Fisheries and Oceans | Pêches et Océans

Fish Habitat Management
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6.4.2

June 20, 2008

Dr. Kathleen Racher
Wek'èezhii Land and Water Board
#1-4905 48th Street
Yellowknife, NT X1A 3S3

Dear Dr. Racher:

RE: BHP Billiton (BHPB) 2007 Aquatic Effects Monitoring Program Report

Fisheries and Oceans Canada, Fish Habitat Management – Western Arctic Area (DFO) has reviewed BHPB's 2007Aquatic Effects Monitoring Program Report.

DFO agrees with BHPB that the AEMP is a key component of an adaptive management plan (AMP). However, the direct linkages with an AMP are not currently clear. As per the Guide for Preparation of Adaptive Management Plans prepared by ESSA Technologies Ltd, components of a successful AMP include:

- A list of the key uncertainties (management questions) to be addressed by the AMP.
- A description of the alternative management actions to be employed in the AMP, and how they relate to the uncertainties listed above.

DFO realizes that BHPB has recently submitted an AMP to the WLWB and that it is not yet approved. There is now an opportunity to modify the AMP to address key uncertainties that have been identified in the 2007 AEMP report (water quality parameters, zooplankton increase, *Ligula intesti*nalis infection rate for slimy sculpin).

Water Quality
In 2007, 10 water quality parameters were found to have increased significantly in affected lakes and streams in the Koala Watershed and 9 parameters increased significantly in the King-Cujo watershed in comparison to reference lakes and streams. In the report CCME limits are focused on.

CCME WQGs are not to be used as "pollute up to" limits as stated in the CCME non-degradation policy: *"The degradation of the existing water quality should always be avoided. The natural background concentrations of parameters and their range should also be taken into account in the design of monitoring programs and the interpretation of the resulting data"*.

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Low effect levels, compared to baseline conditions should also be identified that trigger adaptive management. Each parameter that is shown to be increasing over time as a result of mine activities offers an excellent opportunity to use the Adaptive Management Cycle to explore why the effect was happening, followed by mitigation experiments to attempt to reduce levels to acceptable limits prior to reaching CCME thresholds. It is noted that nitrate has already reached the CCME interim guideline and the confidence intervals for molybdenum overlap the CCME guideline, emphasizing the importance of triggering adaptive management at an early stage.

For parameters such as TDS and total phosphorous where no CCME water quality guideline or WL criterion exists, it is unclear how the monitoring results will be used. There is no sense in monitoring for the sake of monitoring so effect levels have to be provided that are linked to the AMP.

Zooplankton

In 2007, zooplankton density increased in Kodiak Lake and Cujo Lake. The AEMP report states that the cause for the increase was unknown as it was not accompanied by an increase in phytoplankton biomass or density which would be expected for a trophic effect. The following response was provided by Michael Turner, a DFO research scientist at the Freshwater Institute.

I disagree with BHP's assertion that it is necessary for increased zooplankton abundance (density) to be associated with increased phytoplankton abundance. In a simple system an increase in zooplankton abundance would be expected to increase grazing pressure (assuming that it was algal grazers that had increased). Increased zooplankton grazing would decrease algal abundance if algal growth rates were unchanged. If the algae were growing more rapidly (as might have occurred in response to increased nutrients), then there might not be any large change in abundance.

Unfortunately there is insufficient information provided to determine unequivocally the exact relationship between the zooplankton and phytoplanktons. Information on zooplankton (or zoobenthos) and phytoplankton (or phytobenthos) density or abundance provides information only about the size (and composition) of the standing crop (i.e. the compartment size). There is no information provided about the rapidity of algal growth, productivity or photosynthesis (i.e. the rate of compartment turnover). (This is important because a small population growing very rapidly but with high loss rates might be as [or more] productive as a large population growing slowly.) Nor is there information provided about zooplankton grazing rates. Without understanding algal growth rates and grazing rates, it would be speculative to try to link algal and zooplankton densities based on abundance information alone. (Another compositional piece of the puzzle that would be helpful would be to understand which of the zooplankters are algal grazers given that not all zooplankton are created equal in terms of trophic function.)

Zooplankton grazing could selectively decrease 'edible' algal taxa, leaving less desirable species. It is also possible that there were lags in responses of the zooplankton populations to shifts in phytoplankton abundance, which is an argument for increasing the sample frequency.

As stated in the AEMP report, the cause of the increase in zooplankton density is **uncertain**. With this uncertainty identified the AM cycle should again be implemented.

***Ligula intestinalis* infection rate for slimy sculpin**
In Appendix A of the 2007 AEMP report it states that:

"Ligula intestinalis infection rates were generally greater in potentially affected lakes in the Koala watershed than in reference lakes and the infestation incidence appears to resemble the spatial pattern of a mine effect. However, it is **uncertain** whether this truly a mine effect because of the lack of a plausible mechanism to link ligulosis in slimy sculpin, the absence of ligulosis in any other species of fish monitored by the AEMP, and the absence of historical information for before-after comparisons."

This was also the case for the King-Cujo watershed. Again this is an uncertainty that should be addressed by the AMP. Is it possible for the tapeworm to be transferred to lake trout that feed on infected sculpin or even infected copepods?

Fish Sampling
As reported in the 2007 AEMP report, catch per unit effort (CPUE) of round whitefish and lake trout has declined when compared to baseline years and to 2002, most likely as a result of historical sampling. However, further reduction of the sample sizes of these species may not allow the detection of significant changes in a number of parameters being assessed.

It is important to ensure sampling is not having a negative effect on fish populations; however, some level of monitoring is required to determine whether mine effects are occurring.

BHPB has indicated that "the use of slimy sculpin as a surrogate is not yet supported scientifically for EKATI." While sculpin have a different life history and habitat requirements than lake trout and whitefish they should remain as an important component in the AEMP. Elevated levels of mercury in sculpin were recently identified in Lac de Gras through the Diavik AEMP.

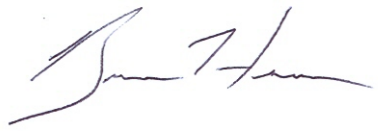
In order to reduce the amount of whitefish and lake trout sacrificed in the next sampling phase of BHPB's AEMP, other alternatives should be assessed. One possibility would be the use of lake chub as a primary indicator species. The following comments on the suitability of lake chub are from Pete Cott, DFO Science and Dr. John Gunn, a professor at Laurentian University, Canada Research Chair for stressed aquatic ecosystems.

Lake chub are a good candidate for fish health studies, and would show affects more quickly than large bodied fish, that tend to be long lived and slow growing and slower to react to environmental changes. Lake chub are low in the food chain - eating benthic organisms - and fast growing and short lived. They are ecologically important linking benthic and near shore energy flow to top level predators like lake trout. Also, they occupy a wide variety of habitats in the lake, so would be representative of the whole lake. From a logistics standpoint they are abundant and easy to catch, and can be caught year after year. Their high fecundity and abundance means that the sample size can be quite large without risk of population level impacts from sampling.

It should be determined what information is necessary to obtain from future lake trout and whitefish sampling and then identify how it can be accomplished in a non-lethal manner. For

instance, non lethal fish tissue plugs could be used for metals analysis to compare to past sampling results if the number of metals being looked at is reduced to focus on particular ones of interest.

If you have any questions concerning these comments, please contact me at (867) 669-4931.



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