The Fraser Watershed and the Moran Proposal

by RODERICK HAIG-BROWN

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Proposed site for the high Moran Dam — *Roderick Haig-Brown*

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British Columbia's Fraser River is 850 miles long from its source in the Rockies to its splendid outflow into the Strait of Georgia just south of Vancouver. Its complex of lakes and tributary streams drains some 90,000 square miles or roughly one quarter of the area of the province. Over the ages the river has built up the productive farm lands of the Fraser Valley between Hope and Vancouver. Its flow substantially influences the nature and quality of the Strait of Georgia, which is one of Canada's most important recreational resources. And the Fraser is one of the world's truly great salmon watersheds—potentially, perhaps, the greatest of all. All five species of Pacific salmon, as well as steelhead trout, run to it in good numbers and its lake systems particularly favor production of sockeyes, the most valuable of the commercial species.

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A HISTORY OF USE AND ABUSE

Like all the other major watersheds of the continent, the Fraser has been abused and its yield of fish has been significantly reduced. Yet it still supports an important international fishery and its full original potential is not seriously impaired—that is, it can still be restored, perhaps even enhanced. There are no obstructions on the river's main stem; salmon can pass right through to Tête Jaune Cache at the foot of the Rockies. The important lake systems, which are the real source of sockeye production, remain accessible. While there is some pollution, particularly in the lower reaches and in the middle reaches below Prince George, the river remains in essentially good condition throughout its length and even the existing pollution should, and readily can, be cleaned up and kept under control.

In spite of this optimistic picture, both the watershed and the salmon runs have suffered serious damage over the past 110 years. The gold rush of the late 1850s and early 1860s undoubtedly caused damage by gravel disturbance and silting more costly over the long-term than all the gold it realized. Primitive irrigation practices caused damage and losses. There have been damaging diversions, notably the Alcan diversion of part of the Nechako flow. Atrociously ill-considered logging practices have also done much damage: an absurd little logging splash dam at the outlet of Adams Lake totally wiped out the important sockeye run to the upper Adams River and this particular genetic stock has not yet been successfully replaced; perversely permitted log driving on the Nadina and Stellaco Rivers did millions of dollars worth of damage to spawning beds; poorly planned and inadequately controlled logging has done and is still doing major damage to temperature and flow conditions on many tributary streams. Over-fishing in the first ten or twelve years of this century greatly reduced three of the four cycle years of the sockeye run and may have caused the loss of some valuable genetic strains. The remaining cycle, of the years 1901-5-9, met the disastrous rockslide at Hell's Gate in 1913 and the catch dropped from nearly 29 million fish in 1913 to less than 7 million in 1917 and less than 2 million in 1921.

THE HELL'S GATE SLIDE

The 1913 slide at Hell's Gate was probably the greatest single disaster to a self-reproducing resource in Canadian history. At least four of the five salmon species, as well as the steelhead, were seriously affected—pink salmon runs above Hell's Gate apparently ceased altogether, presumably because none of this smaller and weaker species could make the turbulent passage. Runs to the Fraser remained at comparatively low levels through the 1920s, 1930s and 1940s. At first there was some hope that hatcheries might restore at least some of the old abundance, but this hope was effectively destroyed by careful and detailed research over several cycles by Dr. R. E. Foerster at Cultus Lake. The rate of adult return from hatchery stock was little if at all superior to that from natural spawning. The cost was great and the numbers of fish handled was insignificant. The solution, it became clear, would not be in hatcheries, but in allowing a sufficiently large proportion of wild fish in the various runs to escape the fishery and pass through to their spawning areas.

THE EARLY WORK OF THE I.P.S.F.C.

In 1937 the International Pacific Salmon Fisheries Commission was formed by treaty between Canada and the United States, with responsibility for controlling the sockeye fishery to permit adequate spawning escapements, dividing the catch between the two countries and restoring so far as possible the former abundance.

One of the Commission's first tasks was to examine the delays in spawning migration that were still being caused by the rock slide and consequent changes in the river channel. These were found to be extremely significant; fish were not getting through in time to reach their rivers and spawn effectively. Special fishways were designed to operate at varying river heights and were installed in 1945-6; the logging splash dam at Adams Lake was removed and additional fishways were built in subsequent years at Yale Rapids, Bridge River Rapids and at Farwell Canyon on the Chilcotin River.

