Cumulative Environmental Management Association
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May 16th, 2014

Andy Ridge
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Terry Zitnak
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Dear Mr. Ridge and Ms. Zitnak:

Re: Validation of the Walleye Evaluation Criteria and Winter Ecology in the Delta- Mesohabitat Biology Recommendations

In 2011, CEMA provided monitoring program recommendations (MTTG 2011) to the provincial and federal regulators to monitor for the effects of the Lower Athabasca River Surface Water Quantity Management Framework. These recommendations included long-term change detection and shorter-term research projects to fill knowledge gaps that arose during the Phase 2 Water Management Framework Committee process (2008-9; Ohlson et al. 2010). The topics covered physical and biological effects of oil sands mine water withdrawals.

Since 2011, CEMA's Surface Water Technical Group (a sub-group of the Water Working Group), has been working on filling the knowledge gaps. To date, two projects have been completed and the results and

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recommendations are summarized below. These are *Validation of the Walleye Evaluation Criteria* and *Winter Ecology in the Delta – Mesohabitat Biology*.

Validation of the Walleye Evaluation Criteria

Background:
Analysis of commercial catch data from Lake Athabasca showed a significant relation between walleye recruitment strength and mean winter flow in the Athabasca River. Evaluation Criteria (EC) were developed using this relation to assess the impact of withdrawals under different management alternatives by the Phase 2 Framework Committee (P2FC). The EC was based on a regression equation of relative year class strength vs. mean winter flow in the Athabasca River, which allowed a quantitative prediction of the incremental effect of withdrawals. There was interest in ongoing validation of this relation.

Data used by the P2FC to assess the relation between walleye recruitment strength and mean winter flow ended in 2000. Some of the lowest winter flows in the last 50 years occurred shortly after, in 2001, 2002 and 2003. There was an opportunity to assess recruitment in these years because walleye live for several years and year class strength from those years would be measured in a sample of the adult population taken in 2011. The Surface Water Technical Group (formerly Monitoring Technical Task Group) recommended that a knowledge gap study be initiated in 2011 to take advantage of the recruitment "signal" that would present in the population and could be used to validate the regression equation.

Knowledge Gap Results:
Updated analyses using the additional age-composition data collected to 2011 no longer supported the regression model used by the P2FC to evaluate water management alternatives. Most notably, the best-fitting model now related recruitment strength to mean discharge in the Athabasca River during the fry rearing period (summer – fall). The fry discharge model was clearly superior over other models. The difference in results between those used by the P2FC and the knowledge gap study were explained by three reasons: a) recruitment in 2001 was higher than predicted (although 2002 and 2003 were both lower than predicted); b) results used by the P2FC did not show strong separation among different hydrologic variables that are correlated among themselves; and, c) the updated analysis used a more rigorous statistical approach that fully accounted for data uncertainty (Paul 2012).

New results from the knowledge gap study are not expected to influence the P2FC's final decision as: a) the Walleye recruitment EC used by the P2FC was not a sensitive metric when comparing different flow alternatives; and, b) applying an updated EC (relating Walleye recruitment to mean discharge for the fry period) from this study is expected to have a ≤8% decrease in recruitment for the lowest flow year in the period of record.

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Recommendations:

1. Results from the knowledge gap studies on Walleye recruitment (Paul 2012; Paul 2013) indicate the P2FC's recommendations would not have been altered or affected. Therefore, no further work is required on this knowledge gap.

2. As part of a monitoring and adaptive management strategy, an annual index of Walleye recruitment could be adopted as a long-term monitoring tool through periodic sampling of the Lake Athabasca commercial fishery. Relevance and value of the monitoring program should be assessed within existing Provincial and Federal government initiatives including: the Lower Athabasca Regional Plan; Alberta Environmental Monitoring, Evaluation and Reporting Agency; and, the Joint Oil Sands Monitoring program.

Supporting documentation:

Monitoring Technical Task Group Meeting notes, November 9th, 2011

Monitoring Technical Task Group (MTTG). 2011. Monitoring Recommendations for the Phase 2 Water Management System, September 27, 2011. Monitoring Technical Task Group, Surface Water Working Group, Cumulative Environmental Management Association. Fort McMurray, AB.

Ohlson, D., G. Long, and T. Hatfield. 2010. Phase 2 Framework Committee Report – CEMA Contract 2008-0009. Prepared for Cumulative Environmental Management Association (CEMA), Fort McMurray, Alberta, by Compass Resource Management and Solander Ecological Research.

Paul, A.J. 2009.Evaluation criteria for flow alterations in the lower Athabasca River – Walleye Recruitment. Prepared for the Instream Flow Needs Technical Task Group of the Surface Water Working Group, CEMA.

