

LATE-RUN FRASER RIVER SOCKEYE MIGRATION BEHAVIOR

July, 2002, Update

Introduction

Abnormally high rates of freshwater mortality prior to spawning in adult Late-run Fraser River sockeye salmon were observed again in 2001. Early river entry of these stocks resulted in the premature mortality of approximately 90% of potential spawners. The majority of these fish were destined for lower Fraser tributaries, such as Weaver Creek, Harrison River and Cultus Lake, but included small returns to upper Fraser spawning areas in the Adams River and Portage Creek. Since the dominant year return of the world-famous Adams River sockeye is due to return in 2002, the urgency to understand the causes of the early migration behavior and to develop appropriate fishery management responses was reemphasized.

With regard to our understanding of the causes of the change in migratory behavior, the Committee on Scientific Cooperation (CSC) reported to the Pacific Salmon Commission (PSC) at its annual meeting February 11-15, 2002, on the results of studies carried out in 2001 (see the executive summaries of these statements at <http://www.psc.org/pubs/laterun/ExecutiveSummaries.pdf>). The Commission had funded seven studies in the areas of oceanography, contaminant science and fish physiology to collect information on possible causes of the early entry pattern in Late-run sockeye and to develop testable hypotheses about this change in migration behavior. While no answers to the early migration question were found, the scientists involved in the studies now have a better grasp of the problem.

As a follow-up to the 2001 studies, the CSC proposed an ambitious research plan for 2002 and recommended that a long-term approach be developed for research on the problem. The Commission approved funding of \$1.0 million (Cdn.) from both the Canadian and United States governments for studies proposed by the CSC. Of first priority in the 2002 studies is a proposal to use electronic tags to assess the migratory behavior of individual Late-run sockeye during migration to their natal streams.

Continuation and expansion of oceanographic, physiological, disease/parasite and contaminant studies has been funded as well.

In 2001, PSC staff also presented information suggesting that, in addition to Late-run sockeye salmon, Fraser River pink salmon and, possibly, Fraser River chinook and chum salmon, have had altered migration behavior in recent years. No related mortality issues have been identified for these other species and additional analyses are required to document possible early migration problems for them. Nevertheless, the possible involvement of these other species provides additional impetus to the research effort.

Background

Early river entry of adult Late-run Fraser River sockeye salmon was first recorded in 1996 when Weaver Creek and other smaller stocks failed to delay in the Strait of Georgia for the normal 4-6 weeks, but rather, entered the river approximately three weeks earlier than expected. Since that first time, Late-run sockeye stocks have behaved abnormally **every** year. While the change in delay behavior is troubling and suggests that changes in the environment have affected the fish, the consequences of the altered behavioral pattern for Late-run sockeye have been extremely serious (see the June 2001 statement at: <http://www.psc.org/pubs/laterun/LateRunStatement2001.pdf>). En route and pre-spawning mortality of adults at the natal streams and lakes led to over 90% loss of potential spawners in 2000 and 2001.

Biological and Fishery Impacts

The biological consequences of premature mortality fall into two main categories: reduced production and stock viability questions. Of immediate concern to the fishery managers and user groups is the lower recruitment of adult fish in the future that will result from the reduced levels of successful parent spawners. While some decrease in recruitment has been experienced in 2000 and 2001 as the result of lower escapements in 1996 and 1997, these were minor because Late-run stock abundance was small those

years. Reduced production from the affected stocks will be felt in a major way for the first time in 2002. Premature mortality of Adams River and Lower Shuswap River sockeye in 1998, the parent year of the 2002 return, was estimated at about 850,000 fish, or 39% of the potential spawning. Based on the low estimate of juvenile sockeye abundance in Shuswap Lake in the Fall, 1999, Fisheries and Oceans Canada (DFO) has forecasted that the Adams/Lower Shuswap sockeye return in 2002 will only reach 1.7 to 2.3 million fish compared to a dominant cycle average of 7.6 million.

While escapement levels have been low for several Late-run sockeye stocks, the question of stock viability has become critical to date only for Cultus Lake sockeye. Low survival of early migrating adults from 1999 to 2001 has resulted in only a few viable spawners and very low juvenile production each year. Intensive review of the Cultus Lake sockeye history and returns by DFO suggests that radical measures may be needed to ensure that this stock survives as a genetically distinct population. While other stocks are not as urgent a priority from a stock viability perspective, continuation of these early migration and mortality problems similar to 2000 and 2001 would bring other stocks to a point of serious concern within a few generations.

Fishery consequences of the early river entry and subsequent mortality are more obvious. Since the Late-run group of stocks includes the world-famous Adams River run and Weaver Creek sockeye, both of which contribute heavily to fisheries in both Canada and the United States, reduced production of adults will reduce future harvests. As the seriousness of the problem has grown in recent years, the Fraser River Panel and the Parties have had to constrain fisheries in Canadian and United States waters when these stocks are present. In 2000 and 2001, conservation measures included closures of commercial, Aboriginal and recreational fisheries in an attempt to increase the escapement of these stocks to compensate for expected mortality. Reduced harvest rates on smaller runs in the future must be anticipated.

