mission was estimated at 2,385,000 adult sockeye. Fraser River Indian catches and spawning ground escapements accounted for a total of 2,505,000 adults, 7% more than estimated in-season.

PINK SALMON REPORT

The Fishery

Fraser River pink salmon returns were estimated at 18,864,000 fish, the largest since the IPSFC assumed regulatory responsibility in 1957 and likely the largest run since 1913. The 1985 run marked the fourth consecutive pink salmon return of over 14 million fish (Table 8) and further substantiated the validity of the management strategy, begun in 1977, which was aimed at greater utilization of Fraser River spawning habitats. The return was 18% higher than the preseason forecast of 16,000,000 pink salmon. Considerable difficulty was experienced by Commission staff in estimating run size during the season; projections ranged from 15,000,000 to 19,000,000. Escapement projections in-season were also well below actual.

TABLE 8. Total Fraser River pink salmon runs, 1959-1985.

Year	Total Run
1959	6,460,000
1961	1,888,000
1963	5,477,000
1965	2,320,000
1967	12,968,000
1969	3,928,000
1971	9,767,000
1973	6,789,000
1975	4,894,000
1977	8,243,000
1979	14,404,000
1981	18,685,000
1983	15,346,000
1985	18,864,000

Increased pink salmon escapements in recent years (1977-83) have resulted in an average egg to fry survival rate of 12.3% (Table 9) compared to an average of 13.4% for the prior eight brood years (1961-75), despite a more than doubling of the egg deposition. This small negative response in freshwater survival suggests that even larger escapements (with proper spawning distribution) may be possible without significantly reducing incubation survival. Additionally, marine survival for 1983 brood pink salmon fry was 3.4%, slightly above the 11 year average of 3.1% (Table 9). The apparent independence of fry abundance and marine survival suggests that even larger fry production would not necessarily result in lower marine survival.

Fraser River pink salmon catches totaled 12,403,000 fish in all areas, the second largest catch since catch estimates began in 1959. In addition, a record escapement of 6,461,000 fish reached the spawning grounds. Commercial fishermen in the United States harvested 3,802,000 Fraser pink salmon while Canadian commercial catches totaled 8,387,000 fish (Table 10). Addition of sport and Fraser River Indian fishery catches brought the totals to 3,825,000 Fraser pinks in United States Waters and 8,578,000 in Canada.

TABLE 9

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	1981	1983
Total Spawners (millions)	1.094	1.953	1.191	1.831	1.529	1.804	1.754	1.367	2.388	3.561	4.488	4.632
Female Spawners (millions)	0.654	1.216	0.692	0.973	0.957	1.096	1.009	0.781	1.362	2.076	2.560	2.931
Potential Egg Deposition (billions)	1.569	2.435	1.488	2.132	2.018	1.923	1.865	1.493	2.960	3.787	4.814	4.702
Fry Production (millions)	143.6	284.2	274.0	237.6	195.6	245.0	292.4	279.2	473.3	341.5	590.2	554.8
Adult Return Catch + Escapement (millions)	5.477	2.320	12.968	3.928	9.767	6.789	4.894	8.243	14.404	18.685	15.346	18.864
Freshwater Survival	9.2%	11.7%	18.4%	11.1%	9.7%	12.7%	15.7%	18.7%	16.0%	9.0%	12.3%	11.8%
Marine Survival	3.8%	0.8%	4.7%	1.7%	5.0%	2.8%	1.7%	3.0%	3.0%	5.5%	2.6%	3.4%

TABLE 10. 1985 Fraser River pink salmon commercial catch.

	Catch	%
CANADA		
Fraser River Panel Area	2,782,000	22.8
Non-Panel Areas	5,606,000	46.0
Total	8,388,000	68.8
UNITED STATES		
Fraser River Panel Area	3,734,000	30.6
Non-Panel Areas	67,000	0.6
Total	3,801,000	31.2
Total Commercial Catch	12,189,000	100.0

Since the Pacific Salmon Treaty requires an accurate assessment of Fraser River pink salmon stock composition in all fisheries, in-season racial analysis of pink salmon by protein electrophoretic methods was attempted for the first time; however, run reconstruction estimates were used for the final stock allocation. The United States share in 1985 was to be 3,600,000 (32.7%) of a forecast total 11,000,000 TAC. The preliminary allocation computation is as follows:

Actual Total Run	18,864,000
Net Escapement	-6,461,000
Total Allowable Catch (for computation)	12,403,000
United States Allocation:	
(3,600,000/11,000,000) x 12,403,000 =	4,059,000

The United States catch of Fraser pinks was 227,000 fish less than that allowed under the sharing agreement. This deficit would be compensated in subsequent years.

Within the United States Fraser River Panel Area, the commercial catch of Fraser River and other stocks of pink salmon totaled 3,865,000 fish (Tables VII to X in Appendix). Purse seines harvested 3,346,000 (86.6%) pinks, the third largest catch by this gear since 1957. Gill net fishermen landed 348,000 (9.0%) pinks while reef nets accounted for 76,000 (2.0%). Catches by net gear were similar to 1981 in number and percentage catch. However, trollers harvested only 95,000 (2.4%) pinks, the smallest percentage and catch for several years. Purse seine and gill net landings increased sharply from 1983 but reef net and troll catches declined slightly. Treaty Indian fishermen harvested 1,918,000 pink salmon of all stocks or 49.6% of the total United States commercial catch of pink salmon.

In the Fraser River Panel Area, Canadian fishermen harvested 3,226,000 pink salmon of all stocks, the large majority of which were caught in areas westerly of William Head. Area 20 catches totaled 2,175,000 (67.4%) pink salmon and 513,000 (15.9%) were taken by troll fishermen off southwest Vancouver Island. Pink catches easterly of William Head totaled 539,000 fish or 16.7% of the Fraser River Panel Area catch. Troll catches were 724,000 fish or 22.5% of the Area total. Purse seines landed 2,123,000 pinks (65.8%) and gill nets caught 378,000 (11.7%).

The relatively small catch by Canada in the Fraser River Panel Area was the result of large catches outside the Area due in part to a significant migration of the Fraser pink salmon run via Johnstone Strait, estimated at 35% of the run. Catches in the Johnstone Strait net fisheries totaled 3,987,000 Fraser pink salmon and accounted for 47.6% of the Canadian catch. Trollers operating north of the 49 N along the west coast of Vancouver Island and in Johnstone Strait landed 1,619,000 additional Fraser pinks or 19.3% of the catch. Thus, 66.9% of the Canadian commercial catch of Fraser pinks was taken outside the Fraser Panel Area.

Canadian pink salmon catch allocation by gear encompassed both the Fraser River Panel Area and non-Panel Area fisheries. The MAC allocation objectives for the Fraser River pink salmon catch in Canada were: troll, 33%, purse seine, 62% and gill net, 5%. In total, trollers landed 2,250,000 (26.8%) Fraser pink salmon, purse seines caught 5,577,000 (66.5%) and gill nets, 561,000 (6.7%) (Table 11).

TABLE 11. 1985 Canadian commercial catch of Fraser River pink salmon by gear and area.

Gear		Catch	%
Troll			
Areas 11-12, 20, 121-127		1,941,000	23.1
Areas 13-16		102,000	1.2
Areas 17, 18, 29*		207,000	2.5
	Total	2,250,000	26.8
Purse Seine			
Areas 11-16		3,790,000	45.2
Area 20*		1,787,000	21.3
	Total	5,577,000	66.5
Gill Net			
Areas 11-16		198,000	2.4
Area 20*		43,000	0.5
Area 29*		320,000	3.8
	Total	561,000	6.7
	Total Catch	8,388,000	100.0

* Fraser River Panel Area fisheries regulated by the I.P.S.F.C.

Fishing time directed at pink salmon in 1985 was more limited than proposed in preseason regulations (Table 12). Time for fishing was also reduced compared with recent years and was reflected in somewhat reduced exploitation rates.

TABLE 12. Numbers of days directed toward pink salmon harvest in Fraser River Panel Area fisheries.

	Preseason Schedule	Actual Days Fished
CANADA:		
Area 20	8	6
Area 29	2	3
UNITED STATES:	8*	5*

* I.P.S.F.C. regulated fisheries.

The weight of pink salmon migrating via Juan de Fuca Strait was unusual with a variation in average weight from 5.7 pounds for the early fish to 4.7 pounds for the fish near the peak of the migration. Fraser River pinks entering via Johnstone Strait were uniformly small at about 4.3 pounds. The overall average weight for the total run was 4.8 pounds, next to the smallest on record. There was a geographic pattern to the size variations. Troll catches off Oregon consisted of very large fish while pink salmon caught off northern Vancouver Island were small, consistent in weight with those taken in Johnstone Strait. The better growth of pinks off Oregon and northern California may have caused early maturation and, hence, early migration. These large fish appeared to have been from many pink salmon stocks, including non-Fraser streams.

In 1983, over 70% of the pink salmon escapement spawned in the main Fraser River between Chilliwack and Hope. Total survival from egg to fry in the watershed was reasonably good (11.8%), suggesting that the large main Fraser population had successfully

reproduced. This population contributed approximately 75% of the returning fish in 1985. Good production was also attributable to the Seton Creek and Thompson River stocks. Late run pink salmon migrating to Harrison and Chilliwack-Vedder Rivers were in lower abundance compared to former years.

Escapement

Fraser pink salmon escapements in 1985 totaled 6,461,000 fish (Appendix Table XI), probably the largest of any year since the early 1900's. The preseason escapement goal was 5,000,000 spawners, thus the 1985 escapement was 29% larger than originally planned. The total escapement was actually much greater than projected during the season and indicates the need for improved methods for estimating numbers of fish in Georgia Strait, such as acoustic procedures. In addition, the distribution of the escapement was uneven between the various spawning grounds.

Main Fraser River spawning areas contained 5,249,000 pink salmon or about 81% of the watershed total. Both the escapement number and the percentage using this area were the highest yet observed. The area has vast streambed gravel areas and appears capable of providing good spawning habitat for even a larger population than spawned in 1983, which reproduced well. High water after the peak of spawning in 1985 may have caused some fish to deposit eggs in areas which would dry up and freeze the eggs during the winter. However, the bulk of spawning was at normal water levels. The optimum escapement for this area has not yet been established.

Continuing a trend observed since 1979, the percentage of the total escapement migrating above Hell's Gate declined again. These stocks accounted for only 7% of the 1985 total escapement, down from 21% in 1983. The actual number of fish arriving at areas above the Fraser Canyon also declined. Escapement into the Thompson River and tributaries was only 193,000 pink salmon, the smallest number recorded since 1961 (Figure 2). In addition, Seton Creek escapement dropped to 208,000 spawners, the lowest since 1969. Declining escapement in 1985 was associated with severe delays and blockage experienced by the fish in the Fraser Canyon at points of difficult passage. It is possible that the small size of individual pink salmon associated with large numbers of fish contributed to fish passage problems. The decline in escapement above Hell's Gate was a major disappointment and a serious setback in restoration of upriver stocks.

Late-run pink salmon spawn in the Harrison and Chilliwack-Vedder Rivers. As the main Fraser River population has grown, these late runs have become a smaller proportion of the run than in past years. Escapement into the Harrison River increased in 1985 to 438,000 spawners, three times greater than the number in 1983. The Chilliwack-Vedder system contained 96,000 fish, about the same number as in 1983. In total, only 8% of the watershed escapement was in these two areas, yet the total late-run escapement of 558,000 spawners was the largest since 1963 and slightly above the preseason goal of 500,000 fish.

Escapements much larger than normal were present in small Fraser Canyon streams as a result of the drop-back of pinks experiencing migratory problems in the canyon. However, some tributaries, such as the Coquihalla River, also appear to have had excellent production from the brood year escapements. Those streams from just below Hope to Hell's Gate increased in spawners from 44,000 in 1983 to a total of 179,000 fish in 1985. A decline of spawners using Fraser Canyon tributary streams above Hell's Gate paralleled the observations at Thompson River and Seton Creek.

