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

1983

COMMISSIONERS

ALVIN W. DIXON
C. WAYNE SHINNERS
MICHAEL W.C. FORREST
HERBERT A. LARKINS
ROLLAND A. SCHMITTEN
TED A. SMITS

NEW WESTMINSTER
CANADA
1984

INTERNATIONAL PACIFIC SALMON FISHERIES COMMISSION

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

CANADA

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

UNITED STATES

Edward W. Allen	1937-1951
	1957-1957
B.M. Brennan	1937-1942
Charles E. Jackson	1937-1946
Fred J. Foster	1943-1947
Milo Moore	1946-1949
	1957-1961
Albert M. Day	1947-1954
Alvin Anderson	1949-1950
Robert J. Schoettler	1951-1957
Elton B. Jones	1951-1957
Arnie J. Suomela	1954-1961
DeWitt Gilbert	1957-1974
George C. Starlund	1961-1966
Clarence F. Pautzke	1961-1969
Thor C. Tollefson	1966-1975
Charles H Meacham	1969-1970
Donald R. Johnson	1971-1980
William G. Saletic	1974-1983
Donald W. Moos	1975-1977
Gordon Sandison	1977-1980
Herbert A. Larkins	1980-1983
Rolland A. Schmitten	1981-
Ted A. Smits	1983-

DIRECTOR OF INVESTIGATIONS

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

Richard Nelson

Member of the International Pacific Salmon Fisheries Commission from 1966 to 1976 and Advisory Committee Member from 1938 to 1966. Mr. Nelson who died on December 15, 1983 was a pioneer in the British Columbia salmon industry. He devoted a great amount of time furthering the work of the Commission and had a keen interest in the resource. By his actions he created a friendly spirit among both Commissioners and staff.

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REPORT OF THE INTERNATIONAL PACIFIC SALMON FISHERIES COMMISSION FOR THE YEAR 1983

Serious fishery management problems were experienced in 1983 resulting from abnormally high diversion of Fraser sockeye and pink salmon via Johnstone Strait where intense Canadian fisheries harvested 49.6% of the entire 1983 sockeye run and 45.2% of the pink run. Additional catches in other non-Convention area fisheries also outside the Commission's regulatory control further restricted the Commission's ability to regulate Convention area fisheries for escapement and division of catch. Consequently, the 1983 season ended with significant discrepancies in division of catch of both species as well as lower than desired escapements for both sockeye and pink salmon.

The migration pattern of Fraser River sockeye and pink salmon runs in 1983 was most unusual. It is estimated that 80% of the sockeye run and 66% of the pink salmon run approached the Fraser River via Johnstone Strait (Figures 1 and 2). These were the highest percentages on record for both species and possibly the highest for the past century during which these stocks have been commercially harvested. From 1952 through 1977 the average annual diversion rate for sockeye was 16%. Since 1978 an average of 54% of the Fraser sockeye runs have migrated through Johnstone Strait instead of the normal migration in Juan de Fuca Strait. For pink salmon, the average migration through Johnstone Strait through 1981 was 29%. The record diversion rate of 66% in 1983 exceeded the previous high by some 23% but in terms of actual diversion was not as extreme as shown by the sockeye run.

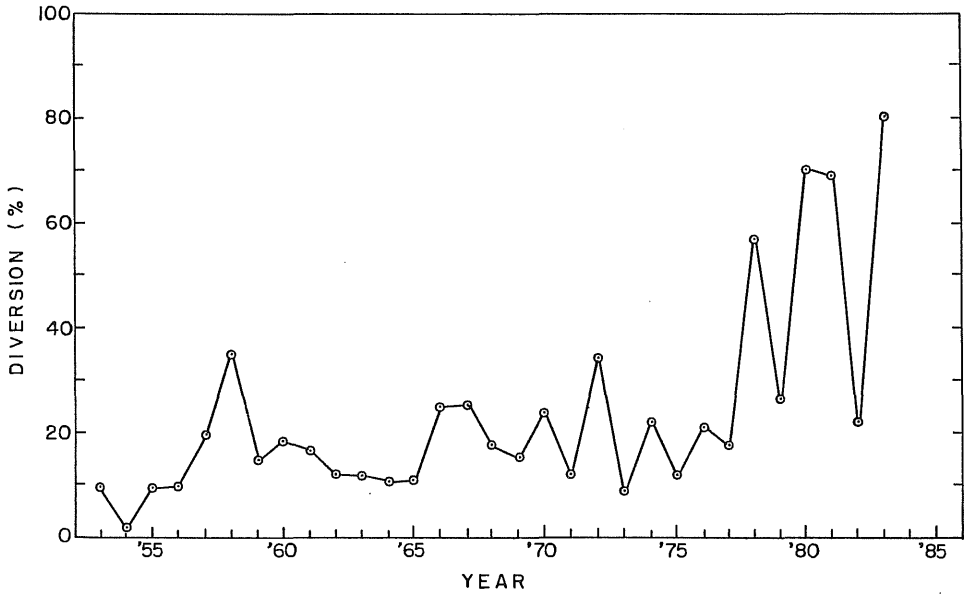

FIGURE 1. Fraser River sockeye salmon percentage migration via Johnstone Strait.

The aberrant migratory behavior of Fraser sockeye and pink salmon in 1983 was directly linked to an unusually strong oceanographic-atmospheric event termed an "El Nino". Particularly apparent on the coast were elevated sea surface temperatures. The

migration pattern of Fraser sockeye returning in 1983 appears related to the spring (March to May) mean temperature off the coast of British Columbia (Figure 3). The relationship for all years (1953-1983) is statistically significant, r = 0.70 (n = 31). However, for the most recent years (1973-1983) the correlation appears even more strongly related, r = 0.94 (n = 11). It is apparent that over the thirty year period other factors must have also influenced migratory behavior since in the three years of maximum temperatures (1958, 1981 and 1983), the percentage diversion varied from 35 to 85%. "El Nino" events caused increased sea surface temperatures in 1958 and 1983 but were not involved in the high diversions observed in 1978, 1980 and 1981. Diversion of sockeye in these latter years appear related to local temperature anomalies.

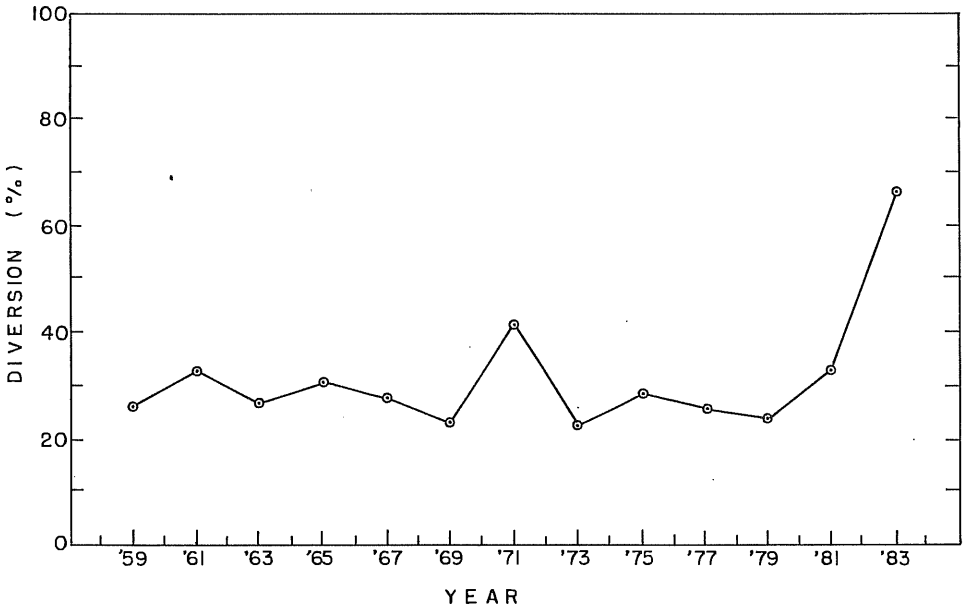

FIGURE 2. Fraser River pink salmon percentage migration via Johnstone Strait.

From the inception of Commission regulations in 1946 to the mid-1950's, it was common for 90% or more of all Fraser sockeye caught to be taken in Convention Waters under Commission regulations. The percentage decreased gradually to approximately 75% by the mid-1970's and subsequently decreased rapidly in the late 1970's and early 1980's. In 1983, control of the catch of Fraser River stocks by the Commission was reduced to the extent that a record 81% (Figure 4) of the total sockeye catch and 79% of the pink catch was taken under regulations promulgated by agencies other than the Commission. Multi-agency management is contrary to the concept advocated and agreed upon by the two governments more than 80 years ago, which eventually resulted in the present Convention. Both governments earnestly sought to eliminate the conflicts arising from multi-national control of the fisheries and eventually placed the control under one agency, the Commission. This understanding was clearly recognized many years prior to the Hell's Gate disaster in 1913 and subsequent depletion of the runs. Presently, the Fraser River sockeye and pink salmon runs have been restored significantly but multi-agency management has greatly reduced Commission control of the harvest, thus endangering the gains made from 38 years of fishery management.

The untenable management situation that has developed must be corrected if effective management of the resource is to be maintained. Unfortunately, the returns from

1983 brood year spawning will be affected because of overfishing and consequent reduction in escapement. The Commission cannot control the migration patterns of the stocks but it can ensure a management program that will be effective under all conditions given the mandate and support of both governments. Single agency management has proven beneficial for Fraser River sockeye and pink salmon stocks commencing in 1946 and would continue so with a renewed commitment of the Parties to re-establish single management authority.

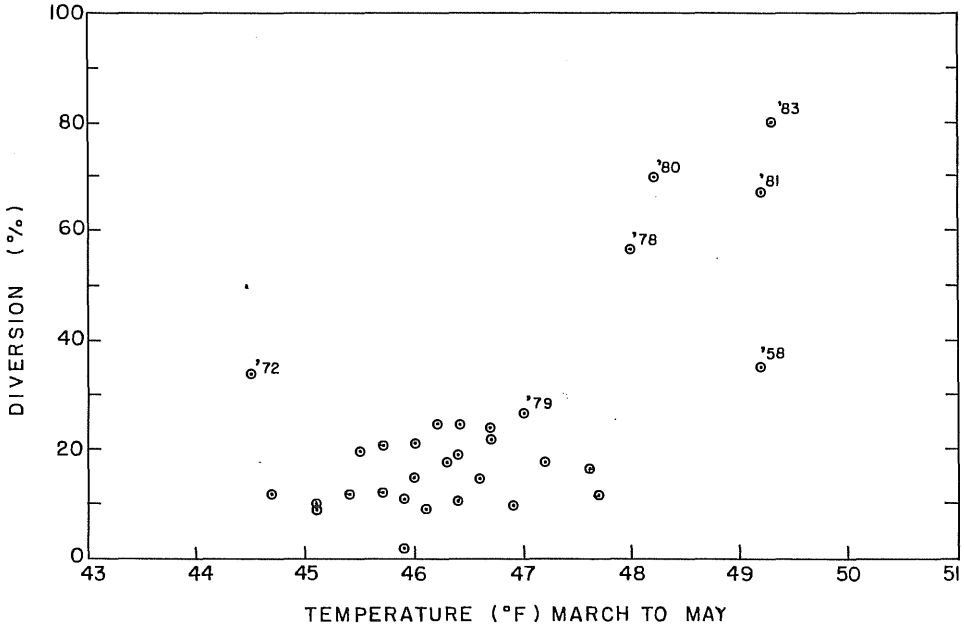

FIGURE 3. Relationship of Fraser River sockeye salmon migration rate via Johnstone Strait and sea surface temperature at Kains Island and Langara Island from March to May of the return year.

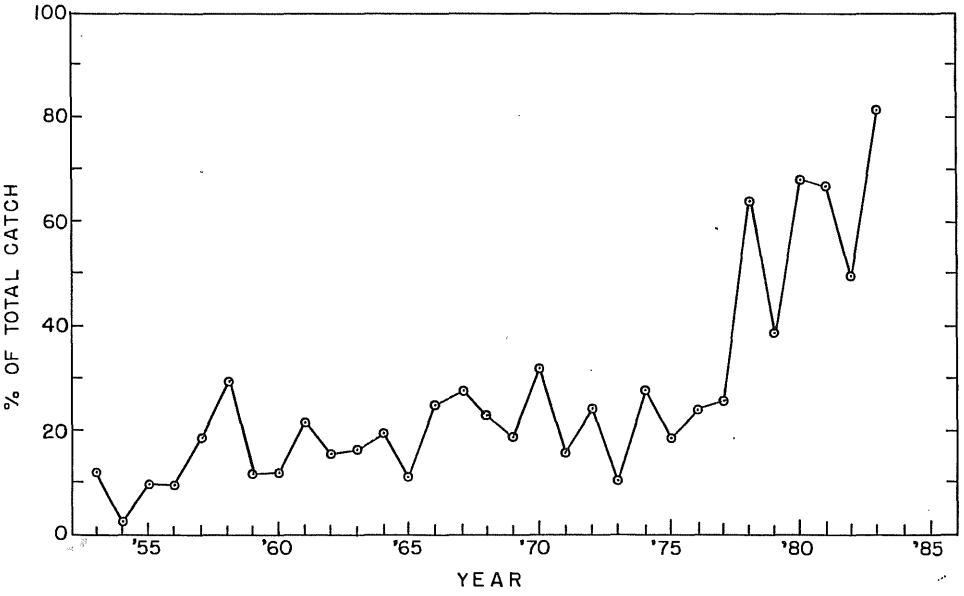

FIGURE 4. Percent of Fraser River sockeye catch taken outside I.P.S.F.C. regulations.

COMMISSION MEETINGS

The International Pacific Salmon Fisheries Commission held eighteen formal and twelve telephone meetings during 1983 with the approved minutes of the meetings being submitted to the Governments of Canada and the United States.

On July 8 the Commission approved the appointment of Mr. Brian Fahey to the Advisory Committee representing Canadian Troll Fishermen. At the December 9 meeting the Commission approved the reappointment of Mr. Frank Nishii to the Advisory Committee representing Canadian Gill Net Fishermen.

The membership of the Advisory Committee for 1983 was as follows:

Canada	*United States*
J. Brajcich Purse Seine Fishermen	W. Green Purse Seine Fishermen
B. Fraser Salmon Processors	J. Lind Salmon Processors
F. Nishii Gill Net Fishermen	R. Suggs Gill Net Fishermen
N. Carr Purse Seine Crew Members	T. Philpott Reef Net Fishermen
J. Makowichuk (to July 7) B. Fahey (from July 8) Troll Fishermen	C. Finley Troll Fishermen
A. Downs Sports Fishermen	E. Engman Sports Fishermen
D. Guerin (to August 5) Native Indian Fishermen	C. Peterson Native Indian Fishermen

The first meeting of 1983 was held January 17 when the Commission met with the Chief Negotiators for the Canada/United States Salmon Treaty, Dr. M. Shepard for Canada and Dr. L. Alverson for the United States. The Exchange of Notes section of the proposed Pacific Salmon Treaty was reviewed and recommendations were submitted.

At its meeting of January 28, Mr. A. W. Dixon served as Chairman and Mr. R. A. Schmitten as Vice Chairman and Secretary. The Commission met with its Advisory Committee regarding tentative recommendations for regulatory control of the 1983 sockeye and pink salmon fishery in Convention Waters, as submitted to the Committee on December 10, 1982. After certain regulatory revisions, the Commission approved the recommended regulations for submission to the two national governments.

On June 10 the Commission approved the budget request for the fiscal year 1984-1985. A draft of the 1982 Annual Report was approved and other administrative matters were discussed including a review of the potential impact of the Kemano Completion Project.

During the period July 8 through October 7, the Commission held twelve formal and twelve telephone meetings for adjustments of fishing regulations to achieve the desired escapement and, as nearly as practicable, equitable division of the allowable catch of Fraser River sockeye and pink salmon in Convention Waters. On October 13 the Commission inspected the Seton Creek artificial spawning channel. The Commission met November 14 to review the report on Alcan's Kemano Completion proposal and statement on the proposed Canada/United States Salmon Treaty.

The Commission met December 2 to review the Annual Meeting presentation. The eighteenth and final formal meeting of the year was held on December 9 in Richmond, British Columbia, when the Commission held its Annual Meeting with its Advisory Committee and approximately 200 representatives of industry, government and press. Mr. H. A. Larkins announced his resignation from the Commission. A review of events during 1983 sockeye and pink salmon season was presented by the Chairman. The catch and escapement statistics were given by the staff. Prospects for the 1984 fishing season were presented and tentative regulations for the 1984 fishery were proposed for consideration by industry and their representatives on the Commission Advisory Committee.

1983 REGULATIONS

Recommendations for regulations governing the 1983 sockeye and pink salmon fishery in Convention Waters were adopted at a meeting of the Commission held January 28, 1983 and were submitted to the two national governments for approval on February 21, 1983. On April 27, 1983, the United States Government informed the Commission that its recommended 1983 regulations were approved with the exception that certain Treaty Indians were excluded and would be regulated under separate United States regulations. The National Marine Fisheries Service was designated as the enforcing agency in cooperation with other federal agencies. The recommendations for Canadian Convention Waters were implemented during the fishing season under the Fisheries Act, Pacific Commercial Salmon Fishery Regulations.

