



DEPARTMENT OF THE ARMY
MISSISSIPPI VALLEY DIVISION, CORPS OF ENGINEERS
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REPLY TO
ATTENTION OF:

CEMVD-PD-L

11 August 2017

MEMORANDUM FOR CECW-MVD (Redican)

SUBJECT: Recommend Certification for Regional Use of the Middle Mississippi River Sturgeon Chub Model

1. References:
 - a. Engineer Circular 1105-2-412: Assuring Quality of Planning Models, dated 31 March 2011.
 - b. US Army Corps of Engineers. Assuring Quality of Planning Models - Model Certification/Approval Process: Standard Operating Procedures. February 2012.
 - c. Model Certification Review Plan, Middle Mississippi River Sturgeon Chub Model, dated 02 March 2017. (Encl 1).
 - d. Model Documentation, Middle Mississippi River Sturgeon Chub Model, dated 22 June 2017. (Encl 2).
 - e. Final Model Review Comment Record, Middle Mississippi River Sturgeon Chub Model, dated 13 June 2017 (Encl 3).
 - f. Application Calculator, Middle Mississippi River Sturgeon Chub Model, dated 22 June 2017 (Encl 4).
2. The National Ecosystem Restoration Planning Center of Expertise (ECO-PCX) evaluated the Middle Mississippi River Sturgeon Chub Model (Sturgeon Chub Model) using references 1.a., 1.b., and 1.c. Based on the evaluation results, the ECO-PCX recommends certification of the model for use within the Middle Mississippi River (Encl 2, Figure 1). Please log in this recommendation with the Office of Water Project Review for the Model Certification Panel to consider.
3. The development of the Sturgeon Chub Model (Encl 2) was led by the St. Louis (MVS) and St Paul (MVP) Districts to assess habitat quality for key main channel border habitat in the Middle Mississippi River. Specifically, the model facilitates a better understanding of river training structure impacts on shallow to moderate depth, moderate to high velocity habitat. Model development followed a common ecological modeling process of conceptualization, quantification, evaluation, and application. The initial concept and structure was developed during an Ecological Modeling Workshop facilitated by the U.S. Army Engineer Research and Development Center – Environmental Laboratory on April 12-14, 2016. Model quantification and evaluation was continually refined through an iterative process with the Missouri Department of Conservation, Illinois Department of Natural Resources, and U.S. Fish and Wildlife Service. The model was quantified based on empirical data from the project location and established peer-reviewed literature. Finally, the model was coded as a Microsoft Excel spreadsheet calculator (Encl 4), tested (Encl 2) and reviewed (Encl 3), and documented.

The resulting model consists of quantified suitability curves for habitat variables of water depth, water velocity, substrate, and the degree of structured channel border. These represent key variables in determining sturgeon chub habitat quality and more generally main channel border habitat. Each variable is assigned a dimensionless suitability index value that represents the relationship between an

environmental variable and habitat suitability. Each variable is represented quantitatively as a series of linear suitability curves, with a minimum value of 0.0 for unsuitable to 1.0 for optimal habitat. When combined, the model provides an overarching assessment of main channel border and sturgeon chub habitat integrity in the Middle Mississippi River.

4. The ECO-PCX managed an intermediate level review in accordance with References 1.a., 1.b., and 1.c. The review team possessed extensive experience and knowledge of USACE planning policy, alternative evaluation and comparison, large riverine ecology, and sturgeon chub life history and habitat. Reviewers included Mr. Clayton Ridenour (Biologist, Omaha District [NWO]), Mr. Eric Laux (Chief, Environmental Planning Branch, NWO), Mr. Shane Simmons (Biologist, MVS), and Dr. Martin Hamel, University of Nebraska-Lincoln). The reviewers received electronic versions of the model review documents and a charge that solicited comments on 20 questions developed to assess the technical quality, system quality, usability, and conformance with USACE policy (Encl 1).

In summary, the reviewers found the model to be well-documented and structured around well-established ecological principles. Although empirical data for the sturgeon chub is limited, the authors did a good job of constructing the model around the best available science; quantifying the model through sound science; and evaluating, testing, and validating the model through interagency partner consensus. The review resulted in 19 comments (six high significance, three medium significance and 10 low significance). The high significance issues and related updates are summarized below. The full text of the comments, evaluations, and resolutions can be found in the Final Model Review Comment Record (Encl 3). All comments were addressed and incorporated to the satisfaction of the reviewers and the ECO-PCX.