In 1985 the Commission supervised a transplant of pink salmon eggs from the Fraser River and Chilliwack-Vedder system carried out at the Alouette Regional Correctional Centre. Eggs were taken for incubation to the facility on the Alouette River to augment eggs taken from pinks returning to the Alouette from a similar 1983 transplant (from Harrison River stock). This program is intended to rehabilitate the historic pink salmon run to the Alouette

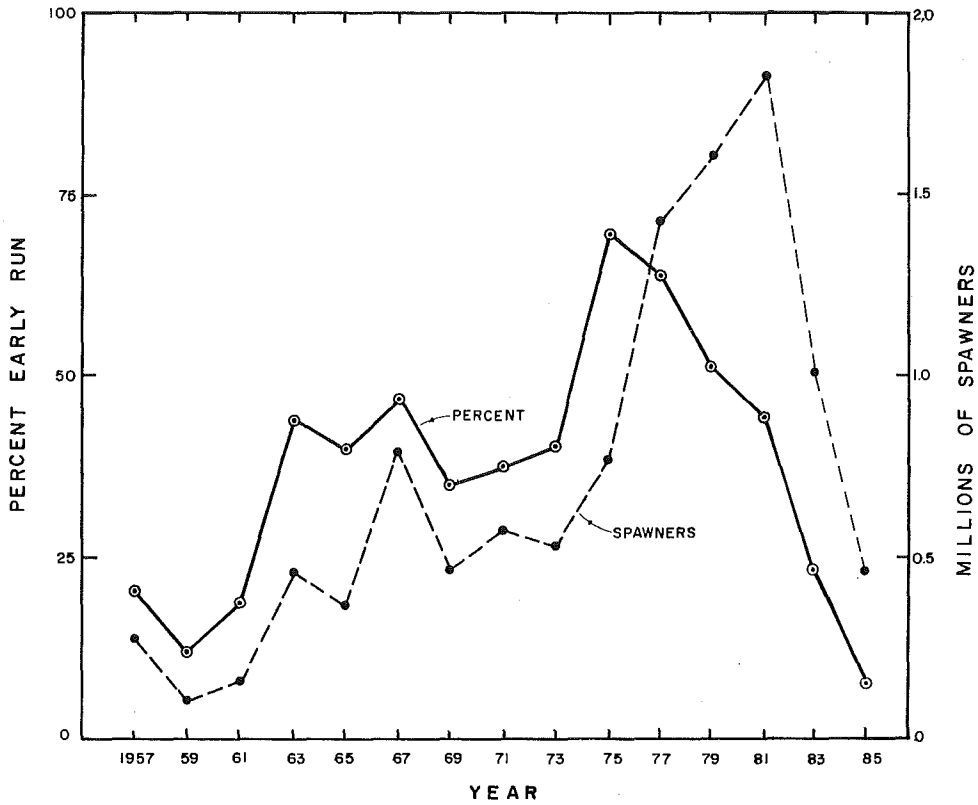


FIGURE 2. Percent of total Early run escapement spawning above Hell's Gate and number of spawners.

River which became extinct several decades ago due to operation of the hydroelectric dam at the outlet of Alouette Lake and degradation of the river. The return in 1985 of an estimated 3,000 adult pinks from the 1983 transplant was encouraging and supports the continued rebuilding of this stock. No pink salmon had been in this system for at least 20 years.

The success of spawning females was good in all areas. Increases in female spawner abundance resulted in a 25% higher egg deposition in 1985 than estimated in 1983.

A very sudden and severe cold weather period in November may have had an adverse impact on both sockeye and pink salmon incubating eggs.

SPAWNING CHANNEL OPERATIONS

The sockeye fry emergence from four channels operated during the winter of 1984 and spring of 1985 (1984 brood spawning) is presentd in Table 13.

Fry production in the Upper Pitt incubation channel was 3,710,000 fish. The escapement of about 15,800 sockeye in all areas of the river provided the brood stock for obtaining 4,371,000 eggs in the fall of 1984 and emergence of fry showed 84.9% survival. Both the numbers of fry produced and percentage survival were near normal for this facility.

TABLE 13. Sockeye salmon fry production from the 1984 brood at spawning and incubation channels.

Site	Egg Deposition	Fry Produced	Percent Survival
Upper Pitt	4,371,000*	3,710,000	84.9
Weaver Creek	97,523,000	45,373,000	46.5
Gates Creek	27,832,000	14,813,000	53.2
Nadina River	11,228,000	4,138,000	36.9

* eggs taken

Production of fry in the Weaver Creek channel was 45,373,000 fish which was 46.5% of the eggs deposited. The escapement into the channel in 1984 was substantial (45,000) and the number of eggs deposited (97,523,000) was considerably above average. The total number of fry produced by the channel was somewhat below the 52,603,000 fry produced in the brood year.

The escapement of sockeye into the Gates Creek channel was excellent in 1984; however, the number of eggs deposited was reduced greatly due to high prespawning mortalities. The number of eggs deposited was 27,832,000 and fry emergence was 14,813,000 fish, a survival rate of 53.2%. The numbers of fry produced this spring was more than 3,000,000 greater than during the previous brood year.

Nadina River channel production of 4,138,000 fry in 1985 was more than twice that of the previous cycle (1,962,000). The egg to fry survival rate was 36.9%. The egg to fry survival rates in recent years at this channel have been below design expectations.

Returns of adult sockeye attributable to the four channels in 1985 was 304,000 fish and these fish came from 1980, 1981 and 1982 brood year spawning. The total production of these channels in 1985 was 2.2% of the total Fraser River sockeye return in 1985. About 347,000 sockeye were produced by these four channels in the brood year (1981).

The return of Pitt River sockeye was only 9,200 fish, the lowest on record back to 1952 (Figure 3). Only 6,800 fish were attributable to the incubation facility. This was similar to the lowest number on record (5,300 in 1982). The Pitt River return continued the downward trend in productions that started in 1977. The decline is alarming and should be thoroughly investigated, as both natural and incubation channel production is disappointing, if not disappearing.

The Weaver Creek total return in 1985 was 246,000 sockeye, of which 203,000 were produced by the spawning channel. This facility continues to contribute consistently as the production data shown in Figure 4 illustrates. The 1985 return was somewhat larger than in the brood year. The Gates Creek run in 1985 is an off-cycle year and only 19,400 sockeye were accounted for in catch and escapement. Almost all (98%) of the return was produced by the spawning channel. Production in 1985 was below the brood year level of about 20,000 fish from the channel.

The Late Nadina River sockeye run in 1985 was only 79,000, just over half the 148,000 fish recorded in 1981, the brood year. A total of 76,000 of the returning fish this year (1985) were from the spawning channel.

The two pink salmon spawning channels at Seton Creek produced 621,300 pink salmon this year. The 1985 return of pink salmon produced by Seton Creek spawning channels formed only 3.3% of the total Fraser River pink salmon run.

It is clear that the vast majority of the sockeye and pink salmon returning in 1985 were the result of natural spawning and were not derived from artificial propagation. While spawning channels have and will continue to play a productive role in certain situations, the real contributions to the commercial fisheries will result from natural production.

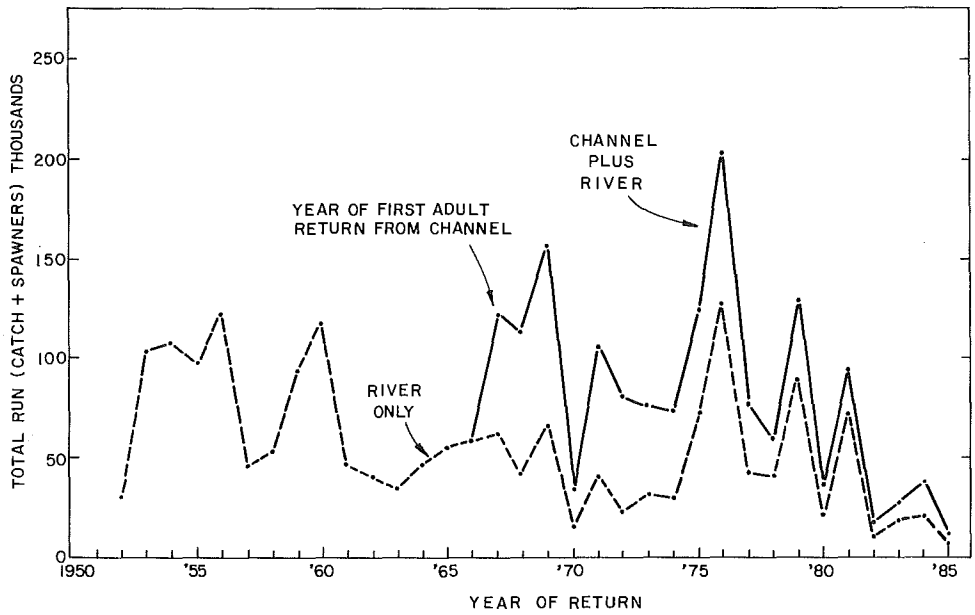


FIGURE 3. Sockeye production from Pitt River and Pitt incubation channel, 1952-1985.

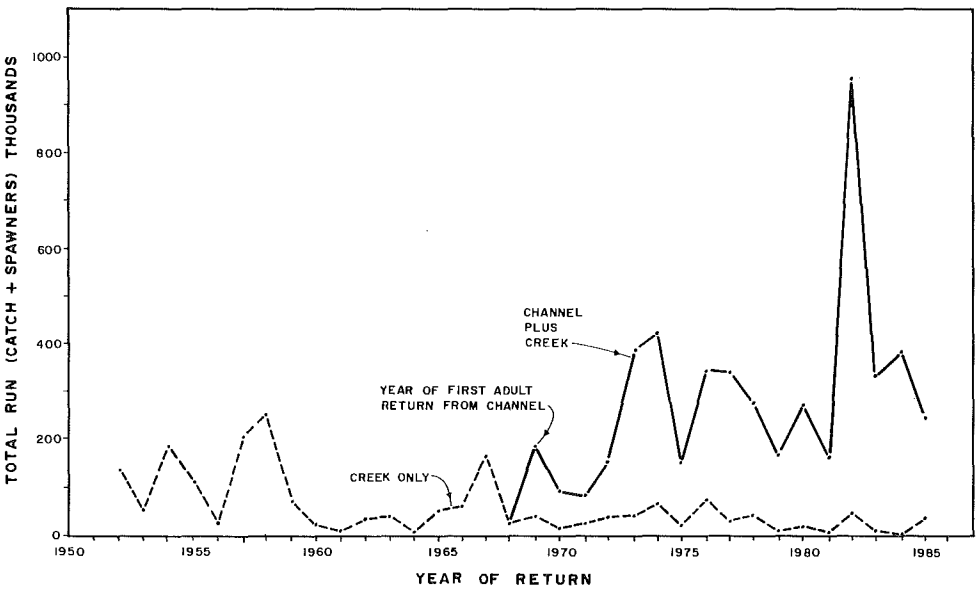


FIGURE 4. Sockeye production from Weaver Creek and Weaver channel, 1952-1985.

RESEARCH

The rehabilitation program for the Upper Adams in 1984 produced a total of 771,000 fry in the spring of 1985. An estimated 380,000 fry were produced from a plant in a prepared gravel bed located below the spawning grounds of the Upper Adams River. In addition, 360,000 fry were produced from an incubation box. Approximately 60,000 of these were released at emergence, while 300,000 were held in floating pens in Adams Lake and fed freeze-dried plankton for four to six weeks prior to release. An additional 31,000 fry were used for diet tests. These fry were also released into the Adams Lake system after the three-month diet research.

The growth of the fry fed the plankton was much better than the growth of the fry from the 1980 brood. After 28 days of feeding, the 1985 fry had almost doubled their dry weight (from 20 mg to 37 mg) with a mean weight of approximately 37 mg, while the 1981 fry fed an identical time had mean dry weights of 20 and 26 mg in two different lots (Figure 5).

The total fry production from the rehabilitation program exceeds by 50% the estimated fry production from the 1,866 females which spawned naturally in the Upper Adams River. This increased fry production, plus the added impetus of the genetic input from the Upper Adams males should provide the basis for a further rapid increase in population as we have seen in several Fraser River stocks such as the Lower Shuswap and Horsefly populations.

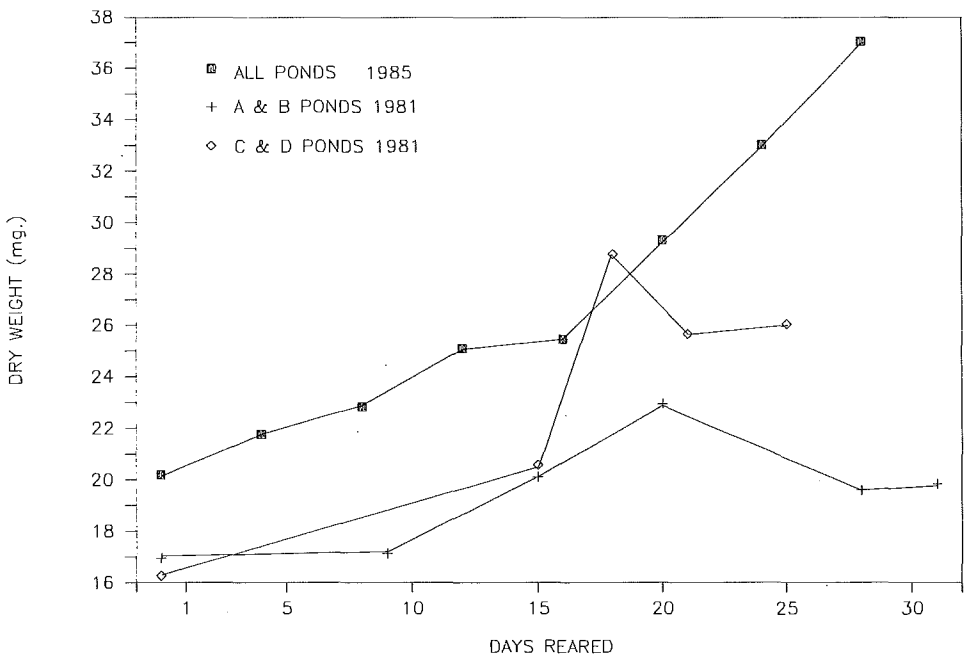


FIGURE 5. Dry weight of sockeye fry reared at Upper Adams in 1981 and 1985.