The recommendations of the Commission were as follows:

Canadian Convention Waters

"The International Pacific Salmon Fisheries Commission appointed pursuant to the Convention between Canada and the United States of America for the protection, preservation and extension of the Sockeye Salmon Fisheries of the Fraser River System, signed at Washington on the 26th day of May, 1930, as amended by the Pink Salmon Protocol signed at Ottawa on the 28th day of December, 1956, hereby recommends to the Canadian Government that, in the interests of such fisheries, the following Fraser River Sockeye and Pink Salmon Fishery Regulations for Convention Waters for the season of 1983 be adopted by Order-in-Council pursuant to Section 34 of the Fisheries Act, namely:

1. (1) No person shall retain sockeye 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, 1983 to the 30th day of July, 1983, both dates inclusive.

(2) No person shall retain pink salmon taken by commercial trolling gear in those waters described in subsection (1) of this section from the 15th day of June, 1983 to the 6th day of August, 1983, both dates inclusive.

(3) Regulatory control of the waters described in subsection (1) of this section shall be relinquished effective 12:01 a.m. September 11, 1983.

2. (1) No person shall fish for sockeye or pink salmon in Pacific Fishery Management Area 20-1, 3 and 4 from the 19th day of June, 1983 to the 6th day of August, 1983, both dates inclusive.

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

(a) From the 7th day of August, 1983 to the 13th day of August, 1983, 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 14th day of August, 1983 to the 27th day of August, 1983, both dates inclusive, except from half past six o'clock in the forenoon to half past six o'clock in the afternoon of Monday and Tuesday of each week; and

(c) From the 28th day of August, 1983 to the 10th day of September, 1983, both dates inclusive, except from seven o'clock in the forenoon to seven o'clock in the afternoon of Monday and Tuesday of each week; and

(d) From the 11th day of September, 1983 to the 17th day of September, 1983, both dates inclusive, except from seven o'clock in the forenoon to seven o'clock in the afternoon of Monday.

(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 7th day of August, 1983 to the 13th day of August, 1983, 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 14th day of August, 1983 to the 27th day of August, 1983, both dates inclusive, except from half past six o'clock in the afternoon of Monday to half past six o'clock in the forenoon of Tuesday and from half past six o'clock in the afternoon of Tuesday to half past six o'clock in the forenoon of Wednesday of each week; and

(c) From the 28th day of August, 1983 to the 10th day of September, 1983, 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 of each week; and

(d) From the 11th day of September, 1983 to the 17th day of September, 1983, both dates inclusive, except from seven o'clock in the afternoon of Monday to seven o'clock in the forenoon of Tuesday.

(4) No person shall troll commercially for sockeye or pink salmon in the waters described in subsection (1) of this section from the 7th day of August, 1983 to the 17th day of September, 1983, 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 19th day of June, 1983 to the 1st day of October, 1983, both dates inclusive.

(2) No person shall troll commercially for sockeye or pink salmon in Pacific Fishery Management Area 18-1 from the 7th day of August, 1983 to the 1st day of October, 1983, both dates inclusive.

4. (1) No person shall fish for sockeye or pink salmon with nets in Pacific Fishery Management Area 29:

(a) From the 19th day of June, 1983 to the 9th day of July, 1983, both dates inclusive; and

(b) From the 10th day of July, 1983 to the 6th day of August, 1983, both dates inclusive, except from eight o'clock in the forenoon of Monday to eight o'clock in the forenoon of Tuesday of each week; and

(c) From the 7th day of August, 1983 to the 13th day of August, 1983, both dates inclusive, except from eight o'clock in the forenoon of Monday to eight o'clock in the forenoon of Wednesday; and

(d) From the 14th day of August, 1983 to the 3rd day of September, 1983, both dates inclusive, except from eight o'clock in the forenoon of Monday to eight o'clock in the forenoon of Tuesday of each week; and

(e) From the 18th day of September, 1983 to the 8th day of October, 1983, both dates inclusive.

5. No person shall fish for sockeye or pink salmon with nets in Pacific Fishery Management Area 29-1 to 5 from the 4th day of September, 1983 to the 17th day of September, 1983, 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.

6. No person shall fish for sockeye or pink salmon with nets in Pacific Fishery Management Area 29-6 to 17 from the 4th day of September, 1983 to the 17th day of September, 1983, both dates inclusive.

7. No person shall troll commercially for sockeye or pink salmon in Pacific Fishery Management Area 29-1 to 7 and 9 to 10 from the 7th day of August, 1983 to the 8th day of October, 1983, both dates inclusive, except at times that net fishing may be permitted within those areas.

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

United States Convention Waters

"The International Pacific Salmon Fisheries Commission appointed pursuant to the Convention between Canada and the United States of America for the protection, preservation and extension of the Sockeye Salmon Fisheries of the Fraser River System, signed at Washington on the 26th day of May, 1930, as amended by the Pink Salmon Protocol

signed at Ottawa on the 28th day of December, 1956, hereby recommends to the United States Government that regulations to the following effect, in the interests of such fisheries in Convention Waters, be adopted for the year 1983, and that an approved copy of said regulations be forwarded to the Director of Fisheries of the State of Washington for implementation by virtue of authority in him vested by Section 6 of Chapter 112 of the Laws of the State of Washington of 1949, namely:

1. (1) No person shall retain sockeye 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, 1983 to the 30 day of July, 1983, both dates inclusive.

(2) No person shall retain pink salmon taken by commercial trolling gear in those waters described in subsection (1) of this section from the 15th day of June, 1983 to the 6th day of August, 1983, both dates inclusive.

(3) Regulatory control of the waters described in subsection (1) of this section shall be relinquished effective 12:01 a.m. September 11, 1983.

2. No person shall fish for sockeye or pink salmon with nets from the 19th day of June, 1983 to the 16th day of July, 1983, both dates inclusive.

3. (1) No person shall fish for sockeye or pink salmon with purse seines in Puget Sound Salmon Management and Catch Reporting Areas 4B, 5, 6, 6C, 7 and 7A:

(a) From the 17th day of July, 1983 to the 13th day of August, 1983, both dates inclusive, except from five o'clock in the forenoon to half past nine o'clock in the afternoon of Monday of each week; and

(b) From the 14th day of August, 1983 to the 17th day of September, 1983, both dates inclusive, except from five o'clock in the forenoon to nine o'clock in the afternoon of Monday of each week.

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

(a) From the 17th day of July, 1983 to the 23rd day of July, 1983; from the 31st day of July, 1983 to the 6th day of August, 1983; and from the 14th day of August, 1983 to the 20th day of August, 1983, all dates inclusive, except from half past seven o'clock in the forenoon to nine o'clock in the afternoon of Sunday of each week; and

(b) From the 24th day of July, 1983 to the 30th day of July, 1983, and from the 7th day of August 1983 to the 13th day of August, 1983, all dates inclusive, except from half past six o'clock in the forenoon to half past eight o'clock in the afternoon of Sunday of each week; and

(c) From the 21st day of August, 1983 to the 27th day of August, 1983, and from the 4th day of September, 1983 to the 10th day of September, 1983, all dates inclusive, except from seven o'clock in the forenoon to half past seven o'clock in the afternoon of Sunday of each week; and

(d) From the 28th day of August, 1983 to the 3rd day of September, 1983, and from the 11th day of September, 1983 to the 17th day of September, 1983, all dates inclusive, except from six o'clock in the forenoon to nine o'clock in the afternoon of Sunday of each week.

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

(a) From the 17th day of July, 1983 to the 23rd day of July, 1983, and from the 31st day of July, 1983 to the 6th day of August, 1983, all dates inclusive, except from seven o'clock in the afternoon of Sunday to half past nine o'clock in the forenoon of Monday of each week; and

(b) From the 24th day of July, 1983 to the 30th day of July, 1983, and from the 7th day of August, 1983 to the 13th day of August, 1983, all dates inclusive, except from seven o'clock in the afternoon of Monday to half past nine o'clock in the forenoon of Tuesday of each week; and

(c) From the 14th day of August, 1983 to the 20th day of August, 1983; from the 28th day of August, 1983 to the 3rd day of September, 1983; and from the 11th day of September, 1983 to the 17th day of September, 1983, all dates inclusive, except from six o'clock in the afternoon of Sunday to nine o'clock in the forenoon of Monday of each week; and

(d) From the 21st day of August, 1983 to the 27th day of August, 1983, and from the 4th day of September, 1983 to the 10th day of September, 1983, all dates inclusive, except from six o'clock in the afternoon of Monday to nine o'clock in the forenoon of Tuesday of each week.

4. (1) No person shall fish for sockeye or pink salmon with purse seines in Puget Sound Salmon Management and Catch Reporting Area 6A:

(a) From the 17th day of July, 1983 to the 13th day of August, 1983, both dates inclusive, except from five o'clock in the forenoon to half past nine o'clock in the afternoon of Monday of each week; and

(b) From the 14th day of August, 1983 to the 10th day of September, 1983, both dates inclusive; and

(c) From the 11th day of September, 1983 to the 17th day of September, 1983, both dates inclusive, except from five o'clock in the forenoon to nine o'clock in the afternoon of Monday.

(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 17th day of July, 1983 to the 23rd day of July, 1983, and from the 31st day of July, 1983 to the 6th day of August, 1983, all dates inclusive, except from seven o'clock in the afternoon of Sunday to half past nine o'clock in the forenoon of Monday of each week; and

(b) From the 24th day of July, 1983 to the 30th day of July, 1983, and from the 7th day of August, 1983 to the 13th day of August, 1983, all dates inclusive, except from seven o'clock in the afternoon of Monday to half past nine o'clock in the forenoon of Tuesday of each week; and

(c) From the 14th day of August, 1983 to the 10th day of September, 1983, both dates inclusive; and

(d) From the 11th day of September, 1983 to the 17th day of September, 1983, both dates inclusive, except from six o'clock in the afternoon of Sunday to nine o'clock in the forenoon of Monday.

5. (1) No person shall fish for sockeye or pink salmon with purse seines in Puget Sound Salmon Management and Catch Reporting Area 7D:

(a) From the 17th day of July, 1983 to the 13th day of August, 1983, both dates inclusive, except from five o'clock in the forenoon to half past nine o'clock in the afternoon of Monday of each week; and

(b) From the 14th day of August, 1983 to the 3rd day of September, 1983, both dates inclusive, except from five o'clock in the forenoon to nine o'clock in the afternoon of Monday of each week.

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

(a) From the 17th day of July, 1983 to the 23rd day of July, 1983, and from the 31st day of July, 1983 to the 6th day of August, 1983, all dates inclusive, except from seven o'clock in the afternoon of Sunday to half past nine o'clock in the forenoon of Monday of each week; and

(b) From the 24th day of July, 1983 to the 30th day of July, 1983, and from the 7th day of August, 1983 to the 13th day of August, 1983, all dates inclusive, except from seven o'clock in the afternoon of Monday to half past nine o'clock in the forenoon of Tuesday of each week; and

(c) From the 14th day of August, 1983 to the 20th day of August, 1983, and from the 28th day of August, 1983 to the 3rd day of September, 1983, all dates inclusive, except from six o'clock in the afternoon of Sunday to nine o'clock in the forenoon of Monday of each week; and

(d) From the 21st day of August, 1983 to the 27th day of August, 1983, both dates inclusive, except from six o'clock in the afternoon of Monday to nine o'clock in the forenoon of Tuesday.

6. No person shall fish for sockeye or pink salmon with commercial trolling gear in Puget Sound Salmon Management and Catch Reporting Areas 4B, 5 and 6C from the 17th day of July, 1983 to the 17th day of September, 1983, both dates inclusive, except from Monday through Friday of each week on those days when purse seine fishing is permitted within that area.

7. No person shall fish for sockeye or pink salmon with nets in Puget Sound Salmon Management and Catch Reporting Area 7B, except for those sockeye and pink salmon taken in nets having mesh of 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 19th day of June, 1983 to the 3rd day of September, 1983, both dates inclusive.

8. (1) No person shall fish for sockeye or pink salmon with nets in that portion of the waters described in subsection (1) of section 3 lying northerly and westerly of a straight line drawn from Iwersen's Dock on Point Roberts in the State of Washington to Georgina Point Light at the entrance to Active Pass in the Province of British Columbia from the 28th day of August, 1983 to the 3rd day of September, 1983, both dates inclusive.

(2) No person shall fish for sockeye or pink salmon with nets in that portion of the waters described in subsection (1) of section 3 lying westerly of a straight line drawn from the low water range marker in Boundary Bay on the International Boundary through the east tip of Point Roberts in the State of Washington to the East Point Light on Saturna Island in the Province of British Columbia from the 4th day of September, 1983 to the 1st day of October, 1983, both dates inclusive.

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

(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 for an equitable share of the season's catch by fishermen of the United States and Canada, the approved regulations as detailed above were later adjusted by the Commission as follows:

July 8, 1983 — In order to secure escapement of Early Stuart sockeye, the Commission cancelled the scheduled opening in Area 29 of Canadian Convention Waters for the week commencing July 10.

July 15, 1983 — In order to secure escapement of Early Stuart and other early timed sockeye, the Commission cancelled the scheduled opening in Area 29 of Canadian Convention Waters and United States Convention Waters for the week commencing July 17.

July 22, 1983 — In the interest of securing additional escapement of early timed summer-run sockeye the Commission approved a 2-day delay of the scheduled opening in United States Convention Waters and Area 29 of Canadian Convention Waters for the week commencing July 24.

July 29, 1983 — In order to secure escapement of early summer-run sockeye the Commission approved a 1-day delay of the scheduled opening of United States Convention Waters and Area 29 of Canadian Convention Waters for the week commencing July 31.

August 5, 1983 — In order to secure additional escapement of Chilko and Stellako sockeye and in the interest of division of catch, the Commission approved the following regulatory changes: 1) That Area 20-1, 3 and 4 and Area 29 of Canadian Convention Waters not open as scheduled for the week commencing August 7. 2) That United States Convention Waters open as scheduled but for 2 days of fishing.

August 12, 1983 — In order to secure additional escapement of summer-run sockeye and for division of catch, the Commission approved the following regulatory changes: 1) That Area 20-1, 3 and 4 and Area 29 of Canadian Convention Waters not open as scheduled for the week commencing August 14. 2) That the scheduled opening in United States Convention Waters be delayed 2 days for 2 days of fishing.

August 19, 1983 — In the interest of division of catch the Commission approved the following regulatory changes: 1) That Area 20-1, 3 and 4 open as scheduled but for 1 day of fishing for the week commencing August 21. 2) That United States Convention Waters open as scheduled but for 2 days of fishing.

August 23, 1983 — In the interest of additional harvest of late arriving summer-run sockeye the Commission approved the following regulatory changes: 1) That Area 29 of Canadian Convention Waters reopen August 25 for 1 day of fishing. 2) That fishing in United States Convention Waters be extended 1 day making a total of 3 days for the week.

August 26, 1983 — In the interest of division of catch the Commission approved United States Convention Waters open as scheduled but for 2 days of fishing for the week commencing August 28.

September 2, 1983 — Due to the smaller than expected pink salmon run size and in the interest of division of catch of pink salmon the Commission approved the following regulatory changes: 1) That Area 20-1, 2 and 3 of Canadian Convention Waters and United States Convention Waters not open as scheduled for the week commencing September 4. 2) That the scheduled opening of Area 29-1 to 6 of Canadian Convention Waters be delayed 1 day for 1 day of fishing.

September 8, 1983 — In the interest of harvest of pink salmon the Commission approved the following regulatory changes: 1) That United States Convention Waters open September 10 for 1 day of fishing. 2) That Area 29-1 to 7, 9 and 10 of Canadian Convention Waters open at 12:00 noon September 9 for 1 day of fishing.

September 10, 1983 — Due to the declining numbers of pink salmon and division of catch the Commission approved the following regulatory changes: 1) That regulatory control of Area 20 of Canadian Convention Waters and Areas 4B, 5 and 6C of United States Convention Waters be relinquished effective 12:01 a.m. September 11 one week earlier than scheduled . 2) That Areas 6, 7 and 7A of United States Convention Waters not open as scheduled for the week commencing September 11. 3) That Area 29-1 to 6 of Canadian Convention Waters open September 12 for 2 days of fishing.

September 13, 1983 — In the interest of additional harvest of pink salmon and division of catch, the Commission approved the following regulatory changes: 1) That Area 29-1 to 6 of Canadian Convention Waters be extended 2 days for a total of 4 days of fishing for the week. 2) That Area 6A of United States Convention Waters not open as scheduled. 3) That Areas 6, 7 and 7A of United States Convention Waters open September 15 for 1 day of fishing.

September 16, 1983 — In the interest of division of catch of pink salmon the Commission approved the following regulatory changes: 1) That Area 29-1 to 6 of Canadian Convention Waters open September 17 for 6 days of fishing. 2) That the remaining United States Convention Waters under Commission control not be relinquished as previously scheduled and remain closed to fishing for the week commencing September 18.

September 23, 1983 — In order to secure escapement and because of catch division, the Commission approved United States Convention Waters remain closed for the week commencing September 25.

September 30, 1983 — Due to declining numbers of pink salmon the Commission relinquished regulatory control of United States Convention Waters lying southerly and easterly of a straight line drawn from the low water range marker in Boundary Bay on the International Boundary across the east tip of Point Roberts to the East Point Light on Saturna Island effective 12:01 a.m. October 2. United States Convention Waters lying westerly of this line remain closed to fishing.

October 7, 1983 — Due to declining numbers of pink salmon in migratory areas and in the interest of obtaining additional pink salmon escapement, the Commission approved the following regulatory changes: 1) That the remaining United States Convention Waters under Commission control be relinquished effective 12:01 a.m. October 9. 2) That control of Area 29 of Canadian Convention Waters be extended to October 16 and remain closed to fishing.

The Commission relinquished regulatory control of the remaining Convention Waters effective October 16, thus completing the Commission's regulatory obligations for Convention Waters for the 1983 season.