The effect of these measures was both prompt and dramatic. Escapements of sockeye salmon to spawning areas upstream from Hell's Gate increased from an annual average of 170,000 in the years 1938-1945 to 544,000 in the years 1946-1971. Pink salmon escapements upstream of Hell's Gate have increased from "none reported" in 1945 to well over half a million spawners in 1971. Essentially the full length of the river was once again open to salmon migration and a return to full production was theoretically possible. But unfortunately a salmon watershed, once damaged, is not so easily restored. There have been losses of genetic strains particularly adapted to certain spawning areas, there has been extensive damage to many spawning areas and, perhaps most serious of all, there have been distortions of natural cycles that have adversely affected lake productivity. While the average annual catch of sockeye in convention waters has increased from 2.4 million fish in the years 1914-1949 to 3.2 million in the years 1950-1971, the average catch before the 1913 slide was about 9 million and the potential of the watershed, if all areas were producing properly, should be an average annual yield of 10 or 11 million. Pink salmon run to the river only every other year and have a two year life history. Recent catches have averaged about 4 million, with a high of nearly 11 million in 1967. Pre-1913 records are not available, but it is estimated that the runs could have produced an average catch of about 22 million with spawning escapements of 3 million. Full rehabilitation should yield returns of 22 to 33 million fish every second year.

Apart from the maintenance of adequate spawning and rearing areas, management of a great salmon watershed like the Fraser calls for the escapement through the fishery of adequate numbers of each genetic stock that uses the spawning areas, whether in the main river or its tributaries. Each local stock is peculiarly adapted to the conditions of its area and once a stock is wiped out it can be extremely difficult to replace. The Upper Adams stock is an outstanding example; all four cycles were destroyed in the 1920s by the small logging dam that blocked access to the lake and the spawning areas above. Efforts to replace it over many years by transplants of stocks from apparently similar areas have so far been unsuccessful, though a small stock from the Seymour River is presently maintaining a precarious return and there is good reason to hope that this can be built up. In the meanwhile some fifty years of production have been lost.

There can be little doubt that other local stocks, of which there are no historic records, have been lost through overfishing or other causes. The present stocks in the Horsefly and Barriere River, for instance, have not been able to adapt to the use of spawning areas that were used by the original

Fishing vessels using gill nets at mouth of the Fraser River
Roderick Haig-Brown

spawning populations. There are unexplained pre-spawning "die-offs" of some early running races, which appear to be linked to certain physio-chemical characteristics. There are apparently suitable spawning areas that have no stocks and at least one lake that does not raise young fish in proportion to its apparent capacity. There are, in fact, many mysteries for which no solution is immediately in sight; but there are also many under-utilized spawning and rearing areas that can certainly be restored to full production by methods already proved effective elsewhere on the watershed.

MANAGEMENT OF A GREAT SALMON WATERSHED

The Commission's methods of controlling the fishery and ensuring adequate spawning escapements have steadily increased in sophistication over the years. The forecasting of run sizes is based on close observation of spawning success, incubation conditions, hatching success and the development of pre-migrants. Counts of downstream migrant fry and smolts are made by sampling. Some further observation is possible in the Strait of Georgia before the young fish move out into the open Pacific. All this data is compared to that of other years to produce an informed estimate of the run in the next cycle year. After that there is the uncertainty of the ocean years; conditions may be favorable to high ocean survival, or unfavorable. In the case of the sockeye there may be some indication of this in the run of precocious males, returning to spawn one year before the time of their cycle. On this partial information the Commission staff predicts the run size and proposes tentative fishery regulations for the coming season.

The Fraser runs pass through three major fisheries — a Canadian fishery at the entrance to the Strait of Juan de Fuca, the U.S. fishery in Puget Sound and a Canadian gill-net fishery in the Strait of Georgia and the lower reaches of the river itself. If conditions are right, any one of these fisheries is capable of catching close to an entire day's run, so fishing times must be controlled in such a way as to provide approximately equal division of the catch between the two countries. At the same time adequate spawning escapements must be allowed through, not only in terms of early and late runs but so far as possible in terms of the specialized local stocks.

This seemingly impossible task is substantially achieved by an unfailing daily flow of information from test fishing boats and commercial landings. The earliest firm information comes from the troll fishery off the west coast of Vancouver Island, outside convention waters. The average size of the incoming fish, for instance, is a normally reliable, though rough, indicator of the approximate size of the pink salmon run to be expected—small average size indicates a large run, and vice versa.

Once the fish enter convention waters a running daily record of the catch is maintained, scale samples are taken from the various landings and are flown to the Commission's headquarters in New Westminster. The origin of the fish is determined by examining the scale nuclei (the part of the scale developed during freshwater life) and the proportion of the different runs passing through the fishery can be determined. In this way it is usually possible to ensure adequate escapements of the different stocks by regulation of the fishery, but in some cases the timing is such that a small but valuable stock enters the fishery at the same time as a strong run to another area that must be fished heavily. Stellaco and Birkenhead stocks, for instance, which the Commission would like to strengthen, run at much the same time as the strong Chilco stock which must be heavily fished three years out of four.

