

## COMMISSION OF INQUIRY INTO THE DECLINE OF SOCKEYE SALMON IN THE FRASER RIVER

### Further Questions of Counsel for the Conservation Coalition Directed to Janice Boyd, Robert Grace, Michael Hagen and Douglas Hill

Technical Report 2 “Potential Effects of Contaminants on Fraser River Sockeye Salmon” by MacDonald et al. sets out a number of recommendations on pages 140-141. At the end of the hearing on pulp and mining effluents, the Commissioner invited counsel for the Conservation Coalition to pursue further questions in relation to these recommendations.

Questions posed to the panel from counsel for the Conservation Coalition provided are provided by **Janice Boyd’s responses:**

1. **Recommendation:** Routine monitoring programs should be developed and implemented to provide the data needed to characterize exposure of sockeye salmon to aquatic contaminants in the incubation habitats, rearing habitats, and migratory habitats that are used by sockeye salmon conservation units.
  - a. Do you agree with this recommendation?
  - b. Are there any further comments you would make with respect to this recommendation?

#### **J. Boyd Response:**

- a. The recommendation seems appropriate as part of a monitoring program. It targets important sockeye salmon habitat and exposure at different life stages in incubation, rearing and migratory habitats or sockeye salmon conservation units. It could clarify the overall goal of the monitoring, the need to refine what aquatic contaminants to characterize exposure of sockeye salmon (more cost-effective) and define benchmarks or triggers for specified ‘effect’ parameters that would drive (support) management actions. For example, a set of parameters define ‘no effects’ conditions for a given type of sockeye habitat or life stage and if exceeded drives corrective actions.
  - b. The two following recommendations seem to belong as part of the proposed monitoring program in this recommendation and could be brought together to show how they fit together in the overall monitoring program goal. Whatever program is developed should also consider how existing programs (e.g., federal and/or provincial monitoring programs) might support or be coordinated with this program to be more cost-effective.
2. **Recommendation:** Such monitoring programs should evaluate water quality, sediment quality, and fish-tissue quality on temporal and spatial scales that are relevant for assessing effects on sockeye salmon and other key indicators of environmental quality conditions.
  - a. Do you agree with this recommendation?
  - b. Are there any further comments you would make with respect to this recommendation?

#### **J. Boyd Response:**

- a. Water, sediment, and fish tissue quality measures may be effective but should not preclude consideration of other parameters that may also be useful to monitor 'effects on sockeye salmon' and 'key environmental quality conditions' in respect of the key sockeye life stages (incubation, rearing, and migration). Whichever are used should be clear in how they were selected, what they represent and what results trigger or support corrective actions.
  - b. Environmental Effects Monitoring (EEM) Programs under both the *Pulp and Paper Effluent Regulations* (PPER) and the *Metal Mining Effluent Regulations* (MMER) provide examples for evaluating effects in fish, benthic invertebrate communities and fish tissues. The overall goal determines if the regulations (effluent load limits) adequately protect the fish, fish habitat and the use of fisheries resources. The regulations define 'effect' parameters for fish (age, weight at age, condition, liver size and gonad size), benthic invertebrate communities (density, taxa richness, evenness index and Bray Curtis similarity index) and fish tissue (contaminants concentrations, selected specific to pulp and paper and metal mining effluents, respectively). Specific water and sediments parameters provide supporting environmental measures that help verify comparability of reference versus effluent exposure areas. If an 'effect' measure is confirmed (same effect occurs in two consecutive cycles of monitoring) it drives further actions to investigate extent and magnitude, cause and solutions to eliminate the effect(s).
3. **Recommendation:** Such monitoring programs should address the aquatic contaminants identified in this investigation. To help focus such monitoring programs, the contaminants of concern in each area of interest have been identified (Table 8.1). Near-term priorities should include TSS and streambed substrate quality monitoring in incubation habitats, nutrient monitoring in rearing habitats, dissolved metal monitoring in all habitats, and selenium, PCB and PCDD/PCDF monitoring in all habitats and selenium, PCB and PCDD/PCDF monitoring in fish tissues. It is likely that well-designed surveys will be required to identify the appropriate scale of monitoring for endocrine disrupting compounds and contaminants of emerging concern.
- a. Do you agree with this recommendation?
  - b. Are there any further comments you would make with respect to this recommendation?

#### **J. Boyd Response:**

- a. Recommended near-term priority contaminants are focused and realistic compared to 200 contaminants listed in Table 8.1. It is possible that existing information on some contaminants could further refine what and where to measure. For example, the recommendation to monitor PCDD/PCDF (dioxins/furans) in all habitats and fish tissue could further consider available information exists to determine more cost-effectively monitoring of this contaminant. Fish tissue data for these contaminants may not exist for

sockeye per se but there is available data for resident fish in the Fraser through federal and provincial program requirements related to pulp mill effluents.

- b. Agree that well-design surveys are necessary and may evolve to appropriate approaches based on our EEM experience. Considerations of a design effective monitoring for endocrine disrupting compounds (EDCs) and contaminants of emerging concern could benefit from broader discussion (e.g., workshop) among scientists and regulators to refine what contaminants to measure, current research underway including work on EDCs.
4. **Recommendation:** Ambient monitoring programs should also include direct measures of effects on sockeye salmon, such as morphology, physiology, en-route mortality, pre-spawn mortality, and egg viability.
- a. Do you agree with this recommendation?
  - b. Are there any further comments you would make with respect to this recommendation?

#### **J. Boyd Response**

- a. I can't comment on specific measures, not knowing what is collected in ambient programs. It would seem Fisheries & Oceans (DFO) or the Pacific Salmon Commission (PSC) scientists and fisheries managers would be better sources to consult. Egg counts (in support of fish reproduction effects) have been a useful parameter of potential fish effects in the federal Environmental Effects Monitoring (EEM) program in the PPER and MMER comparing mill/mine effluent exposed and unexposed areas. External/internal quantitative and qualitative fish morphological measures have also been useful as supporting data.
  - b. The second recommendation above references assessing 'effects on sockeye salmon. Not sure if the reference of measuring effects on sockeye salmon here relate to those noted above but would help to clarify and/or connect.
5. **Recommendation:** Coordination among government agencies and regulated interests should be improved to ensure the requisite data are being collected and compiled into a single database or multiple databases that are compatible.
- a. Do you agree with this recommendation?
  - b. Are there any further comments you would make with respect to this recommendation?

#### **J. Boyd Response:**

- a. Agree that coordination among government agencies and regulated interests should occur. I don't have the expertise to comment on the best way to store the data and whether a single database is feasible and/or multiple modules of a single database or multiple compatible databases. However, suggest using existing databases where

possible. Scientists with more experience in database development and IT personnel would be more helpful with this recommendation.

- b. Ensure allocated resources not only to develop the database (use existing database where possible) but also to maintain the database; the latter does not always get sufficient attention.
6. Do you have any additional recommendations that you would add based upon the MacDonald recommendations?

**J. Boyd Response:**

With reference to the recommendation in the report on page 141 to the need for focus research programs to fill gaps in toxicity of endocrine disrupting compounds (EDC) , there may be more research in progress that may be useful although not specific to sockeye. For example, a current project in EEM involving industry/academic/government research scientists studying potential causes of EDC effects from pulp mill effluents which includes comparative lab and field studies.

The recommendation that follows that support developing a cumulative effects assessment program is highly supported. Although the current focus in on sockeye salmon, consideration of broader scope could be considered in the long term. Given the broad scope of potential contaminants of concern, coordinating with existing program/mandates and partnerships is key to be more cost-effective monitoring.