SOCKEYE SALMON REPORT

The Fishery

The 1983 Fraser River sockeye return of 5,167,000 sockeye was 21% less than the preseason forecast of 6,500,000 fish. While the 1983 run was slightly above the cycle year average of 4,927,000 sockeye (1951-1979) only 2,277,000 Fraser sockeye or 44.1% of the total run entered Convention Waters, the lowest percentage on record. Of those sockeye entering the Commission management area, 939,000 (41.2%) were caught in the commerical fishery, 362,000 (15.9%) were taken by the Fraser River Indian fishery and 976,000 (42.9%) reached the spawning grounds (Tables I to VI in Appendix). An estimated catch of 3,000 non-Fraser sockeye was also taken in Convention Waters. Fraser sockeye were intercepted for the first time on record by Alaskan fishermen off Noyes Island (96,000 fish) and by Canadian fishermen in non-Convention Waters of Johnstone Strait (2,564,000) and coastal waters north of the Convention area (230,000), primarily on the west coast of the Queen Charlotte Islands.

The 1983 Convention Waters catch of 943,000 sockeye was a decrease of 2,454,000 fish (72.2%) from the brood year (1979). The drastic decline in catch was attributable primarily to the record Johnstone Strait diversion of Fraser sockeye in 1983, estimated at 80% of the total run, and to the intense fishery exploitation in that area. In addition, reduced production contributed to the lower catch. Landings in non-Convention Waters commercial fisheries and in the United States Treaty Indian and Fraser River Indian fisheries amounted to 3,252,000 fish or 77.6% of the total catch. This was by far the largest proportion of the catch made outside of Commission regulations since inception of management responsibility in 1946. With Canadian fisheries targeting on Fraser sockeye prior to their arrival in the Convention area combined with a series of years of high diversion via Johnstone Strait, the number of sockeye available in Convention Waters for catch and escapement has been reduced significantly.

Management of the Convention area fisheries has become more difficult because of the problem of estimating the exploitation rate sustained by sockeye migrating via Johnstone Strait. Significant changes between weeks in the fleet efficiency were not obvious during the 1983 season and whereas certain stocks arrived in adequate numbers for escapement and minor local catch, other runs were essentially overfished in the Johnstone Strait fishery. Consequently, spawning ground escapements of these stocks did not reach Commission established goals.

Further exacerbating the recent problems of Convention Waters sockeye management has been the continued action of the United States Government establishing regulations for certain Treaty Indian fishermen outside the jurisdiction of the Commission. These regulations have been preferentially aimed to harvest early timed sockeye stocks rather than spread proportionally through the season. Certain early runs were adversely affected again in 1983 by the increase in exploitation generated in this fishery.

The Commission made representation to the respective governments in 1983 concerning the serious management problems caused by heavy exploitation in Johnstone Strait and by United States Government action regulating the Treaty Indian fishery. These problems threaten the Fraser sockeye resource which has been vigorously conserved and managed by Commission action for 38 years.

In Convention Waters, the Canadian catch was 573,000 sockeye (60.8%) while United States fishermen landed 370,000 sockeye (39.2%). The division of catch difference of 203,000 fish was the largest on the cycle since 1975 and the percentage difference was the largest on a non-strike year since 1947. The large catch difference was due, in major part, to the record low proportion of the run (20%) available to United States fishermen while sockeye escaping from both Johnstone Strait and Juan de Fuca Strait routes were available to Canadian Area 29 fishermen. A late season catch of 196,000 sockeye in Area 29 during pink salmon fisheries constituted the division of catch difference. Further catch of sockeye in United States waters was not possible due to the cessation of migration and lack of surplus late run fish for harvest.

All United States gear types experienced severely reduced catches relative to 1979 (Appendix Table I). Purse seines landed 165,000 sockeye in 1983 a decrease from 943,000 in 1979 and the lowest catch of any year since 1947. The catch percentage for purse seines (44.8%) was the second lowest on record. The gill net catch was 190,000 fish or 51.4% of the United States total. This was the lowest catch by gill nets of any year since 1964 but the percentage catch was the highest on the cycle and the second highest on record. The reef net catch of 14,000 sockeye was the second smallest catch since 1947 for this gear, however, the catch percentage rose to 3.8%. Fishing effort in United States waters dropped dramatically in response to the scarcity of Fraser sockeye in Convention Waters and good catches in Alaska (Table l).

TABLE 1. Fishing units operating in Convention Waters.

		SOCKEYE			
	Year	Purse Seines	Gill Nets	Reef Nets	Total
Canada	1979	131	835	—	966
	1983	Closed	567	—	567
United States	1979	184	1,133	56	1,373
	1983	148	515	46	709

Treaty Indian fishermen landed 140,000 sockeye while fishing under United States Department of Interior regulations during the period of Commission control. These catches were taken principally in the early season (132,000 to August 11) during which time only 54% of the catch under Commission regulations had been taken.

In Canadian Convention Waters, purse seines landed only 4,200 sockeye, the lowest catch and percentage catch (0.7%) since 1945. Gill net harvest declined from 1,111,000 fish in 1979, the brood year, to 514,000 sockeye in 1983. Although this was a serious decline in actual catch, the Canada gill net catch percentage reached 89.8%, the highest on the cycle and highest of all years since 1968. Trollers landed 54,000 sockeye, primarily in Area 29 during late August and September fisheries directed toward pink salmon. This catch by trollers was a decrease from 217,000 sockeye in 1979 while the percentage catch dropped to 9.5% from 13.4% in the brood year.

The 1983 fishery in Canadian Convention Waters was strongly influenced by the very high Johnstone Strait diversion of Fraser sockeye. Lack of fish for harvest in the west coast of Vancouver Island Convention area troll fishery and the imposition of catch regulations caused the troll fleet to shift activity to the northern coast of Vancouver Island. Purse seine catches in Area 20 were essentially eliminated owing to the need to provide fish from the southern approach to the United States fishery and for escapement. Fishing effort in Canadian waters declined in 1983 similar to that in United States waters (Table 1).

Fish size was affected by the unusual environmental conditions. The 1983 4-year-old adults averaged 5.1 pounds, 0.7 pounds lower than the long term average. Adams River sockeye returning in mid-August weighed approximately 5.0 pounds, an 18% decrease from the long term average of 6.1 pounds for that period.

The three stocks that were forecast to contribute heavily to the 1983 return were Chilko, Stellako and Adams Rivers sockeye. The return of Chilko (1,550,000) and Adams-Lower Shuswap sockeye (1,647,000) were close to the preseason forecast. The Chilko River run increased 8% over the brood year while the Chilko Lake beach spawning population produced 126,000 fish, similar to the brood year. Adams and Lower Shuswap sockeye production was 60% above the brood year and was the largest return on the cycle since 1971.

The Stellako River run was approximately 510,000 fish rather than the 1,000,000 forecast and was a large decrease from the 1979 record return of 1,700,000 fish. Reduced production was noted as well for the other Nechako watershed stocks including Late Nadina (85,000 in 1983 vs 301,000 in 1979), Early Stuart (92,000 vs 223,000) and Late Stuart stocks (15,000 vs 197,000) despite cyclic record level escapements in all cases in 1979. A much lower than forecast return to Bowron River indicated that all upper watershed stocks were affected. Record warm overwinter temperatures occurred prior to the smolt migration in 1981 and may be responsible, in part, for the lower production. Stellako River sockeye recruitment is negatively related to overwinter temperatures for the period 1952-1983.

Weaver and Birkenhead sockeye which rear primarily in Harrison Lake both showed improved production over 1979. Over 50% of the Weaver run of 336,000 adult sockeye and the Birkenhead return of 396,000 adults were 5-year-old fish from the very successful 1978 brood. Four-year-old returns were similar to the brood year for Weaver and nearly double for Birkenhead.

Escapement

The total spawning ground escapement of 976,000 sockeye (Appendix Table VI) was over 500,000 fish below the preseason goal and 432,000 lower than the brood year

escapement. Spawner abundance was less than desired in all but Chilko River, Chilko Lake, Gates Creek and Portage Creek stocks.

Early Stuart sockeye production was less than one-third the forecast causing cancellation of the limited scheduled commercial fisheries. However, an intense Indian fishery below Hell's Gate removed 40% of the recorded gross escapement of this stock. Emergency closure of the Indian fishery from July 14 to 24 by the Department of Fisheries and Oceans, at the request of the Commission, reduced the catch but resumption of fishing after July 24 resulted in significant catches above Hell's Gate. The spawning ground escapement of 23,900 spawners was 27% of the escapement goal. Following severe migratory losses experienced in 1982, management of Early Stuart sockeye will require stringent protection in future years if the stock is to contribute to the Indian and commercial fisheries as was the case on the cycle from 1971 through 1979.

Late Stuart escapement was 2,200 spawners, down 93% from the 1979 spawning (31,900). The late run to Nadina River totaled 26,900 sockeye of which 23,800 entered the spawning channel. This total escapement was a decline from 55,700 spawners in the brood year. The lower than forecast Stellako River run provided an escapement of 122,000 spawners compared with 290,000 in 1979. In total, 178,000 sockeye escaped to Nechako watershed streams in 1983, just over one-half the goal of 350,000 spawners.

Bowron River sockeye sustained a dramatic decline to 6,500 spawners from 35,000 in 1979. The Horsefly area escapement, however, increased to 2,200 fish on this off-cycle year. Five-year-old sockeye from the successful 1978 brood spawning contributed 77% of the Horsefly area spawners.

Chilko area stocks showed increased escapement in 1983 associated with good returns of both Chilko River and Chilko Lake beach spawners. The lake population increased 70% to 55,000 fish while the major Chilko River escapement reached 332,000 spawners, an increase of 38% over 1979.

Sockeye entering the Seton Creek system produced well and had satisfactory escapements. Gates Creek and channel received 8,400 spawners, the largest observed on the cycle. Moreover, 7,400 were adults, nearly double the brood year abundance. Off-cycle production and escapement of Gates sockeye has been steadily increasing as a result of the spawning channel. The escapement to Portage Creek of 7,900 spawners was more than double the brood year.

Thompson River watershed stocks showed uniformly lower escapements in 1983 despite generally favorable returns. Seymour River sockeye decreased 40% to 30,000 spawners due to lower production. Adams River and associated spawning areas, however, produced well but excessive harvest resulted in only 204,000 spawners, 30% below the brood year level. More importantly, the escapement was less than one-half the preseason goal. Lower Shuswap spawners declined by 28% to 7,300 fish. Increased escapement on this cycle will be a priority in the future.

All stocks in the Lower Fraser district showed declines in escapement. Upper Pitt River received 16,900 spawners, most of which were 5-year-olds from the 1978 escapement. Birkenhead declined by 37% to 49,000 spawners in 1983. Weaver Creek sockeye produced well in 1983 with the escapement being 40,000 spawners compared with 51,000 in 1979. Cultus Lake decreased from 32,000 in 1979 to 20,000 in 1983. A drastic decline was observed at Harrison River where only 4,200 spawners arrived compared with 46,000 in 1979.

Success of spawning was favorable in most areas in 1983. The small size of fish, however, resulted in lower fecundity (Adams sockeye fecundity declined 13.7%). The resulting egg deposition was lower than for comparable escapements in other years.

Thus, the below optimum escapements along with lower fecundity and small egg size reduce significantly the reproductive potential of the 1983 escapement. Adams River sockeye egg deposition in 1983 was only 55% of the brood year level.

PINK SALMON REPORT

The Fishery

Fraser River pink salmon returns in 1983 totaled 15,172,000 fish, the second largest run since the Commission assumed regulatory jurisdiction in 1957 (Figure 5). However, the 1983 run was substantially lower than the preseason forecast of 20,000,000 fish. Beginning in 1977, pink salmon escapement goals have been increased annually to provide for greater utilization of available spawning areas. Increased fry production has been observed from these escapements (Table 2), while egg to fry survival has declined only slightly from an average 13.4% with 1,565,000 spawners (1961-1975 brood years) to 12.4% with 3,479,000 spawners for 1977-1981. Subsequent marine survival has been similar for recent years of large fry output, compared with earlier years. Returns in 1979, 1981 and 1983 have been the three largest in the period of Commission management. It is clear from these data that continued good pink salmon production depends upon rigorous maintenance of escapements. The lack of strong density dependent effects suggests that larger escapements are feasible and necessary for historical level returns.

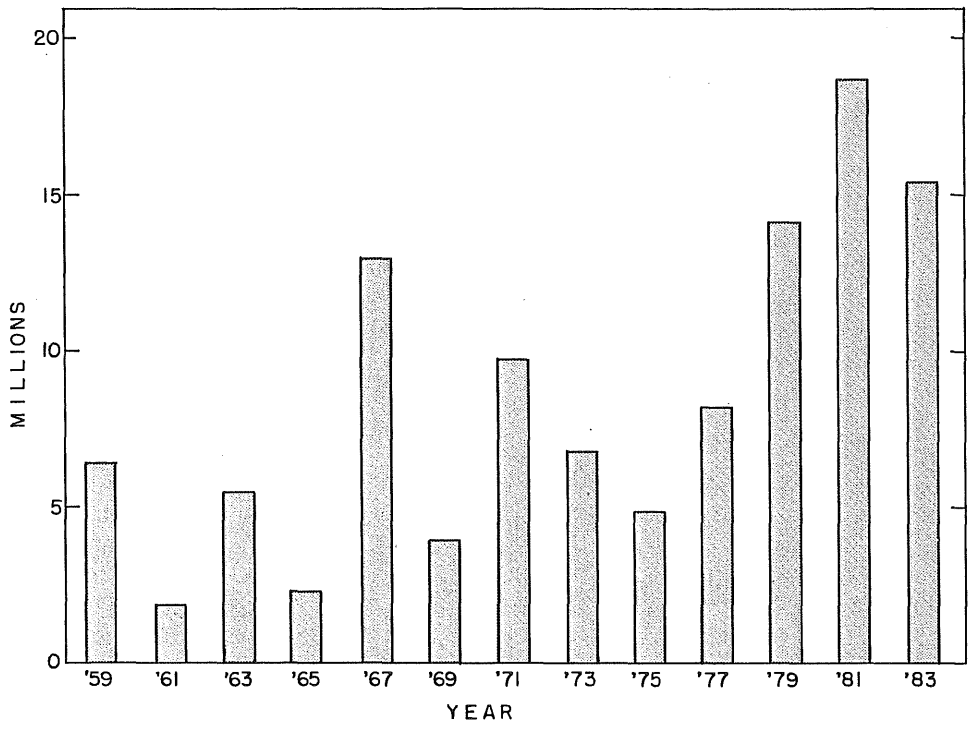

FIGURE 5. Fraser River pink salmon total runs.

TABLE 2. 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**
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
Female Spawners (millions)	.654	1.217	.692	1.015	.961	1.103	1.015	.806	1.421	2.113	2.597
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
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
Adult Return Catch + Escapement (millions)	5.326	2.271	12.850	3.849	9.707	6.753	4.867	8.173	14.100	18.400	15.172
Freshwater Survival	9.2%	11.7%	18.4%	11.1%	9.7%	12.7%	15.7%	18.7%	16.0%	9.0%	12.3%
Marine Survival	3.7%	0.8%	4.7%	1.6%	5.0%	2.8%	1.7%	2.9%	3.0%	5.4%	2.6%

While the 1983 return was large, only 7,531,000 Fraser pinks entered Convention Waters. Of these, 2,814,000 (37.4%) were landed in the commercial fishery, 84,000 (1.1%) were caught by Fraser Indian fishermen and 4,632,000 (61.5%) escaped to spawn (Tables X to XVI in the Appendix). An estimated 126,000 non-Fraser River pink salmon were also caught in Convention Waters fisheries (Table 3). Fraser pink salmon were landed in large numbers by the Johnstone Strait fishery (6,862,000 fish) and the coastal troll fishery north of Convention Waters (773,000).

Within Convention Waters, United States fishermen landed 1,871,000 pinks (63.6%) and Canadian fishermen caught 1,070,000 pink salmon (36.4%). The division of catch difference of 800,000 pinks was the largest since 1953 while the percentage difference was the largest since 1951, both years prior to the inclusion of pink salmon in the Treaty.

TABLE 3. Calculated catches and percentage harvest from pink salmon runs entering Convention Waters in 1983.

	SOURCE OF RUN			
	United States	*Fraser River*	*Canada Non-Fraser*	*Total*
Total entering Convention Area	1,051,000	7,531,000	51,000	8,633,000
Catch in Canadian Convention Waters Westerly of William Head	27,000	145,000	1,000	173,000
Easterly of William Head		892,000	5,000	897,000
Total	27,000	1,037,000	6,000	1,070,000
Percent Harvest	2.57	13.77	11.76	
Catch in United States Convention Waters	74,000	1,777,000	19,000	1,870,000
Percent Harvest	7.04	23.60	37.25	
Total Catch in Convention Area	101,000	2,814,000	25,000	2,940,000
Percent Harvest	9.61	37.37	49.02	

Purse seine fishermen normally harvest the major portion of the Canadian catch, but in 1983, this gear landed only 71,000 pink salmon, 6.6% of the total. The 1983 purse seine catch dropped from 2,794,000 (66.7%) in 1981 and was the lowest catch and percentage catch since 1945. The reduction in catch was attributable to high Johnstone Strait diversion, greatly reduced effort (Table 4), and significant reduction in fishing time. Gill net fishermen landed 851,000 pinks or 79.5% of the Canadian catch. This was the largest catch by gill nets since 1967 and the highest percentage catch since 1945. Trollers caught 149,000 pinks (13.9%), the lowest number and percentage catch by this gear since 1965.