Paul, A.J. 2012.River discharge and the recruitment of Walleye in Lake Athabasca. Prepared for the Surface Water Working Group, CEMA by Fish and Wildlife Division, Cochrane, AB.

Paul, A.J. 2013.Environmental flows and recruitment of walleye (*Sander vitreus*) in the Peace-Athabasca Delta. Can. J. Fish.Aquat. Sci. 70:307-315.

Winter Ecology in the Delta – Mesohabitat Biology

Background:
The Phase 2 Framework Committee (P2FC) defined mesohabitats as 10m X 10m areas of habitat in the Athabasca River that were defined by depth, velocity and substrate type. The P2FC developed Evaluation Criteria (EC) that quantified how water withdrawals affected the area of these mesohabitats in the mainstem and delta. The mesohabitat approach was supplemental to the more conventional fish

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habitat approach and was used as a "check" on the entire aquatic ecosystem. That is, were there changes in habitat types that were not being captured by the fish-based approach?

Twenty-seven mesohabitats were defined by 3 categories for each of depth, velocity and substrate. The EC was developed based on changes in each of these mesohabitat types from water management alternatives proposed by the P2FC. The EC showed mesohabitats in Segments 2 to 5 (mainstem) were always below thresholds established for identifying potentially irreversible consequences of flow alteration. However, the mesohabitat EC showed considerable sensitivity in Segment 1 (delta) to upstream water withdrawals during the winter period. This occurred because quantity of medium velocity, deep mesohabitat changed rapidly with river discharge in the range between 100 – 200 m^3/s (i.e., the habitat versus discharge relationship had a steep slope within this range). Several of the water management alternatives assessed, including the P2FC's recommendations on weekly water withdrawal limits (Ohlson et al. 2010), had EC responses that were greater than the potentially irreversible effects threshold for this habitat type (≥30% habitat loss in lowest flow years). However, the P2FC did not have information that species were dependent on this deep, moderate velocity habitat; and therefore, were not able to ascribe a biological impact to this habitat change.

The P2FC noted that species preference for mesohabitat types during winter were not well understood and recommended this knowledge gap be addressed.

Knowledge Gap Results:
Winter field studies were completed on the Athabasca River in 2012 and 2013 to assess positive relations between benthic invertebrates or fish with different mesohabitat types. The study was completed in Segment 2 (immediately upstream of the delta) of the Athabasca River as all relevant mesohabitat types were known to be present across a wide range of river discharge in this segment. Benthic invertebrates were sampled with a substrate grab sampler and fish were sampled using dual-frequency identification sonar (DIDSON).

Results from the study showed both benthic invertebrate and fish density were strongly associated with river velocity but not depth (Johnson et al. 2013). Benthic invertebrates and fish were observed at higher densities and were more likely to be present in slow velocity mesohabitats than higher velocity mesohabitat types. However, fish detection probabilities using the DIDSON differed among mesohabitats which could potentially explain the observed patterns in fish density (Johnson et al. 2013). Regardless, results from this knowledge gap study did not support a hypothesis of benthic invertebrate or fish preference for deep, moderate velocity mesohabitats during winter relative to other mesohabitat types.

Recommendations:

1. Although the medium velocity, deep mesohabitat type is sensitive to winter water withdrawals from the P2FC recommendations, the loss in this specific mesohabitat is not expected to disproportionately impact benthic invertebrate or fish abundance or biodiversity.

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2. The P2FC's water withdrawal recommendations are not expected to have an irreversible impact on benthic invertebrate or fish communities in the delta through changes in winter availability of medium velocity, deep mesohabitat. Therefore no further work is required on this knowledge gap.

Supporting documentation:

Johnson, P., E. Plate, D. Robichaud, L. Renzetti, R. Bocking and Marc Gaboury. 2013. Winter ecology in the Athabasca River 2012 – 2013: Mesohabitat species associations. Prepared for the Water Working Group, CEMA by LGL Limited, Sidney, BC.

Monitoring Technical Task Group (MTTG). 2011. Monitoring Recommendations for the Phase 2 Water Management System, September 27, 2011. Monitoring Technical Task Group, Surface Water Working Group, Cumulative Environmental Management Association. Fort McMurray, AB.

Ohlson, D., G. Long, and T. Hatfield. 2010. Phase 2 Framework Committee Report – CEMA Contract 2008-0009. Prepared for Cumulative Environmental Management Association (CEMA), Fort McMurray, Alberta, by Compass Resource Management and Solander Ecological Research.

Paul, A. J. and A. Locke. 2009. Evaluation criteria for flow alterations in the lower Athabasca River – abundance and diversity of mesohabitat. Prepared for the Instream Flow Needs Technical Task Group of the Surface Water Working Group, CEMA.

If you have any questions or concerns, please contact me at (780) 799-8140.

Regards,

Glen Semenchuk,
Executive Director, CEMA