Surveys of Adams, Shuswap, Little Shuswap, Mara and Cultus Lakes were included in the 1985 Plankton Program. There were three Wisconsin-type surveys of Adams Lake scheduled throughout the growing season (May 8, July 10 and September 26). These surveys were used to determine an index of zooplankton productivity as well as water quality in Adams Lake. This information will be useful in the analysis of the success of the Upper

Adams River fry transplant. Initial analysis of the data indicated that Adams Lake was a colder, less productive lake than Shuswap Lake.

A single plankton survey of Shuswap, Little Shuswap and Mara Lakes with a Clarke-Bumpus sampler was conducted on September 23-25. This survey provided baseline limnological data during a period of low fingerling abundance. Initial analysis of the data indicated that conditions were normal in Shuswap and Little Shuswap Lakes but an exceptionally high density of zooplankton was observed in Mara Lake. Experiments comparing Clarke-Bumpus zooplankton sampling with diaphragm pump sampling techniques were also conducted during the Shuswap survey. The results of these experiments will be available in 1986.

The diel vertical migration of zooplankton was examined in Cultus Lake. Time and depth series of Clarke-Bumpus samples were taken during daylight, twilight and dark hours on July 17. The data revealed no significant vertical migration of zooplankton in Cultus Lake, during this one-time sampling period.

Results of a 1983 study examining factors which could be limiting zooplankton production in Shuswap Lake were recently reported in a draft report. Nutrient levels play a significant role in limiting plankton production during a year of high-density fingerling residence.

A hydroacoustic survey of Harrison Lake was conducted on August 7, 1985. The purpose of the survey was to identify the target strength and fish distributions of the two principal species in the lake, juvenile sockeye salmon and longfin smelt. The survey was conducted during hours of darkness using a BioSonics dual-beam hydroacoustic data acquisition system operating at 420 kHz. Fish samples were collected with a 3 m by 6 m mid-water trawl.

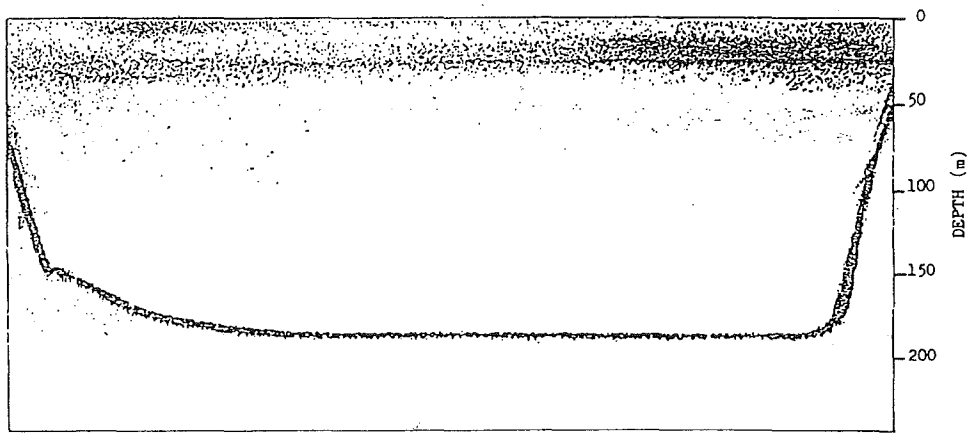


FIGURE 6. Transect 1 on Harrison Lake for the night of August 7, 1985.

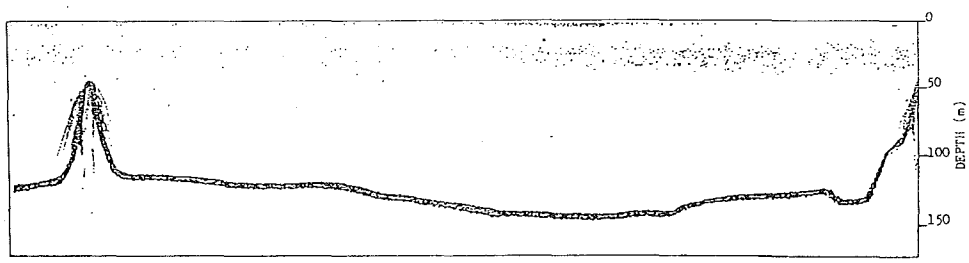


FIGURE 7. Echogram of Transect 7 on Harrison Lake for the night of August 7, 1985.

The fish population was found to be distributed throughout the lake with the highest densities at the north end. The majority of fish captured were longfin smelt. The greatest number of sockeye were captured in the south end of the lake. Figures 6 and 7 illustrate the range of densities encountered at the top end of the lake (transect –1) and the bottom end (transect –7).

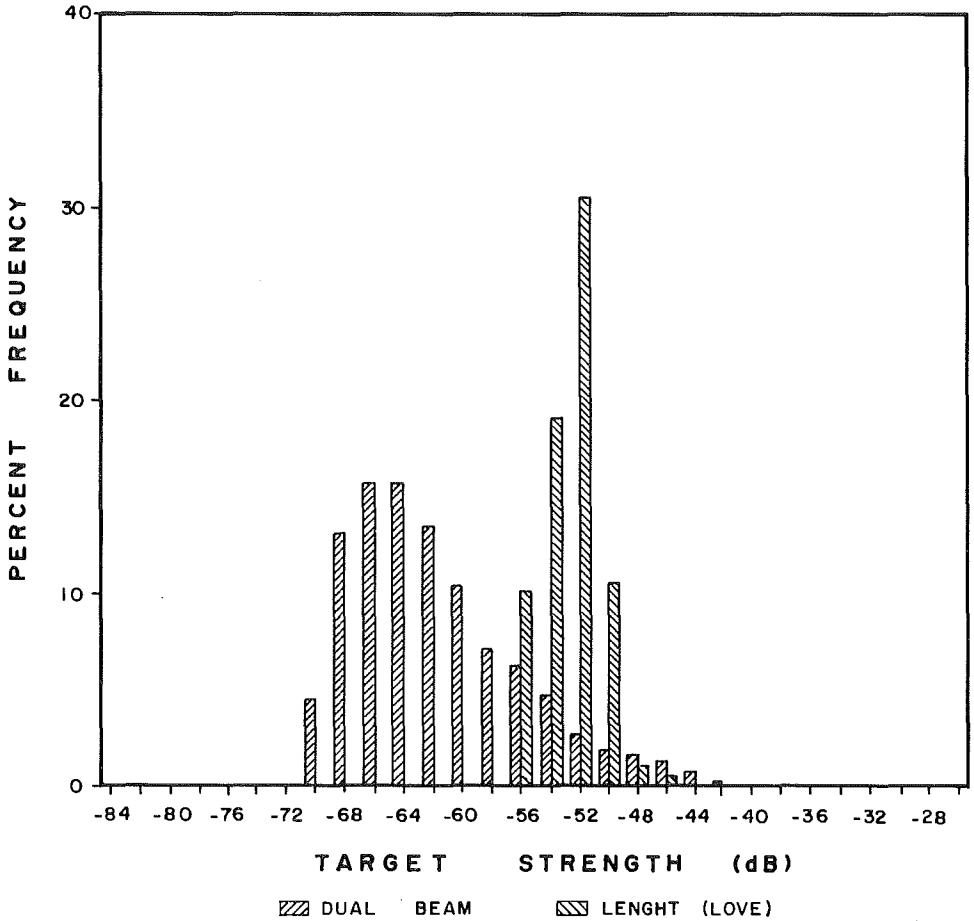


FIGURE 8. Target strength distributions of dual bean target strength and converted length target strength from trawl samples. (Length conversions according to Love 1977).

Acoustically determined target strengths ranged from -70 dB to -40 dB, representing fish targets in the range of 0.6 cm to 25.2 cm, respectively. The trawl caught fish ranged in size from 2.8 to 13.7 cm, with a mean of 4.9 cm. Figure 8 illustrates the two distributions of target strength (the length data were converted to target strength according to Love's 1977 formula). The data fit, in this instance, was not as favorable as the previous year's data collected on the Cultus Lake sockeye population. It is possible that this discrepancy is related to the fishing efficiency of the net. Larval smelt have been caught in our trawl

with the use of a 3 mm mesh bobbin cod end and a Nytex (0.158 mm) insert sleeve. The 3 mm mesh cod end and Nytex sleeve were not used during this survey. Therefore, the net may not have sampled the smaller component of the populations as efficiently as the acoustic system. The literature suggests that the larval smelt in Lake Washington are about 7 mm in length which would represent a target strength of about -68.6 dB. These fish would likely be filtered by the trawl if they were present.

Another factor to be considered is the morphological difference between the larval and juvenile smelt. The formula developed by Love using fully-developed fish may not apply to long-fin smelt in early developmental stages. Further study should be conducted to determine the extent of these discrepancies because it may provide an additional clue to the identification of the target species (juvenile sockeye) among large concentrations of smelt in Harrison Lake.

The 1985 pink salmon run provided an opportunity to test the effectiveness of hydroacoustic techniques on a stock delaying in a terminal fishing area. Hydroacoustic techniques may provide estimates of numbers of fish available in the areas adjacent to the Sturgeon and Roberts Banks in the Strait of Georgia. Figure 9 illustrates the transect design implemented from August 23 to September 20, 1985 to evaluate the feasibility of this technique to estimate population abundance. It was difficult to maintain precise tracks due to the influence of currents and tides in the Strait of Georgia. Additionally, the long (3 mile) transect legs were subsequently shortened due to low target detection in offshore waters.

The hydroacoustic system consisted of a BioSonics Model 101 dual channel echo sounder, a Model 115 chart recorder, a Model 120 echo integrator and a Model 171 recorder interface. Target strength data were digitized and recorded on a Sony VCR, while biomass data were processed as being collected by the echo integrator and subsequently to a portable computer.

A survey consisted of two data components: acoustic data and fish collections. The acoustic data were collected in a systematic fashion along the predetermined transects. The fish samples were taken by a 30 m seine boat fishing a herring seine.

Seven of 12 planned surveys were completed during the two month sample period (August and September). The most promising results were obtained after dark at the mouth of the Fraser River on September 18. Figure 10 shows a chart recording indicating a large concentration of pink salmon in the 3 to 10 m range. The targets detected below 10 m were other species which were observed rising from the bottom at dusk.

Target strength distributions for all depths are shown in Figure 11. The majority of single target detections were in the −47 to −43 dB range for targets in the 2.50 to 60.00 m depth range. Figure 12 shows the tendency toward smaller (acoustically) targets in the deeper depths and larger targets near the surface. During the period when these echoes were recorded, numbers of jumping pink salmon were observed around the boat. Therefore, it is believed that the fish in the surface layers were adult pink salmon. The average target strength in the two top depth strata (2.50-14.00 m) was −41.6 dB which corresponds to an average fish length of 18.5 cm according to Love's equation:

$$TS = 18.4 \log (L) - 1.6 \log (f) - 61.6$$

where, L = length in centimeters,
f = frequency in kHz.

The equation is based on an average return over 45' from dorsal aspect. It is likely that many targets were ensonified at tail aspect due to the frightening effect of the boat noise and lights, thus the target strength distribution is slightly lower than one would expect.

There were, undoubtedly, other species ensonified in these layers as well which would bring the average target strength below that expected for an adult pink salmon. The average size of seine caught pink salmon on September 20 was 48.5 cm or −33.9 dB.

