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
1967

COMMISSIONERS

SENATOR THOMAS REID
W. R. HOURSTON
RICHARD NELSON
DeWITT GILBERT
CLARENCE F. PAUTZKE
THOR C. TOLLEFSON

NEW WESTMINSTER
CANADA
1968

INTERNATIONAL PACIFIC SALMON FISHERIES COMMISSION

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DIRECTOR OF INVESTIGATIONS
LOYD A. ROYAL

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REPORT OF THE
INTERNATIONAL PACIFIC SALMON FISHERIES COMMISSION
FOR THE YEAR 1967

The estimated 1967 Fraser River sockeye run totalled 6,500,000 fish, the largest run on the cycle since 1899 and for any year since 1958. The Fraser River pink salmon run was estimated at 12,740,000 fish, approaching the magnitude of any previous run since 1947. The major share of the population of each species was available in Convention waters as usual. However, increasing numbers of pink salmon have been taken in recent years by trollers outside Convention waters off the west coast of Vancouver Island, Washington and Oregon.

The favorable return of the Fraser River sockeye and pink salmon runs came at an opportune time, for pink salmon runs elsewhere, with few exceptions, were mediocre in size or relative failures, and sockeye were in short supply because of an off-year run to Bristol Bay, Alaska. While good runs of both pinks and sockeye were predicted for 1967, the return of 3,100,000 sockeye destined for Adams River from a brood escapement of 156,000 spawners exceeded the Commission's most optimistic expectations. Such favorable returns raised considerable interest and prompted questions by a knowledgeable fishing industry, questions which apparently have not been answered satisfactorily in the general terms used previously in the Commission's reports to the industry. However, the Commission has refrained from utilizing specifics in its pre-season predictions of run size, pending accumulation of more thorough knowledge of the individual factors related to ultimate survival and assessment of the possible interrelationships of these factors. Without full knowledge of how the apparent controlling factors operate, individual judgment must be exercised in weighing the relative importance of each in predicting ultimate survival. Such judgment is difficult to express as a usable formula.

For five of the last six years preceding the record 1967 population, the annual Fraser River sockeye runs have not been particularly productive, although a few important exceptions have occurred in individual cases such as the return of 1,177,000 fish destined for the Horsefly River in 1965. The question arises as to why the return in 1967 was almost phenomenal, while returns in all other recent years except 1963 have been unfavorable. Similarly, since 1957, runs of pink salmon to the Fraser River were poor for three cycle years, and of fair size for one year during the period prior to the excellent return in 1967. What caused the poor runs and what was responsible for the good run in the current year? More specific questions can also be raised. Why did only 2,200,000 adult pink salmon return from a fry production of 284,000,000 from the 1963 brood when 12,740,000 adults returned from a fry production of 274,000,000 from the 1965 brood? Why would 1,150,000 Adams River spawners in 1962 return only 2,700,000 adults in 1966, when 156,000 spawners in 1963 returned 3,100,000 sockeye in 1967? At Chilko Lake, why did 35,000,000 sockeye smolts from the 1960 brood produce only 958,000 adults in 1964, when 10,000,000 smolts from the 1963 brood year produced 1,000,000 adults in 1967? There are many other similar examples, all requiring a thorough knowledge of salmon population dynamics to explain.

In view of the great variation in survival of Fraser River sockeye and pink salmon runs in recent years, the Commission is prepared to depart from its usual conservatism and attempt to indicate the possible answers. It does so recognizing

that similar explanations may not apply elsewhere and also that the explanations detailed now may have to be modified in future years as additional knowledge is gained on the subject of complex salmon populations. If the present discussion will stimulate others to help in obtaining the required fundamental knowledge, and will aid in maintaining the confidence of the industry which is dependent on the resource under Commission management, the effort will be considered worthwhile.

Any initial study of population dynamics must begin by following a philosophy based on all available facts, but must necessarily be limited in scope by the size of the research organization. After careful analysis, the Commission has limited its studies to the effects of freshwater and estuarial environment on survival, based on the philosophy that these environments control adult survival no matter where or when mortality occurs. This logic originates from the evidence that the year class size of marine fishes tends to be set early in life, and that rather extreme variation may occur in the adult return of individual salmon stocks in the same year, even though they form a homogeneous population during residence in the high seas.

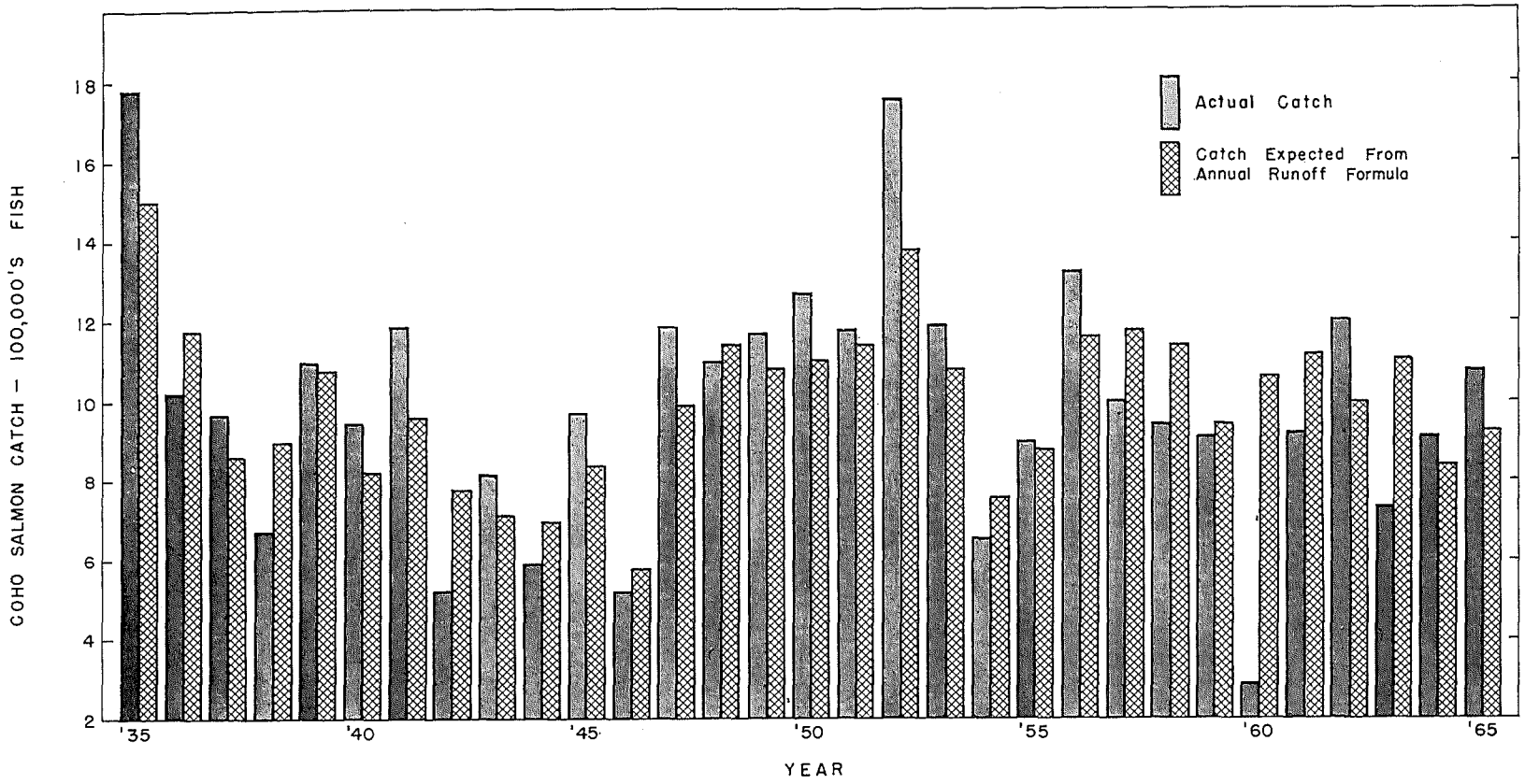
The background for the Commission's environmental studies of Fraser River sockeye and pink salmon is a study of coho (silver) salmon initiated by the Director of the Commission when he was previously associated with the Washington State Department of Fisheries. This study examined the possible effect of variations in stream flow during the stream life of young coho on the number of returning adults, and was subsequently published (Smoker, 1955)[1]. The original data have been brought up to date through the courtesy of the Washington State Director of Fisheries.

Although Smoker was unable to establish a relationship between stream flow and survival for individual streams, he found that annual precipitation in Western Washington during the year of stream life of the young coho was closely related to the regional abundance of adult coho in the year of maturity. A deviation was noted in the relationship in years having very dry summers and a correction factor was incorporated to adjust for this situation. An additional modification has been added in recent years by Washington State biologists, since a significant proportion of the total coho population is now produced by improved hatchery rearing operations. Using a modified formula as discussed above, the accompanying figure illustrates the remarkable relationship between the predicted coho production, a year in advance of the adult return, and the actual catch. It is interesting to note that the size of the escapement, which is not known, is not utilized in compiling the size of the predicted catch. The failure of the formula to predict the drop in the 1960 catch shows that unusual circumstances can intervene to upset the normal situation.

In 1957, when the Commission's terms of reference were expanded to include responsibility for pink salmon in Convention waters, one of the first investigations examined possible relationships between environmental conditions during the early life history of Fraser River pink salmon and their adult abundance. Vernon (1958)[2] established a number of such relationships but was unable at the

[1]Smoker, W.A. 1955. Effects of streamflow on silver salmon production in Western Washington. Univ. of Wash., Ph.D. Thesis, 175 pp.

[2]Vernon, E.H. 1958. An examination of factors affecting the abundance of pink salmon in the Fraser River. Internat. Pacific Salmon Fish. Comm., Prog. Rept. 5, 49 pp.



Actual and Expected Catches of Coho Salmon off the coast of Western Washington, 1935-1965

time to assess their individual importance or potential mode of operation. With additional information now available, further examination of these and other relationships has added to the understanding of pink salmon survival.

The individual Fraser River pink salmon populations are large in size and few in number. The major portion of each year's run spawns in streams subject to what might be termed a continental climate and, because of this, incubation in several different streams takes place in much the same relative environment. This part of the total population spawns in the main Fraser River between Chilliwack and Hope, B.C., in the main Thompson River between Spences Bridge and Kamloops Lake, and in Seton Creek. The biennial size of these three populations tends to overshadow the variations in the other two substantial runs spawning in the Harrison and Chilliwack-Vedder Rivers. The two latter spawning streams have individual environments not necessarily related to the main Fraser, the Thompson River, Seton Creek or to each other. The Harrison population spawns in a relatively warm lake outlet stream subject to coastal climate. Spawning occurs later than in other areas and the Harrison fry are the first to emigrate in the spring. The Chilliwack-Vedder population is subject to a coastal climate similar to most pink salmon streams draining directly into the North Pacific area. Fortunately, dry fall weather does not create any of the usual low water problems in the Chilliwack-Vedder system, but extreme floods during spawning or incubation of the eggs can result in serious losses.

Since the continental climate affects by far the largest segment of the Fraser River pink salmon population, the total size of the returning runs (even though the Harrison and Chilliwack-Vedder populations are included) can be used to assess the possible influence of this environment. Three environmental factors are now known to be related to the survival of this major segment of the pink salmon population. The first factor involves the flow of the Fraser River at peak spawning time. Flow during this period, although dropping, is governed to some extent by fall rains, hence it can fluctuate considerably from year to year. The Fraser flow then continues to decline, reaching a fairly stable low winter level. The higher the flow at spawning time, the greater the winter exposure of the spawning beds when water levels drop, with a related decrease in the egg-to-fry survival. In the table to follow, the term "poor" for spawning flow represents a Hell's Gate gauge reading of over 33, a "fair" flow lies between gauge readings of 27 and 33, and a "good" flow is any point below gauge 27.

The second environmental factor related to pink salmon survival is water temperature during the alevin stage of the incubation period. In the following table, incubation temperature represents the mean water temperature of the Fraser River measured at New Westminster for the months of December, January and February. This period covers the stage of pink salmon development leading up to emergence of the fry and, based on limited evidence, thermal environment during this period may determine condition of the fry. The relationship between ultimate survival and water temperature is inverse, with low mean temperatures related to good returning runs and high mean temperatures to poor returning runs. The range in recorded mean temperatures lies between 35° and 41.5°F.

When pink salmon fry leave the Fraser River, beginning in March, they seek the shallow waters adjacent to the islands lying westerly and southerly of the river mouth. They feed voraciously and grow at a rapid rate. By late July,

young pink salmon appear in schools in the deeper waters and gradually emigrate to the high seas. Similar to the second environmental factor, an inverse relationship exists also between water temperature in the estuarial area from April to August and eventual adult survival. Just how important the mean estuarial temperature is to ultimate survival remains to be determined, for there are indications of some relationship between the incubation temperature in the Fraser River and the estuarial temperature the following summer.

An examination of the following table reveals that when all three environmental factors are "good", as discussed above, the returning pink salmon run is "good". When one or more factors fall below the classification of "good" the run almost always returns at a fair or poor level.

Classification of Three Environmental Factors Related to Survival of Fraser Pink Salmon

Brood Year	*Peak Spawning Flow*	*Incubation Temperature*	*Estuarial Temperature*	*Returning Run*
1927	Good	Good	Good	Good
1929	Good	Good	Good	Good
1931	Good	Good	Fair	Fair
1933	Good	Poor	Poor	Fair
1935	Good	Fair	Fair	Poor
1937	Good	Fair	Poor	Poor
1939	Good	Poor	Poor	Poor
1941	Poor	Poor	Poor	Poor
1943	Good	Fair	Fair	Fair
1945	Good	Fair	Good	Good
1947	Good	Good	Good	Good
1949	Good	Good	Good	Good
1951	Good	Good	Good	Good
1953	Good	Good	Good	Good
1955	Good	Good	Fair	Fair
1957	Good	Poor	Poor	Poor
1959	Poor	Poor	Good	Poor
1961	Good	Fair	Good	Fair
1963	Fair	Poor	Good	Poor
1965	Good	Good	Good	Good

In the table above, the size of the escapement is not considered except in recent years since it was not known accurately prior to 1957. This does not mean the escapement is not of significance but that the variation in escapements for the years listed merely affected the size of the runs within the arbitrary categories of poor, fair and good.