In United States Convention Waters, purse seines harvested 1,523,000 pink salmon or 81.4% of the catch. The catch was only 46% of 1979 and 1981 landings while percentage catch by purse seines was the lowest since 1975. Gill net catches totaled 156,000 pinks, the lowest since 1969. The gill net percentage catch (8.3%) increased

slightly over 1981. Reef nets caught 87,000 pinks (4.7%), the largest landing since 1973 and the highest percentage catch since 1971. Troll catches decreased 41% to 104,000 fish but the catch percentage increased to 5.6%.

TABLE 4. Fishing units operating in Convention Waters

		PINKS			
	Year	Purse Seines	Gill Nets	Reef Nets	Total
Canada	1981	155	525	—	680
	1983	27	665	—	692
United States	1981	310	500	47	857
	1983	232	223	42	497

Record high diversion (66%) of Fraser pink salmon via Johnstone Strait, resulted in major shifts in the 1983 fishery. Canadian troll fishermen and Area 20 net fishermen were affected by reduced availability of pinks and by regulations imposed by the Commission and the Government of Canada. Large catches of Fraser pink salmon outside the Convention area in Johnstone Strait diminished the stock available for catch in Convention Waters. There were severe reductions in fishing time in Area 20 and United States waters (Table 5). Difficulties were experienced in estimating escapement through the Johnstone Strait fishery due to the very large fleet fishing the area. The Juan de Fuca Strait run size was not well estimated owing to the lack of fishing time and greatly reduced gear effort. Subsequent fishing in Georgia Strait was terminated despite a major division of catch difference when escapement monitoring revealed that an escapement shortfall was imminent.

TABLE 5. Number of fishing days allowed for pink salmon harvest.

	1979	1981	1983
CANADA:			
Area 20	7	12	3
Area 29	1	3	12
UNITED STATES	7*	13*	4*

* Commission Regulations

Oceanographic conditions which affected sockeye were likewise major influences on pink salmon. The high diversion was the most prominent feature of the 1983 return attributable to the "El Nino" event. High coastal sea surface temperature and nutrient poor oceanic water appear to have led to severely reduced growth of pink salmon. The expected average weight with a 15.2 million fish run would be approximately 4.9 pounds (Figure 6). The 1983 fish averaged 4.1 pounds, 16% smaller than expected and the lowest average weight on record. Thus, Convention area fishermen suffered multiple effects of the unusual oceanographic events. Reduced catches and small fish size combined to lower yields to fishermen.

Escapement

Pink salmon escapements to Fraser River spawning areas amounted to 4,632,000 fish, the largest on record and a 3% increase over 1981. The largest portion of the escapement, over 3,300,000 fish, spawned in the main stem of the Fraser River between

Chilliwack and Hope. This was an increase of 1,055,000 spawners over the previous largest escapement in 1981. Although main Fraser spawners have traditionally been the largest spawning stock in the watershed, the 1983 escapement in this area was 71% of the total escapement which was the highest proportion on record. The main Fraser population has grown from 315,000 spawners in 1975 to 3,300,000 in 1983 and has accounted for much of the growth in the Fraser run and escapement since 1975.

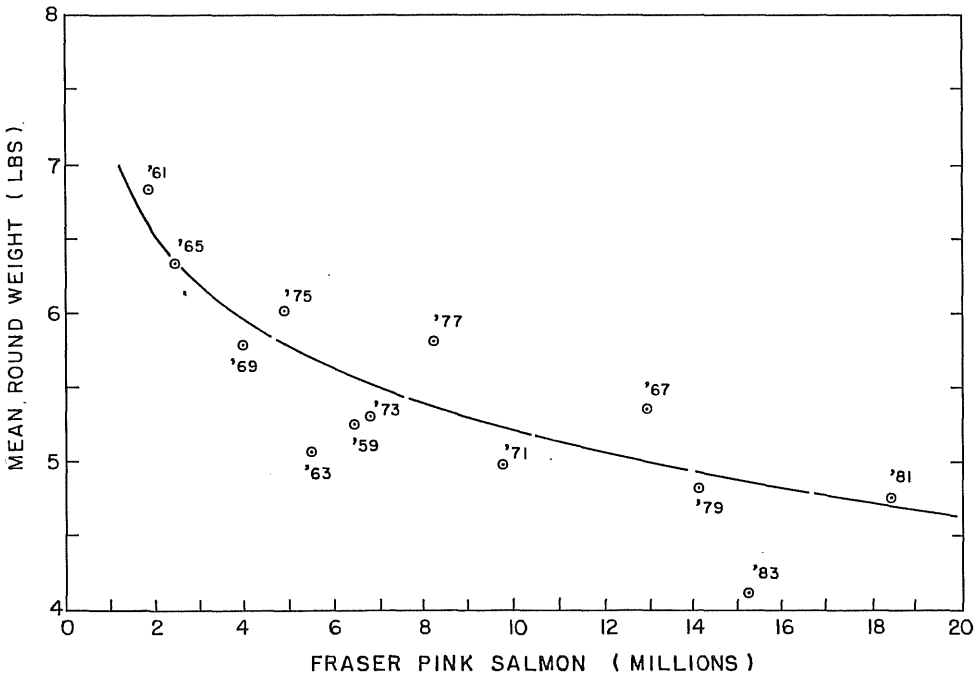

FIGURE 6. Relationship of Area 20 pink salmon average weight to Fraser River pink salmon total run.

While the main Fraser escapement increased, most tributary stocks showed escapement declines in 1983. A major reduction was observed in the Thompson River with a decrease from 1,163,000 spawners in 1981 to 508,000 fish in 1983. Commencing in 1977, when 40.7% of the Fraser pink salmon escapement spawned in the Thompson River, the percentage escapement has declined annually to only 11.0% of the total escapement in all areas in 1983. The Seton Creek pink salmon escapement declined to 450,000 spawners, a 20% decrease from the brood year.

Late run pink salmon spawners of the Harrison River declined 52% from 315,000 in 1981 to 146,000 in 1983. The Chilliwack-Vedder River escapement, however, increased 45% to 99,000 pink salmon. Late run stocks were major contributors to the watershed escapement for many years. From 1957 to 1975, these stocks averaged 25.4% of the annual escapement. Since 1977, as the pink salmon escapement has been increased, the late run spawners have averaged only 8.4% of the total escapement. A portion of this decline is apparently due to spawning area limitations in the Harrison River and to periodic flooding in the Chilliwack-Vedder River.

Success of spawning was high, as is normal for pink salmon. The small fish size caused the lowest recorded fecundity of 1,604 eggs per female, 15% lower than in 1981. However, the sex ratio was quite unbalanced at 63.7% females which compensated for

the low fecundity. These factors resulted in a decrease of only 2% in the egg deposition compared with the brood year.

There are stocks of pink salmon destined for areas other than the Fraser River found in Convention Waters. The escapement to Washington State streams (Appendix Table XV) showed great improvement and obviously benefited from the reduction in fishing time in southern approach fishing areas. The escapement of 895,600 was the largest since 1963. A substantial reduction in escapement to 34,000 spawners was recorded for Canada non-Fraser rivers located north of the Fraser River. This was the lowest escapement on record back to 1959.

SPAWNING CHANNEL OPERATIONS

The Commission operates four sockeye and two pink salmon spawning and incubation channels in the watershed. These channels serve to: (a) mitigate for habitat loss (i.e. Seton Creek), (b) compensate for incubation losses caused by instability of natural spawning streams associated with timber harvest or development of the watersheds (i.e. Weaver Creek, Upper Pitt River and Gates Creek) or (c) enhance the natural fry production in an area of restricted spawning environment and large rearing area potential (i.e. Nadina River).

Emergence of 1982 brood sockeye fry from spawning channels in 1983 is presented in Table 6.

TABLE 6. Sockeye fry production from the 1982 brood at spawning and incubation channels.

Site	Egg Deposition	Fry Produced	Percent Survival
Upper Pitt	2,657,000*	2,137,000	80.4
Weaver Creek	122,603,000	56,054,000	45.7
Gates Creek	1,546,000	1,157,000	74.8
Nadina River	4,076,000	1,327,000	32.6

* eggs taken

At Upper Pitt River a low escapement in 1982 resulted in a below capacity egg take. The survival of 80.4% was normal but the emergence of 2,137,000 fry was 70% of the 1963-1981 average of 3,065,000 fry.

A record escapement of 58,000 spawners into Weaver channel in 1982 deposited 122,603,000 eggs and gave 56,054,000 fry in 1983. The emergence was the largest to date for this facility (Figure 7).

Gates channel received only 500 female spawners in 1982 and these produced 1,157,000 fry. Although small relative to dominant cycle years, the emergence was nearly six times the previous cycle year production (200,000). Off-cycle fry production has increased steadily each year. These off-cycle returns now provide significant fishery catch benefits.

The sockeye fry emergence at Nadina channel was 1,327,000 fish, a decline from 2,818,000 in the brood year. Survival was very low at 32.6%. Emergence at low and moderate female spawner densities has been poor in recent years. Studies are under way to examine possible factors influencing fry production at this facility and preliminary results are discussed in the Research section of this report.

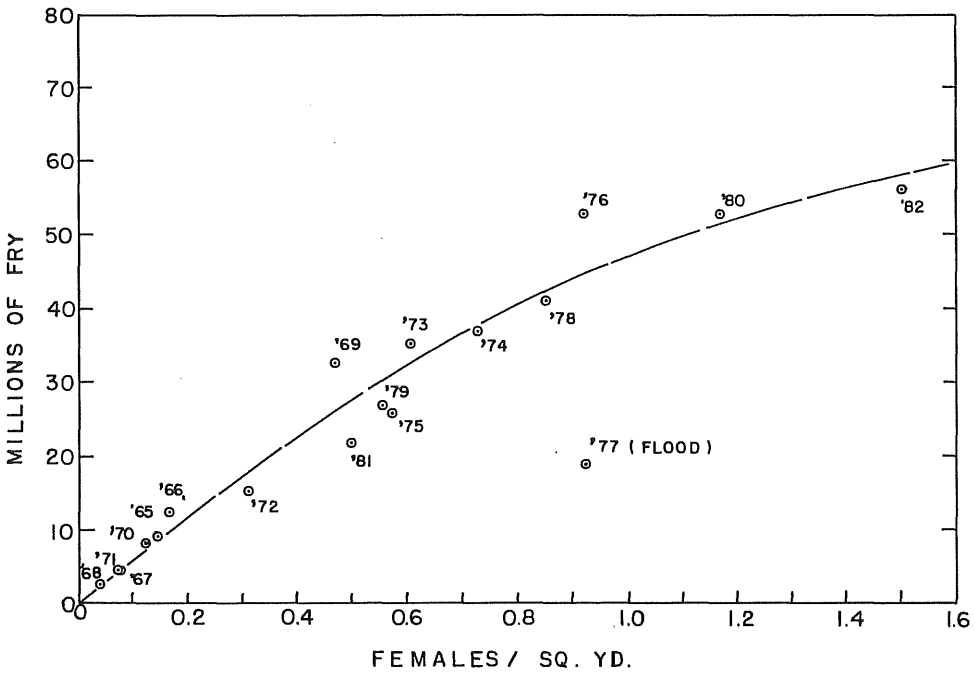

FIGURE 7. Relation of Weaver channel sockeye fry emergence to female spawner density.

Sockeye returns attributable to spawning channels in 1983 resulted from the 1978, 1979 and 1980 brood years spawning. Total production from the four facilities was estimated to be 426,000 sockeye. This was 8.2% of the total production to all areas in 1983. Since 1977, the first year that all sockeye channels had adult returns, an average of 6.7% of the annual Fraser production has been generated by spawning channels. In 1983 the commercial catch of sockeye from channels was estimated at 331,000 fish.

Returns of Pitt River sockeye attributable to the channel were 9,300 fish from a total production of 28,000 (Figure 8). Continued low returns of Pitt River sockeye are of concern. Density dependent growth in Pitt Lake appears normal, suggesting that juvenile survival has not been affected. Post-lake survival may have suffered recently due to an observed shift in the maturation schedule whereby a higher proportion of the returning adults have matured as 5-year-olds. Gates Creek channel sockeye production was 16,900 fish in 1983 compared with 20,600 in 1979.

Excellent returns of 1978 brood Weaver sockeye in 1982 were followed by the return of large numbers of 5-year-old fish in 1983. The total 1978 brood return attributable to the channel is now estimated at 1,066,000 fish. Total sockeye returns in 1983 were estimated at 336,000 fish of which 325,000 were attributable to the spawning channel (Figure 9).

Production of Nadina sockeye was estimated at 85,400 fish of which 74,300 were from the channel. A much reduced return compared to the brood year (301,000) was associated with the low survival of all Nechako River watershed stocks.

Pink salmon returns from Seton Creek spawning channels were estimated at 99,700 fish for the upper channel and 504,900 fish from the lower spawning channel. This return formed 4.0% of the Fraser pink salmon run in 1983. Commercial catch was estimated to be 416,000 fish.

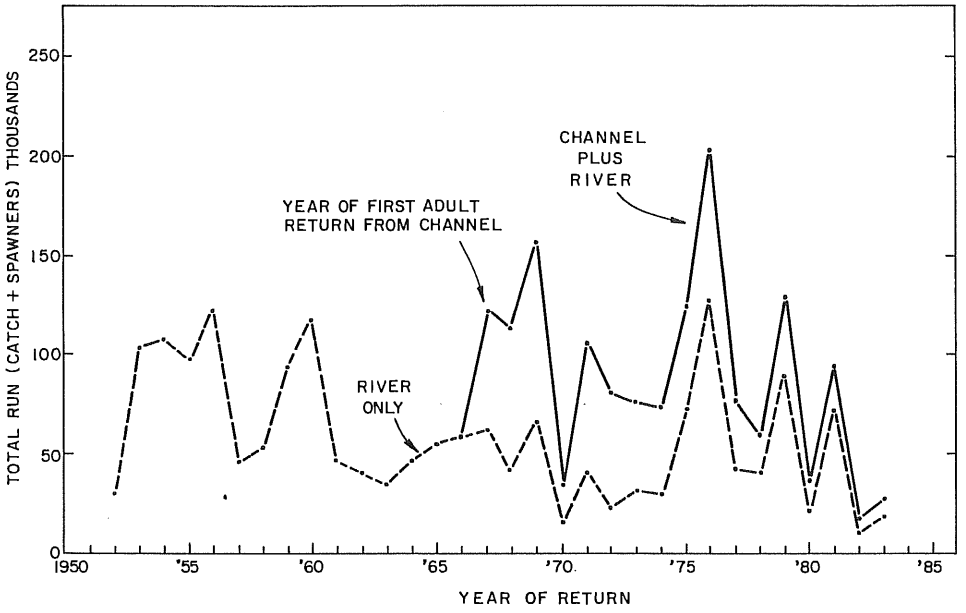

FIGURE 8. Sockeye production from Pitt River and Pitt incubation channel, 1952-1983.

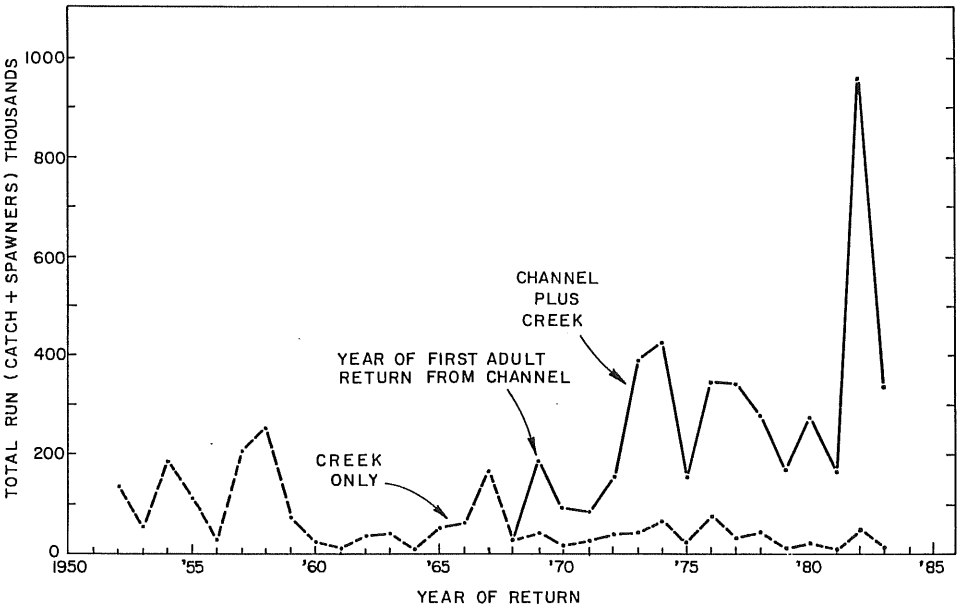

FIGURE 9. Sockeye production from Weaver Creek and Weaver channel, 1952-1983.

In the fall of 1983, 4,789,000 eggs were taken for the Upper Pitt River incubation channel reaching the desired capacity of this facility. Spawning escapements to Weaver and Nadina channels were lower than brood year levels. Weaver channel escapement declined 15.9% to 19,200 fish while Nadina escapement dropped 42.1% from 41,200 in

1979 to 23,800 in 1983. The 1983 spawners, however, deposited 6.9% more eggs at Weaver channel due to the high proportion of females, while Nadina spawners deposited an estimated 43,600,000 eggs, a 5.4% increase over the brood year which had suffered high prespawning mortality. The 1983 Nadina channel egg deposition was the highest observed. Gates channel sockeye escapement increased from 4,100 fish to 7,500 fish in 1983. Most importantly, egg deposition nearly doubled from 5,110,000 in 1979 to 9,427,000 in 1983. Pink salmon escapements to Seton Creek channels were 9,700 spawners in the upper channel and 31,000 fish in the lower channel. These escapements were reductions of 6.8% and 8.3% from 1981 levels for the upper and lower channels, respectively.