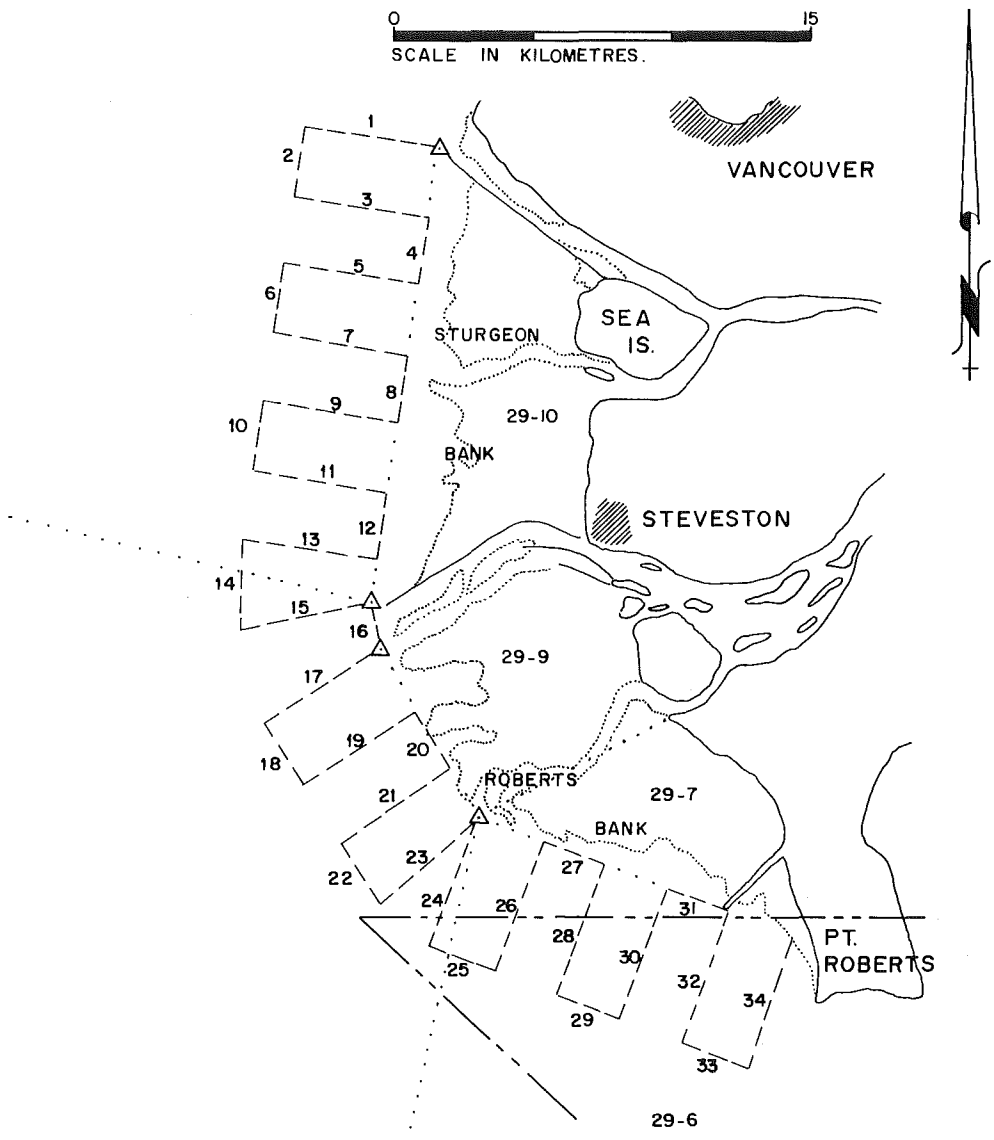


FIGURE 9. Map showing transect location in the Strait of Georgia.

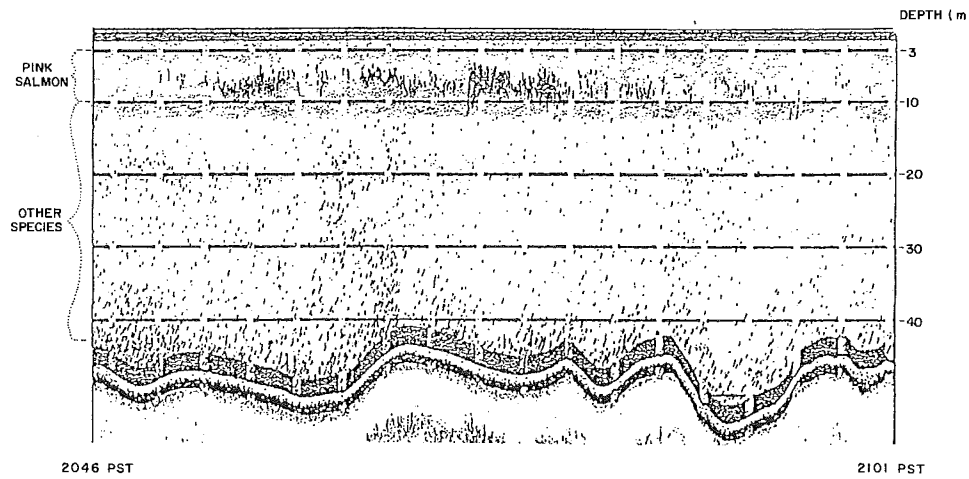


FIGURE 10. Echogram showing pink salmon concentration near the mouth of the Fraser River.

The herring caught in this area averaged 19.4 cm or −41.2 dB. The presence of herring in the near surface layers would have affected the overall distribution by further reducing the average target strength.

Although these results are preliminary, it appears promising, with further research, to develop a method capable of classifying targets in an area outside the Fraser River to provide accurate stock information.

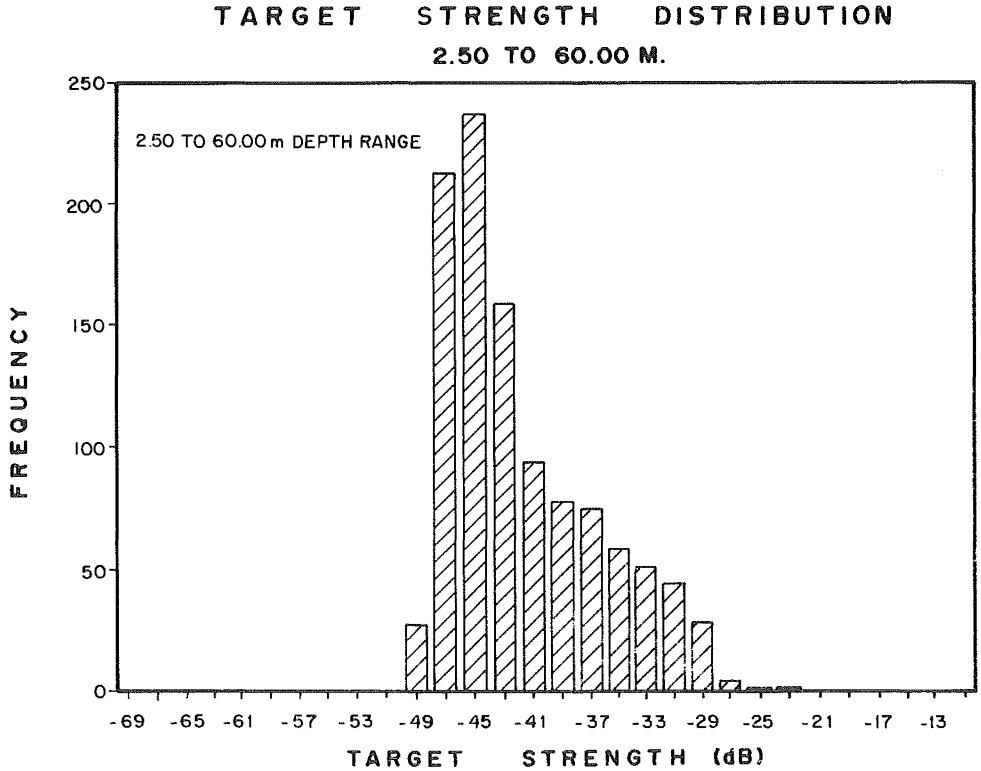


FIGURE 11. Frequency of target strength distribution in the depth range 2.5-60 m.

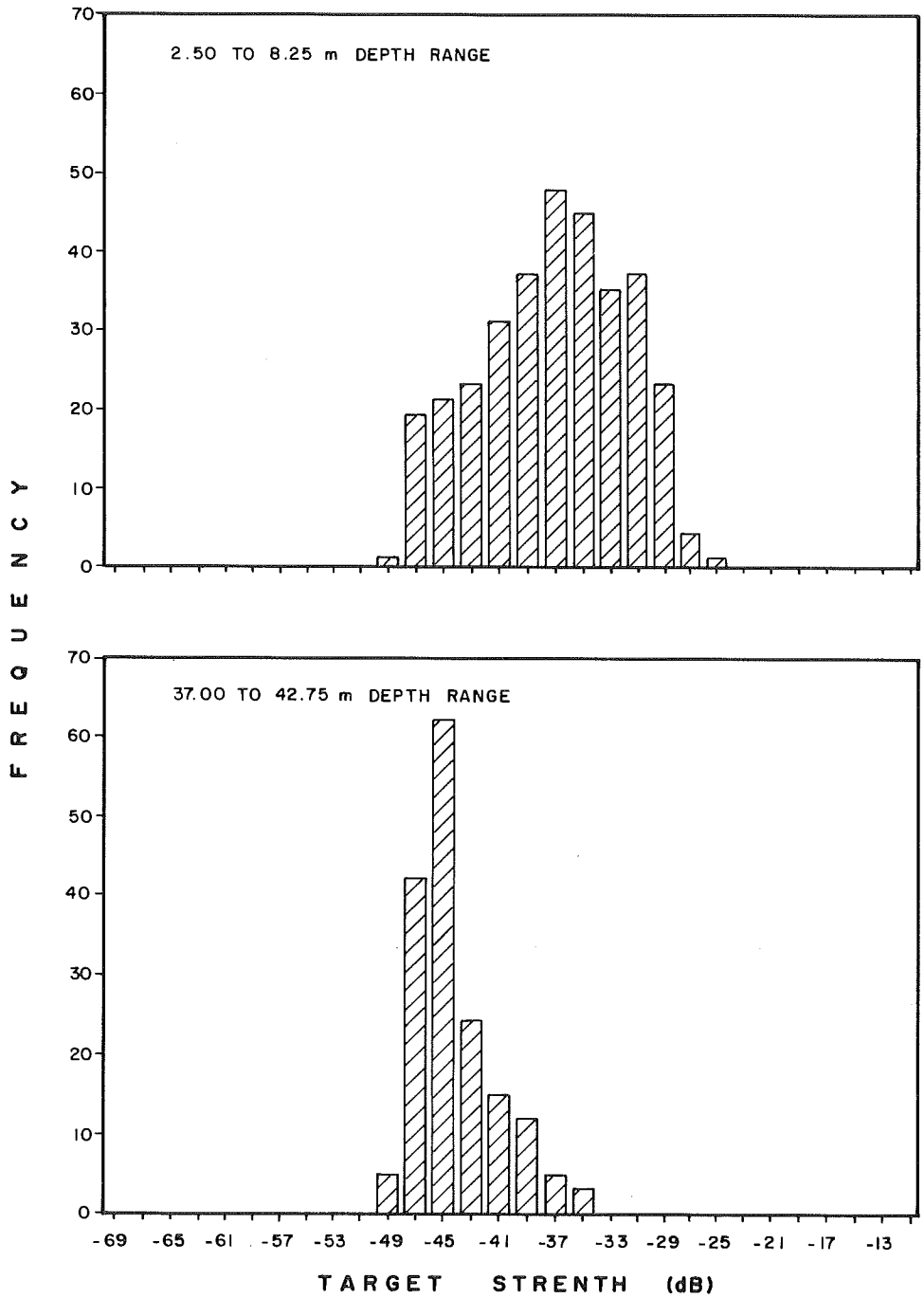


FIGURE 12. Frequency of target strength distribution in the depth range of (a) 2.50-8.25 m depth range.

ENVIRONMENT CONSERVATION

A study was conducted at Quesnel River Pulp Company between September 1983 and November 1984 to determine the feasibility of treating thermomechanical (TMP) and chemical thermomechanical effluents (CTMP) to meet regulatory specifications, especially detoxification, using an on-line pilot plant. The study was directed by a committee composed of representatives from the Commission, Environmental Protection Service, Waste Management Branch, Quesnel River Pulp Company and its consultant. The treatment problems were considered unique since TMP and CTMP effluents were produced alternately on about a two week schedule. The study concentrated on aerobic lagoon treatment processes since the results would be applicable to upgrading the existing aeration lagoon.

Level A Objectives for mechanical pulping effluents in British Columbia specify BOD and suspended solids at 7.5 and 10 kg/ADMT, respectively, or less. Objectives also specify a 96 h LC50 of 100 percent. Total residual BOD was within the Objectives for all treatments tested with the exception of five days treatment of CTMP effluents. Due to the high concentrations of MLSS, Objectives for suspended solids were generally exceeded. Accordingly, secondary sedimentation appears required to reduce suspended solids to meet Objectives.

Treatment time and nutrient addition ratios influenced detoxification of TMP and CTMP effluents. At a nominal five days treatment of TMP and CTMP effluents, residual resin acids were sometimes in the lethal range suggesting that five days was insufficient time for consistent detoxification. Prolonging treatment to seven days resulted in non-lethal amounts of resin acids but ammonia and nitrite increased to levels lethal to salmon. At six days treatment, resin acids were generally removed to non-lethal levels and ammonia and nitrite were minimized. Results of the treatability study were detailed in a committee report and were presented by the Commission at the Canadian Pulp and Paper Industry Environment Conference, September 24-26, 1985, Toronto.

As a consequence of the treatability study, the Committee recommended certain procedures be modified concerning sampling and testing of treated effluents at Quesnel River Pulp. These recommendations, summarized below, were put into force by the B.C. Waste Management Branch.

a) Dissolved oxygen is to be maintained near saturation during the 96 hour bioassay of treated effluents.

b) The effluent shall be coarse filtered to remove biological solids before conducting bioassay tests.

c) Samples shall be collected for later chemical assay of ammonia, nitrite and resin acids if the test effluent is lethal during the bioassay test.

Quesnel River Pulp Company proposed a study to evaluate high-rate anaerobic treatment followed by an aerobic lagoon. The proposal suggested that this combination may have operational and economic advantages over the aerobic lagoon alone.

Treatability studies at Belkin Paperboard indicated that effluents could be detoxified in one to two days treatment in an aerated lagoon. However, the space required for aerated lagoons posed siting problems, according to the company. Alternatively, the Commission recommended treatment be applied to selected high-strength low volume effluent streams since space requirements could be less than for an aerated lagoon.