Since Vernon's report was published in 1958, the Commission has enumerated the pink salmon escapements to the Fraser River, estimated the resulting fry production, made continuing observations of abundance in the estuary, and through a formula devised by the Pink Salmon Coordinating Committee is now able to estimate the total Fraser pink run regardless of the number caught outside Convention waters. The following table illustrates in some detail the survival history of the last two Fraser River pink salmon runs.

	1963 Brood	*1965 Brood*
Escapement	1,953,000	1,191,000
Peak Spawning Flow Measured at Hell's Gate	Gauge 33 (Fair)	Gauge 22 (Good)
Fry Production	284,000,000	274,000,000
Incubation Temperature	39.5°F (Poor)	37.6°F (Good)
Estuarial Temperature	56.3°F (Good)	57.2°F (Good)
Abundance Observations by Purse Seiners in Late July	Poor	Good
Returning Run	2,200,000	12,740,000
Fry-to-Adult Survival Rate	0.8%	4.65%

Admittedly, two years of accurate data compared above are too few to provide definitive answers. With the accumulation of more years of similar measurements and more knowledge regarding the functioning of these environmental factors in controlling survival of Fraser River pink salmon, any conclusions could be modified or strengthened. However, when one examines the previous classification table, certain conclusions based on these more detailed data appear to be logical. It would appear now that:

1. A large egg-to-fry mortality occurred in the year of the larger escapement because of high spawning flow and subsequent winter exposure. Thus, even though the escapement in 1963 was 64 per cent greater than in 1965, the fry hatch for both years was essentially the same. Any suggestion that the larger escapement was less productive because of its larger size is not considered to be pertinent at the moment because of the vast area of available spawning grounds.

2. A heavy mortality of the 1963 brood of fry apparently occurred in the Fraser River estuary between their spring emigration and late July. During the latter period schools of fingerlings are observed in the nets of salmon purse seiners. These four- to five-inch pink salmon tend to remain in the seine net until alarmed when they diperse through the net with ease. The scarcity of fingerlings in the summer following the 1963 brood year was quite acute, whereas an abundance of these fish was obvious following emigration of the 1965 brood fry population.

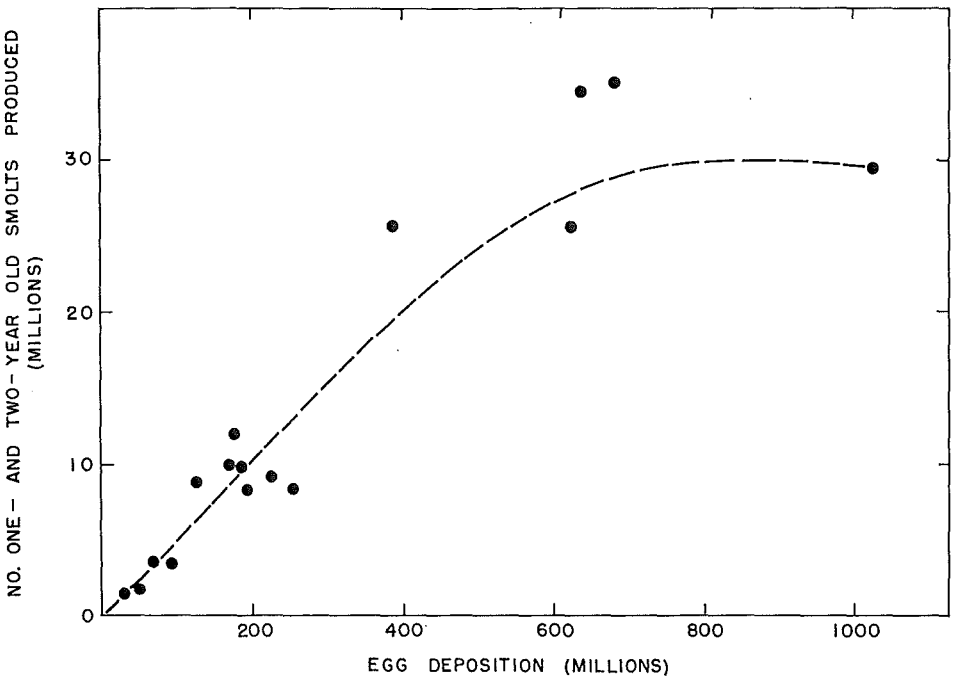
3. The mortality of the 1963 brood fry population was apparently the result of warm incubation temperatures, whatever may have been the direct cause of mortality. If the estuarial temperature, such as was evident in the summer following 1963, is accepted as favorable to survival, then the mortality could have been the result of unfavorable incubation temperatures even though this mortality occurred in the estuary.

In seven of the 20 years used in relating environmental factors to the return of Fraser River pink runs, all three factors were rated as "good" and the returning runs were "good". In 12 other years where one or more factors were rated below the "good" classification, the returning run was also below the "good" classification. Only once, for the 1945 brood, was a "good" return produced in spite of an incubation temperature classed as "fair". However, analysis of this run reveals that the major portion of the population was produced by the Harrison and Vedder Rivers, areas not influenced by the incubation temperature recorded on the main Fraser.

The importance of the relationship established between environment during the early life of Fraser River pink salmon and ultimate survival cannot be ignored and provides further justification for the Commission to direct its research program to a study of *how* early environment limits salmon populations. In making this decision the Commission wishes to emphasize once again that any such relationship established for Fraser River salmon may not apply in other areas where environments during the early life history of salmon may be quite different. Conceivably such environments could be so consistent from year to year that only the size of the escapement would affect the size of the returning run.

In the examination of possible relationships between the freshwater environment of Fraser River sockeye and ultimate adult survival, the Commission is fortunate to have detailed life history data on the sizeable Chilko sockeye population collected for the past 16 annual populations. Investigations of the effect of environment could not progress without these valuable background data which measure survival through each stage in the sockeye life history.

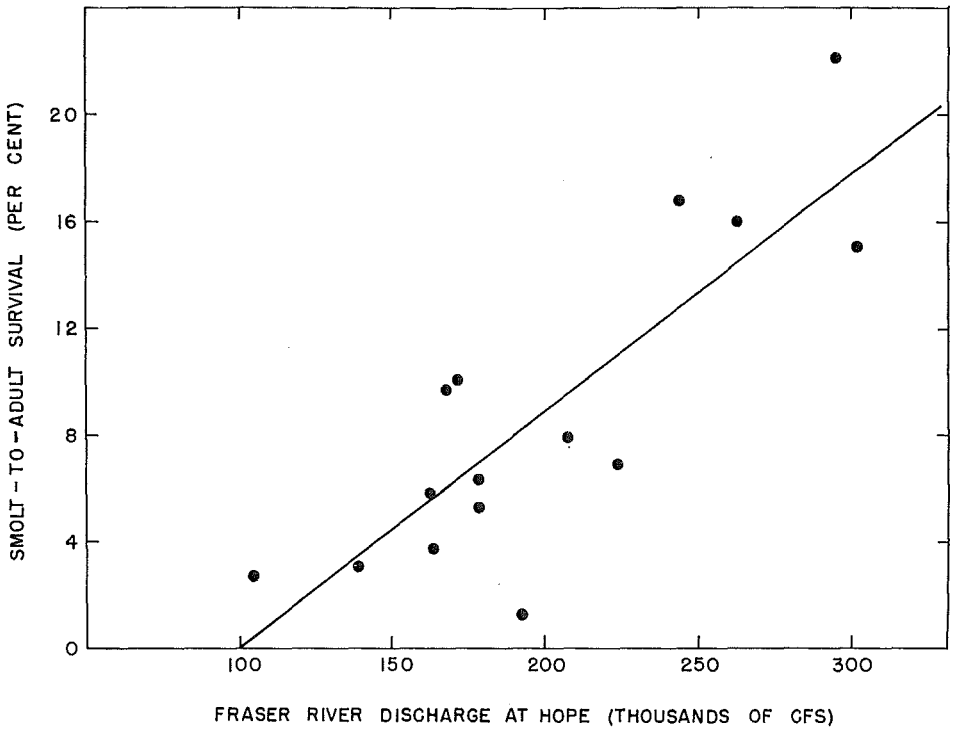
Spawning and incubation environments for sockeye at Chilko are reasonably consistent from year to year, except when high water temperatures at spawning time occasionally result in the mortality of unspawned adults. Of the eggs actually deposited there is a close relationship to the number of emigrating smolts produced. In the illustration of egg-to-smolt survival shown below, the consistency of this relationship is further emphasized when it is noted that in the two years having the largest smolt migration, the survival rate was increased by the removal of a substantial number of highly predacious char from Chilko Lake.



Relationship of egg deposition and smolt production, Chilko Lake sockeye.

The foregoing figure demonstrates that the number of yearling and two-year-old smolts emigrating from Chilko Lake is related quite closely to the number of effective spawners. Thus within the limits shown, it would be possible to predict the number of smolts on the basis of the spawning escapement, without regard to the environment prevailing during the incubation period or during the one to two years of lake residence.

Records of returning Chilko sockeye runs show that a highly variable mortality occurs after the smolts leave Chilko Lake. In the past 15 years, the smolt-to-adult survival rate has varied from approximately 1 to 22 per cent. With evidence available that Fraser River sockeye smolts migrate to the high seas without any appreciable delay in the river or estuary, and at a rather remarkable rate of travel, the obvious conclusion would be that the large variation in survival rate is the result of conditions on the high seas. Such a conclusion probably would be erroneous. As illustrated below, the highly variable smolt-to-adult survival rate is shown to be related to the discharge of the Fraser River at the approximate time of smolt downstream migration. However, investigations to date have not resolved the question of whether the Fraser flow directly affects survival or whether it represents a series of preceding environmental conditions which determine the *ability* of the smolts to survive.



Fraser River discharge 15 days after smolts leave Chilko Lake (weighted to relative smolt abundance) and per cent survival to adults.

The foregoing data demonstrate that the production of sockeye smolts at Chilko is easily solved by procuring maximum escapements each year. However, large numbers of smolts do not always return large numbers of adults, so the production of smolts does not in reality solve the problem. This precipitates the question—what causes the extreme variation in smolt-to-adult survival rate which produces an equally variable impact on the economy of the fishery? Since the survival rate of smolts appears to be established before their seaward migration, the answer may lie in the physical condition of the smolts as they proceed to their marine habitat. The study of smolt condition inaugurated by the Commission in 1966 may thus provide the answer to variability in survival of the year classes of sockeye smolts.

Since smolt-to-adult survival rates vary so widely, the size of the returning adult sockeye runs would appear to be due solely to conditions beyond the control of the Commission or of the industry dependent on the resource. No doubt random environmental changes bring about some variation in the ability of a smolt to survive, resulting in similar variation in the size of the annual runs. However, superimposed on this random variability may be an ecological force which creates a quadrennial pattern in most Fraser sockeye populations of one large run, one smaller run and two very small runs, known as dominance. The environmental force, causing indiscriminate variation in survival, and the dominance-causing force which results in a relatively consistent variation in survival between the year classes could be so intimately related that a radical change in one may upset the effects of the other. The sensitivity of sockeye to these two controlling forces on ultimate survival, which appear to exist in fresh water, indicates the possible necessity of a careful control of annual escapements. Conceivably, an imbalance in the annual escapements of a race having a dominance-controlling factor might bring one or both of the forces controlling survival into operation in a manner adversely affecting the size of all returning runs.

If both the inconsistent and the consistent controls on the survival of sockeye smolts are reflected in the condition of the smolt, it may be extremely difficult to differentiate between the two. However, with the condition of Chilko smolts now being evaluated each year, and the condition of the smolts being determined for all dominant year classes elsewhere in the watershed, it is hoped that such a differentiation can be accomplished.

The existence of quadrennial dominance in the Chilko sockeye population is evident in all available escapement records for earlier years, as shown in the following table.

CHILKO SOCKEYE ESCAPEMENT RECORDS

Provincial Department of Fisheries Reports	1906	Few fish	
	1907	Few fish	
	1908	Good run	
	1909	*Bumper run*	
	1910	No record	
	1911	Few fish	
	1912	Good run	Large number of jacks
	1913	*Bumper run*	
	1914	Few fish	
Federal Department of Fisheries Reports	1926	1,500	All figures believed to be low but still should be relative
	1927	400	
	1928	20,000	
	1929	*70,000*	
	1930	900	
	1931	2,500	
	1932	70,000	
	1933	*100,000*	
	1934	3,500	
	1935	2,500	
	1936	74,000	Sub-dominant run
	1937	*110,000*	Dominant run
	1938	7,000	
Commission Data	1939	2,000	
	1940	300,000	Sub-dominant run
	1941	*580,000*	Dominant run badly blocked at Hell's Gate
	1942	34,000	
	1943	13,500	
	1944	*328,000*	New dominant year
	1945	*192,000*	Large number of 5-year-olds (1940 brood)
	1946	59,000	Not fished
	1947	50,000	Not fished
	1948	*670,000*	Dominant year
	1949	59,000	Old dominant year gone
	1950	29,000	Large number of jacks
	1951	118,000	New sub-dominant run
	1952	*490,000*	Dominant year

The structure of the Chilko population, represented by one very large run preceded by a smaller run and followed by two very small runs, maintained itself in spite of the Hell's Gate obstruction until 1941. In that year, a large escapement from the dominant run was obstructed, delayed, and physically injured by high water at Hell's Gate. The effects of the Hell's Gate obstruction in 1941 apparently resulted in a shift of dominance to the year of the sub-dominant run, becoming obvious in 1944-1945, and created a new sub-dominant run on the 1943 cycle, becoming obvious in 1951. Starting in 1959, a second and similar shift apparently occurred in the dominance pattern at Chilko due to unbalanced escapements. The existence of such a shift has not been proved as yet since Fraser River flow has, in itself, accounted for all fluctuations in smolt-to-adult survival rate through 1967. The true test will come when the "dominant" Chilko run returns in 1968. A large emigration of smolts in 1966 during a high flow indicates an excellent run in 1968. However, the condition of these smolts, as measured in the inaugural year of the Commission's observations,

was very poor and a very small number of three-year-old jacks returned in 1967. Thus, if the 1968 run is poor it will be in contrast to all previous years of favorable flow when the returning runs were good. If such is the case, the existence of a dominance-controlling factor, whatever it is, should be apparent and distinct from the indiscriminate environmental effects which appeared favorable to a good run.