RESEARCH

The Commission and the Department of Fisheries and Oceans examined potential problems to migrating and spawning salmon created by the construction of a Canadian National Railway second track along the Fraser and Thompson Rivers. Pink salmon were selected for this study as they are considered the weakest of the salmonids. The overall investigation included six major experimental studies on adult pink salmon during river migration and spawning in the fall of 1983. The experimental studies included; 1) metabolic rates of pink salmon, 2) critical swimming speed of pink salmon, 3) body composition changes during migration and spawning, 4) fish health, 5) stress assessment, and 6) radio telemetry for migration behavior. Analysis of data from these studies will continue into 1984.

The studies indicate that pinks entered the Fraser in an advanced state of maturity. The female gonads gained very little weight compared to sockeye as reflected in the mean gonadosomatic index, which changed from 14.6 at Ft. Langley to 16.6 at the spawning grounds. In conjunction with this, the endocrine assessment indicated a significant shift in hormone levels between Yale and Lytton suggesting that the fish were ready to spawn upon arrival at the spawning grounds.

The fish health checks, including pathogen screening, histopathology and stress assessment, indicate a faster rate of deterioration to senility and death than in other species of salmon.

The studies on metabolic rates, body composition and swimming speed indicate that pinks have less swimming capacity than sockeye, and they expended energy at a 30% greater rate than sockeye swimming at the same speed. Equivalent energy expenditure from river entry to completion of spawning was 550 kcal/kg for males and 503 kcal/kg for females.

All of the data analyzed to date suggest that pink salmon are weaker and would be more sensitive to delay and that an obstruction in the migration path which might have little effect on sockeye could have a serious effect on pink salmon. These research findings are supported by the fact that pink salmon were absent above Hell's Gate from 1913-1945 while many late run sockeye were able to migrate upstream under water conditions that prevented the passage of pink salmon.

A program was initiated to examine the survival rates from egg to fry of Nadina channel sockeye. This was initiated because of the unusually low survival rates documented in 1980 and 1982 (Figure 10). Hydraulic sampling was carried out in the channel from November 16-19, 1983. Data from 27 samples (4,400 eggs) taken at random indicate that overall survival (92.4%) to the advanced eyed stage was excellent (range from 73.3% to 100%). Further samples will be obtained early in 1984 to determine the overwinter survival of eggs and alevins.

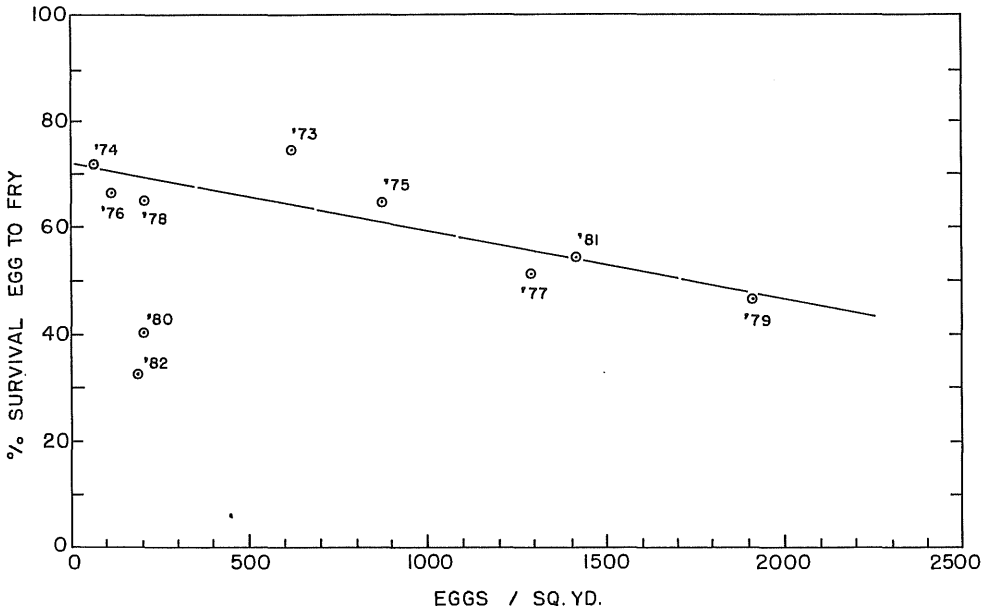

FIGURE 10. Percent survival of Nadina sockeye from egg-fry versus density of eggs deposited in the channel 1973-1982, 1980 and 1982 deleted from regression.

The research program directed towards the lacustrine stage of the life cycle of sockeye salmon continued in 1983, with the examination of three lakes as well as an evaluation of dual-beam/integration technique for estimating juvenile sockeye abundance in lakes. Shuswap, Harrison and Cultus Lakes were sampled acoustically to determine abundance, distribution and production of juvenile sockeye salmon as well as the production and distribution of the zooplankton populations. Stomach contents of sockeye sampled from these lakes during the field surveys provide an insight into the interactions of plankton and sockeye and their zooplankton food supplies.

During 1983, the primary emphasis for lake studies was placed on Shuswap Lake to coincide with dominant year juvenile sockeye rearing in the lake. Two hydroacoustic surveys were completed during the year, one from September 17-21 and another from October 25-31. Both surveys indicated the presence of juvenile sockeye salmon as illustrated in Figure 11. During the month separating the two surveys, a noticeable change had occurred in the fish distribution both vertically and horizontally as the echograms indicate. In September, transects displayed dense, well defined, stratified aggregations of sockeye. In October, the aggregations were less well defined in depth and often clumped near shore. Trawl samples were extracted from the population in order to obtain basic growth information on the juvenile sockeye. The catch was almost exclusively juvenile sockeye and most of those fish were classed as 0-age sockeye. Subsequent analysis will provide information on the distribution and numbers of juvenile sockeye within the lake. Additional information will also be available on the size and feeding habits of the sockeye.

Harrison Lake was surveyed on November 14, 1983 employing a standard transect series of seven parallel transects orthogonal to the long axis of the lake. Harrison Lake juvenile sockeye are generally difficult to locate due to the large abundance of longfin smelt and threespine stickleback. This survey was an exception, however, due to depth stratification of the species as was observed in the lake during November of 1979 and

reported in the 1979 Annual Report. The juvenile sockeye shown in the echogram in Figure 12 were located between 40 and 100 meters with the largest aggregation from 60 to 80 meters. The separation of the juvenile sockeye from a relatively sparse population of smelt and stickleback compared to other years will provide a reasonable means of estimating the abundance from 1982 brood year spawning.

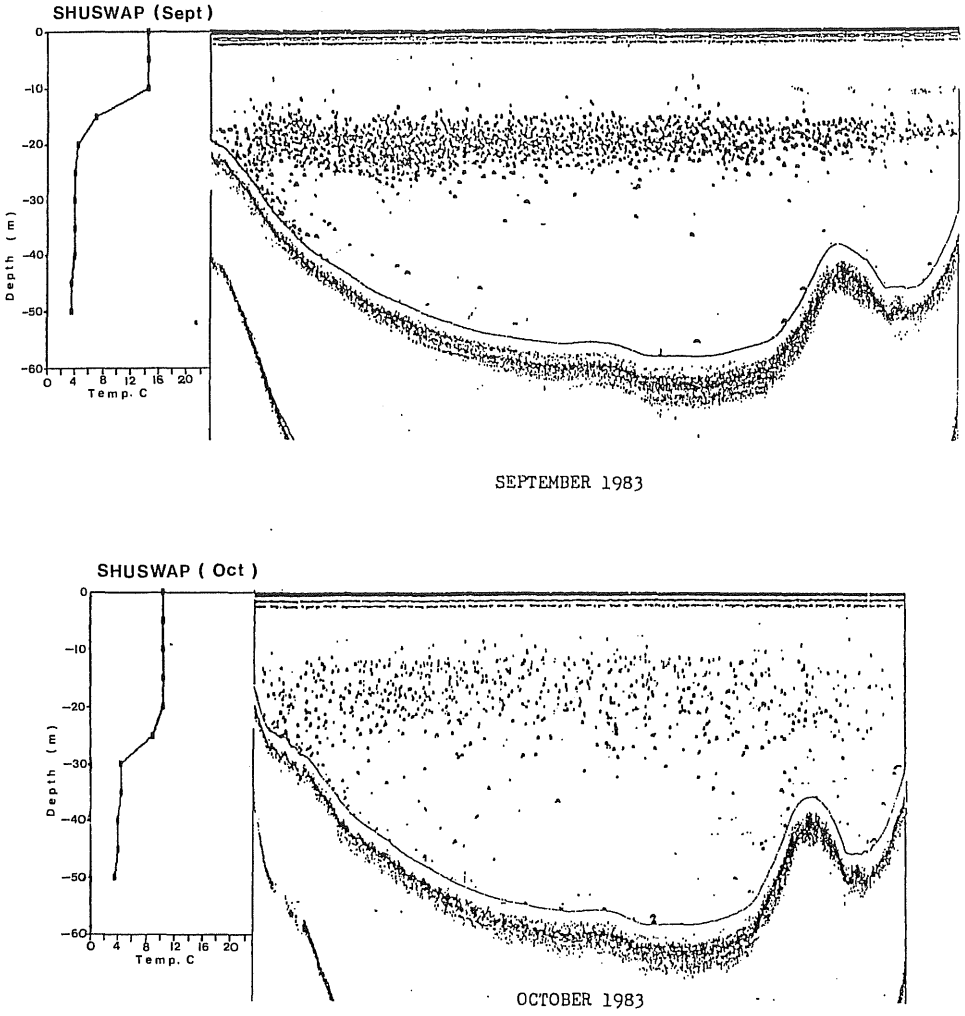

FIGURE 11. Distribution of juvenile sockeye salmon in Shuswap Lake in September and October 1983. (Transect #9). The difference in transect width is due to slightly different boat speeds.

A joint Salmon Commission and BioSonics Inc. dual-beam hydroacoustic survey was conducted on Cultus Lake during July 6 and 7, 1983. A subsequent survey was conducted on Cultus Lake on July 11, 1983 using the traditional single-beam technique. The objective of the surveys were to evaluate the use of the combined echo integration/ dual-beam techniques in relation to our traditional echo integration/echo counting procedure and to evaluate its applicability to other sockeye-rearing lakes in the Fraser River watershed.

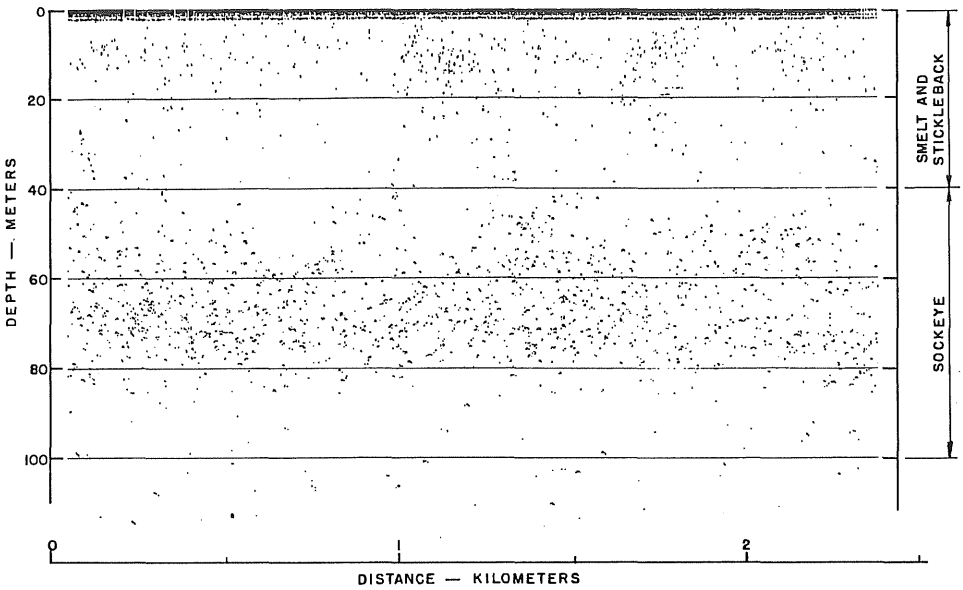

FIGURE 12. Distribution of juvenile sockeye salmon in Harrison Lake on November 14, 1983. (Sockeye located from 40 to 100 meters).

The dual-beam survey consisted of three phases. First, a regular 7 transect survey of Cultus Lake was performed on July 6 utilizing in situ integration of the received echoes. Second, information on target strength or acoustic size of the fish was gathered on July 7 using transect number 6 and a special longitudinal transect run down the center of the lake from one end to the other. Finally, fish were sampled from the lake using a mid-water trawl in conjunction with the traditional single-beam survey on July 11.

The number of sockeye estimated for July 6, 1983 using the dual-beam system was 2,657,000 (±201,000) representing a survival of 6.7% from potential egg deposition. The single-beam echo counting technique provided a sockeye estimate of 3,651,000 (±289,000) representing a survival of 9.1% from potential egg deposition.

Although these results are by no means conclusive of the accuracy of the dual-beam system approach, two advantages were noted in the use of the system. The data was processed in about half the time required to process the traditional single-beam method, and the data was much less susceptible to human errors in processing due to high density situations. Additional experimentation should be conducted to substantiate the estimates and to establish confidence in the various data processing parameters for target discrimination in the dual-beam processing phase.

Unusual oceanographic conditions were responsible for the high diversion of sockeye via Johnstone Strait in 1983. These conditions were partially the result of an equatorial atmospheric-oceanographic event termed an "El Nino". Periodic reversals in the equatorial Pacific currents cause warm oceanic water to flood the coasts of South America and, less frequently, North America. In the winter 1982-83, a strong current was noted bringing tropical water northward and causing southern area water (but not tropical) to push toward British Columbia and southeastern Alaska. At the height of the "El Nino" current in spring, 1983, coastal temperatures were elevated by 2°C and greater. Record high late winter-spring sea surface temperatures (Figure 13) and sea level measurements and record low coastal salinity along with very high onshore surface water transport were all observed at coastal stations in 1983. Part of the extreme values seen in the above parameters were also driven by record low sea level winter air pressures in the

Gulf of Alaska. At present, it is impossible to say how much of the anomalies were due to unusual atmospheric conditions in the tropical or alternatively in the temperate North Pacific.

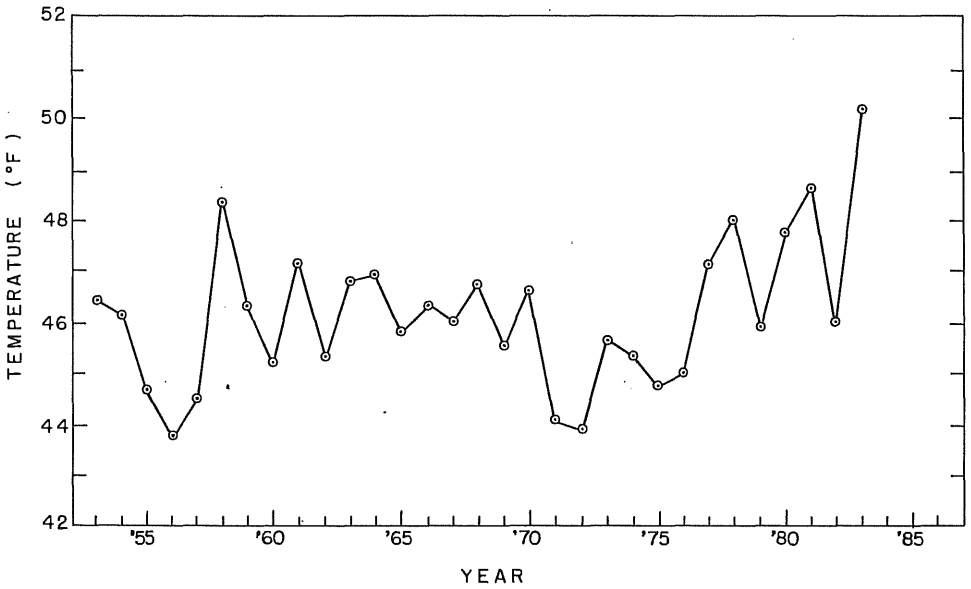

FIGURE 13. Sea surface temperature (°F) at Kains Island (north-western Vancouver Island) in March for the years 1953 to 1983.

The effects of the 1983 "El Nino" event were felt most strongly in coastal waters and, in fact, central Gulf of Alaska temperatures in late winter and spring, 1983, were not abnormal. Time of arrival of the runs was therefore relatively normal but Fraser sockeye made an extreme northerly landfall and entered into the catch at Noyes Island, Alaska. The high diversion via Johnstone Strait appeared to be caused by the northerly landfall, high temperatures and possibly events associated with dispersal of coastal runoff.

ENVIRONMENT CONSERVATION

Effluent treatment at Quesnel River Pulp Company failed to meet detoxification criteria specified in federal regulations or the B.C. Waste Management Branch discharge permit. The causes of substandard detoxification appeared related to the high organic loads placed on the treatment system, especially when chemical thermal mechanical pulp (CTMP) was made. Additional aeration capacity became operational in July and this was reflected in an improvement in treatment when thermal mechanical pulp (TMP) was being made. However, whenever the mill switched to CTMP, which occurred at two to three week intervals, the treatment system was unable to detoxify the effluent.

In 1982 the Commission recommended that the company conduct treatability tests to determine the conditions required to obtain consistent detoxification. A treatability study commenced in September 1983 under guidance of a committee composed of representatives from the Commission, Environmental Protection Service, Waste Management Branch, Quesnel River Pulp and its consultant. Two pilot plants of five and seven days treatment time were constructed at the pulp mill and operated by mill personnel to treat

effluents under controlled conditions. Samples of effluent were forwarded to the Commission laboratory for bioassays to evaluate performance of the two pilot plants and the aerated lagoon.