Pulp mill effluents discharged to the Fraser River system are subject to Canadian Federal Pulp and Paper Effluent Regulations. These regulations have been under review since 1982 by a technical advisory group consisting of representatives from industry and federal and

provincial governments. A toxicity subcommittee, including a representative from the Commission, was formed to review the toxicity criteria specified in the regulations. At issue in the review was the appropriateness of acute lethal bioassay criteria as a component of the regulations.

All pulp mills on the Fraser River system have been subject to federal and British Columbia acute lethal bioassay criteria since the first chemical pulp mill commenced operation at Kamloops in 1965. Based on this experience, the Commission's position in the toxicity subcommittee favored retention of the acute lethal bioassay since it provided safeguards necessary to protect Fraser River sockeye and pink salmon.

The toxicity subcommittee summarized the limitations and advantages of the acute lethal bioassay as a regulatory tool and submitted these to the technical advisory group. The report of the technical advisory group was forwarded to Environemntal Protection Service where revisions to the Federal Regulations would be made.

The discharge permit for the Northwood Pulp and Timber bleached kraft mill at Prince George was amended by the British Columbia Waste Management Branch to authorize predilution of treated effluent for bioassays to assess compliance with detoxification Regulations and Objectives. The rationale for pre-dilution was based on the premise that low water usage per ton of pulp production concentrated contaminants at a level which would remain lethal to fish in bioassays in spite of treatment. However, analyses of results for similar discharges of treated kraft pulp mill effluent indicated treated effluents passed detoxification criteria without pre-dilution even when water usage was low. The evidence indicates that successful detoxification was independent of water usage but influenced by mill operations. Furthermore, operational problems and spills may go undetected or uncorrected if pre-dilution is practised. Finally, and of considerable significance, no analytical evidence has been produced to show that residual, non-biodegradable toxicants have increased to lethal levels owing to reductions in water usage. Environmental Protection Service raised the issue of pre-dilution with the Waste Management Branch.

Since 1963, water quality and benthic invertebrates have been surveyed in the Fraser River near pulp mill effluent discharges at Prince George and Quesnel. At Prince George, the surveys indicated benthic invertebrate communities were stimulated, possibly due to organic enrichment. At Quesnel there was evidence of a negative impact on benthic invertebrates in the immediate vicinity of the Quesnel River Pulp discharge. Based on the results of the surveys the monitoring methodology, frequency and chemical parameters were revised for future surveys.

Water quality and biological surveys have been conducted in Kamloops Lake and Thompson River to monitor effluent from the kraft pulp mill at Kamloops. Surveys and various experimental studies demonstrated that phosphorous inputs stimulated benthic algal growths in the Thompson River. The pulp mill at Kamloops was identified as a significant point source of phosphorous. The pulp mill has taken various steps to reduce phosphorous discharge while recognizing that phosphorous is essential to the biological treatment process used to detoxify the effluent.

The Greater Vancouver Sewerage and Drainage District received a permit authorizing construction and operation of a deep-water outfall for effluent from the Iona sewage treatment plant. The permit specified that the outfall be operational by December 31, 1987. The permit also specified the pre- and post-operational monitoring be conducted. An ad hoc committee composed of representatives of Greater Vancouver Sewerage and Drainage District, B.C. Waste Management Branch, Environmental Protection Service, Department of Fisheries and Oceans and the Commission proposed a monitoring program. The program would assess effects of the deep-water sewage discharge on the environment and fishery resources of the area. Emphasis was placed on detecting subtle changes in environmental health of the area with selected species of biota, including salmon, being examined for

bioaccumulation and its effects. Plans call for initiating pre-monitoring in winter 1986. After the first year, results would be examined and recommendations made for a second season of pre-discharge monitoring.

The Greater Vancouver Sewerage and Drainage District received approval from the B.C. Waste Management Branch to discharge limited amounts of raw sewage to the Fraser River in February and June. The discharge in February was required to accommodate inspection and preventive maintenance of major interceptors. The second discharge was scheduled to accommodate realignment of interceptor sewers to suit construction of a bridge across the Fraser River. While being opposed to discharge of raw sewage, the Commission recognized that circumstances occur where controlled discharges are unavoidable but measures should be taken to lessen potential impact. Thus the discharges during two days in February and 25 hours in June were scheduled when minimal numbers of salmon were present. In addition, the June discharge was made during high river flows to obtain as much dilution as feasible. In both cases chemical and biological monitoring tests were conducted. Some mortalities occurred among juvenile salmon caged in the Fraser River but the results were inconclusive since subsequent tests indicated mortalities appeared related to stress caused by the type of cage used.

The Canadian Forest Service and B.C. Ministry of Forests have been evaluating Roundup (glyphosate plus surfactant) and Garlon 4 (butoxyethyl ester of triclopyr) for control of deciduous trees and brush during regrowth of commercial coniferous forests. Bioassays using juvenile sockeye and *Daphnia pulex* demonstrated that the surfactant was the primary source of toxicity in Roundup. The butoxyethyl ester of triclopyr in Garlon 4 was lethal to sockeye and *Daphnia*, but toxicity decreased as the ester hydrolyzed to the acid form. The results of these tests are being prepared for publication.

Documenting the sensitivity of salmon-producing waters to acidic precipitation has been the subject of a joint project with Department of Fisheries and Oceans. Based on background data, selected, highly sensitive streams in the Lower Mainland and on Vancouver Island were sampled in 1985. The results of surveys since 1981, including calculations of buffering capacity for the more sensitive streams, were published jointly (Canadian Technical Report of Fisheries and Aquatic Sciences Series, Nos. 1388, 1389).

Water quality monitoring programs continued in the Nadina, Tachie and Middle River basins to monitor suspended sediments and turbidities. Water samples in the latter two districts were collected by Department of Fisheries officers and forwarded to the Commission laboratory for analysis. Suspended sediment and turbidity values were generally low reflecting the low level of road building and logging activity in the three river basins.

Carolin Mines, located on Ladner Creek in the Coquihalla River basin, ceased mining and milling activities in 1984. To maintain safe water levels behind the tailings dam it was necessary to discharge some supernatant waters to Ladner Creek early in the year. Discharge ceased when water level in the tailings pond was drawn down sufficiently, but discharge resumed in December 1985. Chemical tests indicated the discharges met criteria specified by B.C. Waste Management Branch. In addition, effluents were non-lethal to fish when bioassayed. Effluents are being diluted at least 10:1 in Ladner Creek.

Eaglet Mines Ltd. proposed to develop a flourspar mine on the east shore of the North Arm of Quesnel Lake near Wasko Bay. In support of the proposal, environmental documentation studies were to be conducted in 1984 as agreed to by the proponent's consultant and regulatory agencies. It is understood that the majority of the study was completed but no report was submitted since the proponent's proposal became inactive.

Gibraltar Mines experienced an acid mine drainage problem which was brought under control in 1984. The company plans to apply bacterial leaching technology to the waste rock dump to increase metal recovery. The process will use the current supply of acid mine drainage plus purchased acid. Although this technology has been applied in North America, and on a pilot scale in B.C., the project at Gibraltar Mines is the first full scale application in the province. Accordingly, the effluent and water monitoring programs are being revised. Monitoring will include sampling and analysis of effluents, receiving water (Cuisson Creek) and ground water. It is expected that a revised Discharge Permit will be granted by the B.C. Waste Management Branch in early 1986.

Endako Mines near Francois Lake remain closed. However, seepage from tailings ponds is being collected and returned to the impoundments.

Studies of the effects of suspended sediments on Fraser River sockeye continued in 1985. Tests were conducted to determine the effect of non-lethal concentrations of suspended sediment on the ability of sockeye smolts to adapt to seawater. Although slight impairment of osmoregulatory capacity was noted, plasma chloride levels remained below stressful values. Results obtained from experimental exposures of fingerling, smolt and adult sockeye to Fraser River suspended sediments were reported at the 1985 Sockeye Symposium, Nanaimo, B.C., November 20-22.

ENGINEERING

Facilities of the Commission's spawning channel/incubation projects and fishways were maintained throughout the year to ensure efficient operations.

Extensive work was again required to maintain the natural streambed channels of Sakwi and Weaver Creeks, including the water intake structures to ensure adequate water supply to the Weaver Creek spawning channel. Extensive flood protection work and gravel removal from Corbold Creek (7-Mile Creek), adjacent to the Pitt River Incubation Station, was carried out in the fall to avoid damage from expected floods throughout the 1985/86 winter months.

The Commission's air/water injection unit cleaned extensive streambed gravel prior to spawning of salmon at the Lower Seton Creek channel, the Weaver Creek channel and the Pitt River incubation beds.

Rock pinnacles obstructing migrating salmon at Saddle Rock were blasted out in the early spring as was recommended in the 1984 Annual Report. A preliminary survey indicates that the water surface drops at the former obstruction area were reduced to about 0.75 m as compared with almost 2 m prior to the rock removal.

At the request of the Canadian Coast Guard, wooden pile remnants from an old fish fence installed by the International Pacific Salmon Fisheries Commission in 1946 across the South Thompson River at Pritchard were removed in the fall. The fish fence was operated by the Commission in 1946-47 to enumerate the Adams River sockeye run.

Funding for these works, including flood protection, gravel removal, gravel cleaning, removal of rock pinnacles and the old fish fence, was provided by the Engineering Division (SEP) of the Canada Department of Fisheries and Oceans. General maintenance of project buildings and equipment was also carried out throughout the year.

Blasting on the left (east) bank of Fraser River at CN Mile 8.6-8.7 near Little Hell's Gate Rapids was done by the Canadian National Railway (CN) in late May to remove overhanging rock above the rail line. Little Hell's Gate Rapids has been considered a fish obstruction area since rock dumping by railway construction in 1913. Because of the concern for the effects of additional rock dumped into the river, the Commission recommended to DFO that the work be delayed until fall after the major migration period, or that

the blasting be done so that waste rock would not enter the river. The recommended safety measures were forwarded to CN by DFO for consideration. The recommendations were not accepted by CN and the blasting was done on May 30.

Observations by IPSFC personnel during and after the blasting, indicated that large amounts of rock and railbed embankment entered the river. Large pieces of rock were projected more than half way across the river (Figure 13). The effect of the blasting debris on subsequent migrations will be difficult to assess.

Observations at Little Hell's Gate Rapids during low water in the fall indicated that the river at the blast site was an extremely difficult point for pink salmon to pass. Pink salmon, as described later in this report, were partially or completely blocked at the site during low water stages in September-October. It is recommended that engineering and biological surveys of the Little Hell's Gate Rapids determine whether or not blast rock entering the river on May 30 added to salmon migration problems.

Commission staff continued to participate, in conjunction with DFO, in ongoing studies with respect to "Twin Tracking" of CN's main line through the Thompson and Fraser Canyons. This work consisted of site visits and participation on a Technical Working Group comprised of representatives from federal and provincial agencies, CN, the Alliance of Tribal Councils and project consultants. The objective has been to develop Environmental Design Reports to mitigate and/or compensate the adverse effects of construction upon the fishery resource.