Another situation involving the Adams River sockeye population has had a major impact on the fishery. An all-time record run occurred in the dominant cycle year of 1958. This run was followed by two relative failures in the cycle years of 1962 and 1966. In 1967, the sub-dominant cycle year, 3,100,000 sockeye returned from a brood year escapement of only 156,000 fish, a greater return than was produced in 1966 by 1,150,000 spawners in the dominant cycle year of 1962. Escapements and returns of the last four dominant and sub-dominant cycles of Adams River sockeye are listed below.

Adams River Sockeye Escapements and Total Returns

Dominant Run			*Sub-Dominant Run*		
Brood Year	*Escapement*	*Return*	*Brood Year*	*Escapement*	*Return*
1950	1,268,000	9,310,000			
			1951	145,000	540,000
1954	2,066,000	15,103,000			
			1955	63,000	818,000
1958	2,274,000	2,036,000			
			1959	135,000	342,000
1962	1,150,000	2,700,000			
			1963	156,000	3,100,000

It is unfortunate that physical conditions in the Adams River-Shuswap Lake area are not satisfactory for accurate measurement of mortalities during the various stages in the early life history of this sockeye population as was done with the Chilko population. However, an attempt has been made to index the Adams smolt populations produced by escapements in the dominant brood years of 1954, 1958 and 1962. Although the total numbers of smolts are not known, the relative abundance of these three year classes provides evidence that the size of returning adult runs may be in proportion to the number of emigrating smolts. Limited observations in 1965 also indicated that a substantial run of smolts migrated seaward to produce the large returning adult run in 1967. This evidence of some consistency in the smolt-to-adult survival rate is in direct contrast to the findings at Chilko, but tends to support the conclusion of Ward and Larkin (1964)[3] that dominance in the Adams River run is maintained by a mortality created by a predator population.

While "condition" may be the cause of dominance at Chilko, and predation the cause at Adams, the two factors may not be unrelated. Predator removal at Cultus Lake by Foerster and Ricker (1941)[4] increased the number of smolts

[3]Ward, F.J. and P.A. Larkin. 1964. Cyclic dominance in Adams River sockeye salmon. Internat. Pacific Salmon Fish. Comm., Prog. Rept. 11, 116 pp.

[4]Foerster, R.E. and W.E. Ricker. 1941. The effect of reduction of predaceous fish on survival of young sockeye salmon at Cultus Lake. J. Fish. Res. Bd. Canada, 5(4): 315-336.

emigrating from the lake and brought about a temporary increase in the number of returning adults. This increase was short-lived, however, as "condition" of the smolts underwent a sharp decline and apparently substituted for the predator factor in controlling adult survival. Thus the direct cause of dominance could conceivably vary from lake to lake but would be the result of an ecological equilibrium, each lake having a different balance of forces operating within a quadrennial cycle. In such a situation, an artificial interference with one force in balance with others could conceivably bring another force into operation, resulting in the same type of population control. Perhaps, as Ward and Larkin intimate, the unbalancing of annual escapements within the quadrennial cycle could upset the ecological equilibrium to a point where the dominance pattern was also upset, with an accompanying reduction in the survival rate of all year classes. So far as is known this situation has not occurred at Adams but may have happened at Chilko. It is also conceivable that a natural disturbance of the ecological balance, if sufficiently severe, could bring about a shift in the dominant run to the cycle year of the sub-dominant run.

Whether the dominant Adams run has shifted from the 1966 cycle to the 1967 cycle is not known at this time. Only by enumerating the spawning escapements, estimating the fry survival, and indexing the smolt abundance and condition of the 1966 and 1967 brood years can a start be made to assess the possibility of a shift in dominance. Once these data are collected, they can be associated with those indiscriminate environmental factors such as Fraser River flow which appear to affect the smolt-to-adult survival rate of all major Fraser River sockeye populations. Prediction of the size of returning Adams runs in 1970 and 1971 will be based on the foregoing data and on the number of three-year-old sockeye returning one year in advance of the two runs under detailed observation. If the dominant year has shifted it should be evident by the fall of 1970 when the size of the 1970 run has been established and a final prediction of the 1971 run can be formulated.

Whatever forces control the productivity of sockeye populations on the Fraser River, these forces should be operating to a varying degree on major sockeye populations elsewhere. Investigations of this species being conducted in other areas must therefore be studied carefully so that all available information can be applied to a most complex problem.

COMMISSION MEETINGS

The International Pacific Salmon Fisheries Commission held fifteen formal meetings during 1967 with the approved minutes of these meetings being submitted to the governments of Canada and the United States. The first meeting of the year was held on January 30 and 31 with Senator Thomas Reid serving as Chairman and Mr. DeWitt Gilbert as Vice-Chairman and Secretary. The Commission considered a report on the declining escapements of the Early Stuart run of sockeye in conjunction with other matters pertaining to the administration of the Commission. Mr. Frank Bublé was appointed Advisory Committee representative for purse seine fishermen of Canada to fill the vacancy left by the resignation of Captain Charles Clarke. On January 30 the Commission met with its Advisory Committee composed of the following members:

Canada	*United States*
Peter Jenewein Gill Net Fishermen	D. Milholland (alternate for Vernon Blake, resigned) Gill Net Fishermen
Frank Bublé Purse Seine Fishermen	N. Mladinich Purse Seine Fishermen
K. F. Fraser Salmon Processors	J. F. Repanich (alternate for John Plancich) Salmon Processors
H. Stavenes Purse Seine Crew Members	John Brown Reef Net Fishermen
R. H. Stanton Troll Fishermen	Charles Mechals Troll Fishermen
B. E. Calgrove (alternate for Robert Wright) Sport Fishermen	Howard Gray Sport Fishermen

The tentative recommendations for regulatory control of the 1967 sockeye and pink salmon fishery in Convention waters, as submitted to the Advisory Committee by the Commission on December 16, 1966, were reviewed and certain revisions made on the basis of the representations of the Advisory Committee.

On May 29, 1967, the Commission met in executive session to examine current operating problems. Reports were presented on the following subjects: 1. Sockeye fry and smolt production for the spring of 1967 in various areas throughout the watershed, 2. A review of log driving developments on the Stellako River, 3. The status of waste treatment processes at the pulp mills presently operating on the Fraser system. Additional reports were given on spawning channels, winter snow surveys, possible water diversion from Shuswap River to Okanagan River, and other Commission investigations. Advice was received that a closure of all Indian fishing in the main Fraser River during the Early Stuart sockeye run in concert with a similar closure of commercial fishing in Convention waters had been agreed to by the Department of Fisheries of Canada. The Commission reviewed and approved the 1968-69 fiscal year operational and construction budgets.

Eleven meetings of the Commission were required between July 25 and September 29, 1967, inclusive, to achieve as nearly as practicable, by adjustment of fishing regulations, the desired escapements and equitable division of the allowable catch of sockeye and pink salmon. One of these meetings, on August 25, 1967, was held with the Advisory Committee to discuss the development of regulatory problems during the current fishing season and the need for adjustment in existing regulations. Suggestions for changes in the existing regulations were made by the Commission's staff to close the West Beach-Discovery Bay area for the protection of an apparent small Puget Sound pink run. At the request of the Washington State Department of Fisheries this area was left open temporarily to allow the small amount of fishing effort involved to serve as a test fishery for measuring the size of the pink run. Further regulatory considerations were discussed with the Advisory Committee and modifications in the regulations were adopted. Mr. Robert Christenson attended the meeting as a representative of the United States Gill Net Fishermen replacing Mr. Vernon Blake.

The Commission met again in executive session on November 20 and 21, 1967, to deal with a number of subjects including: 1. A report on the new Gates

Creek spawning channel and also the McKinley Creek temperature control structure, 2. A review of sockeye and pink salmon production from gravel incubation areas and spawning channels operated by the Commission, 3. The status of effluent treatment at pulp mills, an oil refinery and a chemical plant, 4. A review of the 1967 sockeye and pink salmon escapements, 5. A report on the 1967 pink salmon troll catches, 6. A discussion of the proposed diversion of Shuswap River water to the Okanagan system.

The fifteenth and final meeting of the year was held on December 18 and 19, 1967, with the first day devoted to general business including the election of DeWitt Gilbert as Chairman and W. R. Hourston as Vice-Chairman and Secretary for the ensuing two years. The annual open meeting was held with the Advisory Committee on December 19, 1967, and was attended by approximately 600 representatives of the fishing industry and interested government agencies along with five former Commissioners. Senator Thomas Reid, Commission Chairman, announced his retirement from the Commission effective December 31, 1967. Senator Reid had served the Commission continuously since its inception in 1937. Mr. Gilbert paid tribute to Senator Reid's 30-year tenure on the Commission. Mr. Peter Jenewein and Mr. John Brown, representing the fishing industries of Canada and the United States, respectively, also paid tribute to Senator Reid for his vigorous effort on behalf of the Commission. The characteristics of the 1967 fishing season, a summary of possible factors influencing the size of the 1968 sockeye run in Convention waters, and the tentative proposals for regulation of this fishery were presented to the meeting for consideration by the Advisory Committee and their respective segments of the fishing industry.

1967 REGULATIONS

Recommendations for regulations governing the 1967 sockeye and pink salmon fishery in Convention waters were adopted at a meeting of the Commission held on January 31, 1967, and submitted to the two national governments for approval and to the State of Washington for implementation on February 3, 1967. The recommendations for Canadian Convention waters were implemented by the Government of Canada by an Order-in-Council dated March 22, 1967, and for United States Convention waters by an Order of the Director of Washington State Department of Fisheries on April 8, 1967.

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 that regulations to the following effect, in the interests of such fisheries, be adopted by Order-in-Council as amendments to the Special Fishery Regulations for British Columbia for the season of 1967 under authority of the Fisheries Act, namely:

1. (1) No person shall fish for sockeye or pink salmon in the waters of the southerly portion of District No. 3 embraced in Area 20 with purse seines:

(a) From the 25th day of June, 1967, to the 5th day of August, 1967, both dates inclusive; and

(b) From the 6th day of August, 1967, to the 12th day of August, 1967, both dates inclusive, except from six o'clock in the forenoon to six o'clock in the afternoon of Monday, Tuesday and Wednesday; and

(c) From the 13th day of August, 1967, to the 2nd day of September, 1967, both dates inclusive, except from six o'clock in the forenoon to six o'clock in the afternoon of Monday, Tuesday, Wednesday and Thursday of each week; and

(d) From the 3rd day of September, 1967, to the 16th day of September, 1967, both dates inclusive, except from seven o'clock in the forenoon to seven o'clock in the afternoon of Monday, Tuesday, Wednesday and Thursday of each week.

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

(a) From the 25th day of June, 1967, to the 5th day of August, 1967, both dates inclusive; and

(b) From the 6th day of August, 1967, to the 12th day of August, 1967, both dates inclusive, except from

(i) six o'clock in the afternoon of Sunday to six o'clock in the forenoon of Monday; and

(ii) six o'clock in the afternoon of Monday to six o'clock in the forenoon of Tuesday; and

(iii) six o'clock in the afternoon of Tuesday to six o'clock in the forenoon of Wednesday; and

(c) From the 13th day of August, 1967, to the 2nd day of September, 1967, both dates inclusive, except from

(i) six o'clock in the afternoon of Sunday to six o'clock in the forenoon of Monday; and

(ii) six o'clock in the afternoon of Monday to six o'clock in the forenoon of Tuesday; and

(iii) six o'clock in the afternoon of Tuesday to six o'clock in the forenoon of Wednesday; and

(iv) six o'clock in the afternoon of Wednesday to six o'clock in the forenoon of Thursday of each week; and

(d) From the 3rd day of September, 1967, to the 16th day of September, 1967, both dates inclusive, except from

(i) seven o'clock in the afternoon of Sunday to seven o'clock in the forenoon of Monday; and

(ii) seven o'clock in the afternoon of Monday to seven o'clock in the forenoon of Tuesday; and

(iii) seven o'clock in the afternoon of Tuesday to seven o'clock in the forenoon of Wednesday; and

(iv) seven o'clock in the afternoon of Wednesday to seven o'clock in the forenoon of Thursday of each week.

(3) No person shall fish for sockeye or pink salmon with hook and line or trolling gear in the waters described in subsection (1) of this section except for the purpose of personal consumption and not for sale or barter between midnight Friday and midnight the Sunday following of each week from the 11th day of August, 1967, to the 11th day of September, 1967, both dates inclusive.

2. No person shall fish for sockeye or pink salmon in the waters of the southerly portion of District No. 3 embraced in Areas 17, 18 and 19 and in the waters of District No. 1 by means of nets:

(a) From the 25th day of June, 1967, to the 15th day of July, 1967, both dates inclusive; except for those sockeye or pink salmon taken in gill nets having mesh of not less than 8 inches extension measure for linen and 8½ inches for synthetic fibre nets as authorized for the taking of spring salmon by the Regional Director of Fisheries for British Columbia and pursuant to the provisions of the British Columbia Fishery Regulations, and

(b) From the 16th day of July, 1967, to the 12th day of August, 1967, both dates inclusive, except from eight o'clock in the forenoon of Monday to eight o'clock in the forenoon of Thursday of each week; and

(c) From the 13th day of August, 1967, to the 9th day of September, 1967, both dates inclusive, except from eight o'clock in the forenoon of Monday to eight o'clock in the forenoon of Wednesday of each week; and

(d) From the 10th day of September, 1967, to the 16th day of September, 1967, both dates inclusive, except from eight o'clock in the forenoon of Monday to eight o'clock in the forenoon of Tuesday; and

(e) From the 17th day of September, 1967, to the 23rd day of September, 1967, both dates inclusive; and

(f) From the 24th day of September, 1967, to the 14th day of October, 1967, 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.