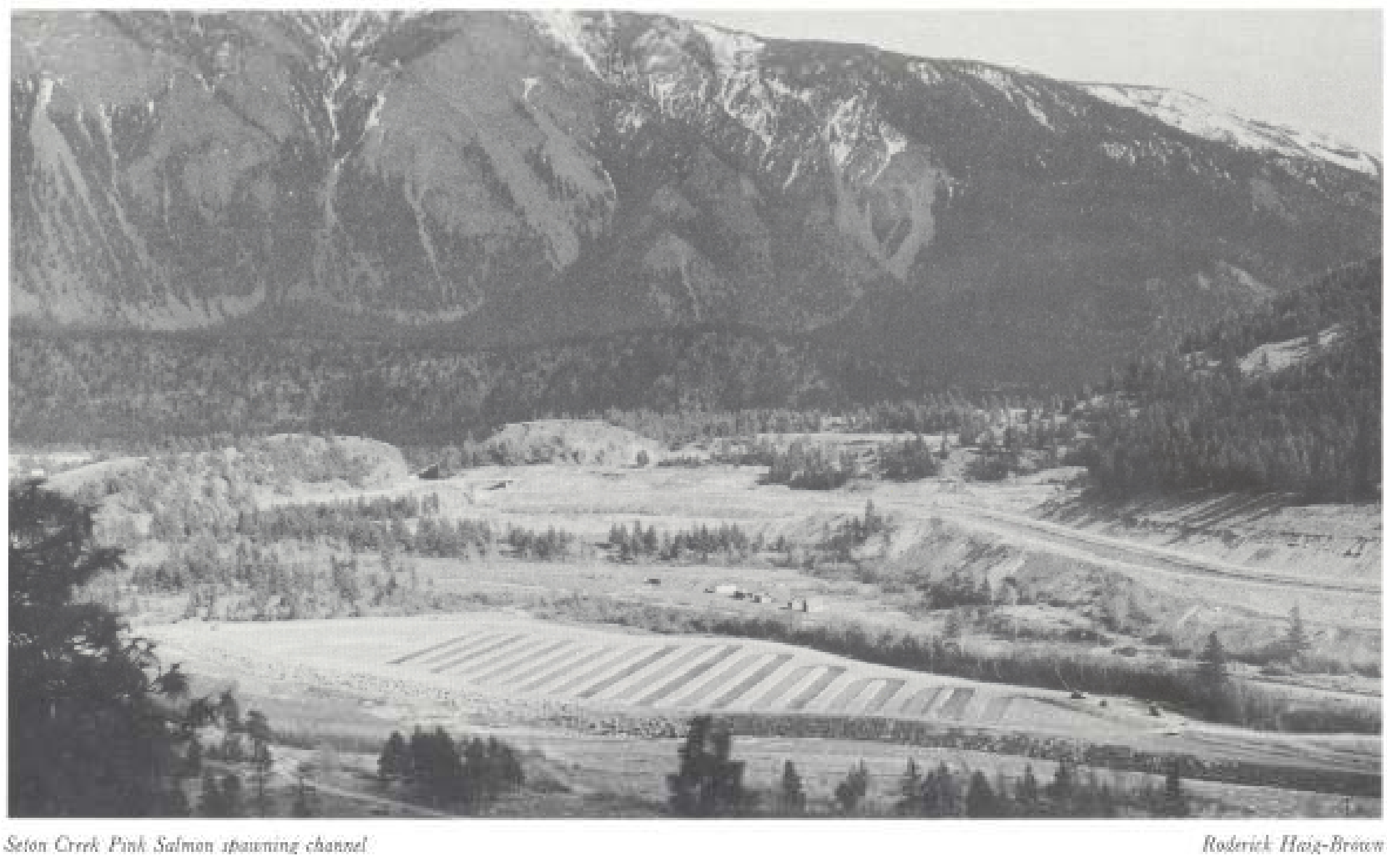
Control and regulation of the fishery is primarily protective in that its purpose, apart from ensuring division of the catch, is to provide spawning escapements large enough to maintain the runs. But it has positive aspects as well in that a given run can be permitted to build up to valuable proportions; close protection of the early Stuart sockeye run in 1963 and 1967, for instance, permitted a catch of 165,000 fish in 1971 with a spawning escapement that built from 4600 in 1963, to 21,000 in 1967 and 96,000 in 1971. But escapements cannot increase runs where spawning or rearing areas are inadequate, while excessive escapements not only represent lost catch value but may reduce the total yield of a four year cycle by depleting the rearing capacity of nursery lakes.

There can, of course, be no escapement to an area that has lost its native stock, except through straying, something that seems to occur very rarely with sockeyes though it is fairly common with pink salmon and seems to be slowly progressive.

