

Jonathan S. Clough
Warren Pinnacle Consulting, Inc.
P.O. Box 253
Warren VT 05674

Environmental / Computer Consultant
jclough@warrenpinnacle.com
<http://www.warrenpinnacle.com/>
(802) 496-3476; fax (802) 496-2355

Key Qualifications

Jonathan Clough has been an environmental consultant since 1994 with special emphasis on developing object-oriented environmental computer models. Since 1995, he has been the primary programmer for the AQUATOX bioaccumulation, toxicant fate, and effects model. Since 1998, Mr. Clough has been programming and applying bioaccumulation models for EPA Region 1 in support of the Modeling Study of PCB Contamination in the Housatonic River including formal reporting of model calibration and validation and response to peer-reviewer comments. He has been developing and applying the SLAMM (Sea Level Affecting Marshes Model) since 1998. Mr. Clough founded Warren Pinnacle Consulting, Inc. in 2001.

Education

B.A. Environmental Studies (Honors), Brown University, 1994.
B.A. Economics, Brown University, 1994.
Phillips Academy, Andover MA, Class of 1989.

Relevant Professional Experience

1995-Present Technical Support Activities for AQUATOX, for U.S. EPA Office of Science and Technology, through AQUA TERRA Consultants (ATC)

2009-Present Application of AQUATOX as part of BASINS Adaptation for Military Facilities, for U.S. Army (through ATC)

2008-2010 Applied SLAMM Model to 66 USFWS National Wildlife Refuges in Regions 1, 4, 5, and 8 under contract to USFWS in support of comprehensive conservation plan production.

2009 Production of SLAMM 6 model including variable accretion feedbacks, improved GUI, and improved memory management. Performed under contract to the Nature Conservancy.

2007 Implemented and tested Di Toro's Sediment Diagenesis model as a component of the [EPA AQUATOX](#) model under contract to EPA Office of Science and Technology (via ATC).

2004-2007 Developed and Applied the [SLAMM model](#) (Sea Level Affecting Marshes Model) under U.S. Environmental Protection Agency STAR grant. Model predicts the effect of different sea level rise scenarios on the entire Georgia and South Carolina Coast through the year 2100.

2007 Applied SLAMM model to entire Chesapeake Bay region including Delaware Bay.

2006-2007 Completed application of SLAMM to [Puget Sound, WA](#) for National Wildlife Federation.

2006-2007 Applied multi-segment AQUATOX model to Lower Boise River ID and Tenkiller Reservoir OK. Calibrated model against existing data for use in nutrient studies.

2006 Applied the SLAMM model to [Florida](#) with National Wildlife Federation Funding.

2004-2006 Development of AQUATOX. Added capabilities for correlated uncertainty and sensitivity analyses.

2004-2006 Validation of QEA Foodchain model for EPA Region 1 in support of the Modeling Study of PCB Contamination in the Housatonic River. Co-authored Final Model Documentation and Peer Review Responsiveness Summary released in November 2006.

2004-2006 Production and teaching of one-day and three-day hands-on workshops on the AQUATOX model. Produced course materials for AQUATOX training and participated in team teaching of hands-on, laboratory-based training for the latest AQUATOX models. Three-day course has been taught in many cities including Seattle WA, Austin TX, Philadelphia PA, Washington DC, Chicago IL, and Santa Clara CA.

- 2004 Consolidated the diverse versions of AQUATOX into one general version including the estuarine version, multi-segmented version, nutrient enhancements, and perfluorinated acid version. Provided support, documentation, and enhancements to the AQUATOX model.
- 2001-2005 Calibrated the QEA Foodchain model for EPA Region 1 in support of the Modeling Study of PCB Contamination in the Housatonic River. Linked model to HSPF hydrology and EFDC PCB fate models for multiple water segments. Created Windows-based shell around existing FORTRAN model for use in automated uncertainty and sensitivity analyses. Queried existing relational databases to filter available empirical data. Performed statistical analyses of empirical data to determine boundary conditions and calibration datasets. Completed comprehensive calibration report to undergo peer-review.
- 2001-2002 Developed the AQUATOX extension for the BASINS GIS modeling system for the EPA Office of Science and Technology. Output from the GIS interface, HSPF and SWAT models are automatically linked to AQUATOX through this new interface. AQUATOX output is made available to the GenScn graphical output processor to allow for additional graphing capabilities and statistical tests.
- 1998-2002 Developed and applied the AQUATOX model for the EPA Office of Water in support of the Modeling Study of PCB Contamination in the Housatonic River. Expanded Model to simulate multiple organic toxicants simultaneously. Expanded dimensionality of AQUATOX to allow the simulation of multiple linked river segments simultaneously. Added mass balance capability to track mass of toxicant through all river segments. Model designed to link with the EFDC and HSPF models to complete the Housatonic River analysis.
- 1998-1999 Scientific Programmer: modified the Sea Level Affecting Marshes Model (SLAMM) to create Version 4 for the EPA Office of Planning and Policy Evaluation. Changes included an upgrade into a 32-bit operating system, a user-friendly interface, the capability to export to GIS ready data, and a screen display component.
- 1996-1999 Scientific Programmer: Developed AQUATOX for the Exposure Assessment Branch of the EPA Standards and Applied Science Division. Dramatically expanded model capabilities including the ability to model stratifying systems, and the capability to perform Latin hypercube uncertainty analyses.
- 1995-1996 Research Assistant: Abt Associates. Designed and implemented user-friendly GUIs for existing models, primarily utilizing object Pascal. Started working with AQUATOX model. Converted model from DOS based model into object-oriented code with Windows GUI. Wrote significant portions of a Pascal statistics package to be used in sensitivity and uncertainty analyses and incorporated package into AQUATOX.
- 1992 Student Programmer: C.S. Draper Laboratory. Programmer within a team environment. Team modified user interface language (Timeliner) written in Ada as an interface to Space Station Freedom. Wrote integrated test documents for NASA. Received Employee Recognition Award for support of project.