3. No person shall fish for sockeye or pink salmon except by angling or trolling for the purpose of personal consumption and not for sale or barter in the Convention waters of Canada (the waters of Howe Sound excepted), lying easterly and inside of a straight line projected from Gower Point at the westerly entrance to Howe Sound to Thrasher Rock light, thence in a straight line to Salamanca Point on the southerly end of Galiano Island, thence in a straight line to East Point on Saturna Island, thence in a straight line towards Point Roberts light to the intersection with the international boundary line, thence following the international boundary line to its intersection with the mainland from the 27th day of August, 1967, to the 7th day of October, 1967, both dates inclusive, except at the times that net fishing other than with spring salmon nets may be permitted within this area.

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

United States Convention Waters

"The International Pacific Salmon Fisheries Commission appointed pursuant to the Convention between Canada and the United States of America for the protection, preservation and extension of the Sockeye Salmon Fisheries in the Fraser River System, signed at Washington on the 26th day of May, 1930, as amended by the Pink Salmon Protocol signed at Ottawa on the 28th day of December, 1956, hereby recommends to the Director of Fisheries of the State of Washington, that regulations to the following effect in the interests of such fisheries, be adopted by him for the year 1967 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 fish for sockeye or pink salmon in the Convention waters of the United States of America lying westerly of a straight line drawn from Angeles Point in the State of Washington across Race Rocks to William Head in the Province of British Columbia with purse seines:

(a) From the 25th day of June, 1967, to the 5th day of August, 1967, both dates inclusive; and

(b) From the 6th day of August, 1967, to the 12th day of August, 1967, both dates inclusive, except from half past five o'clock in the forenoon to half past nine o'clock in the afternoon of Monday, Tuesday and Wednesday; and

(c) From the 13th day of August, 1967, to the 16th day of September, 1967, both dates inclusive, except from five o'clock in the forenoon to nine o'clock in the afternoon of Monday, Tuesday, Wednesday and Thursday of each week.

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

(a) From the 25th day of June, 1967, to the 5th day of August, 1967, both dates inclusive; and

(b) From the 6th day of August, 1967, to the 12th day of August, 1967, both dates inclusive, except from

(i) seven o'clock in the afternoon of Monday to nine o'clock in the forenoon of Tuesday; and

(ii) seven o'clock in the afternoon of Tuesday to nine o'clock in the forenoon of Wednesday; and

(iii) seven o'clock in the afternoon of Wednesday to nine o'clock in the forenoon of Thursday; and

(c) From the 13th day of August, 1967, to the 16th day of September, 1967, both dates inclusive, except from

(i) six o'clock in the afternoon of Sunday to nine o'clock in the forenoon of Monday; and

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

(iii) six o'clock in the afternoon of Tuesday to nine o'clock in the forenoon of Wednesday; and

(iv) six o'clock in the afternoon of Wednesday to nine o'clock in the forenoon of Thursday of each week.

(3) No person shall fish for sockeye or pink salmon in the waters described in subsection (1) of this section with commercial trolling gear from the 11th day of August, 1967, to the 11th day of September, 1967, both dates inclusive, except from midnight Sunday to midnight Friday of each week.

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

(a) From the 25th day of June, 1967, to the 8th day of July, 1967, both dates inclusive; and

(b) From the 9th day of July, 1967, to the 22nd day of July, 1967, both dates inclusive, except from

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

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

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

(c) From the 23rd day of July, 1967, to the 12th day of August, 1967, both dates inclusive, except from

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

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

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

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

(d) From the 13th day of August, 1967, to the 30th day of September, 1967, both dates inclusive, except from five o'clock in the forenoon to nine o'clock in the afternoon of Monday, Tuesday, Wednesday and Thursday of each week.

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

(a) From the 25th day of June, 1967, to the 8th day of July, 1967, both dates inclusive; and

(b) From the 9th day of July, 1967, to the 22nd day of July, 1967, both dates inclusive, except from half past five o'clock in the forenoon to half past nine o'clock in the afternoon of Monday and Tuesday of each week; and

(c) From the 23rd day of July, 1967, to the 12th day of August, 1967, both dates inclusive, except from half past five o'clock in the forenoon to half past nine o'clock in the afternoon of Monday, Tuesday and Wednesday of each week; and

(d) From the 13th day of August, 1967, to the 30th day of September, 1967, both dates inclusive, except from five o'clock in the forenoon to nine o'clock in the afternoon of Monday, Tuesday, Wednesday and Thursday of each week.

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

(a) From the 25th day of June, 1967, to the 8th day of July, 1967, both dates inclusive; and

(b) From the 9th day of July, 1967, to the 22nd day of July, 1967, both dates inclusive, except from

(i) seven o'clock in the afternoon of Monday to nine o'clock in the forenoon of Tuesday; and

(ii) seven o'clock in the afternoon of Tuesday to nine o'clock in the forenoon of Wednesday of each week; and

(c) From the 23rd day of July, 1967, to the 12th day of August, 1967, both dates inclusive, except from

(i) seven o'clock in the afternoon of Monday to nine o'clock in the forenoon of Tuesday; and

(ii) seven o'clock in the afternoon of Tuesday to nine o'clock in the forenoon of Wednesday; and

(iii) seven o'clock in the afternoon of Wednesday to nine o'clock in the forenoon of Thursday of each week; and

(d) From the 13th day of August, 1967, to the 30th day of September, 1967, both dates inclusive, except from

(i) six o'clock in the afternoon of Sunday to nine o'clock in the forenoon of Monday; and

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

(iii) six o'clock in the afternoon of Tuesday to nine o'clock in the forenoon of Wednesday; and

(iv) six o'clock in the afternoon of Wednesday to nine o'clock in the forenoon of Thursday of each week.

3. Section 2 above does not apply to sockeye or pink salmon taken in nets having mesh of not less than 8 inches extension measure from the 25th day of June, 1967, to the 8th day of July, 1967, both dates inclusive, when and where such net fishing gear has been authorized for the taking of chinook salmon by the Director of Fisheries of the State of Washington.

4. No person shall fish for sockeye or pink salmon in the Convention waters of the United States of America lying westerly of a straight line drawn true south from the southeast tip of Point Roberts in the State of Washington (otherwise known as Lily Point) to the international boundary line from the 3rd day of September, 1967, to the 16th day of September, 1967, both dates inclusive.

5. No person shall fish for sockeye or pink salmon in the Convention waters of the United States of America lying northerly and westerly of a straight line drawn from the Iwersen dock on Point Roberts in the State of Washington to the flashing white light on Georgina Point at the entrance to Active Pass in the Province of British Columbia from the 17th day of September, 1967, to the 30th day of September, 1967, both dates inclusive.

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

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

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

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

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

Emergency Amendments

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

July 25, 1967 — Due to the sharp rise in the catch of sockeye salmon in United States Convention waters and since sockeye catches in the lower Vancouver Island troll fishery consisted main-

ly of Chilko and Stellako fish, the Commission recommended an additional 24 hours fishing or a fourth day in all United States Convention waters lying easterly of the Angeles Point-William Head line. The Commission also recommended an additional 24 hours or a fourth day of fishing in all Canadian Convention waters encompassed in Areas 17 and 18 and District No. 1.

August 1, 1967 — In the interest of equalizing the catch of sockeye between the fishermen of the two countries and because the Chilko and Stellako runs were peaking in United States Convention waters, the Commission recommended that Canadian Convention waters lying westerly of the Angeles Point-William Head line be opened one day early effective Saturday, August 5, at 6:00 p.m. giving the fleet in this area a four-day fishing week.

August 7, 1967 — In an effort to obtain a satisfactory escapement of Chilko and Stellako sockeye, the Commission recommended that fishing in Canadian Convention waters lying easterly of the Angeles Point-William Head line be terminated at 12:00 noon Tuesday, August 8, thus reducing the week's fishing to one day. Also, to assist in equalizing the catch of sockeye between the fishermen of the two countries, the scheduled fishing time of three days in United States Convention waters was reduced to two days for the week effective August 6.

August 10, 1967 — In order to harvest a greater portion of an unusually large Adams River sockeye run, the Commission recommended that the scheduled opening of all United States Convention waters be advanced by 24 hours to 6:00 p.m. Saturday, August 12, giving United States fishermen four days fishing. The Commission also recommended that Canadian waters of District No. 1 and Areas 17 and 18 be opened for 48 hours commencing 8:00 a.m. Monday, August 14.

August 15, 1967 — In the interest of division of the catch of both pink and sockeye salmon by Canadian and United States fishermen and to provide for a sizeable early pink salmon escapement, the Commission recommended that fishing time in Canadian Convention waters lying westerly of the Angeles Point-William Head line be reduced by 24 hours to three days fishing for the current week. The Commission also recommended that, because significant numbers of delaying Adams River sockeye were being taken by trollers off the mouth of the Fraser River while the area was closed for gillnetting, commercial trolling in these waters be restricted to the same times as net fishing, with the scheduled closing of this area advanced to become effective 12:00 noon Wednesday, August 16.

August 22, 1967 — To aid in achieving division of the allowable pink catch and to increase pink salmon escapement, the Commission recommended that effective Wednesday, August 23, fishing time in Canadian Convention waters lying westerly of the Angeles Point-William Head line be reduced by 24 hours for a three-day week. Also, to protect delaying Adams River sockeye off the mouth of the Fraser River, the Commission recommended that all United States Convention waters lying northerly and westerly of a line extending from the Iwersen dock on Point Roberts to the Active Pass light be closed effective Sunday, August 27.

August 25, 1967 — In the interest of division of the sockeye catch and to increase the early Fraser pink run escapement, the Commission recommended that Areas 17 and 18 in Canadian Convention waters be closed to all net fishing effective Sunday, August 27, and that the scheduled opening in all United States Convention waters be delayed 24 hours to 6:00 p.m. Monday, August 28.

August 30, 1967 — The Commission recommended that, in the interest of escapement of pink and sockeye salmon and proper division of the allowable catch, the opening for fishing in Canadian Convention waters lying westerly of the Angeles Point-William Head line be advanced 24 hours to 7:00 p.m. Saturday, September 2. The Commission also recommended that the scheduled opening in all United States Convention waters for the week commencing September 4, be delayed 24 hours to 6:00 p.m. Monday, September 5.

September 6, 1967 — To aid in division of the Fraser River pink catch and to provide for escapement of both sockeye and pink salmon, the Commission recommended that an additional 48 hours or a total of six days fishing be granted in those Canadian Convention waters lying westerly of the Angeles Point-William Head line and that fishing in all United States Convention waters be reduced to three days for the current week. The Commission also recommended that fishing be permitted in the waters of District No. 1 lying westerly of the "Blue Line" from 8:00 p.m. Tuesday, September 12 to 8:00 a.m. Wednesday, September 13, and in Area 18 for 48 hours commencing 8:00 a.m. Monday, September 11. The Commission further recommended that all United States Convention waters lying westerly of a line projected true south from Lily Point on the easterly side of Point Roberts to the international boundary be closed effective Sunday, September 10. In addition, the Commission recommended that fishing in United States Convention waters for the week commencing Sunday, September 10 be reduced to two days. To provide additional protection for

pink salmon destined for southern Puget Sound streams, the Commission approved a closure of all United States Convention waters lying southerly and easterly of a line drawn from Dungeness light to Smith Island light to Outer Lawson Reef light to Burrows Island light to Green Point on Fidalgo Head effective Sunday, September 10.

September 12, 1967 — To aid in the division of the catch, the Commission recommended that fishing in all United States Convention waters be increased by 48 hours effective Tuesday, September 12.

September 14, 1967 — Since pink salmon in significant numbers were no longer present in the Dungeness-Discovery Bay area of Convention waters, the Commission recommended that the existing closure in United States Convention waters lying inside and southerly of a line projected from Dungeness light to Smith Island light to Outer Lawson Reef light to Burrows Island light to Green Point on Fidalgo Island be reduced to those waters lying inside and southerly of a line projected from Partridge Point to Smith Island light to Outer Lawson Reef light to Burrows Island light to Green Point on Fidalgo Head effective Sunday, September 17.

September 19, 1967 — In the interest of regulatory requirements for division of the catch of both species, the Commission recommended that all United States Convention waters lying easterly of the Angeles Point-William Head line be closed for the week commencing Sunday, September 24, except that the Commission relinquish control on the above date in those waters lying inside and southerly of a line projected from Dungeness light to Smith Island light to Outer Lawson Reef light to Burrows Island light to Green Point on Fidalgo Island. Further, that the Commission relinquish control in all remaining United States Convention waters effective Sunday, October 1, except for the waters lying westerly and northerly of a line projected from Iwersen's dock on Point Roberts to Active Pass. The excepted waters above to remain closed until Sunday, October 8, when control would be relinquished. The Commission also recommended that all Canadian Convention waters lying easterly of Angeles Point-William Head line be closed until further notice except that fishing be permitted in the waters of District No. 1 including the Fraser River from 7:00 a.m. to 6:00 p.m. Friday, September 22.

September 29, 1967 — The Commission relinquished control of all remaining United States Convention waters effective Sunday, October 1.

The Commission relinquished control of all remaining Canadian Convention waters effective Sunday, October 15, thus completing the Commission's regulatory obligations in Convention waters for the 1967 season.

SOCKEYE SALMON REPORT

The Fishery

The 1967 run of Fraser River sockeye in Convention waters totalled 5,425,842 fish, of which 3,963,308 were caught commercially, 107,200 were taken by the Indian fishery and 1,355,295 were recorded on the spawning grounds (see Tables in Appendix). Since the catch in Convention waters exceeded that of any year on this cycle since 1903, it is believed that the total 1967 run calculated at 6,500,000 Fraser sockeye was larger than that of 1903 and the total catch in all waters significantly greater than in the earlier year.