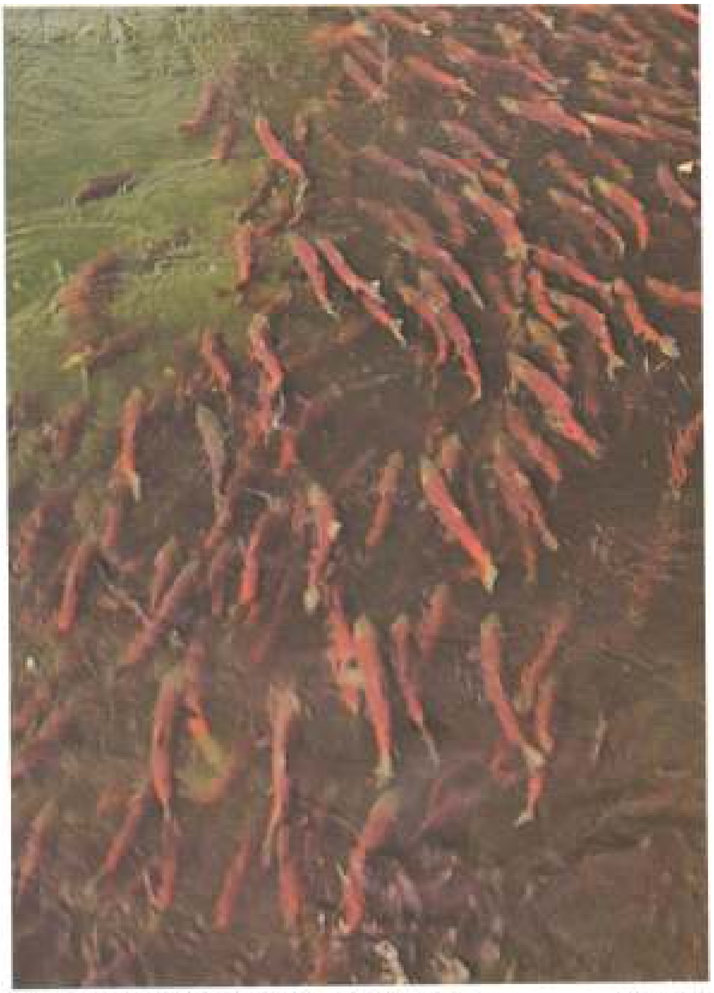
The Commission has already taken steps to restore certain runs depleted by damaged or obstructed spawning areas. In some cases the restoration is quite simple, as for instance, in the restoration of evenly balanced winter flows to the two natural channels of the Lower Adams River. Jobs like this are really maintenance rather than development, but they can and do yield handsome dividends in increased survival rates from natural spawning. Over a million scarlet sockeyes spawned successfully in the Lower Adams in October of 1970, clearly visible against the gravel under the flow of clear swift water. More than a hundred thousand people came to watch them and most of them left with a sharper appreciation of the world they live in and the creatures they share it with. In 1974 the progeny of this spawning will return again to those 300 acres of gravel, and the people will come in still greater numbers to walk the trails under the golden poplars along the banks.

When spawning grounds have been damaged beyond a certain point by flooding, siltation or gravel disturbance, or where their production is seriously reduced by periodic flooding and low water levels, something more is needed. At Seven Mile Creek on the Upper Pitt River the Commission installed two small incubation areas at a cost of $84,000 in 1963. These are essentially ponds of carefully selected gravel through which water is percolated by an underlying system of plastic pipes. Eyed sockeye eggs are then planted in the gravel, allowed to hatch and the fry find their own way out to the stream in their own time. Egg to fry survival rates from this operation have varied from 73 to 88 per cent and adult returns per female spawned have been increased some 14 times over natural spawning. The first year of operation provided a catch value of well over $200,000 to the fisherman, and the returns for the four years of operation have been 66% above the average of the preceding 15 years.

In Weaver Creek, a tributary of the Harrison River below Harrison Lake, an unusually specialized genetic strain produces fry that migrate downstream to the Harrison River, then upstream to use the rearing capacity of Harrison Lake. Floods, erosion and siltation, chiefly caused by logging operations, reduced a 16 year average return of 20,000 spawners to returns of about 10,000 by the early 1960s. Since the Weaver Creek return through the fishery coincides with those of other runs that must be fished heavily, there was serious risk of losing this unique genetic stock entirely and with it the major part of the productivity of Harrison Lake. In 1965 an artificial spawning channel with a capacity of 11,000 sockeye females, protected from all flooding and silting, was built. The capital cost of this channel was $275,000. The first return from its operation produced an escapement of 59,000 spawners to Weaver Creek in 1969, the largest return ever recorded, and a catch of 110,000 fish (landed value $264,000) in the commercial fishery. Subsequent spawning returns are 17% above the average of the preceding 17 years, although the channel has, except in 1969, had no more than 25% of its capacity of spawners. The fry survival rate continues at an average of about 80%, making each channel female the equivalent of 7.4 spawning under natural creek conditions. This means that the rather poor channel return



