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Watershed Talk

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EFFECTS OF HIGH SPAWNER DENSITY ON SHUSWAP AND QUESNEL LAKES

By Ken Shortreed and Jeff Grout

The 2002 sockeye escapement of 5.5 million adults to Shuswap Lake was the highest ever recorded to this lake; 3.7 million of these spawned in the Adams River. In Quesnel Lake, a direct estimate of Horsefly River escapement was not obtained in 2002, but based on the Mitchell River escapement of 1 million adults and the Mission in-season estimate, the total escapement was likely around 3.7 million; also the highest ever recorded after the previous record of 3.5 million spawners set in 2001.

What are the effects of high spawner densities? The productivity of most B.C. sockeye rearing lakes is low because the phosphorus supply is limited. The bodies of adult salmon contain substantial quantities of marine-derived nutrients (MDN), including phosphorus, derived from feeding during their marine life stage. An average spawning sockeye contains about 8-10 g of phosphorus. After a sockeye spawns and dies, phosphorus is released into the water as the carcass decomposes. If enough sockeye spawn in a lake or in streams flowing into the lake, they can substantially increase the phosphorus supply to that lake.

Phosphorous is an essential nutrient for algal (phytoplankton) growth and just as adding fertilizer to a garden will increase plant growth, increasing the phosphorus supply to a lake can make it a better rearing environment for juvenile sockeye by increasing phytoplankton growth. More phytoplankton results in higher densities of zooplankton, the small animals that juvenile sockeye feed on. This results in more and/or bigger sockeye smolts going to sea and can lead to a higher abundance of returning adult sockeye.

Past data relating fry production to spawner abundance and lake productivity models suggests that smolt production from Quesnel and Shuswap lakes levels off above escapements of one and two million, respectively (Hume et al. 1996, CJFAS). The increased nutrient loading from MDN by these record escapements could increase the lakes' productive capacity, allowing them to support larger juvenile sockeye numbers. However, in Shuswap Lake, 76% of the sockeye spawned in locations (e.g. Adams and Little River) where MDN will be flushed downstream without entering Shuswap Lake; although these nutrients will benefit fish rearing in the South Thompson River system. Preliminary estimates from phosphorus loading models indicate that MDN from the 2002 escapement will increase the phosphorous concentration by only about 12%. On the other hand, in Quesnel Lake virtually all carcass nutrients enter the lake. Phosphorus loading models suggest that MDN will increase the natural P load by over 100%. Since Quesnel Lake is strongly phosphorous-limited, this increase in the P load could result in substantial and detectable increases in productivity and productive capacity.

From the mid-1980's to the 1990's, staff from DFO's Cultus Lake Lab have carried out detailed limnological and juvenile sockeye studies of Quesnel and Shuswap lakes. These studies provide reference data to assess changes in lake rearing conditions and fry abundance associated with high spawner densities. In 2003, a juvenile study in Shuswap Lake and a detailed limnological and juvenile sockeye study in Quesnel Lake are being done. The Quesnel Lake study involves monthly (May-October) limnological sampling and acoustic/trawl surveys in summer and fall. Limnological samples of the water column are analyzed for chemical (e.g. phosphorous), biological (e.g. phytoplankton/zooplankton concentrations) and photosynthetic rate data. To assess fry abundance, hydro-acoustic gear is towed on transects in the lake and trawl net samples are collected to confirm the fish species composition, as well as, size, growth and food preferences of the fish observed on the acoustic survey. The fall acoustic survey of Quesnel Lake was completed on September 27 and in Shuswap Lake it is planned for late October.

The key research question of the lake studies is whether the record escapements actually result in a net increase or decrease in fall fry/smolt numbers. The 2003 work on Quesnel Lake will determine if lake productivity and juvenile sockeye rearing capacity has been affected by two consecutive years of record escapements. The importance of salmon carcasses and their MDN to freshwater ecosystems is now well--recognized, and the effect of carcasses on stream productivity has been extensively documented. Although the effects of MDN on lakes has been inferred from sediment core analysis, the impact of MDN on lakes is much less well-

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defined. The record escapements to Quesnel Lake in 2001 and 2002 provide a rare opportunity to do this.

Data collection in 2003 has not been completed and many analyses have not yet been done, but some preliminary results from Quesnel Lake are available. The data strongly suggest that the productivity of Quesnel Lake is higher in 2003 than it was 10-15 years ago. Both chlorophyll concentrations and photosynthetic rates (e.g. phytoplankton growth) are higher than ever before recorded. There is a significant positive correlation between phosphorus concentrations and escapement in the previous fall. These data suggest that the lake's productivity and sockeye rearing capacity have been increased by the two years of record escapements and the accompanying increase in nutrient loading from MDN. Data collected from fall acoustic/trawl surveys in Quesnel and Shuswap lakes should be analyzed by early 2004, so stay tuned for an update of the results.

For further information on this work please contact Ken Shortreed or Jeremy Hume, c/o Fisheries and Oceans, Cultus Lake Lab, 4222 Columbia Valley Hwy., Cultus Lake, BC, V2R 5B6

AAROM IS OPENING FOR BUSINESS

By Jason Yarmish

So for some time now we have been hearing about this new AAROM program, to be delivered from the Department of Fisheries and Oceans. At the BCAFC meeting on October 16, departmental staff spoke to this subject. What is AAROM? The acronym stands for *Aboriginal Aquatic Resource and Management Program* and it is there to "*help Aboriginal groups to participate effectively in multi-stakeholder and other advisory and decision-making processes used for aquatic resources and oceans management*". In other words, it is a pot of money to support the following (as taken from a recent DFO communication):

The main objectives of the AAROM program are:

- *to assist Aboriginal groups in acquiring the administrative capacity and scientific/technical expertise to facilitate their participation in aquatic resource and oceans management;*
- *to encourage the establishment of collaborative management structures that contribute to integrated ecosystem/watershed management and planning processes;*
- *to enhance existing collaborative management structures, where appropriate;*
- *to facilitate sound decision-making in advisory and other processes related to a number of areas of DFO responsibility;*
- *to strengthen relationships through improved information-sharing between Aboriginal communities, DFO and other stakeholders and among Aboriginal communities; and,*
- *to contribute to the federal government's broader objective of improving the quality of life of Aboriginal people.*

So what is in this little treasure chest? Approximately $8 million beginning in April of 2004, but I have a feeling that there may be some money available this fiscal year (I am still trying to get an answer on this). Now this sounds like a lot of money, and it is, but note that it is a National initiative, so slices of this pie could get pretty small, pretty fast. Never the less, it was made clear by the Department that it would not be split evenly among all Canadian First Nations, but rather awarded using a ranked proposal method. Good proposals will get the money, so put on your thinking caps. I will try to find out more and produce an update in the near future.

For more information, contact either; Sophie Galarneau, Manager, Media Relations, Fisheries and Oceans Canada, Ottawa, (613) 998-1530 or Caroline Quinn, Director of Communications, Office of the Minister, Fisheries and Oceans Canada, Ottawa (613) 992-3474.

And, if you are really desperate, you can contact me (although I probably won't have the answer, I'll try my best to come up with something) at (250) 962-2712 or jasonyar@telus.net