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POTENTIAL EFFECTS OF THE KEMANO COMPLETION
PROJECT ON FRASER RIVER SOCKEYE AND PINK SALMON

by

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

An analysis of potential effects of Alcan's 1983 expansion proposal on production of Fraser River sockeye and pink salmon is presented in the above-noted 85-page report. This report, prepared by IPSFC, describes potential problems in the Nechako and Fraser Rivers that could affect sockeye and pink salmon production.

A summary of the report is given in the following pages. Anyone requiring additional details may obtain a copy of the full report by writing to:

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THE ALCAN PROPOSAL

Alcan proposes to proceed with a second stage of development of the existing Nechako-Kemano hydroelectric diversion. Initially, Alcan indicated the second stage would involve complete diversion of the Nechako River above Kenney Dam but subsequently the Company has modified this concept because of the various environmental concerns that were raised. The Company now proposes a schedule of flows to provide for other resource users on Nechako River including maintenance of habitat for chinook salmon and transportation flow and river temperature control for protection of sockeye salmon. The proposed schedule includes a continuous discharge of 1100 cfs of 50°F water at the Nechako-Cheslatta confluence during the adult sockeye migration period and provision for flows up to 6000 cfs at 50°F, which would be used in response to weather forecasts to limit the occurrences of Nechako River temperatures above Stuart River higher than 68°F and eliminate occurrence of temperatures higher than 71°F. The source of this cooling water would be a blend of surface water from the Cheslatta system (including Skins Lake spillway), which would be impounded by a dam at the outlet of Murray Lake, and cold water from the reservoir in the vicinity of Kenney Dam. The mean monthly flows proposed by Alcan would be only 9 to 31% of the pre-diversion flows at Fort Fraser.

10°C

The Kemano Completion Proposal would include construction of additional power generation capacity, a second diversion tunnel from the reservoir, a dam and tunnel to divert water into the Nechako reservoir from

the Skeena system, cold-water release facilities at Kenney Dam, and a dam to store water for release into Nechako River from the Cheslatta system. The existing diversion reduced the average discharge of upper Nechako River above the Nautley River to about 66% of the natural, pre-diversion flow - from about 7100 cfs to 4700 cfs. Alcan's 1983 proposal would reduce the average flow to about 16% of the natural, pre-diversion condition.

SOCKEYE AND PINK SALMON RESOURCES POTENTIALLY AFFECTED

The Nechako system is a very important sockeye producer. In the past 4-year cycle (1979-82), sockeye that originated in the Nechako system produced an average annual commercial catch of 1.05 million sockeye and these stocks also contributed an average of about 136,000 sockeye annually to the native Indian food fishery. On the basis of lake rearing capacity, it has been estimated that the Nechako system could produce an additional commercial catch of 4.6 million sockeye annually or about 53% of the total Fraser River sockeye potential.

The Nechako River stocks would be directly affected by the project and downriver populations of both sockeye and pink salmon could also be affected. The commercial catch of all Fraser River sockeye stocks averaged 5.6 million per year in the 4-year period 1979-82. The catches averaged about 9.0 million per year for the period 1894-1913 and it has been proposed that these historical catches should again be achieved through enhancement of existing stocks.

The commercial catch of Fraser River pink salmon in 1981 was over 13 million pinks, the largest since 1913, and the escapement of 4.5 million spawners was the largest on record. It has been estimated that pink salmon runs as large as 29 million fish are possible, based on available spawning ground area, and commercial catches of about 22 million fish can therefore be expected.

Sockeye migrate up the Fraser and Nechako Rivers from June through September to spawn in streams tributary to Takla, Trembleur and Stuart Lakes in the Stuart River system and to Francois and Fraser Lakes in the Nautley River system. These fish are affected during their migration through Nechako River as a result of altered environmental conditions owing to the existing diversion and the effects could be more severe under the proposed discharge regime. Downriver populations of sockeye and pink salmon could also be adversely affected by the project as a result of environmental changes in the Fraser River migration route and in the major pink salmon spawning area in the main stem of the Fraser between Hope and Chilliwack as well as by changes in estuarial conditions.

THE NECHAKO RIVER TEMPERATURE PROBLEM

On the basis of analyses of probable changes in environmental conditions, it appears that the most significant effect of the project on sockeye salmon would be temperature increases in Nechako River. The migration of adult sockeye through Nechako River would not be physically obstructed as a result of the flow reduction. However, temperature would be a serious concern because the small residual flow would result in higher

water temperatures during the early part of the annual sockeye migration period - from about July 10 to August 20.

Adequate temperature control could be obtained with the proposed cold water outlet at Kenney Dam but the volume of cold water Alcan proposes to discharge would not be sufficient to prevent an increase in the seasonal average temperature during sockeye migration. This increase is a concern because Nechako River temperatures are usually well above the optimum for sockeye migration. Tests have shown that the physiological performance of sockeye reaches a maximum at about 59°F. As temperatures increase beyond this optimum, the effects become progressively more adverse and beyond 68°F the risk of extreme consequences increases substantially. The adverse effects of high temperatures include increased susceptibility to disease, reduced swimming ability, premature depletion of energy stores and other effects that reduce sockeye production by causing pre-spawning mortalities both on the migration route and on the spawning grounds.