New methods of fishing, new marketing conditions, and competition between fishing gear are gradually expanding the area in which Fraser River sockeye and pink salmon runs are being harvested. The result is a significant increase in the percentage of this species being harvested both in the high seas area of Convention waters and in non-Convention waters. While these changes in the fishery do not interfere seriously with the Commission's ability to fulfill its terms of reference, or conflict with the principles underlying the Sockeye Fisheries Convention, total statistics must be considered in formulating the biological basis upon which the Commission's regulations are founded.

In addition, as the percentage of the total run available to the established inshore fisheries declines, social, political and economic problems arise which can only be assessed by examining total statistics. For example, Fraser River gill net fishermen once caught almost the entire Canadian share of Fraser River sockeye. Beginning in 1946, an increasing but variable share of the Canadian catch has been taken in Juan de Fuca Strait. In 1967, the Canadian troll fishery demonstrated for the first time its effectiveness in catching sockeye by landing 161,801 fish, or 8.63 per cent of the total Canadian Convention waters catch. This brought about a further reduction in the number of sockeye available to the Fraser River gill net fleet. Furthermore, United States trollers landed only 182 sockeye in 1967, adding to the problem of dividing the total catch equally between the two national groups. Competition between gear and fishing areas is emphasized by the fact that at one time during the height of the 1967 run about 4,100 units of gear and 8,000 to 9,000 fishermen were fishing on Fraser River sockeye and pink salmon. Only by considering total run statistics can the Commission provide the information necessary for the industry and individual fishermen to make a practical reassessment of the changing conditions in the Fraser River fishery.

Preseason predictions indicated that the 1967 Fraser River sockeye run would equal or exceed the 1966 run in Convention waters. The 1967 run totalled 5,425,800 sockeye compared with 4,760,800 in 1966. However, since the Adams River run exceeded expectations, the 1967 catch was greater than originally anticipated, due in part to the smaller escapement theoretically considered desirable on the sub-dominant cycle of this population.

The Adams River sockeye run, combined with several smaller sockeye populations, coincided with a large run of Fraser River pink salmon in 1967. This was the first year since 1917 when both species occurred in abundance at the same time in the fishery. Each of the two species had its own escapement requirements which complicated management of the fisheries. Ultimately it proved impossible to obtain equal division of the catch made by Canadian and United States fishermen.

United States fishermen caught 2,087,826 sockeye and Canadian fishermen 1,875,482 for a total of 3,963,000—sharing the catch on a basis of 52.68 per cent and 47.32 per cent, respectively (Tables I and II). The catch in Convention waters was 98 per cent greater than that of the brood year of 1963 and 120 per cent greater than the previous 60-year cycle average of 1,802,000 fish. The average weight of four-year-old sockeye was 5.50 pounds, significantly smaller than the cycle average of 5.86 pounds.

The percentage of the Canadian catch of sockeye by purse seines and gill nets in Juan de Fuca Strait was up substantially over that of the brood year, due primarily to the unexpected size of the Adams River run and the necessity for harvesting the concurrent large pink salmon run (see Table below). A maximum of 102 purse seines and 341 gill nets operated in the area and was a record fishing effort for this cycle. One of the outstanding features of the Canadian fishery this year was the catch by the troll fishery of 161,801 sockeye, or 8.63 per cent of the total Canadian catch in Convention waters. In previous years, the troll catch of sockeye has been so small it has not been delineated.

Per Cent of Canadian Sockeye Catch Taken in Juan de Fuca Strait		*Per Cent of Canadian Sockeye Catch Taken by Purse Seines in Juan de Fuca Strait**		*Per Cent of Canadian Sockeye Catch Taken by Gill Nets in Juan de Fuca Strait**	
Cycle Year	*Per Cent*	*Maximum P.S. Units*	*Per Cent*	*Maximum G.N. Units*	*Per Cent*
1967	52.96	102	34.84	341	15.08
1963	21.92	81	14.75	197	6.87
1959	39.33	74	30.90	180	7.50
1955	52.29	97	41.81	269	8.74
1951	19.99	47	16.58	11	0.15
1947	2.46	37	1.44	0	0.0

*Troll catches not listed.

Consistent with the high solar activity recorded in 1967 (which appears to influence the number of Fraser River sockeye approaching from the north), the portion of the 1967 run available in Johnstone Strait was considerably above average. In 1963, the brood year, an estimated 8.6 per cent of the total catch of Fraser River sockeye, or 4.8 per cent of the total run, was taken in the Johnstone Strait fishery. In 1967, an estimated 21.7 per cent of the total catch or 16.9 per cent of the total run was taken in the area. However, it should be noted that the fishery in Johnstone Strait was particularly intense at the time Fraser River sockeye were available in significant numbers, hence the proportion taken of the fish available probably was higher than usual.

The distribution of sockeye catch by gear in United States Convention waters was normal for this cycle with the exception of the catch by reef nets. The reef net share of the catch continued its decline, in spite of the change in regulations which opened reef net fishing in advance of the other gear for the period extending from July 9 to August 13.

Escapement

The net escapement of 1,355,295 sockeye (Table VI) represented 25 per cent of the run available in Convention waters and 20.8 per cent of the total run. Generally, the 1967 escapement was satisfactory but several specific situations should be noted.

Closure of both the commercial and the Indian fisheries during passage of the Early Stuart sockeye run resulted in an escapement of 21,069 fish to this area, compared with only 4,627 in 1963. The closure of the commercial fishery in 1963 without a similar closure of the Indian fishery failed to provide an adequate escapement to the Early Stuart streams, indicating that the Indian fishery in the lower Fraser River has become increasingly effective on these early migrating fish. Increasing and effective fishing by Indians, particularly in the Fraser River below Boston Bar, is jeopardizing the escapements of Early Stuart fish and in effect is nullifying substantial expenditures by the Commission for the construction of fish facilities in the Fraser Canyon expressly made to improve passage conditions for this early run. In the future it may be necessary, except in years of expected large returns to the Early Stuart spawning streams, to close not only the commercial fishery but also the lower river Indian fishery during passage of the Early Stuart sockeye to assure continuing reproduction of this run.

Sockeye populations commonly referred to as midsummer runs, including the Chilko, Stellako, Raft, Late Stuart, Horsefly, Seymour and other smaller populations, were heavily fished in 1967 and escapements to these areas were somewhat below those desired. However, in view of the warm water temperatures prevailing throughout most of the watershed it is perhaps fortunate that larger escapements did not occur to add a density problem to otherwise unfavorable environmental conditions.

A deliberate adjustment was made in the fishing regulations to reduce escapements from the early migrating segment of the midsummer populations subject to the highest spawning ground temperatures. As a result of these regulatory adjustments, the mortality of unspawned Chilko sockeye was held to about 12 per cent. In 1963 under somewhat similar environmental conditions, a much larger escapement to this area during a strike suffered a mortality of about 90 per cent. At Stellako and Raft Rivers, a higher prespawning mortality could not be prevented since these populations migrate several days later and coincide with that portion of the Chilko run required for escapement. Mortalities of unspawned sockeye reached 40 per cent in Stellako River and 50 per cent at Raft River.

Regulatory adjustment to remove most of the early part of the Chilko escapement also resulted in overfishing the Pitt River sockeye population. This smaller population moves through the fishery at the same time as the early segment of the Chilko run, with the result that fishing mortality on the 1967 Pitt run is estimated at 90 per cent. Escapements to Chilko and Pitt Rivers were 176,000 and 10,000 respectively. Clearly, the benefits from such adjustments are much greater to the Chilko run than the adverse effects on the Pitt run and it is hoped that the incubation station on Upper Pitt River will compensate for heavier fishing intensity on this run. Such compensation in the form of increased fry production is essential to avoid endangering the Pitt River run by overfishing, particularly when removal of the early part of the Chilko and Horsefly sockeye populations is considered desirable to prevent excessive mortalities due to warm water on the spawning grounds.

High water temperatures in the Fraser and Thompson Rivers continued throughout the September migration period and resulted in a significant loss of spawners in both Adams and Little Rivers. The unprecedented prespawning losses in these two areas were 16 and 24 per cent, respectively.

An interesting facet of the 1967 sockeye escapement was the contrast in production from the 1963 brood escapements to the lower Adams and Seymour River areas and the related difference in their 1967 escapements. Fry from both of these populations reside for a year or more in Shuswap Lake, yet the 1967 Seymour run and escapement declined substantially from that of the brood year while the Adams population literally exploded. Since this situation has an important bearing on any study of sockeye population dynamics, an examination is to be made of the annual fry production in the Seymour River as compared with that of Adams River. Seymour River drainage has no lakes to moderate possible flood conditions and is known to have an occasional flood during the fall months preceding the winter freeze-up. Lower Adams River has no serious flooding problems since it drains the large volume of Adams Lake. It appears logical to consider the possibility that the 1967 decline in the Seymour population may have resulted from an exceptionally poor fry hatch, especially since productivity of this race has tended in recent years to follow the same pattern as that of the Adams River population.

The 1967 escapement of 846,000 sockeye to Adams River and related streams was greater than the total production on this sub-dominant cycle in any of the past 50 years. Total run size is normally less than 900,000 fish and escapements in recent cycle years have varied from 63,000 to 156,000. High water temperatures in the Fraser River and the concurrent large pink salmon run apparently upset the normal behavior and availability of this sockeye population with the result that early season escapement estimates, normally quite accurate, were far below the actual number. Both test fishing and counts at Hell's Gate indicated that the total Adams escapement was slightly below 400,000 fish. No clear answer is available for the fact that 27.3 per cent of the total Adams River sockeye population escaped the fishery while only 14.4 per cent of the total pink salmon run was recorded on the spawning grounds, even though both species were subjected to the same fishing intensity. Perhaps the difference in the two escapements lies in the troll fishery operating both inside and outside Convention waters. Estimates of this catch show that possibly 2,079,000 pink salmon of Fraser River origin were taken by this gear compared with only 119,000 Adams River sockeye captured at essentially the same time.

Rehabilitation

The Commission's sockeye rehabilitation program progressed satisfactorily during 1967. At Pitt River Hatchery, a total of 3,658,000 sockeye eggs from the 1966 brood were incubated to the eyed stage and transplanted to the adjacent gravel incubation channel. A total of 2,868,000 fry emerged in the spring of 1967 and emigrated to their natural rearing area in Pitt Lake, for an egg-to-fry survival rate of 78.4 per cent. The following table illustrates the operating history of the station, including three years of straight hatchery operation and the last four years of eyeing the eggs in the hatchery for transfer to the gravel incubation channel illustrated in the 1963 Annual Report.

Sockeye Production at Pitt River Hatchery and Incubation Channel

Brood Year	*Incubation Location*	*Eggs Spawned*	*Fry Produced*	*Per Cent Survival*
1960	Hatchery Only	3,257,000	2,508,000	77.0
1961	Hatchery Only	4,060,000	3,735,000	92.0
1962	Hatchery Only	1,357,000	1,126,000	83.0
1963	Hatchery, Incubation Channel	3,189,000	2,417,000	75.8
1964	Hatchery, Incubation Channel	3,700,000	3,256,000	88.0
1965	Hatchery, Incubation Channel	2,133,000	1,776,000	83.3
1966	Hatchery, Incubation Channel	3,658,000	2,868,000	78.4

A combination of highly unstable spawning grounds resulting to a large extent from current logging operations and occasional but unavoidable overfishing is expected gradually to eliminate the commercial value of the important Pitt River sockeye population. Therefore, it is essential that a successful program for artifically increasing the egg-to-adult survival rate be maintained if this valuable sockeye run is to be preserved. Due to an increased egg-to-fry survival rate, the number of fry produced at the Pitt River Station from a relatively small fraction of the spawning population equals or exceeds that produced by the natural spawning run. Therefore, the success or failure of the operation depends entirely on producing fry capable of survival rates at least approaching those of wild fry.

Since young sockeye fry are too small to mark for later identification as adults, the best means available for assessing the number of adults produced by the Pitt River Station lies in examining the percentage of the total run and the actual number of adults returning to Seven Mile Creek where the artificially produced fry are released. The percentage of the total Pitt River sockeye population spawning in Seven Mile Creek varied from 0.9 to 12.0 per cent during the 10-year period preceding the returns from the station, for an annual average of 6.9 per cent or 1,134 adults. The percentage of the run entering Seven Mile Creek during the past three years has risen to an average of 37.5 per cent or 4,833 adults. Although the problem of calculating the economic and biological benefits of the experimental station to date is quite complex, it is obvious that the operation can substitute for lost spawning grounds and can maintain a sockeye run with economic benefits, provided operating costs are kept at a reasonable level. It appears also that the fry-to-adult survival rate of fish produced in the combined hatchery and incubation channel, while higher than that of fry produced in the hatchery alone, is not as yet equal to that of naturally produced fry, even though the ratio is sufficiently high to be economically beneficial. Thus it is essential that studies continue on the dynamics of natural incubation to determine how the adult survival rate of fry produced in incubation channels can be increased.

A total of 10,758,000 fry were counted out of the Weaver Creek spawning channel in the spring of 1967 for an egg-to-fry survival rate of 82.0 per cent.

In contrast, egg-to-fry survival from the natural spawning grounds in Weaver Creek between 1951 and 1958 averaged only 5.4 per cent. Furthermore, with an annual average of 20,480 sockeye spawners in the creek during the above period, the average annual fry production from natural spawning was only 2,200,000, compared with 10,758,000 fry from 6,541 channel spawners in 1966. The adult returns from the first year of operation (1965) will appear in 1969.

In the fall of 1967, high water conditions in Weaver Creek made it difficult to divert adult sockeye into the adjacent spawning channel. Only 2,887 sockeye of a total run of 22,617 entered the channel, along with 464 chums and 123 pink salmon. The Commission has been reticent to install a fixed artificial diverter because of its effect on flood flows but has now designed a structure which will operate at moderate high water, while not obstructing the flow at extreme levels. Construction of this diverter is to be completed prior to the return of the 1968 escapement.

When successful rearing practices have been established for sockeye, as they have been for coho, the effect of poor years of survival under natural environment might be tempered somewhat. Already, the effect of releasing large numbers of hatchery reared smolts on the regional coho production in the State of Washington is a most important phenomenon. In the case of this species, it appears that with modern hatchery and rearing practices the highly variable returns due to variation in natural stream environment can be moderated. Such a situation already may exist in the lower Columbia River watershed where large numbers of adult coho, originating from artificially reared smolts unaffected by any variation in the natural stream environment, have been returning for several years.