The initial phase of the study demonstrated that periodic low concentrations of dissolved oxygen in the pilot plants caused a subsequent failure in detoxification. This condition was eventually corrected by maintaining higher levels of dissolved oxygen. Low pH occurred during the first day of treatment in the pilot plant in spite of raw effluent pH's near neutrality. This condition was corrected by combining the first two days of treatment to increase buffering capacity. By year's end it appeared that the treatability study would define the conditions for upgrading the aerated lagoon to meet detoxification criteria.

Northwood Pulp and Timber Company commissioned their expanded bleached kraft pulp mill at Prince George. A second aerated lagoon was added to give a treatment time of eight days. However, effluent failed to meet detoxification specifications in early spring. Mill personnel concluded that unequal effluent flow to the two aerated lagoons caused one to be overloaded. When the flow was equalized to the two lagoons, effluent was detoxified.

Cariboo Pulp and Paper Company at Quesnel undertook inplant improvements and modifications to the aerated lagoon to correct a poor detoxification record. The former included, (a) installation of new seals to reduce chemical losses during pulp washing, (b) retubing evaporators to reduce black liquor losses and, (c) increasing resin acid soap recovery and storage capacity. A curtain wall was added to the second stage aerated lagoon to prevent effluent from ''short circuiting'' to the outlet. An aerator was added to the spill pond to assist treating spills as they are directed to the treatment system.

In a test of color removal, treated effluent from the Weyerhaeuser bleached kraft pulp mill at Kamloops was passed through infiltration beds constructed on a sand bar in the Thompson River. The company concluded that color removal was too little to warrant full scale application. The company applied to the Waste Management Branch to revise their discharge permit in accordance with current pollution control objectives. The company also requested revision of specifications, ranges and criteria for some effluent characteristics. The Commission commented to the Department of Fisheries and Oceans on the suitability of these proposals.

Belkin Paperboard Company, located on the North Arm of the Fraser River, discharges an effluent which consistently failed to meet detoxification criteria in spite of inplant recycle procedures. In autumn the company sponsored treatability studies using a pilot scale biological treatment system. It was expected that the tests would demonstrate the treatment time and conditions required to produce an effluent which would meet federal regulations and provincial objectives.

Scott Paper Company discharges a non-lethal effluent to the North Arm of the Fraser River after treatment. In 1983 the company constructed a second paper machine and additional treatment capacity similar to that in the original mill. The new paper machine was due to start early in 1984.

Cooperative studies continued with the Chemistry Department, University of British Columbia, to identify metabolites formed during detoxification of certain organic compounds in pulp mill wastes by selected microorganisms. Bioassays using Daphnia pulex demonstrated that 12-chlorodehydroabietic acid was detoxified when hydroxylated by the fungus *Mortierella isabellina*. When 12,14-dichlorodehydroabietic acid was metabolized the final degradation product was the dihydroxy form of the parent compound and was of low toxicity. Bioassays using Daphnia pulex indicated that trichloroguiacol was detoxified by the fungus *Mortierella isabellina*. However, procedural problems prevented

confirmation of the results.

Federal regulations governing disposal of pulp and paper industry effluents came under review by a joint Federal, Provincial and Industry Committee. A toxicity subcommittee composed of representatives from industry, provinces, Environmental Protection Service, Department of Fisheries and Oceans and the Commission reviewed the toxicity criteria for effluents but a concensus was not reached. The review process is continuing under a different format.

The Commission continued a joint program with the Department of Fisheries and Oceans started in 1981 to document susceptibility of salmon bearing waters to acidic precipitation. When acid deposition exceeds the neutralizing capacity of a drainage basin, the acid-base balance of the water is forced to the acid side. Highly acidic waters are lethal to aquatic life but before acidity reaches this level, mortality and sub-lethal toxicity may occur due to increased solubility of metals, especially aluminum. Aluminum is widely distributed in soils and sediments of lakes and streams but does not react with aquatic life under normal acid-base conditions.

Studies have shown alkalinity, the capacity of water to neutralize acid, is the best index of surface water sensitivity to acid deposition. With the foregoing factors in mind, surveys were conducted to measure alkalinity, pH and metal contents of surface waters. Waters with less than 200 ueq/L (10 mg/L $CaCO_3$) of alkalinity were classified as sensitive to acid deposition. Waters considered potentially susceptible were in the range 200 to 600 ueq/L. Waters exceeding the latter were considered not susceptible.

Sockeye rearing lakes downwind of Hat Creek were surveyed in 1981 and 1982 and found to be in the potentially susceptible category. An analysis of Adams Lake by consultants to B.C. Hydro concluded that there would be a negligible impact on pH and alkalinity due to emissions from the proposed coal-fired generating plant.

The data obtained in a joint study by the Commission and the Department of Fisheries and Oceans for streams since 1981 are summarized in Table 7. Only six of the streams sampled in the interior were classified as sensitive and these included Raft and Seymour Rivers. In the Lower Mainland, which includes the Fraser River drainage west of Hope, 26 of 38 streams including Weaver and Sakwi Creeks and Pitt and Chehalis Rivers, were classified as sensitive.

TABLE 7. Sensitivity of Streams to Acid Precipitation.

	Number of Streams Tested		
District	**Sensitive**	**Potentially Susceptible**	**Not Susceptible**
Lower Mainland	26	10	2
Interior	6	11	14

These data serve as a baseline on which future surveys can be compared. Streams and lakes in the sensitive category could be expected to resist acidification providing they are protected. In this regard, the impacts on surface waters of acidic deposition originating from present and proposed industrial complexes and urban centers should be examined. In a related activity, federal and provincial agencies are conducting programs to document the present amounts of acid deposition occurring in British Columbia.

Under terms of a conditional discharge permit issued by the B.C. Waste Management Branch, the Greater Vancouver Sewerage and Drainage District let a contract to consultants to conduct environmental, oceanographic, sediment and engineering studies

associated with a deep outfall off Sturgeon Bank at depths of 200 feet or more. The report was submitted to GVSDD in November and subsequently distributed to federal agencies. The Commission will review the proposals and comment to the Department of Fisheries and Oceans concerning any potential impact on sockeye or pink salmon.

The City of Prince George was issued a revised permit specifying dechlorination of effluent before discharge to the Fraser River. The permit also specified a monitoring program to define the extent of the zone of influence in terms of water quality and effect on the biological community.

Merritt received a discharge permit which specifies a combination of land disposal and discharge to the Coldwater River, a tributary of the Nicola River. Effluent discharged to the Coldwater River must be dechlorinated and be of higher quality than that discharged to infiltration basins.

The City of Kamloops received a discharge permit specifying land disposal and discharge of treated, dechlorinated effluent to the Thompson River. Discharge to the Thompson River is to be minimized during December through March. The object of the disposal schedule is to reduce the amount of phosphorous reaching the Thompson River. Thus, sewage discharged to the Thompson River will receive chemical treatment to lower phosphorous content.

The City of Lillooet requested further delay in upgrading effluent quality. The Department of Fisheries and Oceans and the Commission requested the permit specify that the effluent meet level AA criteria. An assessment by Environmental Protection Service indicated that level AA criteria could be met economically by the existing treatment system. However, Lillooet was granted an amended permit specifying continuation of level BB effluent quality. Environmental Protection Service was continuing negotiations concerning this effluent.

In 1982 Carolin Mines, located north of Hope in the Coquihalla River drainage, operated intermittently owing to unsatisfactory treatment of effluent to remove cyanide. The mine mill operated throughout 1983 but the alkaline chlorination process was not fully effective in destroying the various forms of cyanide in the effluent. To improve treatment, the company added a sulfur dioxide cyanide destruction plant which commenced operation in November. However, operational problems were experienced and further testing was required to stabilize the treatment process.

Effluent from Carolin Mines enters Ladner Creek and then the Coquihalla River where pink salmon spawn in the lower portion of the river. Bioassays indicated that treated effluent met detoxification criteria only part of the time. Bioassays at the mouth of Ladner Creek indicated the diluted effluent was not lethal.

The program to control Eurasian water milfoil (*M. spicatum*) in Cultus Lake continued in 1983. This program has been funded jointly by the provincial and local governments plus contributions from private sources. In 1983 the Department of Fisheries and Oceans also contributed funds. The control methods used in 1983 included harvesting (14,000 m^2), rotovating (28,791 m^2), bottom barriers (1,920 m^2) and diver-dredging (800 m^2). The sockeye spawning grounds at Lindell Beach were rotovated in midsummer after fry had left the area. Inspection of the area by a Commission diver during sockeye spawning in November indicated that the incidence of *M. spicatum* was much reduced from the previous year and spawning was not affected.

At Salmon Arm in Shuswap Lake, *M. spicatum* occurred at moderate density over about 10 ha. The shallower portion of this area was exposed in late autumn and was tilled to dislodge roots of *M. spicatum*. Ice conditions precluded rotovation of those areas under water. Hopefully, the remaining areas can be rotovated in early spring, 1984.

The Commission undertook a comprehensive study of the Early Stuart adult sockeye migration to understand the unexplained losses which have occurred. Documentation was made of suspended solids (non-filtrable residue), turbidity and dissolved gas saturation that sockeye were exposed to during migration in 1983. The data revealed that Early Stuart sockeye encountered highest turbidities and non-filtrable residues in the Fraser Canyon. Comparison of turbidity at Hell's Gate for the period of Early Stuart sockeye migration from 1979 to 1983 revealed that turbidities were lowest during 1983 and highest during 1982.

Dissolved gas saturation measured during the Early Stuart sockeye migration revealed that the maximum values occurred at Lillooet and were 111 to 115 percent. Saturation values measured in 1983 were similar to those measured in early August, 1977. It was doubtful that symptoms of supersaturation would have occurred among Early Stuart sockeye in 1983 since normal migration depths would have compensated for supersaturation.

As an adjunct to measurements of turbidity and suspended solids, studies were conducted in the laboratory to relate these characteristics to possible gill irritation among juvenile sockeye. In the longer range, these procedures would be applied to adult sockeye. Results thus far of the laboratory tests using juvenile sockeye indicate that the lethal level of non-filtrable residue derived from the Fraser River sediments is at least ten times the amount measured in the Fraser Canyon.

Water sampling continued in the Nadina River and Tachie River basins to monitor the effects of logging and road building on suspended solids (non-filtrable residue) and turbidity. Suspended sediment and turbidity followed normal patterns throughout the year. Water sampling was extended to the Middle River basin, upstream of Tachie River and Trembleur Lake, to coincide with development of logging programs. Samples in the Tachie and Middle River basins were collected by Department of Fisheries officers from June through September and were forwarded to the Commission laboratory for analysis.

ENGINEERING

Much of the effort of the Engineering Division in 1983 was directed toward analyzing Alcan's Kemano Completion proposal. The Commission prepared a report outlining possible effects of this development on Fraser River sockeye and pink salmon (Potential Effects of The Kemano Completion Project on Fraser River Sockeye and Pink Salmon). Alcan proposes to proceed with a second stage of development of the existing Nechako-Kemano hydroelectric diversion, which would increase power production by about 70%. The first phase of the development, completed in 1956, reduced the average discharge of upper Nechako River above the Nautley River to about 66% of the natural, pre-diversion discharge and the proposed second stage would cause a further reduction to about 16% of the natural flow. Alcan would provide a continuous discharge of 1,100 cfs at the Nechako-Cheslatta confluence from April 1 to August 31 and 1,000 cfs from September 1 to October 31, which would encompass the period of juvenile and adult sockeye migrations in Nechako River. During extremely warm weather, additional cold water would be drawn from below the thermocline in the Nechako reservoir to provide up to 6,000 cfs at 50°F for controlling Nechako River temperatures above Stuart River. The frequency of occurrence of temperatures higher than 68°F would be reduced as compared to those obtained with the existing Nechako diversion and the mean daily temperature would not be permitted to exceed 71°F.

Extensive analyses were done to estimate the environmental changes that could be expected as a result of the substantial flow reduction. The Commission concluded that the

Kemano Completion Proposal as submitted by Alcan would not provide adequate fisheries protection. However, if the project is approved, the Commission recommended four stipulations for protection of Fraser River sockeye and pink salmon:

1. Additional water should be provided from the reservoir to control the mean daily Nechako River temperature above Stuart River to a maximum of 68°F rather than 71°F as proposed by Alcan and the average temperature during the adult sockeye migration period (July 10-August 20) should not exceed the calculated average of 62.6°F that occurred under natural pre-diversion conditions.
2. All obstructions to adult sockeye and pink salmon migration resulting from lowered water levels caused by the project should be corrected at Alcan's expense.
3. A permanent Task Force should be established, including Alcan and all of the fishery agencies, to plan the most efficient regulation of releases from the reservoir and the Cheslatta system and to evaluate all aspects of fish protection, with the cost of research and monitoring funded by Alcan.
4. If the Task Force found that there were losses in sockeye and/or pink salmon production attributable to the project despite the most efficient use of the provisions made for fish protection, Alcan should compensate for the loss by enhancing these resources in the affected producing areas.

Studies were continued in cooperation with the Department of Fisheries and Oceans to provide further information on factors affecting migration behavior and prespawning mortalities of Nechako salmon stocks. Early Stuart sockeye captured by dipnetting in the Hell's Gate fishways were tagged using internal radio transmitters, Petersen disc tags and spaghetti or ribbon tags. Aerial radio telemetry was used to follow the progress of these fish to the spawning grounds. Environmental parameters, including river discharge, temperature, nitrogen and oxygen levels and silt content, were measured during the progress of migration. Fish were also sampled en route and on the spawning grounds to determine the incidence of columnaris and other diseases.

As part of the above program, and also to provide information for predicting flow requirements for moderating temperatures in the Nechako system for sockeye protection, thermographs were operated at eight locations in the Nechako system. Alcan again complied with the ruling of the B.C. Supreme Court requiring additional discharge of water from the reservoir. Alcan used the thermograph data in conjunction with weather forecasts to predict daily flow requirements. The objective was to limit the average daily Nechako River temperature above Stuart River to not more than 68°F. It is not possible, however, to meet this objective at all times. Under present conditions, any water obtained from the reservoir must be spilled from the surface layers at the Skins Lake spillway, from where it must flow about 80 km through the Cheslatta system before reaching Nechako River. As a result, much of the cooling benefit of the water is lost en route and large quantities of water are required. The large flows also cause erosion and siltation as well as interference with other uses of the river.

Since inception of the proposal by the Canadian National Railway to construct an additional rail line through the North Thompson, Thompson and Fraser River valleys, the Commission has been represented on a Task Force, the object of which has been to minimize adverse effects on other resources utilizing the affected areas. Information has been exchanged with CN and its consultants on a regular basis at office and on-site meetings regarding potential effects of proposed encroachments into the river channel along the sockeye and pink salmon migration route and the Thompson River pink salmon spawning ground. In addition, Commission staff have collaborated with CN's consultants

in making a radio-telemetry study of the migration behavior of pink salmon and in making on-site evaluations of proposed encroachments onto the spawning ground. Since very little information is available for assessing the effects on pink salmon of the higher velocities resulting from encroachments into the river channel, the Department of Fisheries and Oceans funded a study of the swimming ability of pink salmon at various points along the migration route as previously reported.

Observations were made regarding downstream fish passage problems at the Seton Creek hydroelectric installation. Previous studies had indicated substantial mortality of sockeye smolts at the plant and it was considered that laceration and suffocation of smolts due to impingement on fine debris collected on the penstock trash rack may have been an important contributing factor. B.C. Hydro therefore agreed to clean the trash rack frequently during the sockeye migration period and to operate the plant continuously at most efficient load. Observations during the cleaning operations suggested that very few smolts were impinged at the trash rack. However, dead and injured smolts were seen in the tailrace, as in previous years, suggesting significant mortality in the turbine. A method of excluding downstream migrants from the turbine intake is required. The migrations of adult sockeye and pink salmon were monitored by operating a resistivity fish counter in the fishway over Seton Dam and by making daily observations of fish abundance in the tailrace. B.C. Hydro installed a temporary dam in Cayoosh Creek, as in several past years, to divert most of the flow of this creek into Seton Lake. By adjusting the spill flow at Seton Dam to limit the proportion of Cayoosh Creek water at the mouth of Seton Creek to a maximum of 20% during the Gates Creek run and 10% during the Portage Creek run, it was possible to avoid significant delay of sockeye in the tailrace during the majority of the migration period. Portage Creek sockeye appeared lethargic late in the season and a very small proportion of the run remained in the tailrace and in Seton Creek well past the normal migration period. Increased discharge may be required to ensure migration of these fish.

Commission staff have also been involved, along with other resource agencies, in discussions with the Provincial Ministry of Transportation and Highways and its consultants concerning potential adverse impacts of a proposed highway bridge over the Fraser River at Annacis Island. In addition to potential problems during bridge construction, the upstream migration of early sockeye runs could be delayed as a result of increased water velocities. Other potential impacts include increased flood threat due to higher water elevation upstream from the bridge. The bridge abutments and armoring to prevent damage due to ship collisions will confine the river channel to such an extent that average velocities will be increased 18-33%. It has been observed that early sockeye runs, which migrate during a period of high discharge, move into lower velocity areas and tend to stop migrating during ebb tide, when velocities are highest. If the proposed restriction of the river cross section further reduces the daily duration of upstream migration causing delayed arrival of fish on the spawning ground, the productivity of the early sockeye runs could be adversely affected. Therefore the proponent conducted hydraulic model studies to determine the feasibility of improving migration conditions by placing rock groynes in high velocity areas along the abutments and by constructing an alternate migration route consisting of a bypass channel on the bank side of one of the abutments. The groynes will be constructed for the 1984 migration and the behavior of upstream migrants will be studied in 1984 and 1985 using radio-telemetry and ultrasonic tracking to determine whether the bypass channel is required.