- a. A quantifiable definition of main channel border habitat was added to the model documentation to specify the applicability of the model, describe the target habitat, and better understand the effects of river training structures on the habitat.
- b. One reviewer recommended a more refined suitability index scoring system based on percentage of fish within microhabitat zones. While this level of detail would reduce variability and increase fidelity of the model, the data (i.e., sturgeon chub captures) necessary to conduct such an analysis is currently unavailable. Following a discussion with the reviewer, a mutually agreeable path forward was to continue using catch-per-unit-effort. Additionally, as more data is gathered the model can be reevaluated to determine if refinements in model variables or curves are necessary to improve model behavior.
- c. The presence or absence of a river training structures variable was refined two-fold based on comments received. First, the intended use or definition of the model was updated to clearly state the variable represents longitudinal connectivity and barriers to movement of sturgeon chub. Second, the variable was refined to include more categories of barrier to more accurately represent habitat conditions and resulting sturgeon chub abundance.
- d. The reviewers noted caution when categorizing values based on data from outside the Middle Mississippi River or if attempting to apply the model outside of these boundaries. Since the system being represented by the model is so different from other riverine systems the data used to develop the model should come from within the model boundaries. This and the model application boundaries were reinforced in the model documentation.
- e. Model evaluation including a sensitivity test and expert and scenario analysis validation tests were described in the preliminary model testing section of the model documentation. One

reviewer recommended the authors also conduct validation using the real system measurement approach (3rd level of model validation). Due to the limited number of sturgeon chub catches and ancillary data available the development team recommended using future Missouri Department of Conservation data to assess model performance and potentially refine model construction in the future. This was agreeable to the reviewer.

- f. Spreadsheet errors and omissions were identified and fixed to improve system quality and usability. These included incorrect or unusable hyperlinks to model documentation, updates to model variable labels, and reassessment of number of significant digits.
5. The Sturgeon Chub Model has sufficient technical quality. The model development process and documentation represents a transparent and comprehensive structure consisting of all stages of model development, testing, analysis, and application. The resulting model structure and relationships operate on the premise that key environmental characteristics affect sturgeon chub distribution and abundance offering a robust, defensible and quantifiable relationship of sturgeon chub habitat integrity across a gradient of environmental conditions. Documentation of model assumptions, limitations, and application guidelines were improved through peer-review and fully described. The model domain, geographic applicability, and boundary conditions are specified. Formulas and calculation routines forming the basis of the model are logical and ecologically correct.
6. The Sturgeon Chub Model has sufficient system quality. The model is coded in a Microsoft Excel spreadsheet and it was tested for programming errors. The programming is computationally correct and functions well. Model computations are presented in sufficient detail and are ecologically relevant. The model developers implemented system quality testing procedures utilized during model development. The Q/A practices, model testing, and validation procedures ensures the model functions as intended. The spreadsheet incorporates best practices and is locked from editing. Like other approved/certified software and spreadsheets, the ECO-PCX maintains all passwords.
7. The Sturgeon Chub Model has sufficient usability. User documentation is user friendly and complete. The model is well-suited to the tasks for which it was designed. Input requirements are well-specified in the model documentation and requires a nominal level of expertise and some field time. Model outputs are transparent, easy to understand, and facilitate the evaluation and comparison of alternatives in the planning process.
8. The model and methodology are consistent with USACE policies and accepted procedures for ecosystem restoration planning. The model does not incorporate, facilitate, or encourage the use of non-ecosystem parameters or values. The model uses established principles of alternatives evaluation and facilitates trade-off analyses to identify habitat quality and quantity over time.
9. Teams applying the Sturgeon Chub Model in the Middle Mississippi River should remain cognizant that the model represents limited empirical data available on sturgeon chub habitat requirements and thus includes some uncertainty and variability regarding “optimal” habitat. As such, the model was designed to include the minimum factors required for sturgeon chub growth, survival and reproduction. Given the complexities of large riverine habitat and sturgeon chub microhabitat requirements, other local conditions and/or ancillary data and analyses should be considered when evaluating river training structure influence on significant resources.
10. The authors anticipate evaluating and potentially refining the model as additional data becomes available through monitoring and adaptive management of the projects. Targeted model components and procedures for potential refinement are included in the model documentation. These should be

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minor refinements to model curves in an effort to increase the resolution and fidelity of the model. The ECO-PCX will remain engaged in these activities.

11. The ECO-PCX finds the Middle Mississippi River Sturgeon Chub Model has sufficient technical and system quality, meets usability criteria, and complies with USACE policy. The ECO-PCX recommends the model be Certified for Regional Use within the Middle Mississippi River. Please notify the ECO-PCX of the Model Certification Panel's findings.



Encls (4)

Gregory Miller
Operating Director
National Ecosystem Restoration
Planning Center of Expertise

CF (without enclosures)
CECW-P (Paynes)
CECW-PC (Coleman, Matusiak, Trulick, Bee)
CECW-MVD (Brown, Hanneken, Varisco)
CEMVD-PD-L (Chewning, Mallard, Young)
CEMVP-PD-P (Creswell, McCain, Richards, Runyon, Stefanik)
CEMVP-PD-C (Johnson, Simmons)
CEMVS-EC (Brauer, Gordon)
CEMVS-PM (Kohler)
CENAO-WRP (Conner)