Young sockeye apparently are more sensitive to their environment than coho, for fish culturists in the past have had serious difficulty in avoiding heavy mortalities during the rearing period. The Commission believes that the mortality problem during artificial rearing can be overcome for sockeye, once a favorable rearing environment and suitable diet can be defined. Using background information provided by the Salmon Cultural Laboratory of the United States Fish and Wildlife Service, the Commission initiated experimental rearing operations at its Sweltzer Creek Station in 1966. The first results were not satisfactory since an outbreak of bacterial gill disease caused excessive mortality early in the experimental rearing program. In 1967, a virus infection resulted in excessive mortality in one major experiment, but another group of sockeye held in a different environment survived without significant mortality and at the end of the rearing year were in excellent condition. Once a successful rearing program can be defined and can be proved to be economically feasible in terms of cost per adult produced, the Commission is prepared to expand its operations into this field.

PINK SALMON REPORT

The Fishery

The effects of favorable environment during the early life history of Fraser River pink salmon have been amply illustrated by comparison of the adult returns of 1965 and 1967. Both runs originated from approximately the same

number of fry, yet a total of only 2,200,000 adult pink salmon returned in 1965, compared with 12,740,000 in 1967. Of the total 1967 pink salmon run entering Convention waters, the 9,153,000 Fraser fish comprised a major part of the 10,711,000 fish destined for all areas including United States streams, Canada non-Fraser streams and the Fraser River. A table illustrating the population structure of the runs entering Convention waters for 1963, 1965 and 1967 is presented on a following page.

Two outstanding features of the 1967 pink salmon run were the effectiveness of the high seas troll fishery and the character of the landfall along the west coast. Unusually large numbers of pink salmon were available off the Oregon coast, where an estimated 102,256 fish were taken by the Oregon troll fishery, an all-time record. Pink salmon were not available off Washington in the usual relative abundance and the troll fishery harvested only 193,521 fish within Convention waters and 184,050 outside the Convention area. A large proportion of the run made its landfall off the west coast of Vancouver Island and Canadian trollers landed 975,268 within Convention waters and an equal number outside the area.

The unequal distribution of pink salmon available to the different troll fisheries resulted in a decline in the share of the Convention catch taken by Washington fishermen and a substantial increase in the share taken by Canadian troll gear. This situation created a difficult problem in equalizing the catch between the fishermen of the two countries which could not be solved because of the concurrent large runs of both pink and sockeye salmon in the net fishing areas of Convention waters. Tables X to XIII detail the catch statistics in Convention waters by time and gear for United States and Canadian fishermen.

While the total 1967 catch of 7,984,000 pink salmon in Convention waters was less than that of several previous years, a larger than usual percentage of the run was caught outside Convention waters in 1967. Considering all factors, and particularly in view of the small contribution made by non-Fraser runs in 1967, it is estimated that the Fraser River pink run was as large or larger than any run since 1947. The predominance of Fraser fish in the 1967 pink run in Convention waters was evident in the West Beach area where few Fraser pink salmon are available. Only one per cent of the United States catch was made in this area in 1967 in spite of the large run to the Fraser River, compared with 56 per cent in 1963 when the Fraser run was small but a very large number of pink salmon returned to United States streams.

Pink salmon were small this season averaging about 5.4 pounds, thus continuing the established inverse relationship between population size and fish size.

Escapement

The total 1967 escapement of pink salmon to the Fraser River was 1,831,000 fish from the estimated 9,153,000 available in Convention waters, or approximately 20 per cent. Only 14.4 per cent of the total run, estimated at 12,740,000 fish, reached the spawning grounds. The early segment escapement of 1,490,000 fish was up substantially over previous brood years since 1957. The largest number of pink salmon since 1911 reached the spawning areas above Hell's Gate,

CALCULATED CATCHES AND PERCENTAGE REMOVAL FROM PINK SALMON RUNS ENTERING THE CONVENTION AREA IN 1963, 1965 AND 1967

	Source of Run											
	United States			*Fraser River*			*Canada Non-Fraser*			*Total*		
	1963	1965	1967	1963	1965	1967	1963	1965	1967	1963	1965	1967
TOTAL ENTERING CONVENTION AREA	10,330,074	1,344,350	1,405,127	4,520,225	1,912,367	9,152,687	1,317,977	123,706	153,196	16,168,276	3,380,423	10,711,010
CATCH IN CANADIAN CONVENTION WATERS												
Westerly of William Head	2,579,799	244,722	425,362	1,021,940	222,567	3,152,652	114,045	15,169	34,958	3,715,784	482,458	3,612,972
Easterly of William Head	.....	.....	.....	411,999	107,009	534,693	45,505	3,000	9,257	457,504	110,009	543,950
Total	2,579,799	244,722	425,362	1,433,939	329,576	3,687,345	159,550	18,169	44,215	4,173,288	592,467	4,156,922
Per cent Removal	25.0	18.2	30.3	31.7	17.2	40.3						
CATCH IN UNITED STATES CONVENTION WATERS ..	2,790,891	115,812	116,698	1,133,286	390,972	3,633,970	502,055	51,596	76,372	4,426,232	558,380	3,827,040
Per Cent Removal	27.0	8.6	8.3	25.1	20.4	39.7						
TOTAL CATCH IN CONVENTION AREA	5,370,690	360,534	542,060	2,567,225	720,548	7,321,315	661,605	69,765	120,587	8,599,520	1,150,847	7,983,962
Per Cent Removal	52.0	26.8	38.6	56.8	37.7	80.0						

with the number spawning in Seton Creek and the Thompson River being almost double that of the largest previous escapement on record (Table XIV). The escapement to Seton Creek approached the maximum, but in spite of the record run to the Thompson River considerable spawning area remained unused. Extensive area also remains available for that segment of the early run spawning in the main Fraser. The late run escapement to the Chilliwack-Vedder River was of favorable size but the escapement to the Harrison system was far below the desirable level. In fact, the low level of this escapement in both 1965 and 1967 is considered dangerous, and special regulations will be required in 1969 in an attempt to obtain a greater percentage escapement of the Harrison River run.

High water temperatures prevailed in both the Fraser and Thompson Rivers during upstream migration and spawning of these pink salmon populations. Water temperatures in late September were higher than for any of the previous 10 years of record, reaching 63.5°F in the main Fraser, 0.5°F higher than during the warm season of 1963. Minor mortalities of unspawned pink salmon were observed in both the main Fraser and Thompson Rivers, as also occurred in 1963. Otherwise, water levels during spawning and incubation were excellent in all areas except the Vedder River where substantial floods occurred both during and after spawning.

As a part of the Commission's investigation of factors affecting the freshwater survival of pink salmon, the emerging fry are enumerated in both the Harrison and Vedder Rivers. The number of pink fry produced by the total escapement to the Fraser River system are also enumerated by a sampling index at Mission, B.C., as described previously in Bulletin XIX of the Commission's scientific publication series. The data from these investigations are detailed below.

Freshwater Survival of Pink Salmon Fry
Harrison and Vedder Rivers, 1957-1965 Broods

Stream	*Year of Spawning*	*Total Number Adult Female Spawners*	*Calculated Total Egg Deposition*	*Calculated Number of Fry*	*Per Cent Survival Eggs to Fry*
Harrison R.	1957	331,181	665,758,380	24,459,969	3.67
	1959	69,541	125,869,210	13,658,491	10.85
	1961	118,108	301,175,400	33,360,324	11.08
	1963	424,166	853,248,084	66,591,066	7.80
	1965	42,006	80,651,020	17,900,986	22.20
Vedder R.	1957	114,039	234,857,340	20,187,661	8.60
	1959	52,974	96,942,420	5,833,101	6.02
	1961	112,765	287,550,750	25,876,575	9.00
	1963	191,328	382,656,000	19,833,013	5.18
	1965	127,016	243,870,720	31,325,531	12.85

Fraser River Pink Salmon Production*

	Brood Year				
	1957	1959	1961	1963	1965
Total Spawners	2,425,000	1,078,000	1,094,000	1,953,000	1,191,000
Female Spawners	1,423,000	596,000	654,000	1,217,000	692,000
Potential Egg Deposition	2,874,500,000	1,084,700,000	1,569,200,000	2,434,800,000	1,487,800,000
Fry Production	.....	.....	143,600,000	284,200,000	274,000,000
Adult Return (Catch + Escapement)	6,459,000	1,884,000	5,262,000	2,217,000	12,740,000
Freshwater Survival	.....	.....	9.2%	11.7%	18.4%
Marine Survival	.....	.....	3.7%	0.8%	4.6%
Return Per Spawner	2.66	1.75	4.81	1.14	10.70

*Fry production not calculated prior to 1961.

A total of 7,143 pink salmon entered the upper spawning channel at Seton Creek for a capacity egg deposition of 6,278,000. In the lower channel, completed during the summer of 1967, a total of 20,630 fish with a potential egg deposition of 19,589,000 were allowed through the counting fence. Both channels were filled to capacity in a relatively short time by natural selection and thousands of additional fish would have entered had they been permitted to do so.

WATERSHED PROTECTION

There is a growing awareness by the public, industry and government of the practicality of careful planning in the utilization of the many natural resources of the Fraser River watershed to avoid possible conflict of interests. Nowhere is such planning more essential than in connection with the fisheries resource of the river, the very existence of which is dependent on the maintenance of a suitable environment in the river. The large salmon runs produced by the Fraser River are adapted to an environment that has existed since long before the advent of man, and changes in this environment could have severe consequences. Adequate technology is available for the treatment of industrial and domestic waste effluents to protect the salmon from the potentially dangerous effects of pollution. However, the implementation of this technology does not end with provision of the necessary physical facilities, but is dependent upon the same continuous care and attention as would be given to production facilities. For instance, management disinterested in the successful operation of a pulp mill waste treatment system can nullify the benefits from previous planning and cause a serious economic loss to the community as well as to the industry concerned.

The maintenance of suitable stream environment must also be considered when planning water-use projects, and where compatible development is possible, the provisions for protection of the salmon must be operated as planned. In

some cases, such as the scheduling of hydroelectric plant operations and repairs, serious effects on the salmon stocks can often be avoided by the diligent application of a few simple procedures or operating rules, such as are applied to the power production facilities. Here again, the essential requirement is a spirit of cooperation and mutual understanding of the problems involved in management of both the fishery and the power production facilities.

There is no place in multiple resource development for prejudiced decisions in policy or willful disregard of the basic requirements for management of a public resource, just to accommodate special interests. The maintenance of spawning grounds and suitable river environment are two of the basic requirements for preservation of the Fraser River salmon fishery. In the public interest, these needs must be taken into consideration when planning other developments, whether they be pulp mills, sewage disposal, log driving, placer mining, gravel removal, protection of stream banks, or dredging. Good planning and management in resource development is just as essential to the economic welfare of the public as it is to the profitable operation of an individual industrial project.

During 1967, monitoring of the effluent from the three pulp mills now operating in the Fraser River watershed showed that the effluent treatment systems are capable of achieving the objectives when operated properly. At Kamloops Pulp and Paper, the effluent met the specifications at all times. Prince George Pulp and Paper experienced operating difficulties within parts of the mill system, and while the actual treatment system functioned properly, the failure of some of the facilities for detecting and diverting toxic wastes sometimes resulted in a combined effluent that did not meet specifications. In the second half of the year these problems were corrected to the extent that the combined effluent met specifications. At Northwood Pulp at Prince George, there was a complete failure of all waste handling systems for a period of at least two months due to unsatisfactory operation. The system was restored to operating condition in July and functioned properly for several months before failing again, for the same reason. At the request of the Department of Fisheries, corrective measures are being developed. Monitoring of the treated effluent from the new oil refinery at Prince George showed the effluent to be non-toxic to fish as specified. This effluent is discharged into the ground.

The Stellako River was used for driving logs again in 1967 under the auspices of the British Columbia Department of Lands, Forests and Water Resources. The Minister of Fisheries revoked the order prohibiting such a log drive, on the understanding that the Department of Fisheries would be consulted in the planning and operation of the drive, and that a joint study would be made of the drive's effects. The Commission cooperated with the Department of Fisheries in field investigations, and related laboratory research is continuing. The 1967 log drive was not a representative drive because of high water, the small size and number of logs driven and the amount and condition of bark on the logs. These factors tended to minimize the known detrimental effects on the Stellako River sockeye spawning grounds, but nevertheless there was evidence of continued deterioration of the stream environment.

During 1967, the Commission reviewed 249 water licence applications and 143 placer mining lease applications relative to the Fraser River system. Wherever necessary, appropriate recommendations were made to the Department of

Fisheries for measures to protect sockeye and pink salmon. Because of evident public interest in the possibility of diverting water from Shuswap River to Okanagan Lake to provide an additional water supply for irrigation and other uses, the Commission in cooperation with the Department of Fisheries has been studying the proposed diversion to determine its effect on the salmon runs to Shuswap River. A report on the findings will be prepared during 1968.

The second spawning channel for pink salmon at Seton Creek was completed in March, 1967, and was filled to capacity within a few days when the run returned to spawn in October. Plans for a sockeye spawning channel at Gates Creek were completed, and construction started in July. This project will be completed in 1968, well in advance of the sockeye run. Plans were also completed for the McKinley Creek temperature control project on the Horsefly River watershed and orders placed for some of the materials. The first phase of construction will be started in 1968, with completion in time for the 1969 sockeye run.

1967 PUBLICATIONS

1. Annual Report of the International Pacific Salmon Fisheries Commission for 1966.

2. Progress Report Number 16.
Genetic Control of Migrating Behavior of Newly Emerged Sockeye Salmon Fry by E. L. Brannon.