Seton Creek Pink Salmon spawning channel — *Roderick Haig-Brown*



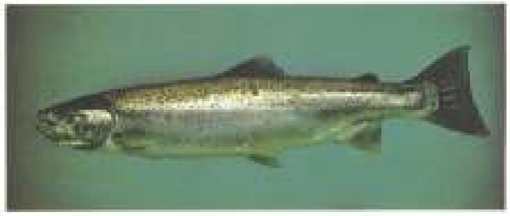
Sockeye salmon school in left channel of Adams River I.P.S.F.C.

Pair of Sockeye spawners

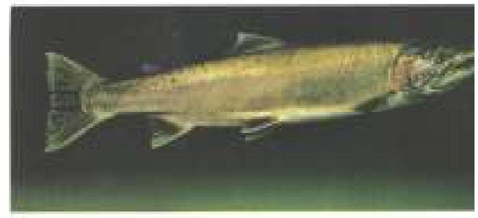
Sockeye salmon moving up the Adams River I.P.S.F.C.

I.P.S.F.C.

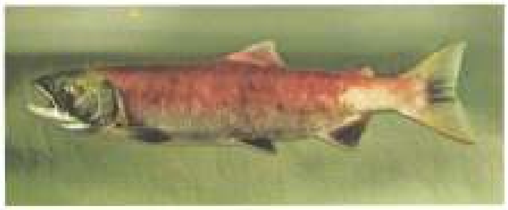
Map showing locations of existing and proposed spawning channels   Roderick Haig-Brown



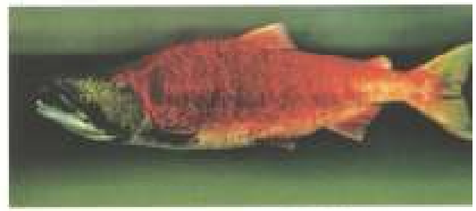
Female Steelhead prior to spawning   F. T. Pletcher



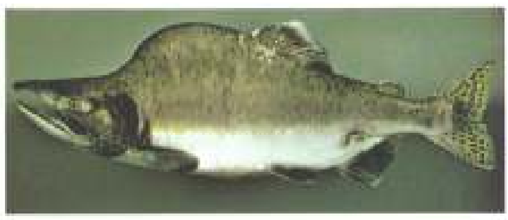
Male Steelhead prior to spawning   F. T. Pletcher



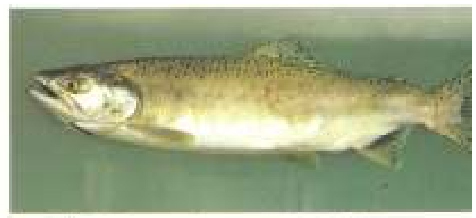
Female Sockeye spawning   F. T. Pletcher



Male Sockeye spawning   F. T. Pletcher



Male Pink Salmon spawning   F. T. Pletcher



Female Pink Salmon spawning   F. T. Pletcher

Female Chum Salmon spawning   F. T. Pletcher

Male Chum Salmon spawning   F. T. Pletcher

Adult male Coho Salmon in sea   F. T. Pletcher

Small Coho Salmon grilse in sea   F. T. Pletcher

Chinook Salmon entering fresh water   F. T. Pletcher

Schooled Chinook Salmon   Roderick Haig-Brown of 1520 females in 1971 is the equivalent of over 11,300 or nearly 3 times the average of the 6 years preceding the building of the channel.

The Commission also operates spawning channels at Gates Creek, above Anderson Lake, for sockeyes and at Seton Creek, below Seton Lake, for pink salmon. The first return to Gates Creek will be in 1972, though there was an encouraging return of precocious males in 1971. The Seton Creek channels have been in operation since 1961 with consistently good results. The 1971 return of pink salmon spawners to Seton Creek and the channels was 298,000, which compares with a return of only 59,000 in 1961. It is significant that Seton Creek comes into the Fraser at Lillooet, some 70 river miles above Hell's Gate, beyond which no pink salmon at all were reported in 1945 and few, if any, between 1913 and 1945.[1]

Although commercially productive, these have been essentially experimental or pilot projects; but their sustained level of success has been so high that the Commission feels the results can be safely projected for proposals in other parts of the watershed. A large sockeye spawning channel is presently under construction on the Nadina River and should be completed in time for the 1973 return. With a capacity of about 14,000 females, it will be followed by a second channel nine miles downstream with spawning area for a further 83,000 females and realize the full rearing capacity of François Lake.