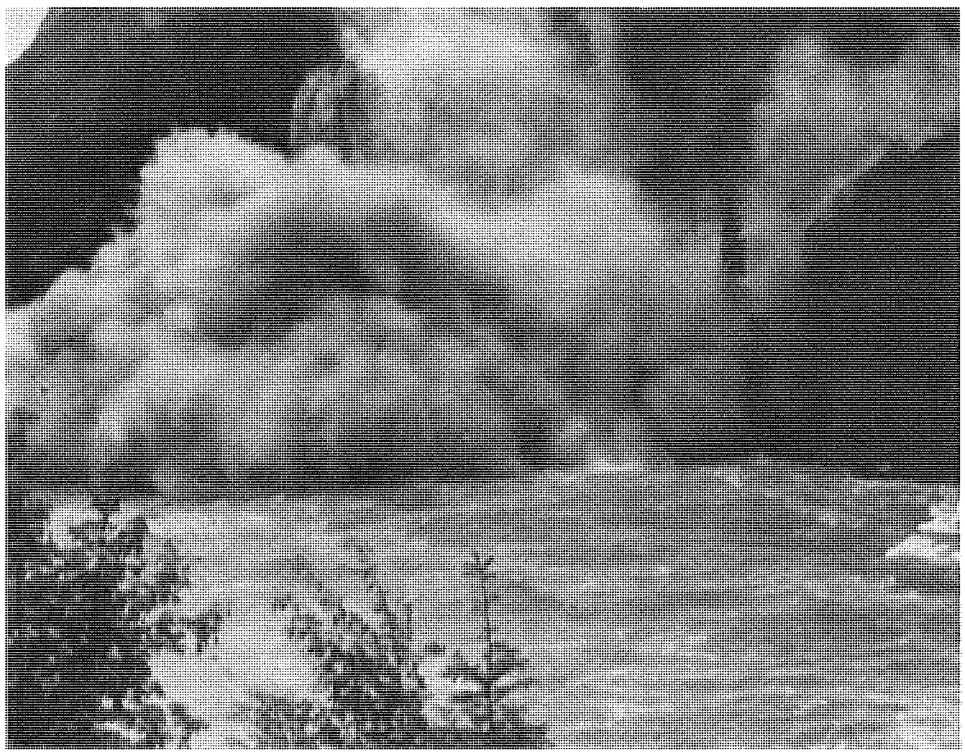
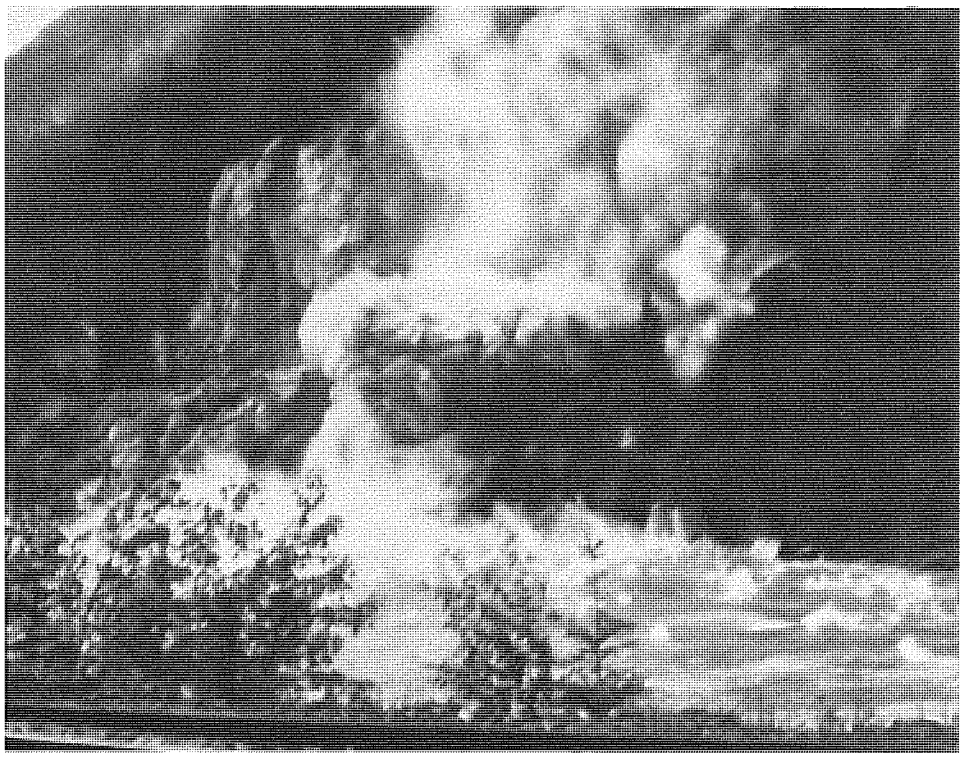


FIGURE 13. Canadian National Railway blasting on May 30, 1985 near Little Hell's Gate in Fraser Canyon.



The importance of protecting salmon migration routes from degradation became evident again in 1985 when pink salmon were partially or completely blocked at several points in the Fraser Canyon. Pink salmon destined for the Seton and Thompson River spawning grounds encountered difficult migration conditions at Saddle Rock, Little Hell's Gate and China Bar Rapids, as shown by visual observations, tagging and dead fish recoveries. In addition, there was some accumulation of fish at Hell's Gate when there was a transition between use of different fishways caused by fluctuating water levels. Blockage occurred at certain higher water levels this year when large numbers of migrating fish were limited to narrow pathways immediately adjacent to the river bank. Based on average brood year returns-per-spawner for the whole Fraser River pink salmon stock and consistent harvest rate on all early run stocks, escapement in 1985 to the upper spawning areas should have been about 1.35 million fish. In contrast, only 470,000 pink salmon successfully reached the spawning areas above Hell's Gate. This was a decline of about 65% from 1983 levels, in spite of the large increase in total pink salmon escapement in 1985.

Large numbers of fish accumulated at the previously referenced locations in the Fraser Canyon in 1985. Fish were so crowded at times that some were forced up on the rocks and others were pushed out into the faster current by the volume of fish. Several hundred thousand fish were estimated to be delayed at specific times. Some congestion problems may have occurred during large escapements in 1979 and 1981 and to a lesser extent in 1983. It is believed that the greater migration passage problem in 1985 resulted from higher water levels this year that made efficient migration much more difficult.

There is also indirect evidence that the smaller individual size of the fish may have contributed to the migration problem in the canyon in 1985. The size of individual fish is inversely related to the abundance of Fraser River pink salmon - the larger the total

numbers of the run, the smaller the size of the fish. This year, with the large run of almost 19 million fish, the average fish weight was reduced to 4.8 lb, one of the smallest on record. It is known that swimming ability is related to fish size, so that the larger fish are more capable of swimming against high water velocities. In earlier years (1960-1970's) when the fish were larger, there probably were no migration problems. This year, the small size of the fish magnified the adverse effects of the migration difficulties. The effect of size on migration abilities is evident from the sex ratios of tagged and untagged fish on the spawning grounds. Normally, more female than male pink salmon escape to the spawning grounds. This occurred in 1985 for the Fraser River pink salmon run as a whole, and for those that spawned in the Lower Fraser River in particular. However, in 1985 the escapement above Hell's Gate, for the first time on record, was numerically dominated by males. The likely explanation is that the males, being larger, were more capable of migrating through the rapids in the Fraser Canyon.

The greater numbers of males implies that only some of the pinks destined for the spawning grounds above Hell's Gate were successful in achieving that goal. Further evidence for this was obtained from a small tagging program conducted in the Fraser Canyon when it became apparent that fish were being blocked. Tags were applied to 900 pink salmon at Saddle Rock and at Little Hell's Gate, two locations where apparent migration blockages were observed. Subsequent recoveries of tagged fish on the spawning grounds indicated that only 12% of those tagged fish reached the spawning grounds above Hell's Gate, where they obviously were destined to go. About 11% spawned in tributary streams downstream from the blockage locations, such as the Coquihalla. The majority of the tagged fish (64%) moved back far downstream to spawn in the Lower Fraser River or major tributaries such as the Harrison River.

These results imply that only 12% of the fish which would have migrated above Hell's Gate actually succeeded. This is probably an exaggeration of the true picture, since tagging took place after a period of known blockage of fish and the tagging operation possibly was selective for fish which had already been delayed and therefore had a reduced likelihood of successful migration. However, it illustrates that a significant blockage of upper-river pink salmon occurred and that the blockage contributed to the sharp decline in upriver escapement. In addition, slightly more females than males were tagged, but nearly 2/3 of the tagged fish recovered on the upper river spawning grounds were males. Similarly, from the enumeration tagging program in the Lower Fraser River, a much higher successful migration rate for male tagged fish compared with females was evident based on recoveries at Seton Creek and Thompson River spawning grounds.

The canyon tagging results also provided some information on the period of delay in the area. Tagged fish were observed passing Hell's Gate for 19 days after tagging. Normally the migration of these fish would take only one or two days. The delay of the pink salmon was also studied for several days by tracking fish implanted with miniature radio transmitters. A number of fish were radio-tagged at Saddle Rock and Little Hell's Gate. It was found that delay at Saddle Rock ranged from a few hours to at least 3-4 days. At Little Hell's Gate, a delay of at least 4 days was observed in some fish, and at China Bar Rapids delays of 1 to 2 days were detected. Several radio-tagged fish disappeared during the study; they may have gone far downstream and out of the study area, as did 64% of the fish tagged with plastic discs.

The successful migration of only 12% of the tagged group may be partially related to the cumulative stresses from tagging, but more importantly from stress experienced by the fish as the result of delay and difficult migration through the rapids. To examine stress, we collected pink salmon at two locations where migration was apparently difficult: at Little Hell's Gate and China Bar Rapids. At both locations, stress levels (as indicated by plasma cortisol levels) in female pink salmon were significantly higher than were observed

in fish sampled in 1983. Also, the stress levels of fish at China Bar Rapids were much higher than those at Little Hell's Gate, only 3 miles downstream, indicating a rapid increase in stress as the fish traversed this short section of the canyon.

It is possible that the high stress levels observed in the 1985 pinks may have occurred in some of the fish in 1981 and 1983 when large numbers of migrating pinks also experienced some congestion at rapids in the canyon. It is also possible that fish which successfully migrate to the spawning grounds but are highly stressed in doing so, may be less successful because of improper egg development or inability to spawn normally. This may partially explain the recent decline in the proportion of the Fraser pink salmon population migrating to the upper spawning areas, even though the total Fraser escapements have increased concurrently. Further stress studies might shed light on the decline of upper river spawners.

Migration pathway improvements will be necessary if the upper river pink salmon production is to be increased and maintained. It appears that the greater the success of the pink salmon population, in terms of total run abundance, the greater will be the migration problems in the Fraser Canyon. Larger runs mean many fish trying to migrate through a limited passageway at the same time; larger runs also mean smaller fish which are less capable swimmers. In essence, we (and the fish) have become victims of our own successes! Critical examination of this problem will be required.

Studies of the impacts on fish of the new Annacis crossing of the Fraser River near New Westminster continued in 1985. Early Stuart sockeye and pink salmon migrations were monitored by hydroacoustic instruments at the bridge site to determine migration distribution. Commission staff collaborated with consultants hired by the Ministry of Highways to study the behavior of radio-tagged sockeye and pink salmon at the bridge site.

Sockeye migrations at the Seton Creek Generating Station were monitored to ensure that sockeye migrations to Gates and Portage Creeks were not unduly delayed at the powerhouse. B.C. Hydro cooperated by implementing protective operating constraints requested by the Commission and DFO to minimize the impact of the hydroelectric plant on both the adult and juvenile salmon populations.

Commission staff installed an electronic fish counter at the Lower Seton pink salmon spawning channel to count fish entering so that the optimum numbers entered the channel.

TABLE I

FRASER RIVER PANEL AREA SOCKEYE CATCH BY GEAR

Gear		1973	1977	1981	1985
United States Waters					
Purse Seines	Units	151	212	171	164
	Catch	1,410,499	822,995	616,846	1,403,512
	Percent	53.68	45.99	47.65	48.01
Gill Nets	Units	725	1,021	867	916
	Catch	1,075,698	899,757	652,674	1,423,830
	Percent	40.94	50.28	50.42	48.71
Reef Nets	Units	48	53	45	39
	Catch	140,921	65,984	24,856	95,967
	Percent	5.36	3.68	1.92	3.28
Troll	Catch	463	873	110	34
	Percent	0.02	0.05	0.01	0.001
TOTAL CATCH		2,627,581	1,789,609	1,294,486	2,923,343
Canadian Waters					
Purse Seines	Units	129	110	54	186
	Catch	1,126,314	448,214	180,706	2,284,774
	Percent	43.67	22.74	15.58	48.86
Gill Nets	Units	1,178	980	737	891
	Catch	1,395,085	1,487,900	948,312	1,788,516
	Percent	54.10	75.48	81.78	38.25
Troll	Catch	57.571	35,039	30,635	602,855
	Percent	3.99	1.78	2.64	12.89
TOTAL CATCH		2,578,970	1,971,153	1,159,653	4,676,145

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

* Data for 1985 taken from Washington Department of Fisheries, Department of Fisheries and Oceans and the IPSFC for the Fraser River Panel Area.

TABLE II

CYCLIC LANDINGS OF SOCKEYE SALMON

	United States	*Canada*	*Total*
1985*			
Total landings (No. Sockeye).....	2,923,343	4,676,145	7,599,488
Share in Fish.....	38.47%	61.53%	
1946-1985			
Total landings (No. Sockeye).....	66,605,899	67,585,133	134,191,032
Share in Fish.....	49.64%	50.36%	
1985 Cycle Catch			
1985.....	2,923,343	4,676,145	7,599,488
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.....	1,558,354	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

* Data for 1985 taken from Washington Department of Fisheries, Department of Fisheries and Oceans and the IPSFC for the Fraser River Panel Area.