TABLE I
SOCKEYE CATCH BY GEAR

United States Convention Waters

	Purse Seines			*Gill Nets*			*Reef Nets*			*Troll*		
Year	*Units*	*Catch*	*Per-centage*	*Units*	*Catch*	*Per-centage*	*Units*	*Catch*	*Per-centage*	*Catch*	*Per-centage*	*Total Catch*
1967	315	1,387,370	66.45	507	595,580	28.53	50	104,694	5.01	182	0.01	2,087,826
1963	191	862,616	65.65	450	365,873	27.84	64	85,110	6.48	446	0.03	1,314,045
1959	257	1,401,819	77.42	446	241,163	13.32	81	163,093	9.01	4,663	0.25	1,810,738
1955	286	621,527	61.74	584	282,995	28.11	88	102,088	10.15	0	0	1,006,610

Canadian Convention Waters

	Purse Seines			*Gill Nets*			*Traps*			*Troll*		
Year	*Units*	*Catch*	*Per-centage*	*Units*	*Catch*	*Per-centage*	*Units*	*Catch*	*Per-centage*	*Catch*	*Per-centage*	*Total Catch*
1967	102	602,495	32.12	1,767	1,111,186	59.25	0	0	0	161,801	8.63	1,875,482
1963	81	115,115	16.76	1,328	561,345	81.75	0	0	0	10,221	1.49	686,681
1959	100	516,585	32.66	1,488	1,040,916	65.80	0	0	0	24,382	1.54	1,581,883
1955	104	462,934	41.78	1,348	625,207	56.42	5	18,548	1.67	1,392	0.13	1,108,081

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

TABLE II
CYCLIC LANDINGS AND PACKS OF SOCKEYE
FROM CONVENTION WATERS

	United States	*Canada*	*Total*
1967			
Total Landings (No. Sockeye)	2,087,826	1,875,482	3,963,308
Share in Fish	52.68%	47.32%	
Total Pack (48 lb. Cases)	168,250	157,590*	325,840
Share in Pack	51.64%	48.36%	
1963			
Total Landings (No. Sockeye)	1,314,045	686,681**	2,000,726
Share in Fish	65.68%	34.32%	
Total Pack (48 lb. Cases)	111,327	46,808***	158,135
Share in Pack	70.40%	29.60%	
1946–1967			
Total Landings (No. Sockeye)	36,375,361	35,522,473	71,897,834
Share in Fish	50.59%	49.41%	
Total Pack (48 lb. Cases)	3,191,675	3,084,151	6,275,826
Share in Pack	50.86%	49.14%	
1967 *Cycle Catch*			
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

* Includes 3,064 cases packed in Canada from sockeye caught in United States Convention waters.
** 1,047,410 sockeye taken by United States fishermen during a strike by Canadian fishermen.
***125,750 sockeye taken but not canned by Canada.

TABLE III

DAILY CATCH OF SOCKEYE, 1955-1959-1963-1967 FROM UNITED STATES CONVENTION WATERS

	JULY				AUGUST				SEPTEMBER			
Date	1955	1959	1963	1967	1955	1959	1963	1967	1955	1959	1963	1967
1					53,990		112,848	83,010	2,556	23,297		17,852
2					75,245		72,265	94,322		18,812	1,282	
3					45,368	51,046					1,032	
4	7,228					91,067			2,364		47	
5	12,418					89,417	81,546		1,621		10	11,025
6	6,713					139,733	48,585	5,594	1,424			11,025
7	3,409				48,429	167,337	29,274	88,268	703	5,401		6,254
8					81,369	132,596	18,439	58,194	205	10,197		
9				251	54,024					7,266	28	
10		CLOSED		4,465	40,503	93,493				11,143	439	
11	7,824			3,762	25,131	124,278			330		421	2,548
12	8,251					80,698	37,789		255			7,379
13	7,563					74,075	12,228	152,217	37			4,728
14	7,265				30,632		14,300	115,530	131			1,982
15					32,409			104,995	48	747		
16				1,145	31,554			64,753		495		
17				16,742	43,279	125,123				218		
18	16,903			12,781	27,280	83,286			142		32	2,631
19	17,687				2,222	64,087	6,193		70		6	604
20	13,795	7,112					4,269		76			515
21	11,878	5,962			16,714		2,680	189,061	123	154		198
22		5,008	33,394		12,623			197,978	77	99		
23			110,105	5,072	17,133	924		156,371		56		
24			130,412	103,996	10,967	125,615		108,378		8		
25	38,584		94,278	74,382	8,413	67,372			36			11
26	13,949		92,026	67,596		17,846	2,648		6			9
27	29,915	16,216	61,186	54,405		33,994	2,686		27			6
28	30,647	20,278			10,136		2,330		45	1,941		
29		28,340	114,620		5,821		151	41,810	12	645		
30		44,671	121,644	6,455	5,372			27,915		553	19	
31			104,333	146,028	4,307	29,018		31,254				
Totals	234,029	127,587	861,998	497,080	682,921	1,591,005	448,231	1,519,650	10,288	81,032	3,316	66,767
Troll and outside seine	10,011	437	240	143	63,702	4,188	203	34	757	27	1	
Monthly Totals	244,040	128,024	862,238	497,223	746,623	1,595,193	448,434	1,519,684	11,045	81,059	3,317	66,767
June, Oct. & Nov. Totals									4,902	6,462	56	4,152
Season Totals									1,006,610	1,810,738	1,314,045	2,087,826

TABLE IV

DAILY CATCH OF SOCKEYE, 1955-1959-1963-1967 FROM CANADIAN CONVENTION WATERS

	JULY				AUGUST				SEPTEMBER			
Date	1955	1959	1963	1967	1955	1959	1963	1967	1955	1959	1963	1967
1					12,463			19,223	6,361	18,874		
2					53,491			16,577	486	19,749	11,459	
3					44,447	15,439				6,740	8,062	2,170
4	8,734				41,692	16,614	91,288			1,581	10,160	29,490
5	13,388					5,000	70,820		22,777		106	27,699
6	9,539					Strike	54,485	73,831	17,051	3,831		476
7	7,305					July 26	44,820	184,860	14,849	7,269		639
8						Aug. 9	9,987	89,770	12,715	14,422		441
9					64,348	Incl.		114,059	128	27,728	15,879	
10					61,049	228,536				31,362	57	
11	5,701				66,105	145,352				306	12	55,886
12	5,122				38,165	125,006	59,034		146			37,370
13	5,984					127,041	27,942		31,216			793
14	5,960						8,205	183,161	16,921	24,349		318
15					41,061		5,783	129,684	29	22,769		
16			784		52,783			104,460	3	16,543	4	
17			1,503	10,864	31,403	165,960				22,802	2	
18	9,561			8,744	29,679	83,683				18		650
19	7,827			6,984	16,703	41,091	43,585		9			371
20	10,906	10,360					13,553		8			208
21	20,569	8,871					3,146	115,565	1	19,365		
22		12,214	3,757		12,249		3,979	76,188	10	10,636		50,985
23			6,900		27,296	55,943	1,955	36,132	1	19,305	15,557	
24			22,877	47,625	24,536	104,920				15,459		
25	58,985		Strike	21,971	21,638	49,084					6	234
26	45,546		July 12	27,672	7,510	32,174	11,487				0	115
27	26,579	4,672	to	26,691			15,577					108
28	14, 064	2,540	Aug. 4				1,175	66,008		6		
29			19,241		4,356		1,276	24,586		2		
30			21,981		20,417		590	5,799		1		
31			47,394	92,491	10,126	31,096		4,370				
Totals	255,770	38,657	124,437	243,042	681,517	1,226,939	468,687	1,244,273	122,711	283,117	61,304	207,953
Troll and outside seine	534	2,163	1,673	32,565	39,667	21,458	5,028	125,490		608	3,057	3,470
Spring salmon gill nets		506	732	1,142					693	37	618	
Monthly Totals	256,304	41,326	126,842	276,749	721,184	1,248,397	473,715	1,369,763	123,404	283,762	64,979	211,423
April, June, Oct. & Nov. Totals									7,189	8,398	21,145	17,547
Season Totals									1,108.081	1,581,883	686,681	1.875,482

CLOSED

CLOSED

TABLE V

THE INDIAN CATCHES OF SOCKEYE SALMON BY DISTRICTS AND THE VARIOUS AREAS WITHIN THESE DISTRICTS, 1963, 1967

	1963		1967	
District and Area	*Catch*	*No. of Fishermen**	*Catch*	*No. of Fishermen**
HARRISON-BIRKENHEAD				
Skookumchuck and Douglas	1,740	21	1,025	8
Birkenhead River and Lillooet Lake	8,500	31	5,325	29
Harrison and Chehalis	520	17	500	42
TOTALS	10,760	69	6,850	79
LOWER FRASER				
Coquitlam to Chilliwack	45,865	88	12,900	162
Chilliwack to Hope	17,860	53	10,150	66
Vedder River and Vicinity	675	18	100	17
TOTALS	64,400	159	23,150	245
CANYON				
Hope to Lytton	55,000	250	28,800	231
TOTALS	55,000	250	28,800	231
LYTTON-LILLOOET				
Lytton to Lillooet	7,898	55	14,500	186
TOTALS	7,898	55	14,500	186
BRIDGE RIVER RAPIDS				
Rapids to Churn Creek	14,102	112	3,000	78
TOTALS	14,102	112	3,000	78
CHILCOTIN				
Farwell Canyon	2,285	10	292	
Hances Canyon	4,749	11	684	
Alexis Creek	4,092	11	1,462	
Siwash Bridge	6,628	26	3,637	
Keighley Holes	2,361	23	468	
TOTALS	20,115	81	6,543	120
UPPER FRASER				
Shelley	212	11	266	
Alkali to Churn Creek	400	32	605	
Chimney Creek	1,851	48	128	
Soda Creek	550	10	290	
Alexandria	60	2	83	
Quesnel	235	3	140	
TOTALS	3,308	106	1,512	119
NECHAKO				
Nautley and Stella Reserves	6,070	30	6,230	44
TOTALS	6,070	30	6,230	44
STUART				
Fort St. James	585	53	1,866	51
Tachie and Trembleur Villages	496	44	1,388	41
TOTALS	1,081	97	3,254	92
THOMPSON				
Main Thompson River	2,850	136	11,350	53
North Thompson River	308	44	350	47
South Thompson River	4,100	96	1,700	120
TOTALS	7,258	276	13,400	220
GRAND TOTALS	189,992		107,239	

*Number of permits issued to Indians in district.

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

TABLE VI
SUMMARY OF THE SOCKEYE ESCAPEMENT TO THE FRASER RIVER SPAWNING AREAS, 1955, 1959, 1963, 1967

District and Streams	1967 Period of Peak Spawning	Estimated Number of Sockeye 1955	1959	1963	1967	Jacks	Sex Ratio Males 4-5 yr.	Females 4-5 yr.
LOWER FRASER								
Cultus Lake	Nov. 15-20	26,000	48,461	20,571	33,492	294	14,767	18,431
Upper Pitt River	Sept. 7-10	17,552	15,740	12,680	10,300	18	5,030	5,252
Widgeon Slough	Nov. 1-4	——	637	353	1,006	6	466	534
HARRISON								
Big Silver Creek	——	191	64	9	0	0	0	0
Harrison River	Nov. 16-20	5,595	28,562	22,287	20,577	29	7,788	12,760
Weaver Creek	Oct. 14-17	21,330	8,379	14,469	22,617	36	10,623	11,958
LILLOOET								
Birkenhead River	Sept. 18-22	25,355	38,604	67,151	58,036	18,160	17,078	22,798
SETON-ANDERSON								
Gates Creek	Sept. 1-7	86	867	4,858	1,665	527	569	569
Portage Creek	Oct. 24-27	43	572	2,011	6,548	43	3,159	3,346
SOUTH THOMPSON								
Seymour River	Sept. 1-4	9,511	52,325	71,690	13,361	0	5,600	7,761
Upper Adams River	——	0	0	6	——	——	——	——
Lower Adams River	Oct. 15-20	54,405	113,230	151,373	765,161	887	345,647	418,627
Little River	Oct. 15-20	9,072	21,080	5,148	74,490	89	35,188	39,213
South Thompson River	Oct. 15-18	0	472	45	270	0	122	148
Lower Shuswap River	Oct. 18-21	23	0	23	5,951	0	2,975	2,976
NORTH THOMPSON								
Raft River	Aug. 31-Sept. 3	5,364	10,210	8,724	1,303	24	564	715
Barriere River	Aug. 25-28	103	203	92	16	0	8	8
Fennell Creek	Aug. 29-Sept. 1	——	27	439	920	4	458	458
North Thompson River	——	——	——	70	——	——	——	——
CHILCOTIN								
Chilko River	Sept. 24-27	128,081	470,621	1,002,252	176,337	1,622	72,563	102,152
Taseko Lake	Aug. 25-28	4,400	16,410	31,667	5,700	0	2,550	3,150
QUESNEL								
Horsefly River	Sept. 1-5	62	Present	86	119	0	59	60
Little Horsefly River	——	——	27	0	——	——	——	——
NECHAKO								
Endako River	Aug. 25-30	594	1,463	2,540	949	0	474	475
Nadina River (Early)	Aug. 24-27	202	351	1,019	1,595	0	667	928
(Late)	Sept. 14-18		1,013	7,304	7,790	0	3,259	4,531
Nithi River	Aug. 17-20	79	218	763	1,688	0	706	982
Ormonde Creek	——	27	74	41	0	0	0	0
Stellako River	Sept. 24-28	51,971	79,355	138,805	90,680	45	37,050	53,585
STUART								
Early Runs								
Driftwood River	Aug. 8-10	0	3	14	52	0	26	26
Forfar Creek	Aug. 6-9	68	281	652	4,815	0	2,024	2,791
Gluske Creek	Aug. 4-8	99	97	0	1,368	3	553	812
Kynoch Creek	Aug. 4-8	1,029	1,123	2,147	6,694	9	3,115	3,570
Narrows Creek	Aug. 8-11	27	167	180	454	3	160	291
Rossette Creek	Aug. 6-8	916	911	1,600	6,566	10	2,872	3,684
Misc. Streams	Aug. 8-16	31	81	34	1,120	0	545	575
Late Runs								
Kazchek Creek	Sept. 10-12	18	7	364	92	0	46	46
Middle River	Sept. 19-23	3,596	3,500	1,838	972	13	351	608
Tachie River	Sept. 20-22	4,000	2,500	1,035	576	0	288	288
NORTHEAST								
Upper Bowron River	Aug. 28-Sept. 1	9,355	29,247	25,144	31,695	0	15,847	15,848
TOTALS*		379,185	946,882	1,599,484	1,355,295	21,822	593,357	740,116