The second stage of the Nadina channel will be part of an intensive program to return the watershed to pre-1913 production, announced by the Commission at the 1971 annual meeting.[2] Seven other sockeye spawning channels are planned to take advantage of lake rearing capacity at present unrealized. The locations are as follows:

Upper Pitt River, for Pitt Lake, capacity 2000 female spawners.

North Barriere River, for Kamloops Lake, capacity 12,400 female spawners.

Horsefly River, for Quesnel Lake, capacity 40,000 female spawners.

McKinley Creek, for Quesnel Lake, capacity 16,600 female spawners.

Tachie River, for Stuart Lake, capacity 163,000 female spawners.

Kazchek Creek, for Trembleur Lake, capacity 27,500 female spawners.

Ankwill Creek, for Takla Lake, capacity 55,000 female spawners.

In addition to these a small incubation channel (capacity 4 million eggs) is planned for the Upper Adams River to build up the precarious stock established there by transplants from Seymour River. If successful, this will replace the extinct Upper Adams genetic strain and in time build a new run of major proportions. Three spawning channels for pink salmon will be located on the Chilliwack River (capacity 73,500 spawners), the Harrison River (117,350 spawners) and the Chehalis River (100,000 spawners). This program should be completed within 10 years, if the necessary funds are forthcoming from the *two countries*, at a cost of about 14 million dollars, though some of the rehabilitated runs may not reach full production for several cycles. The annual return to the fisherman from the program would be about 14 million dollars and the processed value of the fish would be over 30 million. The average benefit cost ratio would be 9.5 to 1. These figures include no allowance for restoration of the Upper Adams run because there is no precedent on which to base its chances of success, but they are in keeping with results already realized from the Commission's other projects.

This review of management and development techniques reveals only a small part of the sensitive complexity of diverse environments and dependent genetic strains that go to making up a great salmon watershed. Every disturbance of the interrelationships represents loss; major disturbance can mean total loss. What I have described reflects only part of the river's salmon resources. Three other species, chinook, coho and chum run to the river. The first two of these are major contributors to the Strait of Georgia sports fishery and to the commercial troll fishery. The third is an important late season commercial fishery, presently in decline, but already showing signs of recovery.

POLLUTION AND HIGH DAMS

Logging, and to some extent mining and agricultural operations, will continue to present problems on the watershed, but none of these will be insuperable if such works are intellingently operated and controlled. Only two things can destroy the watershed as one of the world's major salmon producers: pollution and high dams on the main stream.

I have suggested that pollution is not as yet a major problem, or at all events not demonstrably so. Yet the river does already carry large quantities of unnecessary pollution, especially below Prince George and in the last hundred or so miles of its length through the Lower Fraser Valley. Municipal pollution, mainly sewage, is a major factor in both areas and proper treatment is something that will have to come within the next few years. The lower river also carries a good deal of industrial and agricultural pollution which can and should be controlled; up river four pulp mills, three at Prince George and one on the Thompson River, are already in operation and a fifth is under construction. Fortunately the waste disposal facilities of all these mills were designed with the advice of the Commission's staff scientists and are considered to be as good as any in the world. But such facilities are only as good as their maintenance and operation. Malfunction can be damaging and an accidental spill may be disastrous.

The fact that salmon and other anadromous fish are so far able to pass upstream and down without apparent injury or loss is due in large part to the river's substantial flow and consequently large dilution capacity. Though it may be tolerable in the short-term, this is not a satisfactory situation. The Commission stated as policy some years ago that dilution capacity should be used only as a safety factor, never as a means of treatment. Until this ideal is met, the runs will not be safe.

For the most part, pollution is a creeping, cumulative thing, seldom dramatic and immediate in its effects. There can, of course, be deadly spills of chemicals or other toxics, and certain metals—copper, mercury and cadmium to name only three can be devastating at relatively low levels. But the water quality of large rivers is usually degraded by many small pollutions from many sources. Control is always possible; it just hasn't generally been the practice to exercise it in the past.

The Fraser salmon runs can be destroyed almost totally, and forever beyond recovery, by one dramatic means: high dams on the main river channel. A recurrent threat is the 750 foot dam considered for the Moran Canyon site some 25 miles upstream from Lillooet.

