Manuscript: _Integrated Ecological Response Model_____

Author(s): LimnoTech_____

Name of Reviewer: Barbara L. Bedford, Ph.D._____

1. Are the objectives of the work clearly stated? 1 2 (3) 4 5

   The objectives of the work are not stated as such, but as tasks, purposes, questions, and various other wordings that can be interpreted as objectives. No subsection is entitled "Objectives." They appear in various places in the document and are not always entirely consistent with each other. For example, I could interpret statements in the first paragraph of the "Introduction," and the second and third paragraphs of Sect. 2.1 of the "Contextual Overview" as objectives. I find other such statements in the first and second paragraphs on p. ES 1 of the main document, and again at the top of p. ES-3. Other such statements appear in the second and third paragraphs on p.1 of the main document. Some of the statements are similar, others not. Perhaps a subsection in each part of the total document (Contextual Overview, Executive Summary, and the main document) with objectives explicitly and consistently stated would help.

2. Are the methods employed valid, appropriate and sufficient to address the questions, hypotheses or the problem? 1 (2) 3 4 5

   The answer here is yes and no. Overall, the personnel involved did as well as might be done under the circumstances, and given that the final product is a rather coarse tool. The variation in data availability for model development, calibration and validation is huge, as are the assumptions used in developing the different PIs, and the application of sensitivity analysis or any other method for checking model error. In some cases, no calibration or validation data are available, and no sensitivity analysis is done, and no discussion is provided of the limitations imposed by this lack. Only one model is proposed both for the overall assessment model and for development of each PI. I do not see how this will contribute to adaptive management, as one of the "objectives" indicates this work should. Some of the best supported PIs appear to be those based on work by Wilcox, Midwood, Fracz, and Chow-Fraser, and Usarsky and others. In these cases, extensive data were available, and the algorithms or regression models used were explicitly given. In the cases where extensive data were not available, few of the PIs identified the type of data needed to reduce uncertainty, i.e., what one would want to know for adaptive management. Sensitivity analyses ought to identify which variables have the greatest effect on the model, but some PIs lack a sensitivity analysis.

3. Are the observations, conclusions and recommendations supported by the material presented in the manuscript (e.g., data, model and analyses)? 1 (2) 3 4 5

   The comments above also apply here.

4. Are the assumptions used valid and are the mathematics presented correct? 1 2 3 (4) 5

As noted above, the validity of assumptions used in developing the PIs vary greatly. In most cases, but not all, the assumptions are not explicitly stated. For example, for the SRP PI, there is an implicit assumption that an extracted soil core dried and re-wetted once reflects the SRP flux *in situ* throughout the year, and little current research is cited to support this implicit assumption. My own measurements in wetlands indicate that flux rates are highly variable both temporally and spatially. A table that included a column providing the degree of certainty or uncertainty associated with each PI would be useful. Insofar as there are linkages among the PIs, such a table might then indicate which linkages in the overall conceptual model are more or less certain, and help identify research needs to feed into adaptive management. As I am not a mathematician, I cannot comment on the mathematics.

5. Is the manuscript well organized, material precise and to the point, and clearly written using correct grammar and syntax? 1 2 (3) 4 5

The document could be much more precise and to the point; I found it highly redundant. For example, why not fold the Contextual Overview into Background and Introduction section of the main document? I also found myself wondering who the intended users of the document were – peer reviewers, the IJC's Great Lakes Levels Board, the Adaptive Management Team, technicians who will run the various spreadsheet tools, or all of the above. Grammar and syntax generally were used correctly; typos were relatively few though they did occur. However, the clarity of the document would be enhanced by adding a page explaining acronyms and a page defining terms used at the front of the document and by eliminating jargon, such as "drill down," "leverage," "clipped." I also found inconsistent use of terms, e.g., diversity, Basin supply, net basin supply. And why is Basin capitalized?

6. Are all of the figures and tables useful, clear, and necessary? 1 (2) 3 4 5

Several figures lack keys, e.g., Fig. 2-1; what do the different colors and types of lines (solid, dashed) indicate; is each pair of connected boxes a sub-model as the legend implies? Some figure legends are incorrect, e.g., Figs. 2-2 and 2-3, which use diversity (a term which includes both richness and evenness) when what is graphed is richness, and Fig. 2-3 where "fish habitat richness" is not defined.

7. What is the quality of the overall work? 1 (2) 3 4 5

Given the limitations of data availability, the quality of the overall work is acceptable but could be improved, most simply by employing a very good scientific editor who has not been involved with development of the document and could read it simply for organization, clarity, and consistency.

Recommendation (please circle your response)

A - acceptable
(**B**)- acceptable with suggestions for revision
C - acceptable if adequately revised
D - unacceptable

If you have selected **C**, do you wish to receive the revised manuscript for

further review? yes no

Rating (Circle the rating you would like to give this manuscript. Unacceptable work should be given a score of 40 or less.)

100 90 (80) 70 60 50 40 30 20 10 0

Comments (limit responses to one paragraph for each question; reference pages, charts, and data. Please distinguish if responses are of major or minor concerns.)

A. What is the best/most unique part of the analysis? That is hard to say but I suppose it is the fact that the analysis actually attempted to identify "thresholds" of response. It took a fair amount of courage to do so based on limitations in the available data and the large number of assumptions that needed to be made. It nonetheless identifies some responses as unacceptable, i.e., Zone C, in very simple terms and allows them to be visualized and combined into the vision model.