In addition to the need to allow a greater fraction of the Late-run stocks to escape upriver, these conservation constraints have reduced the harvest of co-migrating

Summer-run sockeye. Larger numbers of Summer-run sockeye have escaped to their natal areas than the spawning escapement targets each year in the 1998-2001 period.

The identification of early upstream migration of Fraser River pink salmon and, potentially, some chinook and chum salmon stocks may assist scientists in deducing the cause(s) of early river entry behavior. The parasite believed responsible for the mortality in Late-run sockeye has been found, as well, in Fraser pink, coho and chinook salmon by DFO scientists. However, en route and pre-spawning mortality has not yet been identified.

Plans for 2002 research

Canadian, United States and Commission scientists believe that finding the cause(s) of the early river entry pattern is key to solving the Late-run sockeye mortality problem. In order to conduct research into the cause of the behavioral change, however, scientists have identified a need to collect detailed information on the actual behavior patterns in the affected stocks. Over the period 1996-2001, a variety of behaviors have been observed. Each year, some fish appear to delay in the Strait of Georgia as in the past and successfully spawn, while others appear to enter the river after short-term delay or enter immediately upon arrival and experience premature mortality. Understanding the differences between normally behaving fish and those with abnormal behavior is critical.

Radio tags will be used in 2002 studies to track individual Late-run as they migrate into the Fraser River and upstream to their natal areas. These electronic tags, inserted into the fish, emit a digitally coded signal that identifies the particular tag, and thus, the fish carrying that tag. The tags will be applied to migratory sockeye in Juan de Fuca and Johnstone Straits. Receivers deployed in the Fraser River from Steveston to the spawning grounds will receive information from the tags providing the time of fish passage at the location of the receiver. From this information, scientists will be able to assess the behavior patterns of early, mid and late migrating components of the Late-run

stocks to determine if fish in all timing components behave similarly. The public will be advised of the commencement of tagging and the results of the study will be published in 2003. Recovery of the electronic tags from fish captured in fishing operations is important. Advisory notices will be posted in fishing areas to alert harvesters to the importance of recovering these tags.

In addition, DFO will conduct a tagging program in the Thompson River to assess the success of migration and spawning of Adams and Lower Shuswap sockeye relative to their river entry timing and maturity. External disk tags will be applied to a large number of sockeye captured in the Thompson River where fish are migrating actively. The fish will be released immediately to continue their migration to the spawning grounds. Spawning ground surveys by specially trained crews will collect tagged fish to obtain information on the survival and success of spawning of early, mid and late components of the runs. The public will be asked to not remove tags from dead fish encountered on the spawning grounds to help ensure successful completion of the study.

The other component of 2002 studies will be the continuation and expansion of investigations into potential causes of the early river entry behavior of Late-run sockeye. Sampling of Adams and Lower Shuswap sockeye along their migration routes in marine and freshwater areas will be conducted in order to compare the physiology and presence of parasites and contaminants in normal and early migrating Late-run sockeye. Summer-run sockeye will be sampled, as well, in order to provide a second measurement of “normal” conditions. These fish and the analysis of their tissues will hopefully provide guidance to the scientific group in deducing potential cause(s) of the early river entry behavior pattern.

Fraser River Panel fishery management plans in 2002

Special management actions are expected to be required for conservation of Late-run sockeye stocks in 2002, particularly for Adams and Lower Shuswap sockeye and including Cultus, Portage and Weaver sockeye. The Fraser River Panel has agreed that

no directed harvest on Late-run sockeye will occur and that incidental harvest impacts will not exceed 15% (except for the earlier timed Birkenhead sockeye). However, accurate in-season estimates of Late-run sockeye abundance will be difficult to obtain for management decisions. Therefore, the Parties will take a precautionary approach to management of these stocks in order to ensure that fisheries directed at Summer-run sockeye do not imperil Late-run sockeye escapements. Weekly information updates will be included in the Fraser River Panel news releases.

Spokespersons:

Pacific Salmon Commission:

- Mr. Don Kowal, Executive Secretary, Pacific Salmon Commission at (604) 684-8081.

United States:

- Mr. Rich Lincoln, Chair, Fraser River Panel; Washington Department of Fish and Wildlife (360) 902-2750.
- Mr. Dave Cantillon, Member, United States Section Fraser River Panel; National Marine Fisheries Service, (206) 526-4140.
- Ms. Lorraine Loomis, Member, United States Section Fraser River Panel; Northwest Indian Fisheries Commission (360) 466-7240.

Canada:

- Mr. Wayne Saito, Vice-Chair, Fraser River Panel; Fisheries and Oceans Canada, 604-666-3271.