TABLE III

DAILY CATCH OF SOCKEYE, 1973-1977-1981-1985* FROM UNITED STATES WATERS

	JULY				AUGUST				SEPTEMBER			
Date	**1973**	**1977**	**1981**	**1985**	**1973**	**1977**	**1981**	**1985**	**1973**	**1977**	**1981**	**1985**
1				1,123	242,792	14,338		55,112	12,031	13	711	12,095
2	110,423			1,996				48,615	7,085		5,719	4,374
3	80,632						5,110		3,912		269	11,252
4	75,761						57,906	52,424				8,993
5		230,143	30,318				38,069	194,013		302		4,342
6		98,478	67,273			12,777	42,319	307,293		15		
7		18,638	28,251			145,053	22,340	104,175			65	2,341
8		39,389	40,673		249,821	3,031	35,587				1,940	5,299
9	153,802					41,953	106,214		1,429		114	2,649
10	78,082					1,060	120,879		484		99	6,123
11	77,654		29,248				114,430		126			5,458
12	60,972		31,465				42,651				30	
13	47,993		9,305				26,427	805,847			1,122	
14		119,339			102,899	2,723	11,207				709	
15					39,203	61,433		32,037			2	
16	35,708					31,546		66,762		18	30	
17	40,820							30,917	49		172	
18	43,260						41,587		22		65	
19							39,773	97,678				
20			39,272		84,981		7,387	90,733		22	5	
21			30,055		58,765	776	6,973	31,589		1	7	
22			34,124		33,417	17,032				4	13	
23	120,363			7,111	10,132	7,411					11	
24	79,529	26,703		44,785		5,522		63,401	6			
25	69,739	386,882		57,010		82	37,029	88,493	9			
26		16,671		65,992		59	20,380	132,628		346		
27			143,894	3,618	30,423		1,808			226		
28				121,069	13,494		2,889			120		
29				109,031		92	6,545	28,452				
30	287,354	15,296		162,111		5,446	11,114					
31	279,495	241,105		49,878		1,414		6,486				
Totals	1,691,587	1,192,644	483,878	623,724	865,927	351,748	798,624	2,236,655	25,153	1,067	11,083	62,926
Troll	285	377	53	21	108	492	57	12	1	0	0	1
Monthly Totals	1,691,872	1,193,021	483,931	623,745	866,035	352,240	798,681	2,236,667	25,154	1,067	11,083	62,927
June & Oct. Totals									44,520	243,281	791	4
Season Totals									2,627,581	1,789,609	1,294,486	2,923,343

* Data for 1985 taken from Washington Department of Fisheries and the IPSFC for the Fraser River Panel Area.

TABLE IV

DAILY CATCH OF SOCKEYE, 1973-1977-1981-1985* FROM CANADIAN WATERS

	JULY				AUGUST				SEPTEMBER			
Date	**1973**	**1977**	**1981**	**1985**	**1973**	**1977**	**1981**	**1985**	**1973**	**1977**	**1981**	**1985**
1					140,333	254,774			2,157	205		
2	77,811		49,795		108,960	49,889			1,489			6,715
3	27,430						150,102		25,190			3,119
4	16,248	216,751					46,535					
5		97,485						553,514		53		
6	Strike				264,462	170,652		278,668		19,158	1,697	19,804
7	July 6-		48,376		50,062	45,466	117,472	400,008			879	
8	July 15				36,412	37,489				17,653	3,795	
9	32,772				150,843	49,295			97		409	9,334
10					61,480	66,984			11,213		2,782	1,535
11			35,688				103,507		70			
12							16,493	564,024	37	25,675		
13		68,514			57,682		15,507	320,070				
14		22,076			138,703			259,878		26,723	3,595	
15	26,786				105,299	96,228						
16	12,961					11,790						3,729
17	8,966								7,972			
18	10,905						30,058	142,360	4			
19							171,135	137,901	7			
20		95,756	36,499		93,807							
21		31,816			26,584			181,851		9,328		
22					26,578	20,032	58,606					
23	243,444				11,668	2,928						
24	150,685			58,746		1,142	39,657		2,595			
25	112,045	351,221					11,337	157,965	22			
26		43,025					11,356	28,526	13,637			
27			130,992		31,894			30,118				
28					7,784			129,701				
29				235,822	11,313	5,771	6,412					
30	150,434			184,305			6,666					
31	215,403			361,549		369	26,643					
Totals	1,085,890	926,644	301,350	840,422	1,323,864	812,789	811,486	3,184,584	64,490	98,795	13,157	44,236
Troll	24,079	17,012	2,467	78,675	28,890	13,699	26,051	512,594	3,574	1,715	2,079	9,553
Spring Salmon Gill Nets									1,769	517		
Monthly Totals	1,109,969	943,656	303,817	919,097	1,352,754	826,488	837,537	3,697,178	69,833	101,027	15,236	53,789
June & Oct. Totals									46,414	99,982	3,063	6,081
Season Totals									2,578,970	1,971,153	1,159,653	4,676,145

* Data for 1985 taken from Department of Fisheries and Oceans and the IPSFC for the Fraser River Panel Area.

TABLE V

INDIAN CATCH OF SOCKEYE BY DISTRICT AND AREA, 1981 AND 1985

	1981		1985	
District and Area	*Catch*	*No. of Fishermen**	*Catch*	*No. of Fishermen**
HARRISON-BIRKENHEAD				
Birkenhead River and Lillooet Lake	5,000	1**	2,729	1**
TOTALS	5,000	1**	2,729	1**
LOWER FRASER				
Below Hope	98,291	492	101,599	553
TOTALS	98,291	492	101,599	553
MIDDLE FRASER				
Hope to Lytton	92,578		148,020	
Lytton to Churn Creek	101,425	1,291	65,915	1,221
TOTALS	194,003	1,291	213,935	1,221
CHILCOTIN				
Farwell Canyon to Siwash Bridge	31,350	95	8,990	151
Keighley Holes				
TOTALS	31,350	95	8,990	151
UPPER FRASER				
Churn Creek to Quesnel	71,660	205	55,432	152
Shelley	10,040	60	6,887	61
TOTALS	81,700	265	62,319	213
NECHAKO				
Nautley and Stella Reserves	11,187	61	18,402	1**
TOTALS	11,187	61	18,402	1**
STUART				
Fort St. James-Pinchi Village	8,933	2	7,416	1**
Tachi, Takla & Trembleur Villages	10,750	2	9,009	1**
TOTALS	19,683	4	16,425	2**
THOMPSON				
Main Thompson	—	—	100	(a)
North Thompson	—	—	—	—
South Thompson	—	25	—	—
TOTALS	—	25	100	(a)
GRAND TOTALS	441,214	2,234	424,499	2,138

* Number of permits issued to Indians in district.

** One permit issued for entire Band, the permit is not included in grand total.

(a) Permit number included with Middle Fraser.

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

TABLE VI

SUMMARY OF THE SOCKEYE ESCAPEMENT TO THE FRASER RIVER SPAWNING AREAS, 1973, 1977, 1981, 1985

District and Streams	1985 Period of Peak Spawning	Estimated Number of Sockeye				Jacks	Sex Ratio Males 4-5 Yr.	Sex Ratio Females 4-5 Yr.
		1973	1977	1981	1985			
LOWER FRASER								
Cultus lake	Late Nov.	858	353	1,159	571	147	215	209
Upper Pitt. River	Sept. 11-17	11,928	13,887	25,327	3,574	14	1,432	2,128
Widgeon Slough	Oct. 29-Nov. 3	427	427	572	801	0	486	315
HARRISON								
Big Silver Creek	Oct. 2-4	270	349	173	106	0	53	53
Harrison River	Nov. 12-Dec. 9	3,060	2,246	3,193	5,097	0	2,828	2,269
Weaver Creek	Oct. 29-Nov. 5	27,807	22,105	24,138	17,621	612	5,035	11,974
Weaver Channel	Oct. 24-31	22,366	33,040	19,655	21,839	1,829	8,292	11,718
LILLOOET								
Birkenhead River	Sept. 18-23	139,295	43,139	65,495	37,612	25,707	5,845	6,060
SETON-ANDERSON								
Gates Creek	Sept. 5-9	231	1,176	821	1,140	478	306	356
Gates Channel	Sept. 4-8	668	1,713	3,988	4,664	748	1,539	2,377
Portage Creek	Nov. 18-21	4,272	7,974	6,086	2,083	318	756	1,009
SOUTH THOMPSON								
Seymour River	Sept. 2-5	2,856	5,911	11,529	6,435	815	2,936	2,684
Scotch Creek	Sept. 4-8	6,235	13,586	18,952	3,442	57	1,903	1,482
Lower Adams River	Oct. 23-26	33,312	57,964	31,097	10,715	10,293	211	211
Little River	Oct. 19-22	6,689	8,684	8,169	972	934	19	19
South Thompson River		545	432	182	0	0	0	0
Lower Shuswap River	Oct. 17-21	7,452	14,695	7,358	3,123	2,306	350	467
Misc. Streams	L. Sept.-E. Nov.	0	0	101	443	197	110	136
NORTH THOMPSON								
Raft River	Sept. 3-7	2,729	648	873	3,638	0	1,496	2,142
Barriere River		22	16	0	0	0	0	0
Fennell Creek	Aug. 27-Sept. 1	205	355	2,113	1,620	22	808	790
North Thompson River	Sept. 10-14		1,372	0	1,883	0	824	1,059
CHILCOTIN								
Chilko River	Oct. 4-10	61,707	54,322	35,909	86,120	14,685	36,373	35,062
QUESNEL								
Horsefly River	Sept. 3-20	253,388	473,008	677,389	1,134,804	0	514,051	620,753
Mitchell River	Sept. 18-20	24,673	42,396	66,106	207,041	0	100,043	106,998
NECHAKO								
Nadina River (Early)	Sept. 4	2,705	1,453	821	18	0	9	9
Nadina river (Late)	Sept. 23-25	7,951	610	1,024	1,516	0	527	989
Nadina Channel	Sept. 22-26	8,786	16,286	17,892	12,291	0	5,452	6,839
Nithi River		54	150	100	0	0	0	0
Stellako River	Sept. 23-28	30,755	23,452	22,021	42,296	197	19,064	23,035
STUART								
Early Runs								
Ankwill Creek	Aug. 6-8	21,790	6,287	8,497	12,012	0	5,581	6,431
Bivouac Creek	Aug. 6-8	1,884	952	285	937	0	424	513
Driftwood River	July 30-Aug. 12	131,172	54,568	47,298	93,959	0	42,427	51,532
Dust Creek	Aug. 6-9	17,850	16,200	5,044	5,459	0	2,362	3,097
Felix Creek	Aug. 5-15	7,465	2,160	6,200	20,606	0	9,526	11,080
15 Mile Creek	Aug. 12-14	1,090	452	815	352	0	139	213
5 Mile Creek	Aug. 12-14	2,408	907	369	638	0	306	332
Forfar Creek	Aug. 1-7	18,924	3,628	12,228	19,433	3	8,813	10,617
Forsythe Creek	Aug. 2-6	10,907	3,677	2,386	3,262	0	1,300	1,962
Frypan Creek	Aug. 1-4	5,799	4,383	1,864	3,044	0	1,476	1,586
Gluske Creek	July 31-Aug. 7	19,450	4,646	10,741	17,381	2	7,754	9,625
Kynoch Creek	Aug. 3-8	22,485	5,893	13,452	20,347	2	9,272	11,073
Leo Creek	Aug. 2-4	1,390	646	78	29	0	13	16
Narrows Creek	Aug. 1-5	5,726	2,844	3,583	4,209	0	2,067	2,142
Paula Creek	Aug. 5-8	2,787	918	1,626	3,219	0	1,434	1,785
Rossette Creek	Aug. 1-5	4,156	2,261	8,018	15,704	2	6,788	8,914
Sakeniche River	Aug. 6-8	4,175	288	6	2,839	3	1,140	1,696
Sandpoint Creek	Aug. 1-5	3,178	1,519	1,224	1,577	0	699	878
Shale Creek	Aug. 3-6	3,260	1,672	1,630	1,678	0	824	854
25 Mile Creek	Aug. 12-14	744	164	923	583	0	296	287
Misc. Streams	Aug. 1-6	14,013	3,952	3,231	7,263	0	3,449	3,814
Early Stuart Totals		(300,653)	(118,017)	(129,498)	(234,531)	(12)	(106,090)	(128,429)
Late Runs								
Kazchek Creek	Sept. 12-16	2,909	720	6,872	1,955	0	773	1,182
Kuskwa Creek	Sept. 21	20,124	9,031	20,520	2,624	0	1,058	1,566
Middle River	Sept. 16-23	91,879	80,420	125,630	114,122	7	48,247	65,868
Pinchi Creek		1,271	1,719	1,494	0	0	0	0
Tachie River	Sept. 20-29	97,445	54,282	94,050	155,655	14	59,848	95,793
Misc. Streams	Sept. 16-20	715	457	1,133	286	0	113	173
Late Stuart Totals		(214,343)	(146,629)	(249,699)	(274,642)	(21)	(110,039)	(164,582)
NORTHEAST								
Upper Bowron River	Aug. 28-Sept. 3	4,700	2,500	1,170	6,359	0	3,080	3,315
TOTALS *		1,181,093	1,113,453	1,442,675	2,138,600	60,714	934,843	1,142,843

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

TABLE VII

FRASER RIVER PANEL PINK SALMON CATCH BY GEAR

Gear		1979	1981	1983	1985
United States Waters					
Purse Seines	Units	327	310	233	232
	Catch	3,354,044	3,310,281	1,523,289	3,346,263
	Percent	82.89	85.41	81.43	86.59
Gill Nets	Units	768	500	233	280
	Catch	388,723	308,649	155,889	347,958
	Percent	9.61	7.96	8.34	9.00
Reef Nets	Units	52	47	43	39
	Catch	42,771	80,148	87,024	75,888
	Percent	1.06	2.07	4.65	1.96
Troll	Catch	260,735	176,493	104,428	94,546
	Percent	6.44	4.55	5.58	2.45
TOTAL CATCH		4,046,273	3,875,571	1,870,630	3,864,655
Canadian Waters					
Purse Seines	Units	184	155	27	159
	Catch	2,480,864	2,794,078	70,520	2,123,414
	Percent	60.05	66.72	6.59	65.82
Gill Nets	Units	661	625	665	730
	Catch	103,738	347,984	850,590	378,158
	Percent	2.51	8.31	79.51	11.72
Troll	Catch	1,546,753	1,045,791	148,750	724,489
	Percent	37.44	24.97	13.90	22.46
TOTAL CATCH		4,131,355	4,187,853	1,069,860	3,226,061

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

* Data for 1985 taken from Washington Department of Fisheries, Department of Fisheries and Oceans and IPSFC for the Fraser River Panel Area.