B. What is the most critical aspect of the study/analysis? Why? I would have liked to see an entire section devoted to an explicit discussion of the limitations of the overall model and of individual component models. Some of this can be found for some PIs in the fact sheets but it is inconsistent from PI to PI and should be in the main body of the paper. A table with all of the PIs (model components, as well as the overall model, with columns indicating the various types of limitations and how they might be reduced would be useful, for both the readers of this document and for the adaptive management team.

C. Which aspect of the analysis/modeling is weakest? Why? How can it be improved? The use of quantitative measures gives the false impression of being definitive. Of necessity, what ends up being used by decision-makers is over-simplified. They may not like being reminded of this, but it is essential. The addition of the new section I identify above would help make them the right degree of skeptical about such simplifications based on "quantitative" metrics derived from limited data and by making often unspecified assumptions.

D. Are there any other suggestions that are related to how this analysis may be used more effectively or the results explicated in a more understandable manner? Stand back and think carefully who your readers are. Then edit accordingly. Have someone outside LimnoTech edit the document.

Additional sheets follow with other comments and suggestions.

Please indicate any confidential comments to the Co-Chair(s) of the Independent Peer Review Group in the space below. Comments for transmission to the author(s) should be on a separate sheet attached.

Signature: _Barbara L. Bedford_____ Date: __April 20, 2011_____

Comments for Transmission to Authors

It would be useful to have both general comments and specific comments for major and minor revision. Please use additional sheets should they be required.

None.

Additional Comments for Authors:

GENERAL COMMENTS

Overall, I think you did a very good job addressing the huge task before you given what you had to work with. You undoubtedly are as aware of the many pitfalls and limitations of combining lots of data and making numerous assumptions to draw an overly-coarse final picture ("coping zones" and "vision") as I am. While it may be lost on your audience, I do nonetheless think that in the name of scientific integrity you should make clear, more so than you have already done, what those limitations are. I think it especially important that you note the high variability among the individual PIs. Say explicitly where you are more and less uncertain. Most importantly, if you and the adaptive management group are serious about adaptive management, say where improved data would help reduce uncertainty. Identify specific research needs. Adaptive management is about acting to reduce uncertainties, not passively waiting passively to see what happens. You have done this on p. 61 at the end of the second paragraph, where it gets lost. Pull all such recommendations into one prominent place.

I am most concerned about the nutrient flux data. Insofar as this is one key measure of "ecosystem function," which is a threshold variable between "coping zones," I think it incumbent on you to identify the severe limitations embodied in this PI. My impression is that the people who developed this PI are not totally up-to-date with respect to what we currently know about nutrient flux rates, nor the methods for measuring them. The data used to develop this PI are extremely limited in their ability to say what might happen with water levels outside the historical regime.

I also take issue with your statement that no historical data exist (p. 4) to guide us as climate changes. In the sense that we are talking about the "no analog" issue for climate change, you are correct. However, superb paleo-ecological data exist for lakes and wetlands. Among other familiar to you, Doug Wilcox knows this literature rather well.

SPECIFIC COMMENTS

In terms of Poff's and others' "natural flow regime," timing is as important as magnitude and duration. You initially mention this fact, but then many of the PI's exclude timing.

The references use inconsistent formatting, e.g., sometimes the names of journals are abbreviated, sometimes not; sometimes the names of journals are italicized, sometimes not; a few references are incomplete.

You know what you mean by GLEI, as do I, but perhaps other readers do not. The relevant citations to the overall GLEI work do not appear in the references for the main document but only in some of the appendices. See Section 2.2.1.a for example. Section 2.2.1.b. does give those specific GLEI references.

If Fig. 2-1 is the overall conceptual model referred to at the beginning of section 2.1, then insert (Figure 2-1) after the first four words in that section.

I would find it easier to read if you capitalized Fact Sheet every time you refer to one.

The wetlands that would seem to warrant special attention are the meadow marshes and the Georgian Bay wetlands. The meadows and some of the Georgian Bay wetlands are relatively uncommon in the Great Lakes, and contain some unusual flora.
It seems especially important to me that the executive summary be written in plain English, with all acronyms spelled out. On p. ES-4, for example, you refer to the codes for various criteria, which then are not defined until p. 53 of the main document.

This could be me, but the last paragraph before the start of Section 3.1.1. (p. 54) does not seem to follow to me with respect to the numbers regarding glacial isostatic adjustment.

All caveats with respect to the PIs and Coping Zone criteria should be summarized in one place, or at least more prominently than they are at the ends of several paragraphs in the main document and the appendices. For example, I think the last sentence in the first paragraph of Section 3.1.2. belongs in the Executive Summary.

Is "disbenefits" a real word, e.g., p. 61 but it is used in several places.

Section 3.3 would be an excellent place to add a prominent paragraph on the cautions and limitations of the Coping Zone Calculator, and the PI's that go into it. For example, consider your point at that top of p. 62 about conflicts between individual criteria. These types of caveats and caution are scattered throughout the main document and in the appendices. Find a way to pull them out, make them more prominent, and discuss why you think the coping zones are robust nonetheless.

Shouldn't stand-alone be hyphenated, e.g., last paragraph on p. 62, bottom of p. 63.

Is there a kind of "handbook" or set of guidelines for people who will actually use the Coping Zone Calculator?

Say "fewer Zone C occurrences" rather than "less," bottom of p. 64. Also see top of p. 73.

Point 2 under Section 4.4 should provide references for the climate change models.

The second to the last sentence in the second paragraph from the end of p. 73 seems to be incomplete or missing something.

I do find it interesting that many of the references are to unpublished work.