To determine whether a pink salmon population could be reestablished in Alouette River, approximately 800,000 eggs were transplanted from Harrison River to incubation facilities operated by the B.C. Corrections Branch on Alouette River. The progeny will be released in Alouette River in the spring of 1984 after a short period of feeding. Since

Alouette River has not supported a significant population of pink salmon for about 30 years, a substantial return of adult pinks in 1985 would justify a more extensive development program. The native Alouette River pink salmon population was destroyed by gravel removal operations and possibly also by operation of a hydroelectric storage dam upstream from the spawning ground.

Routine maintenance was performed at the fishways at Hell's Gate, Yale Rapids and Bridge River Rapids on the Fraser River. Additional abrasion-resistant steel plate was attached to concrete surfaces in particularly vulnerable areas at the Hell's Gate fishways. Maintenance work at the Commission's enhancement facilities included gravel cleaning at the Weaver Creek spawning channel and the Pitt River incubation channel, using two models of the air-water-jet gravel cleaner. Deterioration of the species separator at the Weaver channel necessitated rebuilding this structure, which had been operated on an experimental basis for several years. It was again necessary to remove bedload and wood debris from Weaver and Sakwi Creeks to reduce the risk of flood damage to the spawning channel and the natural spawning areas. Maintenance work was also done at the Pitt River incubation channel, including repair of the degassing tower and installation of a flow deflector at the water intake in an effort to reduce bedload deposition.

TABLE I

SOCKEYE CATCH BY GEAR

Gear		1971	1975	1979	1983
United States Convention Waters					
Purse Seines	Units	182	232	184	148
	Catch	1,607,117	896,416	942,566	165,424
	Percent	57.07	57.32	53.08	44.76
Gill Nets	Units	650	902	1,133	515
	Catch	1,016,984	615,790	779,807	189,999
	Percent	36.11	39.38	43.91	51.41
Reef Nets	Units	48	65	56	46
	Catch	191,682	51,096	52,201	14,100
	Percent	6.81	3.27	2.94	3.81
Troll	Catch	346	549	1,302	76
	Percent	0.01	0.03	0.07	0.02
TOTAL CATCH		2,816,129	1,563,851	1,775,876	369,599
Canadian Convention Waters					
Purse Seines	Units	173	116	142	27
	Catch	1,233,531	43,201	291,859	4,159
	Percent	39.61	6.71	18.01	0.73
Gill Nets	Units	1,357	842	835	593
	Catch	1,689,607	550,783	1,111,288	514,371
	Percent	54.25	85.46	68.59	89.77
Troll	Catch	191,160	50,489	217,118	54,455
	Percent	6.14	7.83	13.40	9.50
TOTAL CATCH		3,114,298	644,473	1,620,265	572,985

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

TABLE II

CYCLIC LANDINGS OF SOCKEYE FROM CONVENTION WATERS

	United States	*Canada*	*Total*
1983			
Total Landings (No. Sockeye).....	369,599	572,985	942,584
Share in Fish	39.21%	60.79%	
1946-1983			
Total Landings (No. Sockeye).....	62,042,189	61,333,139	123,375,328
Share in Fish	50.29%	49.71%	
1983 Cycle Catch			
1983	369,599	572,985	942,584
1979	1,775,876	1,620,265	3,396,141
1975	1,563,851	644,473	2,208,324
1971	2,816,129	3,114,298	5,930,427
1967	2,087,826	1,875,482	3,963,308
1963	1,314,045	686,681	2,000,726
1959	1,810,738	1,581,883	3,392,621
1955	1,006,610	1,108,081	2,114,691
1951	1,136,795	1,288,162	2,424,957
1947	88,220	355,035	443,255
1943	242,077	349,011	591,088
1939	555,233	568,943	1,124,176
1935	615,502	825,508	1,441,010
1931	975,591	458,048	1,433,639
1927	1,069,557	713,930	1,783,487
1923	495,490	361,463	856,953
1919	778,669	470,199	1,248,868
1915	736,939	1,088,524	1,825,463
1911	1,447,919	730,714	2,178,633
1907	1,030,359	691,210	1,721,569
1903	1,911,127	2,341,492	4,252,619

TABLE III

DAILY CATCH OF SOCKEYE, 1971-1975-1979-1983 FROM UNITED STATES CONVENTION WATERS

	JULY				AUGUST				SEPTEMBER			
Date	**1971**	**1975**	**1979**	**1983**	**1971**	**1975**	**1979**	**1983**	**1971**	**1975**	**1979**	**1983**
1	1,068				9,704			31,900	79,685			
2					145,517			49,028	60,079	12,595		
3					94,802			16,879	87,853		2,009	
4					53,159			12,396	56,222		38	
5	12,708						162,300		1,411			
6	8,111						570,259	7,581	87,582			
7	9,281	72,530					231,876	19,791	69,145			
8	4,588	27,405			7,447			28,574	33,948	866		
9		20,843			155,896			20,913		683		494
10					88,141			4,883				1,060
11	1,714				58,076	194,558						498
12	20,210				39,934	124,550						
13	17,672						39,498					
14	15,708	31,499			4,037	111,121	76,602		281	249		519
15	9,213	12,561			109,435		33,180		4,431	152		2,586
16			12,889		113,464			3,909	3,305	113	703	816
17			2,341		104,877			18,595	1,891		1,064	359
18	6,773		3,987		108,613	99,033		15,592			35	
19	56,405				76,550	80,684	4,354		175		10	292
20	45,037				50,385	42,852	62,270		1,163			343
21	37,835	103,060			547		66,914	5,329	980			
22		73,338	29,307		112,368		4,586	26,450	594			
23			166,862		93,858		32,736	18,122		39		
24			24,654		86,382		1,611	8,325		111		
25	16,459			17,015	55,063		1,195					
26	105,003			16,899	19,109	37,880	20,420	491	7			
27	72,329			27,170		18,493	13,936	2,449	396			
28	85,289	187,942					612	1,420	116			
29	89,638	122,179					7,179	4,724	64	18		
30		93,726	160,301		6,599		201	4,116	38	13		
31		91,233	40,500		94,802		89					
Totals	615,041	836,316	440,841	61,084	1,688,765	709,171	1,329,818	301,467	489,366	14,939	3,859	6,967
Troll	122	189	562	2	190	316	738	74	6	8		
Monthly Totals	615,163	836,505	441,403	61,086	1,688,955	709,487	1,330,556	301,541	489,372	14,947	3,859	6,967
June, Oct. & Nov. Totals									22,639	2,912	58	5
Season Totals									2,816,129	1,563,851	1,775,876	369,599

TABLE IV

DAILY CATCH OF SOCKEYE, 1971-1975-1979-1983 FROM CANADIAN CONVENTION WATERS

	JULY				AUGUST				SEPTEMBER			
Date	**1971**	**1975**	**1979**	**1983**	**1971**	**1975**	**1979**	**1983**	**1971**	**1975**	**1979**	**1983**
1	231				114,248				19,968	232		
2	Strike				189,823			104,348	34,675	28,563		
3	June 26-				113,015				124,765			
4	July 10					50,455			16,483		9,256	
5	953					40,096	456,514		20,106	11,838		
6	915						178,519		50,720	597		8,797
7	850	36,951								454		
8	874								40,196	40,283		
9		8,136	34,395		288,641				46,210			19,243
10					188,407	6,174			36,579			
11	39,111				198,973	4,731			32,316			
12	16,037					11,665	106,815		27,253			12,415
13						10,241	57,850		3,514			7,923
14		30,328					47,713		18,537	7,177		6,234
15	12,044								18,225	223		19,765
16			10,485		190,798		87,925			131	323	
17					87,209					43	856	14,136
18						25,011				12,914		14,624
19	21,756					9,082						26,047
20	13,361					8,015	96,442		391			17,397
21		26,256				7,752	9,430		167			15,118
22		17,519			60,261	3,278	2,863	71,183	16,238	6,173		13,492
23			43,593		86,106		19,211		7,811	66		
24		Strike			16,933							
25		July 25-				40,306	8,000	70,438		3,254		
26	187,654	Aug. 24			142,151	18,025	5,021		22,579			
27	40,513			87,440	100,315	2,516	62,022		2,315			
28	18,266	25,123										
29		13,201						7,948	6,281	3,378		
30			156,952		173,063		1,498	300	2,812	13		
31					54,019							
Totals	352,565	157,514	245,425	87,440	2,003,962	237,347	1,139,823	254,217	548,141	115,339	10,435	175,191
Troll	21,857	2,145	55,795	2,790	166,518	41,800	160,891	28,646	2,460	6,337	218	23,019
Spring Salmon Gill Nets	617								4,786	3,571		
Monthly Totals	375,039	159,659	301,220	90,230	2,170,480	279,147	1,300,714	282,863	555,387	125,247	10,653	198,210
June, Oct. & Nov. Totals									13,392	80,420	7,678	1,682
Season Totals									3,114,298	644,473	1,620,265	572,985

TABLE V

INDIAN CATCH OF SOCKEYE BY DISTRICT AND AREA, 1979 AND 1983

	1979		1983	
District and Area	*Catch*	*No. of Fishermen**	*Catch*	*No. of Fishermen**
HARRISON-BIRKENHEAD				
Birkenhead River and Lillooet Lake	14,000	1**	9,961	1**
TOTALS	14,000	1	9,961	1
LOWER FRASER				
Below Hope	100,642	579	83,808	481
TOTALS	100,642	579	83,808	481
MIDDLE FRASER				
Hope to Lytton	61,661		107,751	218
Lytton to Churn Creek	54,521	1,326	66,890	1,283
TOTALS	116,182	1,326	174,641	1,501
CHILCOTIN				
Farwell Canyon to Siwash Bridge	19,281		44,600	200
Keighley Holes	1,645	102		
TOTALS	20,926	102	44,600	200
UPPER FRASER				
Churn Creek to Quesnel	4,618	218	23,850	355
Shelley	750	24	4,950	16
TOTALS	5,368	242	28,800	371
NECHAKO				
Nautley and Stella Reserves	21,294	84	13,376	34
TOTALS	21,294	84	13,376	34
STUART				
Fort St. James-Pinchi Village	5,459	50	2,301	10
Tachie, Takla & Trembleur Village	4,173	110	2,814	19
TOTALS	9,632	160	5,115	29
THOMPSON				
Main Thompson	2,300	161	1,155	87
North Thompson				
South Thompson			100	40
TOTALS	2,300	161	1,255	127
GRAND TOTALS	290,344	2,654	361,556	2,743

* Number of permits issued to Indians in district.

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

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

TABLE VI

SUMMARY OF THE SOCKEYE ESCAPEMENT TO THE FRASER RIVER SPAWNING AREAS, 1971, 1975, 1979, 1983

District and Streams	1983 Period of Peak Spawning	Estimated Number of Sockeye				Jacks	Sex Ratio	
							Males	Females
		1971*	1975*	1979	1983		4-5 Yr.	4-5 Yr.
LOWER FRASER								
Cultus Lake	Early Nov.	9,145	11,478	32,045	19,952	8	8,454	11,490
Upper Pitt River	Sept. 9-14	15,469	39,942	37,558	16,858	6	6,645	10,207
Widgeon Slough	Oct. 28-31	394	936	599	943	0	390	553
HARRISON								
Big Silver Creek	Sept. 17-20	0	31	119	230	15	107	108
Harrison River	Nov. 5-10	3,790	5,987	45,706	4,239	0	2,072	2,167
Weaver Creek	Oct. 15-23	2,887	12,195	28,515	21,024	297	4,351	16,376
Weaver Channel	Oct. 21-26	2,736	19,816	22,888	19,243	629	6,577	12,037
LILLOOET								
Birkenhead River	Sept. 20-29	32,672	92,928	78,088	48,841	4,812	20,156	23,873
SETON-ANDERSON								
Gates Creek	Aug. 19-23	797	788	907	927	116	363	448
Gates Channel	Aug. 26-Sept. 4	1,502	3,768	4,118	7,498	925	2,502	4,071
Portage Creek	Oct. 30-Nov. 3	281	3,829	3,663	7,945	198	2,798	4,949
SOUTH THOMPSON								
Seymour River	Aug. 30-Sept. 6	19,028	37,024	49,321	29,838	7	15,667	14,164
Upper Adams River	—	0	23	0	0	0	0	0
Lower Adams River	Oct. 18-22	280,176	148,187	275,616	201,669	59	106,470	95,140
Little River	Oct. 20-25	2,821	7,268	10,443	Present (a)	—	—	—
South Thompson River	—	10	16	144	Present (a)	—	—	—
Lower Shuswap River	Oct. 13-18	6,117	11,652	10,092	7,308	0	3,009	4,299
Misc. Late Runs	Oct. 18-30	1,169	1,442	3,418	2,447	0	1,303	1,144
NORTH THOMPSON								
Raft River	Sept. 2-7	840	2,664	1,708	2,857	77	959	1,821
Barriere River	—	5	0	0	0	0	0	0
Fennell Creek	Aug. 25-30	1,300	4,127	15,590	5,018	41	2,264	2,713
North Thompson River	Oct. 1-5	888	123	1,009	750	0	338	412
CHILCOTIN								
Chilko River	Sept. 15-Oct. 2	161,943	220,554	240,294	331,510	2,290	138,690	190,530
Chilko Lake South End	Mid to Late Sept.	12,323	55,144	32,400	55,061	1,448	18,187	35,426
Taseko Lake	Sept. 5-10	10,500	4,394	—	1,630	0	702	928
QUESNEL								
Horsefly River	Sept. 4-8	171	101	511	1,998	0	650	1,348
Upper McKinley River	Aug. 25	—	100	0	38	0	12	26
NECHAKO								
Endako River	Sept. 1-7	284	192	1,294	583	0	263	320
Nadina River (Early)	Sept. 7-11	1,222	481	1,809	1,337	0	771	566
Nadina River (Late)	Sept. 20-25	14,525	4,013	14,474	3,035	0	1,159	1,876
Nadina Channel (Late)	Sept. 17-22	—	11,306	41,212	23,843	2	9,836	14,005
Nithi River	Aug. 31-Sept. 2	1,796	1,144	1,300	990	0	447	543
Ormonde Creek	—	0	0	0	0	0	0	0
Stellako River	Sept. 20-25	39,726	176,079	290,116	121,739	47	54,920	66,772
STUART								
Early Runs								
Driftwood River	—	335	20	247	Present	—	—	—
Forfar Creek	Aug. 2-13	25,178	6,818	15,805	3,591	0	1,260	2,331
Gluske Creek	July 31-Aug. 7	14,305	10,370	10,040	3,781	0	1,325	2,456
Kynoch Creek	Aug. 2-8	22,932	25,124	34,228	7,822	7	3,005	4,810
Narrows Creek	Aug. 10-13	3,467	1,704	1,575	895	0	310	585
Rossette Creek	Aug. 2-7	16,445	8,543	15,893	3,304	0	1,114	2,190
Misc. Streams	Aug. 1-23	13,271	13,188	14,975	4,481	0	1,534	2,947
Early Stuart Totals		(95,942)	(65,767)	(92,763)	(23,874)	(7)	(8,548)	(15,319)
Late Runs								
Kazchek Creek	Sept. 24-28	40	—	100	11	0	4	7
Middle River	Sept. 24-27	873	6,704	18,111	639	0	226	413
Tachie River	Sept. 25-28	360	7,525	10,940	853	0	302	551
Late Stuart Totals		(1,535)	(14,229)	(31,918)	(2,246)	(0)	(795)	(1,451)
NORTHEAST								
Upper Bowron River	Aug. 24-28	25,497	29,700	35,000	6,451	0	2,580	3,871
TOTALS**		747,523	990,716	1,407,828	975,901	10,984	423,661	541,256

* Numbers for some populations have been revised from the respective Annual Reports.
** Totals include small numbers of fish in small tributaries not listed in the table.
a—Included in the Lower Adams River population.