A dam at the Moran site was under active consideration in the 1950s, on the assumption that modern technology in some miraculous way would be able to solve the obvious salmon problems. It was soon demonstrated that no practicable solutions existed or were anywhere in sight. The Commission, in cooperation with the Federal Department of Fisheries, drew up an exhaustive report on the fisheries problems associated with the proposed dam, which has now been brought up to date in the light of further experience with salmon and dams on the Columbia River and elsewhere, and improved knowledge of factors affecting salmon behavior. The conclusions of this report[3] are as follows:

1. The minimum effect of Moran Dam would be the destruction of all salmon and steelhead trout populations that spawn upstream from the dam.
2. It is probable that catches in commercial, sport and Indian food fisheries of salmon and steelhead trout populations that utilize the Fraser River and its tributaries downstream from Moran would be reduced by about 50 per cent due to environmental changes in the river and estuary.
3. Hatcheries and other alternate methods of production could not be used to compensate for existing natural production.
4. The resource values represented by existing runs of salmon and steelhead that would be lost if Moran Dam were constructed would increase the cost of Moran power to the extent that alternate power sources would be more economical.

The Moran Dam Fisheries Report correctly lists, and examines in detail, the many factors that make safe passage for salmon over the propsed dam, whether upstream or down, now or in the foreseeable future, an impossibility—problems of collecting spawners below the dam, transportation above, over or round the dam; movement through the dead water above the dam; and matching problems for the young fish moving downstream, complicated by additional problems of nitrogen saturation, altered flow patterns and temperature variations. It is unequivocal, unassailable and final.

The same conclusions could be reached with only slightly less force, by examining the question of upstream migrants alone. Salmon are animals, closely adapted to the conditions that developed them. The Fraser sockeye runs are the product of the lake systems—Stuart, Takla, Trembleur, François and Fraser, Bowron, Quesnel, Chilco, Shuswap and others. The runs populated these areas gradually, behind the retreating ice age, constantly stretching their own limits of inherited strength and endurance. Most up-river races die within five days after the completion of spawning. A delay of only three days in the upstream movement can seriously impair spawning. Delays of ten or twelve days mean that most of the fish will never reach their spawning areas.

Changes in flow below the dam could extend the average migration period by as much as 9 days. Lowered temperatures below the dam (by as much as 19° F) would slow the metabolism rate of the fish and their migration speed, causing further delay. Any collection system at the dam would cause a minimum delay of 2 days, with at least another day in passage through a fishway some three miles long. Further delay could be expected in passage up the lake above the dam through disorientation of the fish and surface temperatures above optimum metabolic levels. The sum of these delays, all of which are minimum estimates and dependent upon the construction and efficient operation of massive and costly facilities, suggests there would be little successful spawning of the up-river races, even without losses and injuries from nitrogen super saturation below the dam and possibly in the lake itself.

The report estimates the probable annual loss at 24.1 million dollars based on wholesale value of present catches and 71.1 million dollars based on potential catches. These figures include the Indian food fishery potential (2.4 million dollars) but exclude sport fishery values (about 23 million dollars annually). Somewhat different figures can be arrived at by other methods of calculation, but it is important to emphasize that dollar losses are not necessarily the most significant.

Salmon are one of the world's important protein resources—high in yield, readily recoverable, self-reproducing in large measure from ocean resources. Under proper protection and management, the yield of the Fraser runs can be maintained indefinitely into the future. The life of a hydro dam is perhaps fifty to a hundred years, depending on siltation rate and other factors, while its effective importance may be very much less than that in the light of other power sources presently under investigation and development.

Destruction of the Fraser runs would mean serious dislocation in the lives of some 11,000 fishermen and their families, as well as further disadvantage to those Indian populations that still use the historic food fishery as part of their way of life and subsistence. The 175 mile lake backed up behind the proposed dam would wipe out a number of existing settlements, as many as a hundred archeological sites presently unexplored, and yet more of the province's limited valley lands, including critical wintering areas of California Bighorn sheep. Water quality changes in a lake of this size, with a depth of 6-800 feet at the dam site will be significant. Climatic changes involving snowpack may be involved. Major landslides from flooded hillsides are considered a possibility, as is earthquake activity from the weight of water superimposed upon the land. I am not aware of any serious study of these last three questions, but it seems clear enough that they merit intensive consideration.

Below the dam the river would have sharply changed temperatures and flow regime, as well as a super saturation of nitrogen at certain seasons, extending to an unknown distance below the site. In addition, the water would be silt-free.

The Fraser is a major influence on the ecology of the Strait of Georgia, an inland sea 150 miles long, extending southward into Puget Sound and northward to Seymour Narrows, which supports much of the recreational salmon fishing and a well-developed tourist industry. The Strait is of critical importance in the early saltwater life history and survival of salmon stocks, and an important producer of herring, ground-fish and shellfish. It also supports large seasonal populations of waterfowl. It is conceded that in the present state of knowledge the effects of the dam on the ecology of the Strait cannot be accurately predicted. The reduction in silt load would almost certainly affect species composition and vertical distribution of plankton, which in turn could affect larger species. Clearer water would certainly alter some existing predator-prey relationships to a significant degree. Reduction of annual silt-load presumably would, in time, lead to erosion of beaches and flats, with adverse effects on waterfowl populations and perhaps to industrial installations.