TABLE VIII

CYCLIC LANDINGS OF PINK SALMON

	United States	*Canada*	*Total*
1985			
Total landings (No. Pinks)	3,864,655	3,226,061	7,090,716
Share in Fish	54.50%	45.50%	
1957-1985			
Total landings (No. Pinks)	37,145,683	35,421,449	72,567,132
Share in Fish	51.19%	48.81%	
1985 Cycle Catch			
1985 *	3,864,655	3,226,061	7,090,716
1983	1,870,630	1,069,860	2,940,490
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

* Data for 1985 taken from Washington Department of Fisheries, Department of Fisheries and Oceans and the IPSFC for the Fraser River Panel Area.

TABLE IX

DAILY CATCH OF PINK SALMON, 1979-1981-1983-1985* FROM UNITED STATES WATERS

	JULY				AUGUST				SEPTEMBER			
Date	**1979**	**1981**	**1983**	**1985**	**1979**	**1981**	**1983**	**1985**	**1979**	**1981**	**1983**	**1985**
1				13			4,179	966		35,858		222,073
2				16			5,834	773		461,655		143,182
3						3,229	3,481	386	306,247	3,835		409,333
4						13,656	3,390	386	59,389			458,745
5		32			14,791	11,571		2,125				59,238
6		110			33,009	13,013	1,568	3,574				115,669
7		23			34,056	4,538	3,168	3,284		18,918		264,185
8		91				6,772	7,852			471,496		176,591
9						18,899	6,118			40,374	80,267	577,783
10						21,083	1,567			36,505	292,682	162,273
11		200				26,709				4,353	136,841	56,150
12		666				12,446				24,795		11,511
13		164			42,539	10,487		18,448		105,752		
14		256			132,837	11,252				53,736	163,495	
15					113,410			2,511		6,130	250,517	84,786
16	4,266						6,221	8,113	12,762	7,113	45,826	47,166
17	925						42,926	2,801	70,785	35,350	48,937	14,037
18	1,608					165,098	42,297		3,790	11,586		4,492
19					7,602	177,216		24,919	1,620	1,462	23,282	
20		2,609			476,678	88,850		22,022		337	71,637	
21		2,325			478,797	79,974	6,277	13,039		4,793		
22	5,203	4,100			95,190		55,275			7,447		
23	13,237			354	345,863		55,356			3,024		
24	8,198			866	60,371		45,182	42,208				
25			1,200	1,066	28,794	483,314		94,365				
26			2,037	1,346	548,344	498,424	13,005	271,988				
27		9,255	3,156		457,938	115,077	48,861					
28		3,202		768	35,947	136,034	31,670					
29				1,246	347,355	170,459	122,634	270,540				
30	12,529			1,630	15,619	273,423	138,926	22,022				
31	3,019			695	12,722			161,398				
Totals	48,985	23,033	6,393	8,000	3,281,862	2,341,524	645,787	965,868	454,593	1,334,519	1,113,484	2,807,214
Troll	34,918	35,736	1,812	4,753	224,700	139,418	102,416	77,975	2	479	200	562
Monthly Totals	83,903	58,769	8,205	12,753	3,506,562	2,480,942	748,203	1,043,843	545,595	1,334,998	1,113,684	2,807,776
June & Oct. Totals									1,213	862	538	283
Season Totals									4,046,273	3,875,571	1,870,630	3,864,655

* Data for 1985 taken from Washington Department of Fisheries and the IPSFC for the Fraser River Panel Area.

TABLE X

DAILY CATCH OF PINK SALMON, 1979-1981-1983-1985 FROM CANADIAN WATERS

	JULY				AUGUST				SEPTEMBER			
Date	**1979**	**1981**	**1983**	**1985**	**1979**	**1981**	**1983**	**1985**	**1979**	**1981**	**1983**	**1985**
1												
2							273					635,832
3						234						274,677
4						5,331			49,036			
5								13,324				
6					75,235			9,806		248,776	34,692	25,975
7					499	758		8,740		150,069		
8										121,764		
9	66									52,801	89,817	344,202
10										48,062		200,331
11						747						
12					1,547	77,045		47,219			37,414	
13					119,176	101,425		33,789			32,657	
14					155,509			27,607		154,919	28,634	
15											139,676	
16	165				2,886							74,346
17									6,309		98,984	
18						93,787		3,944	3,678		82,413	
19						105,277		95,931			104,745	
20		260			317,597						69,824	
21					240,369			8,207			69,633	
22					98,272	4,006	24,485				45,460	
23	182				2,467							
24				121		226,658						
25					623,102	293,375	9,102	5,649				
26					384,563	237,385		367,522				
27		12,232	263		244,486			395,662				
28								48,500				
29				2,424		384,824	22,435					
30	175			2,384	257,934	432,006	28,644					
31				3,143		389,248						
Totals	588	12,492	263	8,072	2,523,642	2,352,106	84,939	1,065,900	59,023	776,391	833,949	1,555,363
Troll	129,911	123,278	501	49,997	1,297,321	667,981	90,484	246,139	35,543	249,699	57,765	197,356
Monthly Totals	130,499	135,770	764	58,069	3,820,963	3,020,087	175,423	1,312,039	94,566	1,026,090	891,714	1,752,719
June & Oct. Totals									85,327	5,906	1,959	103,234
Season Totals									4,131,355	4,187,853	1,069,860	3,226,061

* Data for 1985 taken from Department of Fisheries and Oceans and the IPSFC for the Fraser River Panel Area.

TABLE XI

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

District and Streams	*1985 Period of Peak Spawning*	*Estimated Number of Pink Salmon*			
		1979	**1981**	**1983**	**1985**
EARLY RUNS					
LOWER FRASER					
Main Fraser	Oct. 14-20	1,521,856	2,252,368	3,307,834	5,248,742
FRASER CANYON					
Coquihalla River	Oct. 7-11	16,468	24,029	29,190	118,921
Jones Creek	Oct. 2-15	4,993	4,485	973	3,095
Misc. Tributaries	Oct. 3-25	4,149	14,720	16,293	42,421
SETON-ANDERSON					
Seton Creek	Oct. 14-20	549,512	519,393	407,791	169,957
Upper Seton Channel	Oct. 14-20	9,956	10,402	9,691	4,485
Lower Seton Channel	Oct. 14-20	34,494	33,846	31,045	33,807
Portage Creek	Oct. 16-22	51,842	18,733	10,202	4,116
Bridge River	Sept. 22-Oct. 10	65,759	43,940	41,909	61,755
Gates Creek		1,277	88	0	0
THOMPSON					
Thompson River and Tributaries	Oct. 5-22	885,402	1,166,348	512,398	193,448
TOTALS*		3,154,945	4,097,269	4,373,049	5,886,698
LATE RUNS					
HARRISON					
Harrison River	Oct. 14-20	269,858	314,519	146,014	438,022
Chehalis River		2,067	169	452	0
Weaver Creek	Oct. 28-Nov. 3	117	1,006	1,439	3,310
Weaver Channel	Oct. 25-30	737	1,287	1,887	4,772
CHILLIWACK-VEDDER					
Chilliwack-Vedder River	Oct. 14-20	124,041	68,601	99,240	95,556
Sweltzer Creek	Oct. 16-22	8,889	5,213	9,134	14,712
TOTALS*		405,709	391,067	258,572	573,918
GRAND TOTALS*		3,560,654	4,488,336	4,631,621	6,460,616

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

COMMISSION PUBLICATIONS, 1985

1. Annual Report of the International Pacific Salmon Fisheries Commission for 1984.

2. Progress Report 41. Application of dual-beam acoustic procedures to estimate limnetic juvenile sockeye salmon by R. L. Johnson and J. J. Burczynski.

STAFF PUBLICATIONS IN OTHER JOURNALS

1. Survey of selected British Columbia and Yukon salmon streams for sensitivity to acidification from precipitation. 1985. M. A. Sullivan, S. C. Samis, J. A. Servizi and R. W. Gordon. Canadian Technical Report of Fisheries and Aquatic Sciences 1388. June.

2. Survey of selected streams for sensitivity to acidification from the proposed Hat Creek Coal Development. 1985. J. A. Servizi, R. W. Gordon , S. C. Samis, L. G. Pella, M. A. Sullivan and M. D. Nassichuk. Canadian Technical Report of Fisheries and Aquatic Sciences 1389. July.

INTERNATIONAL PACIFIC SALMON FISHERIES COMMISSION

Advisory Committee Members and Period of Service since Inception of the Commission

CANADA

Salmon Processors

Richard Nelson	1938-1966
Ken Fraser	1966-1971
Lloyd Monk	1971-1977
J. O'Connor	1977-1980
Brian Fraser	1980-1985

Purse Seine Fishermen

M. E. Guest	1938-1939
W. T. Burgess	1941-1945
George Miller	1945-1949
H. Martinick	1949-1950
W. J. Petrie	1950-1956
George T. Brajcich	1956-1957
C. N. Clarke	1957-1967
F. Buble	1967-1972
John Lenic, Jr.	1972-1973
John Brajcich	1973-1984
Larry Wick	1985-1985

Gill Net Fishermen

F. Rolley	1938-1944
Homer Stevens	1944-1949
P. Jenewein	1949-1970
Frank Nishii	1970-1985

Troll Fishermen

W. A. Hawley	1938-1939
A. E. Carr	1944-1952
M. Berg	1952-1955
H. North	1955-1960
R. H. Stanton	1960-1969
M. Guns	1969-1971
	1975-1979
W. Edwards	1971-1973
M. Ellis	1973-1975
John Makowichuk	1979-1983
Brian Fahey	1983-1985

Purse Seine Crew Members

H. Staveness	1958-1975
Nick Carr	1976-1985

Sport Fishermen

M. W. Black	1938-1961
J. C. Murray	1961-1965
R. H. Wright	1965-1972
H. English	1972-1980
A. Downs	1980-1984

Native Indians

D. Guerin	1981-1983
S. Douglas	1984-1985

UNITED STATES

Salmon Processors

C. J. Collins	1938-1949
J. Plancich	1949-1972
D. Franett	1972-1980
J. Lind	1980-1983
	1985-1985
J. Theodore	1984-1984

Purse Seine Fishermen

L. Makovich	1938-1946
N. Mladinich	1946-1976
W. Green	1976-1984
V. Barcott	1984-1985

Gill Net Fishermen

C. Karlson	1938-1958
J. F. Jurich	1946-1946
J. Erisman	1958-1964
V. Blake	1964-1967
R. Christensen	1967-1982
R. Suggs	1982-1985

Troll Fishermen

S. Leite	1938-1945
E. Larum	1939-1943
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	1981-1982
C. Finley	1982-1984
M. Davis	1984-1985

Reef Net Fishermen

J. R. Brown	1958-1974
G. H. Schuler	1974-1978
T. Philpott	1978-1985

Sport Fishermen

K. McLeod	1938-1953
H. Gray	1953-1972
E. Engman	1972-1985

Native Indians

C. Peterson	1981-1985

STAFF

John F. Roos, Director

NEW WESTMINSTER

Dr. D. J. Blackbourn
O. T. Brockwell
J. D. Cave
P. Cheng
Dr. R. C. Cook (to April)
Mrs. M. Coventry
M. R. Fretwell
J. H. Gable
Mrs. G. Grant
Mrs. E. M. Green
I. C. Guthrie (from July)
H. K. Hiltz
R. B. Kent
Mrs. K. Kroeker
K. N. Medlock, Administrative Officer
K. L. Peters
W. S. Saito
Mrs. F. Sato
P. B. Saxvik, Chief Engineer
D. F. Stelter
R. A. Stewart, Chief Operations Division
Miss. B. Tasaka
Mrs. A. Townsend
Mrs. R. Wien
Dr. J. C. Woodey, Chief, Management Division
L. V. Woods

SWELTZER CREEK LABORATORY

D. P. Barnes
H. J. Enzenhofer
R. W. Gordon
R. L. Johnson
A. H. Lesberg
C. J. Mack
D. W. Martens
K. F. Morton
Miss S. Morelli
Dr. J. A. Servizi, Chief, Environment Conservation Division
E. R. Stewart (to October)
G. Suther
I. V. Williams, Chief, Biology Division

HELL'S GATE FISHWAYS	F. R. Johnston
UPPER PITT FIELD STATION	A. R. Stobbart
WEAVER CREEK CHANNEL	V. E. Ewert
GATES CREEK CHANNEL	W. J. Stevenson (to March) W. E. Wells
SETON CREEK CHANNELS	M. King, B. J. Thompson
CHILKO LAKE	M. N. Pond
NADINA RIVER CHANNEL	B. A. Van Horlick