TABLE VII

DAILY CATCH OF SOCKEYE, 1968-1972-1976-1980 FROM UNITED STATES CONVENTION WATERS

	JULY				AUGUST				SEPTEMBER			
Date	**1968**	**1972**	**1976**	**1980**	**1968**	**1972**	**1976**	**1980**	**1968**	**1972**	**1976**	**1980**
1					95,135	104,974						194
2	749					78,450		13,772	3,109			2,511
3	223					57,077	188,368	12,907	2,239			991
4	24					229	107,849	48,224	1,796	106		614
5					3,291			7,651	1,076	213		85
6					69,286			8,604		190		
7					68,089	96				52		
8					50,987	26,887	312,686				754	188
9					57,251	264,096	220,219	33,988	772		235	481
10						100,648	112,490	55,003	702		407	194
11						67,670		62,389	146			82
12					82,039			34,997	143			3
13					24,597			16,088		53	381	
14	28				3,519	3,632				6	50	12
15	2,662				357	28,126				5	91	92
16	4,530	1						15,302	46			70
17	5,079	2,861						22,401	88			32
18		2,990						38,774	83	35		20
19		4,696	92,800		12,075			28,291	59	24		
20			50,093	7,998	9,103	2,809		19,145			96	
21	2,170			14,365	3,314	23,404		4,678			21	10
22	44,615			3,929	35	17,222					3	40
23	40,911	6,394		6,934		252			108		2	64
24	39,630	58,086							24			90
25	44,582	44,344							14	31		11
26		53,366	152,359		3,182				10	89		
27		50,708	82,055		4,458					879		
28					2,172	137				211	1	
29	15,711				33	65					1	555
30	96,552	7,840				55			20			813
31	86,860	116,110										
Totals	384,326	347,396	377,307	33,226	488,923	775,829	941,612	422,214	10,435	1,894	2,042	7,152
Troll	90	111	332	29	66	182	98	53				
Monthly Totals	384,416	347,507	377,639	33,255	488,989	776,011	941,710	422,267	10,435	1,894	2,042	7,152
June, Oct. & Nov. Totals									2,030	2,780	647	3,499
Season Totals									885,870	1,128,192	1,322,038	466,173

TABLE VIII

DAILY CATCH OF SOCKEYE, 1968-1972-1976-1980 FROM CANADIAN CONVENTION WATERS

	JULY				AUGUST				SEPTEMBER			
Date	**1968**	**1972**	**1976**	**1980**	**1968**	**1972**	**1976**	**1980**	**1968**	**1972**	**1976**	**1980**
1	875					108,624					26,461	16,249
2	1,761					66,001	114,159		1,823		34,117	
3	2,481						331,770		5,017			
4								53,398	655	185		5,703
5					233,366				584	5,783		
6					57,248					35		
7	C					217,308					51,294	
8	L					76,235					12,709	5,383
9	O					84,294	101,107		748			3,752
10	S						84,325	35,465	3,800			
11	E							132,180	206	2,184		8,491
12	D				88,114	38,626						
13					25,694	153,479					3,512	
14					2,774	15,165						
15	3,565				83,013							
16	2,078						32,817		39			
17		4,546					18,006		2,360			7,164
18		4,142					54,068		13	8,694		
19			19,499		49,457			26,314				
20			11,614		4,318						1,806	
21				7,479	3,426	49,742						
22	29,390					15,006		30,586				
23	24,249					3,317	58,676		1,614			6,809
24		76,873					5,154		610			
25		71,895				13,362	23,660	32,551				
26			165,363		698		17,274	22,364				
27			124,928		518			10,783				
28				21,912	10,970	22,240		10,317				
29	160,129					1,531						
30	44,117					617	30,411		2,269			
31	28,164					5,376	486					
Totals	296,809	157,456	321,404	29,391	559,596	870,923	871,913	353,958	19,738	16,881	129,899	53,551
Troll	25,627	7,005	13,101	3,158	10,841	7,540	20,357	3,055	107	627	2,781	30
Spring Salmon Gill Nets	268	768	282							1,999	3,557	
Monthly Totals	322,704	165,229	334,787	32,549	570,437	878,463	892,270	357,013	19,845	19,507	136,237	53,581
June, Oct. & Nov. Totals									7,106	18,018	19,190	13,015
Season Totals									920,092	1,081,217	1,382,484	456,158

TABLE IX

SUMMARY OF THE SOCKEYE ESCAPEMENT TO THE FRASER RIVER SPAWNING AREAS, 1968, 1972, 1976, 1980

District and Streams	1980 Period of Peak Spawning	Estimated Number of Sockeye			
		1968*	1972*	1976*	1980
LOWER FRASER					
Cultus Lake	Nov. 15-20	25,736	10,660	4,450	1,687
Upper Pitt River	Sept. 12-16	16,988	13,412	36,530	17,135
Widgeon Slough	Oct 29-Nov. 4	1,552	302	1,391	389
HARRISON					
Big Silver Creek	Sept. 12-18	1,090	2,552	1,642	610
Harrison River	Nov. 8-13	5,391	1,399	5,130	5,092
Weaver Creek	Oct. 24-28	2,606	15,505	22,867	33,244
Weaver Channel	Oct. 24-31	1,910	11,043	28,211	41,595
LILLOOET					
Birkenhead River	Sept. 21-27	83,750	113,097	108,121	90,922
SETON-ANDERSON					
Gates Creek	Aug. 30-Sept. 4	4,005	1,762	2,889	4,354
Gates Channel	Sept. 3-6	6,284	6,807	14,855	21,140
Portage Creek	Nov. 19-23	173	1,460	3,800	1,998
SOUTH THOMPSON					
Seymour River	Aug. 30-Sept. 2	3,957	2,889	8,489	8,390
Lower Adams River	Oct. 20-24	3,983	4,325	5,013	2,560
Little River	Oct. 20-23	0	81	175	32
Scotch Creek	Aug. 28-31	126	47	41	205
Upper Adams River	Aug. 27-30	—	31	40	560
Momich-Cayenne Creek	Aug. 26-29	617	1,003	1,998	3,345
NORTH THOMPSON					
Raft River	Aug. 29-Sept. 1	8,121	11,151	8,684	5,418
Barriere River	Aug. 30-Sept. 3	275	94	85	133
Fennell Creek	Aug. 28-Sept. 3	954	1,931	4,090	8,437
North Thompson River	Sept. 15-18	—	465	500	36
CHILCOTIN					
Chilko River	Sept. 20-29	414,446	564,465	364,311	468,658
Chilko Lake South End	Early Sept.	Present	2,132	23,156	30,168
Taseko Lake	Mid Sept.	—	2,287	634	679
QUESNEL					
Horsefly-McKinley Creek	Sept. 10-15	5,686	3,385	2,064	3,162
Mitchell River		4	85	101	14
Little Horsefly River		73	18	32	0
NECHAKO					
Endako River	Early Sept.	18	27	40	25
Nadina River (Early)	Aug. 26-29	902	827	101	205
Nadina River (Late)	Sept. 25-29	1,496	2,702	279	58
Nadina Channel	Sept. 18-21	—	—	1,394	3,021
Nithi River	Late Aug.	20	58	0	54
Ormonde Creek		81	54	30	0
Stellako River	Sept. 24-28	30,420	36,771	150,741	72,073
STUART					
Early Runs					
Forfar Creek	July 27-31	149	835	1,249	2,328
Gluske Creek	Aug. 1-5	18	591	966	1,049
Kynoch Creek	July 27-Aug. 1	833	2,534	6,727	10,661
Narrows Creek	July 30-Aug. 3	41	104	244	257
Rossette Creek	July 28-Aug. 1	518	834	2,090	2,054
Takla Streams	Aug. 9-13	0	143	1,120	428
Misc. Streams	July 27-Aug. 1	28	15	252	249
Early Stuart Totals		(1,587)	(5,086)	(12,648)	(17,026)
Late Runs					
Kazchek Creek		33	65	33	0
Middle River	Sept. 20-23	288	972	330	198
Tachie River	Sept. 20-23	149	7,527	2,637	756
Late Stuart Totals		(470)	(8,704)	(3,000)	(979)
NORTHEAST					
Upper Bowron River	Sept. 7-11	3,634	4,138	2,250	2,894
TOTALS**		626,706	830,128	823,453	848,320

* Numbers for some populations have been revised from the respective Annual Reports.

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

TABLE X

PINK SALMON CATCH BY GEAR

Gear		1977	1979	1981	1983
United States Convention Waters					
Purse Seines	Units	266	327	310	233
	Catch	1,777,767	3,354,044	3,310,281	1,523,289
	Percent	81.98	82.89	85.41	81.43
Gill Nets	Units	907	768	500	223
	Catch	197,178	388,723	308,649	155,889
	Percent	9.09	9.61	7.96	8.34
Reef Nets	Units	53	52	47	43
	Catch	30,069	42,771	80,148	87,024
	Percent	1.39	1.06	2.07	4.65
Troll	Catch	163,416	260,735	176,493	104,428
	Percent	7.54	6.44	4.55	5.58
TOTAL CATCH		2,168,430	4,046,273	3,875,571	1,870,630
Canadian Convention Waters					
Purse Seines	Units	111	184	155	27
	Catch	807,194	2,480,864	2,794,078	70,520
	Percent	38.89	60.05	66.72	6.59
Gill Nets	Units	913	661	625	665
	Catch	280,674	103,738	347,984	850,590
	Percent	13.52	2.51	8.31	79.51
Troll	Catch	987,610	1,546,753	1,045,791	148,750
	Percent	47.59	37.44	24.97	13.90
TOTAL CATCH		2,075,478	4,131,355	4,187,853	1,069,860

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

TABLE XI

CYCLIC LANDINGS OF PINK SALMON FROM CONVENTION WATERS

	United States	*Canada*	*Total*
1983			
Total Landings (No.Pinks)	1,870,630	1,069,860	2,940,490
Share in Fish	63.62%	36.38%	
1957-1983			
Total Landings (No.Pinks)	33,281,028	32,195,388	65,476,416
Share in Fish	50.83%	49.17%	
1983 Cycle Catch			
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

TABLE XII

DAILY CATCH OF PINK SALMON, 1977-1979-1981-1983 FROM UNITED STATES CONVENTION WATERS

	JULY				AUGUST				SEPTEMBER			
Date	**1977**	**1979**	**1981**	**1983**	**1977**	**1979**	**1981**	**1983**	**1977**	**1979**	**1981**	**1983**
1					1,040			4,179	17,172		35,858	
2								5,834			461,655	
3							3,229	3,481		306,247	3,835	
4							13,656	3,390	1,641	59,389		
5	220		32			14,791	11,571		152,848			
6	203		110		854	33,009	13,013	1,568	10,868			
7	71		23		8,841	34,056	4,538	3,168			18,918	
8	189		91		109		6,772	7,852			471,496	
9					8,300		18,899	6,118			40,374	80,267
10					644		21,083	1,567			36,505	292,682
11			200				26,709				4,353	136,841
12			666				12,446				24,795	
13			164			42,539	10,487		219		105,752	
14			256		1,796	132,837	11,252				53,736	163,495
15					46,828	113,410					6,130	250,517
16	1,776	4,266			70,333			6,221	5,344	12,762	7,113	45,826
17	409	925						42,926	55	70,785	35,350	48,937
18		1,608					165,098	42,297		3,790	11,586	
19						7,602	177,216		36	1,620	1,462	23,282
20			2,609			476,678	88,850		2,042		337	71,637
21			2,325		23,559	478,797	79,974	6,277	1,623		4,793	
22		5,203	4,100		446,813	95,190		55,275	995		7,447	
23		13,237			246,590	345,863		55,356			3,024	
24	2,163	8,198			275,569	60,371		45,182				
25	4,015			1,200	21,322	28,794	483,314					
26	1,363			2,037	20,728	548,344	498,424	13,005	743			
27			9,255	3,156		457,938	115,077	48,861	780			
28			3,202			35,947	136,034	31,670	243			
29					9,689	347,355	170,459	122,634				
30	422	12,529			360,684	15,619	273,423	138,926				
31	4,657	3,019			250,303	12,722						
Totals	15,488	48,985	23,033	6,393	1,794,002	3,281,862	2,341,524	645,787	194,609	454,593	1,334,519	1,113,484
Troll	40,202	34,918	35,736	1,812	118,162	224,700	139,418	102,416	4,394	2	479	200
Monthly Totals	55,690	83,903	58,769	8,205	1,912,164	3,506,562	2,480,942	748,203	199,003	454,595	1,334,998	1,113,684
June & Oct. Totals									1,573	1,213	862	538
Season Totals									2,168,430	4,046,273	3,875,571	1,870,630

TABLE XIII

DAILY CATCH OF PINK SALMON, 1977-1979-1981-1983 FROM CANADIAN CONVENTION WATERS

	JULY				AUGUST				SEPTEMBER			
Date	**1977**	**1979**	**1981**	**1983**	**1977**	**1979**	**1981**	**1983**	**1977**	**1979**	**1981**	**1983**
1					12,490				50,134			
2					5,713			273				
3							234					
4	75						5,331			49,036		
5									30,598			
6					1,433	75,235			108,270		248,776	34,692
7					23,843	499	758				150,069	
8					20,702				69,472		121,764	
9		66			24,390						52,801	89,817
10					693						48,062	
11							747					
12						1,547	77,045		28,051			37,414
13	172					119,176	101,425		1,279			32,657
14						155,509			44,759		154,919	28,634
15					207,768							139,676
16		165			116,168	2,886						
17										6,309		98,984
18							93,787			3,678		82,413
19							105,277		548			104,745
20	173		260			317,597			126			69,824
21	152					240,369			9,285			69,633
22					37,831	98,272	4,006	24,485				45,460
23		182			136,178	2,467						
24					55,838		226,658					
25	4,633					623,102	293,375	9,102				
26	120					384,563	237,385					
27			12,232	263		244,486						
28												
29					3,685		384,824	22,435				
30		175				257,934	432,006	28,644				
31					87,617		389,248					
Totals	5,325	588	12,492	263	734,349	2,523,642	2,352,106	84,939	342,522	59,023	776,391	833,949
Troll	274,529	129,511	123,278	501	604,639	1,297,321	667,981	90,484	45,067	35,543	249,699	57,765
Spring Salmon Gill Nets									3,527			
Monthly Totals	279,854	130,499	135,770	764	1,338,988	3,820,963	3,020,087	175,423	391,116	94,566	1,026,090	891,714
June & Oct. Totals									65,520	85,327	5,906	1,959
Season Totals									2,075,478	4,131,355	4,187,853	1,069,860

TABLE XIV

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

District and Streams	*1983 Period of Peak Spawning*	*Estimated Number of Pink Salmon* 1977	1979	1981	1983
EARLY RUNS					
LOWER FRASER					
Main Fraser	Oct. 7-14	775,016	1,521,856	2,252,368	3,307,834
FRASER CANYON					
Coquihalla River	Oct. 10-15	2,821	16,468	24,029	29,190
Jones Creek	Oct. 11-13	3,350	4,993	4,485	973
Misc. Tributaries	Oct. 1-27	3,687	4,149	14,720	16,293
SETON-ANDERSON					
Seton Creek	Oct. 14-20	341,256	549,512	519,393	407,791
Upper Seton Channel	Oct. 14-20	11,122	9,956	10,402	9,691
Lower Seton Channel	Oct. 14-22	37,163	34,494	33,846	31,045
Portage Creek	Oct. 10-17	19,904	51,842	18,733	10,202
Bridge River	Oct. 12-16	25,800	65,759	43,940	41,909
Gates Creek	—	96	1,277	88	0
THOMPSON					
Thompson River and Tributaries	Oct. 7-18	972,941	885,402	1,166,348	512,398
TOTALS *		2,193,156	3,154,945	4,097,269	4,373,049
LATE RUNS					
HARRISON					
Harrison River	Oct. 22-28	126,782	269,858	314,519	146,014
Chehalis River	Oct. 12-15	2,613	2,067	169	452
Weaver Creek	Oct. 20-25	2,397	117	1,006	1,439
Weaver Channel	Oct. 20-25	963	737	1,287	1,887
CHILLIWACK-VEDDER					
Chilliwack-Vedder River	Oct. 14-18	48,561	124,041	68,601	99,240
Sweltzer Creek	Oct. 25-Nov. 4	5,093	8,889	5,213	9,134
TOTALS *		186,409	405,709	391,067	258,572
GRAND TOTALS *		2,387,811	3,560,654	4,488,336	4,631,621

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

TABLE XV

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

United States Spawning Areas	1977	1979	1981	1983
Nooksack	25,000	31,400	15,000	60,000
Skagit	500,000	300,000	100,000	470,000
Stillaguamish	38,000	135,000	18,000	126,100
Snohomish	125,000	180,000	90,000	198,000
Puyallup	28,800	28,500	11,500	11,600
Dosewallips	16,300	13,900	1,700	4,300
Duckabush	10,800	11,900	2,300	8,700
Dungeness	35,500	50,000	2,900	2,800
Elwha	5,000	7,100	200	200
Miscellaneous	38,500	19,500	4,200	13,900
TOTALS	822,900	777,300	245,800	895,600

Canadian Non-Fraser Spawning Areas	1977	1979	1981	1983
Jervis Inlet	26,000	13,750	29,430	7,220
Howe Sound	3,200	4,725	13,925	1,425
Burrard Inlet	22,130	22,475	41,450	25,070
TOTALS	51,330	40,950	84,805	33,715

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

COMMISSION PUBLICATIONS, 1983

1. Annual Report of the International Pacific Salmon Fisheries Commission for 1982.
2. Potential Effects of The Kemano Completion Project on Fraser River Sockeye and Pink Salmon.

STAFF PUBLICATIONS IN OTHER JOURNALS

1. Studies related to biological detoxification of kraft pulp mill effluent. VI. The Biodegradation of 12,14-Dichlorodehydroabietic Acid with *Mortierella isabellina*. James P. Kutney, Eugene Dimitriadis, Gary M. Hewitt, Philip J. Salisbury, Mahatam Singh, James A. Servizi, Dennis W. Martens and Robert W. Gordon. Helvetica Chimica Acta, Vol. 66, Fasc. 3, p. 921-928. 1983.
2. Studies related to biological detoxification of kraft pulp mill effluent. VII. The biotransformation of 12-Chlorodehydroabietic Acid with *Mortierella isabellina*. James P. Kutney, Gary M. Hewitt, Philip J. Salisbury, Mahatam Singh, James A. Servizi, Dennis W. Martens and Robert W. Gordon. Helvetica Chimica Acta, Vol. 66, Fasc. 7, p. 2191-2197. 1983.

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M. Berg	1952-1955
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R. H. Stanton	1960-1969
M. Guns	1969-1971 1975-1979
W. Edwards	1971-1973
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H. Staveness	1958-1975
Nick Carr	1976-

Sports Fishermen

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

Native Indians

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Salmon Processors

C. J. Collins	1938-1949
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D. Franett	1972-1980
J. Lind	1980-

Purse Seine Fishermen

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

Gill Net Fishermen

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

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-

Reef Net Fishermen

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

Sports Fishermen

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

Native Indians

C. Peterson	1981-

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