While the nature and degree and timing of such changes may be unpredictable, it is certain that there would be change and the history of man-made ecological change has not been anything to inspire confidence. To risk such changes without exhaustive long-term study would be irresponsible in the light of past experience.

It is difficult not to believe that the age of hydro power, with its enormous incidental costs to other resources, is almost at an end. British Columbia is presently exporting coal and natural gas, both of them prime energy sources; and nuclear power, with its many advantages, is becoming steadily safer and more efficient. At least these other power sources permit some flexibility and later change of direction. A Moran Dam once built, though it might be abandoned, is virtually indestructible, its effects irrevocable and irreversible by future generations.

Flood control is considered a secondary purpose of the Moran Dam as presently proposed. No one could possibly question the need for flood control on the lower reaches of the Fraser; the matter has been thoroughly investigated and adequate and practicable proposals for control have been in existence for many years. The failure of the governments concerned to implement them long before this is an incredible demonstration of lackadaisical incompetence. But mainstem dams such as the Moran proposal are crude and costly flood control devices. Protection of headwater timber and land quality, with strategically placed headwater dams and adequate dyking of low-lying areas are considered the most efficient means of flood control.

FLOODS IN THE LOWER FRASER

Even with storage at Moran, an extensive and well-maintained dyking system would be needed throughout the Lower Fraser Valley. By improving the existing system of dykes at a cost of 4.9 million dollars (1966 figures) protection could be provided against a flood crest of 26 feet at Mission, significantly higher than the levels of the 1894 and 1948 floods.[4] A more ambitious plan, agreed to by the Federal and Provincial governments in 1969, would improve the dykes to a height of two feet above the 1948 and 1894 flood levels and provide protection without upstream storage. If the additional safety factor of upstream storage is considered essential, it can be realized by the Fraser River Board's proposed System E.[5] System E would call for a number of dams on tributary streams which would also produce substantial amounts of power. Salmon runs affected would be mainly chinooks and the effects could be compensated for in large measure by fish passes, dam modifications and spawning channels. System E would involve five dams on the Clearwater system, tributary to the North Thompson, and these would destroy most of the recreational potential of Wells-Gray Provincial Park. System E, obviously, is not a happy prospect and the need for it seems doubtful if the dykes are adequately improved; but its destructive effects would be in no way comparable to those of a high-head, main river dam such as Moran.

CONCLUSIONS

To discuss all this factually and dispassionately is in some ways a betrayal of the salmon and their meaning. The Pacific salmons are almost the last of the North American continent's mighty manifestations of abundance. They are an abundance that man, by taking thought, can live with, maintain, use and enjoy. They provide bodily sustenance, recreation and an individual way of life that many men find rewarding and satisfying, both in spite of and because of its hardships and uncertainties. Their abundance is at once continuing evidence that the province's waters are in relatively good condition and a compelling reason for keeping them so. Man has responded to the salmon runs, from earliest times, with a sense of wonder and gratitude that adds to his own stature; and each new understanding of their sensitivity and complexity expands him and enhances his concept of the world that sustains him and, thus far, tolerates him.

To set against all this power "needs" that can be better met in other ways is an aberration, an insensate arrogance, that has no place in modern thinking. Moran would satisfy some three or four years of increasing power demand and then the "need" would have to be satisfied elsewhere. The Fraser salmon runs have served mankind for ten thousand years. If we give them a chance they can last as long as mankind, perhaps longer. It is their triumph that they will not fit conveniently into man's shallow technological concepts, a triumph of life and individuality that deserves to endure for its inspirational and emotional as well as its intrinsic values. To destroy them would be an act of vandalism that British Columbia cannot afford, Canada cannot afford and the world cannot afford. It would leave a burden of guilt that the collective conscience of the nation cannot sustain. To preserve them is an act of faith in the future. □

[1] Annual Report, 1957. International Pacific Salmon Fisheries Commission, p. 21.
[2] Annual Report, 1971. International Pacific Salmon Fisheries Commission.
[3] Fisheries Problems Related to Moran Dam on the Fraser. Prepared by Technical Staffs of the Canada Department of the Environment, Fisheries Service and the International Pacific Salmon Fisheries Commission, Vancouver, B.C., August 1971.
[4] Final Report, Fraser River Board on Flood Control and Hydroelectric Power in the Fraser River Basin pp. 79-80. September 1963. Victoria B.C.
[5] Ibid. pp. 59-81.