Water temperatures were measured for the 3-year period prior to construction of Kenney Dam and comparison of these temperatures with measurements made during operation of the Kemano I diversion indicates the effect of the reduced flow. Air temperatures were above average during the pre-diversion measurement period and water temperatures would therefore tend to be higher than average. Despite this warmer than usual weather, the highest mean daily temperature in the pre-diversion period exceeded 63°F on only 1 day. During Kemano I operation, when discharges were generally reduced, temperatures exceeded 68°F in 15 of 27 years, reaching as high as 77.3°F in 1971. In some years there were many days when temperatures exceeded 68°F. It has been estimated that the average July-August flow reduction of 4348 cfs during Kemano I operation caused an average temperature increase of 0.7°F in Nechako River above Stuart River during the sockeye migration period.

The flow regime proposed by Alcan for the Kemano Completion Project would cause a further temperature increase of about 0.9°F on average. The frequency of temperatures above 68°F would be reduced compared to the Kemano I regime and all temperatures above 71°F would be eliminated. Under the Kemano I regime, the peak temperature occurrence was in the 62-63°F range but under Alcan's proposal this peak would be shifted upwards to the 66-67°F range. Elimination of temperatures higher than 71°F would be an advantage over the Kemano I regime but the proposed temperature control would not provide adequate fisheries protection because it would not restore the natural temperature regime. The frequency of temperatures above 68°F would be greater than under natural conditions and the average temperature would be higher than both natural conditions and the Kemano I conditions.

The adverse temperatures in the Nechako River would be a serious consequence of Alcan's proposal but this problem could be corrected if Alcan would provide sufficient cold water from the reservoir.

OBSTRUCTION TO ADULT SALMON MIGRATION IN THE FRASER RIVER

The Fraser River discharge would be reduced by 2000 to 9000 cfs during the latter part of the sockeye and pink salmon migration in September and October when these fish are occasionally obstructed by low-water conditions. This flow reduction would lower the river levels 0.7 to 3.0 ft at Hell's Gate, which would cause the existing fishways to become inoperative at earlier dates than previously occurred. Similar passage problems would occur at Bridge River Rapids fishways and at natural low-water obstructions such as China Bar Rapids and Saddle Rock. The fish might also have increased difficulty entering tributary spawning streams. These problems would have to be corrected by constructing fishways or other passages.

OTHER POSSIBLE PROBLEMS

The following additional possible effects of the project upon the Fraser River sockeye and pink salmon resources were considered in the analyses and it was concluded that the risk of serious loss would be relatively minor:

1. Introduction of predators, competitors, fish parasites or diseases into the Fraser system from diversion of Skeena water.
2. Diversion of returning Nechako River sockeye to Kemano River instead of the Fraser system.
3. Delay of adult sockeye migration owing to increased temperature difference at the Nechako-Fraser and Nechako-Nautley confluences.
4. Increased predation loss of seaward migrants because of slower migration and changed environmental conditions.
5. Increased water pollution owing to discharge reduction.
6. Increased mortality of seaward migrating sockeye and pink salmon at the Seton Creek hydroelectric plant owing to lower Fraser River level.
7. Occasional increase in water temperatures at Hell's Gate as a result of reduced discharge.
8. Reduction of pink salmon spawning ground area in the main stem of the Fraser River between Hope and Chilliwack because of reduced discharge.
9. Later entry of some late-run sockeye into the Fraser River from Georgia Strait owing to reduced discharge.
10. Marine survival could be affected as a result of reduced Fraser River flow and changed estuarial conditions.

CONCLUSION

Because of the probable serious consequences of adverse Nechako River temperatures and the possibility that the other threats to sockeye and pink salmon production would be more serious than indicated by available information, the Commission concluded that the Kemano Completion Proposal as submitted by Alcan would not provide adequate fisheries protection. However, since the present Alcan proposal incorporates temperature control as originally requested by the fishery agencies for the Kemano I project, this capability could be utilized to reduce the risks attributable to high water temperatures by improving the temperature regime obtainable under the Kemano I scheme.

RECOMMENDATIONS

1. To provide adequate temperatures during the sockeye migration period, it was recommended that the average monthly base flows outlined in the Alcan proposal be the minimum permissible, with additional water provided to control the mean daily Nechako River temperatures above Stuart River to a maximum of 68°F (rather than 71°F as proposed by Alcan) and to provide July 10-August 20 mean temperatures equal to the estimated pre-diversion condition, 0.7°F lower than the average measured during Kemano I (rather than 0.9°F higher as proposed by Alcan). These measures would also offset increased heating below Stuart River and the effects of reduced flows in increasing the severity of environmental stressors such as spatial restriction, increased pollutant levels and other factors.
2. To avoid obstructing the upstream migration of adult sockeye and pink salmon, it was recommended that measures necessary to remedy obstructions to the migration of adult sockeye and pink salmon in the Nechako and Fraser Rivers attributable to reduced water levels due to the Nechako diversion be funded by Alcan.
3. To obtain most efficient management of the fish and water resources of Nechako River it was recommended that a permanent Task Force be established, involving Alcan and all of the fishery agencies, to plan the most efficient regulation of releases from the reservoir and the Cheslatta system and to evaluate all aspects of fish protection, with the cost of research and monitoring funded by Alcan.
4. Recognizing that all of the possible adverse effects of the proposal might not have been foreseen or might not be resolvable, it was recommended that if the Task Force found that there were losses in sockeye and/or pink salmon production attributable to the Kemano Completion Project despite the most efficient use of the provisions made for fish protection, Alcan be required to compensate for reduced fish production by enhancement of these resources in the affected producing areas.