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

TABLE VII

DAILY CATCH OF SOCKEYE, 1952-1956-1960-1964 FROM UNITED STATES CONVENTION WATERS

Date	JULY				AUGUST				SEPTEMBER			
	1952	1956	1960	1964	1952	1956	1960	1964	1952	1956	1960	1964
1	5,011				40,805	59,168	117,041		711		3,777	378
2	8,640	4,286				41,245	54,285		597			377
3	7,943	3,885					45,840	79,585	432	1,418		
4	4,857	2,365			32,815		45,845	73,612	434	606		
5		1,038		CLOSED	25,891			59,668	140	500	1,784	
6					16,978	141,861				454	1,524	
7	14,008		CLOSED		18,488	98,859	194,605		722	146	1,295	
8	9,369				13,920		181,344		201		614	163
9	8,090	2,429					126,087		573			152
10	6,796	1,803					96,389		636	78		83
11	4,187	2,189			6,865		65,882		557	58		
12		1,423			7,055		42,416		410	33		
13				3,118	2,697	24,347		25,336		119	CLOSED	
14	9,159			1,463	2,712	21,450			434	100		314
15	10,812				2,831	12,509			299			48
16	13,794	4,677				9,102			272			104
17	16,876	8,146						15,456	193	43		143
18	11,786	12,101	6,574		4,096			12,122	202	146		
19		15,053	6,329		3,143		CLOSED	5,160	151	49	50	
20			6,823	6,956	2,730	13,151				23	130	
21	90,696		7,550	8,672	967	8,831			117	37	56	50
22	32,619			16,773	612	4,955			135		38	49
23	34,320	78,518				2,252			85			61
24	110,491	59,695						5,773	48	3		13
25	134,294	39,052	78,450		220			1,845	47	3		
26		31,635	38,405		720			1,205	34	4	CLOSED	
27			33,335	79,632	1,167	651				5		
28	128,339		32,087	54,204	1,310	727			20	5		22
29	100,767			53,412	931	389	3,587		20			6
30	96,565	113,200				524	2,064		31			4
31	56,664	70,572			654		3,024	681				
Totals	916,083	452,067	209,553	224,230	187,607	440,021	978,409	280,443	7,501	3,830	9,268	1,967
Troll and outside seine			142	165	2	3,816	851	113	17	34		
Monthly Totals	916,083	452,067	209,695	224,395	187,609	443,837	979,260	280,556	7,518	3,864	9,268	1,967
June, Oct. & Nov. Totals									2,265	7,104	746	1,169
Season Totals									1,113,475	906,872	1,198,969	508,087

TABLE VIII

DAILY CATCH OF SOCKEYE, 1952-1956-1960-1964 FROM CANADIAN CONVENTION WATERS

	JULY				AUGUST				SEPTEMBER			
Date	1952	1956	1960	1964	1952	1956	1960	1964	1952	1956	1960	1964
1	10,225				11,392	54,068			13,562		760	1,684
2	8,532					25,441	47,301		5,599			103
3	12,241	8,554					194,327	114,881	3,343			
4	1,184	4,731	7,347					42,299	6,475	4,403		
5		6,501	6,170	CLOSED	108,955			22,772	10	1,448	491	
6			4,544		36,472						222	
7	13,476				23,048						71	2,491
8	10,009				911	154,050	108,471		8			664
9	8,732					78,176	208,985		7			23
10	9,000	4,773					87,843		7			
11	1,317	2,782	8,358		38,878		34,455		11	584		
12		2,474	4,686		12,321			102,832	12	260	1,402	
13			4,341	2,441	11,433			28,793			464	
14	13,063				9,381	53,080					32	9
15	8,249				110	15,765			28			9
16	13,221						96,388		28			
17	22,896	7,570					45,676	35,135	27			
18	11,729	7,067	11,420		17,786		56,111	15,025	17			
19		9,459	14,424		9,714			5,341	17	6,916		
20			24,164	6,922	6,218					2,753	CLOSED	
21	5,299			8,331	5,443	17,444						1,393
22	5,299				67	5,804	53,752					
23	5,299						17,274					1
24	39,207	57,027						20,527		1,383		1
25	48,841	22,609	84,939		21,489			7,093	1	193		3
26		29,237	51,124		9,583			953	1	94		
27			60,451	49,543	6,535					29		
28	211,103			13,561	5,162	6,907					614	
29	109,483			12,826	13	2,863	2,292		2		185	0
30	79,096						806		2			0
31	120,159	181,981					885	4,927				
Totals	767,660	344,765	281,968	93,624	334,911	413,598	954,566	400,578	29,157	18,063	4,241	6,381
Troll and outside seine		91	670	1,775	811	111,659	2,092	1,637		57	109	15
Spring salmon gill nets				675			253			220	268	565
Monthly Totals	767,660	344,856	282,638	96,074	335,722	525,257	956,911	402,215	29,157	18,340	4,618	6,961
June, Oct. & Nov. Totals									21,844	6,383	11,028	9,298
Season Totals									1,154,383	894,836	1,255,195	514,548

TABLE IX
SUMMARY OF THE SOCKEYE ESCAPEMENT TO THE FRASER RIVER SPAWNING AREAS, 1952, 1956, 1960, 1964

District and Streams	1964 *Period of Peak Spawning*	*Estimated Number of Sockeye* 1952	1956	1960	1964
LOWER FRASER					
Cultus Lake	——	18,910	14,133	17,689	11,143
Upper Pitt River	Sept. 13-16	48,887	32,258	24,511	13,804
Widgeon Slough	Nov. 3-5	1,648	1,000	400	667
HARRISON					
Bear Creek	——	——	——	189	41
Big Silver Creek	Sept. 23-25	6,031	6,187	4,522	3,926
Harrison River	Nov. 6-12	25,794	3,184	17,279	2,202
Weaver Creek	Oct. 13-15	33,983	8,472	7,042	1,370
LILLOOET					
Birkenhead River	Sept. 19-21	79,082	57,899	38,916	69,939
SETON-ANDERSON					
Gates Creek	Aug. 27-28	6,883	9,059	5,449	19,971
SOUTH THOMPSON					
Seymour River	Sept. 4-6	6,785	2,684	3,047	2,784
Lower Adams River	Oct. 25-30	8,692	7,512	2,152	796
Little River	——	1,964	661	66	0
Scotch Creek	——	357	163	11	0
South Thompson River	——	200	0	0	0
Upper Adams River	Sept. 3-5	0	0	Present	162
Momich River	Aug. 31-Sept. 2	——	——	1,000	823
NORTH THOMPSON					
Raft River	Sept. 4-6	15,819	9,582	5,553	5,500
Barriere River	Sept. 10-12	——	——	23	85
Fennell Creek	Sept. 1-3	——	——	0	146
North Thompson River	——	——	——	——	38
CHILCOTIN					
Chilko River	Sept. 29-Oct. 3	489,473	647,479	420,746	238,601
Taseko Lake	Aug. 27-Sept. 3	3,647	1,995	2,524	433
QUESNEL					
Horsefly River	Sept. 10-12	7,013	2,944	3,087	19,800
Mitchell River	——	——	14	5	169
Little Horsefly River	Sept. 25-27	——	——	23	355
NECHAKO					
Endako River	——	146	18	0	7
Nadina River (Early)	Aug. 24-Sept. 1	1,677	1,311	1,566	1,397
(Late)	Sept. 16-20			157	232
Nithi River	Aug. 23-26	45	36	31	13
Ormonde Creek	Aug. 29-Sept. 1	996	331	158	180
Stellako River	Sept. 26-30	40,462	38,459	38,884	31,047
STUART					
Early Runs					
Driftwood River	——	38	50	34	2
Forfar Creek	Aug. 14-17	6,975	5,497	1,755	27
Gluske Creek	Aug. 12-17	5,911	4,619	2,138	218
Kynoch Creek	Aug. 12-17	13,439	9,535	4,154	1,147
Narrows Creek	Aug. 14-17	1,453	697	598	22
Rossette Creek	Aug. 12-16	3,575	3,863	4,558	952
Shale Creek	——	414	185	139	27
Misc. Streams	——	1,775	711	1,196	26
Late Runs					
Kazchek Creek	——	295	223	5	0
Middle River	Sept. 20-25	476	500	1,056	743
Tachie River	Sept. 26-30	364	600	1,687	1,157
Sakeniche River	——	——	131	0	0
NORTHEAST					
Upper Bowron River	——	18,672	6,996	7,620	1,500
TOTALS		851,881	878,988	619,970	431,452

TABLE X
PINK CATCH BY GEAR

United States Convention Waters

	Purse Seines			Gill Nets			Reefs Nets			Troll		
Year	*Units*	*Catch*	*Per-centage*	*Units*	*Catch*	*Per-centage*	*Units*	*Catch*	*Per-centage*	*Catch*	*Per-centage*	*Total Catch*
1967	315	3,203,781	83.71	507	310,744	8.12	50	118,994	3.11	193,521	5.06	3,827,040
1965	230	410,444	73.51	234	48,823	8.74	49	21,264	3.81	77,849	13.94	558,380
1963	357	3,454,287	78.04	262	382,424	8.64	69	89,768	2.03	499,753	11.29	4,426,232
1961	199	344,214	67.69	360	71,924	14.14	79	28,513	5.61	63,893	12.56	508,544

Canadian Convention Waters

	Purse Seines			Gill Nets			Troll		Total
Year	*Units*	*Catch*	*Per-centage*	*Units*	*Catch*	*Per-centage*	*Catch*	*Per-centage*	*Catch*
1967	102	2,289,207	55.07	1,767	892,447	21.47	975,268	23.46	4,156,922
1965	89	336,478	56.79	1,268	182,059	30.73	73,930	12.48	592,467
1963	159	2,936,194	70.36	1,246	797,385	19.10	439,709	10.54	4,173,288
1961	82	313,636	57.53	1,116	142,518	26.14	88,974	16.33	545,128

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

TABLE XI
LANDINGS AND PACKS OF PINK SALMON FROM CONVENTION WATERS

	United States	*Canada*	*Total*
1967			
Total Landings (No. of Pinks)	3,827,040	4,156,922	7,983,962
Share in Fish	47.93%	52.07%	
Total Pack (48 lb. Cases)	266,690	294,858*	561,548**
Share in Pack	47.49%	52.51%	
1967 Catch	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

* Includes 781 cases packed in Canada from Pinks caught in United States Convention waters.

**77,132 pinks caught by United States fishermen and 50,729 pinks caught by Canadian fishermen were sold on the fresh and frozen market.

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

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

TABLE XIII

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

	JULY				AUGUST				SEPTEMBER			
Date	1961	1963	1965	1967	1961	1963	1965	1967	1961	1963	1965	1967
1					14,821			528				
2							10,495	474		67,539		
3	1						12,117			182,611		117,540
4	1					5,237	10,252			210,058		134,138
5		CLOSED				31,344			3,335	178,872		128,994
6			3			57,540		10,829	2,198			65,626
7			2			67,174		14,045			17,544	93,898
8						775		17,863			10,086	100,559
9					18,773		23,992	20,326		24,161	5,416	
10	4				22,031		24,346			131,138		
11	4						25,866			91,215		218,008
12	6		10			77,691			936			136,118
13	29	Strike	10		4,954	86,575			569		6,151	73,745
14		July 12			3,753	81,750		146,394			4,110	31,250
15		to			80,913	106,538		108,014			3,383	
16		Aug. 4			56,892		49,953	105,629		14,390	3,314	
17	13,807			8			43,342			8,865		
18	8,909			7			40,776					29,284
19			22	4		142,007			344			16,313
20			49			113,020			260		52,695	10,361
21			182		15,144	125,864		67,700	431		718	
22					39,029	372,486		150,862			383	54,442
23						187,652		168,186		71,976		
24	27,564			328								
25	22,427			266			81,419			5,651		10,133
26	18,841			308		12,340	37,969		89	1,790		6,294
27			353	454		419,589			30		317	4,998
28			147		5,480	243,875		210,531	22		163	
29			198		12,061	229,443		293,634			32,671	
30			70			220,827	5,307	239,917				
31	9,097			1,037				221,137				
Totals	100,690	0	1,046	2,412	273,851	2,581,727	365,834	1,776,059	8,214	988,266	136,951	1,231,701
Troll	26,208	100,316	14,990	99,288	34,659	214,245	51,148	663,415	20,038	106,578	7,378	197,605
Spring salmon gill nets									37,330	12,894	13,508	
Monthly Totals	126,898	100,316	16,036	101,700	308,510	2,795,972	416,982	2,439,484	65,582	1,107,738	157,837	1,429,306
June, Oct. & Nov. Totals									44,138	169,262	1,612	186,432
Season Totals									545,128	4,173,288	592,467	4,156,922

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

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

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

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

United States Spawning Areas	1961	1963	1965	1967
Nooksack	100,000	150,000	12,500	20,000
Skagit	400,000	1,190,000	150,000	100,000
Stillaguamish	125,000	640,000	185,000	105,000
Snohomish	50,000	275,000	185,000	95,000
Puyallup	10,000	10,000	25,000	22,000
Dosewallips	22,000	400,000	125,000	190,000
Duckabush	14,000	100,000	30,000	70,000
Dungeness	70,000	400,000	75,000	95,000
Elwha	8,000	40,000	15,000	10,000
Miscellaneous	9,000	19,000	10,400	19,000
TOTALS	808,000	3,224,000	812,900	726,000

Canadian Non-Fraser Spawning Areas	1961	1963	1965	1967
Jervis Inlet	259,000	211,000	43,275	25,000
Howe Sound	398,000	750,000	81,000	37,000
Burrard Inlet	76,000	200,500	35,250	13,000
TOTALS	733,000	1,161,500	159,525	75,000

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