Honors and Awards

- Brown University:** Phi Beta Kappa, University Scholar, Faculty Scholar, Omicron Delta Epsilon: National Economics Honor Society, Class of 1994
Environmental Studies Award, Honors Thesis, 4.0 GPA
- Phillips Academy:** Cum Laude Honors Society

Computer Experience

Software Developer, Database Developer, Website Developer, Network Administrator,

- Programming Languages:** C++, Object Pascal, Ada, FORTRAN
Object Oriented Design: Delphi 2008, Compaq Visual FORTRAN, Microsoft Visual C++
GIS Work: ArcView, Spatial Analyst, Mapwindow

Publications:

- Clough, Park, Fuller 2010. *SLAMM Technical Documentation, Release 6.0 beta*, Draft January 2010. Warren Pinnacle Consulting, Inc.
- Carleton, J. N., R. A. Park, and J. S. Clough 2009. Ecosystem Modeling Applied to Nutrient Criteria Development in Rivers. *Environmental Management* 44 (3) 485-492.
- Park, R. A., and Clough J.S. 2009. *AQUATOX (Release 3) Modeling Environmental Fate and Ecological Effects in Aquatic Ecosystems. Volume 2: Technical Documentation*. August 2009, U.S. Environmental Protection Agency, Office of Science and Technology, Washington, DC.
- Craft C, Clough J, Ehman J, Guo H, Joye S, Machmuller M, Park R, and Pennings S., 2009 Effects of Accelerated Sea Level Rise on Delivery of Ecosystem Services Provided by Tidal Marshes: A Simulation of the Georgia (USA) Coast. *Frontiers in Ecology and the Environment*. 2009; 7, doi:10.1890/070219
- Park, R. A., J. S. Clough, and M. C. Wellman, 2008. AQUATOX: Modeling environmental fate and ecological effects in aquatic ecosystems. *Ecological Modelling* 213:1-15.
- Glick, Clough, National Wildlife Fed'n et al., 2006. *An Unfavorable Tide: Global Warming, Coastal Habitats and Sportfishing in Florida*. <http://www.targetglobalwarming.org/files/AnUnfavorableTideReport.pdf>
- Weston (Weston Solutions, Inc.). 2006a. Responsiveness Summary to the Peer Review of Model Calibration: Modeling Study of PCB Contamination in the Housatonic River. Prepared for U.S. Army Corps of Engineers and U.S. Environmental Protection Agency. DCN GE-080105-ACUD. [co-author]
- Weston (Weston Solutions, Inc.). 2006b. Model Validation: Modeling Study of PCB Contamination in the Housatonic River. Prepared for U.S. Army Corps of Engineers and U.S. Environmental Protection Agency. DCN GE-030706-ADBR. [co-author]
- Clough, J. S., and R. A. Park. 2006. *AQUATOX (Release 3) Modeling Environmental Fate and Ecological Effects in Aquatic Ecosystems, Addendum to Release 2 & 2.1 Technical Documentation*. U.S. Environmental Protection Agency, Washington, DC.
- Imhoff, Clough, Park, Stoddard, and Hayter, 2005, "Comparison of Chemical Bioaccumulation Models to Assist in Model Selection for Ecological Assessments and TMDL Development" *Watershed* Glenn E. Moglen - Editor, July 19-22, 2005, Williamsburg, Virginia, USA
- Park, R.A., J.S. Clough, and M.C. Wellman. 2004. *AQUATOX for Windows: A Modular Fate and Effects Model for Aquatic Ecosystems-Volume 1: Release 2 User's Manual*. EPA-823-R-04-001.
- Park, R.A., and J.S. Clough. 2004. *AQUATOX for Windows: A Modular Fate and Effects Model for Aquatic Ecosystems-Volume 2: Release 2 Technical Documentation*. EPA-823-R-04-002.
- Imhoff, J. C., J.S. Clough, R.A. Park, and A. Stoddard. 2004. *Evaluation of Chemical Bioaccumulation Models of Aquatic Ecosystems: Final Report*. Athens GA: U.S. Environmental Protection Agency.
- Weston (Weston Solutions, Inc.). 2004a. Modeling Framework Design: Modeling Study of PCB Contamination in the Housatonic River. Prepared for the U.S. Army Corps of Engineers and U.S. Environmental Protection Agency. DCN GE-042104-ACDP. [co-author]
- Weston (Weston Solutions, Inc.). 2004b. Model Calibration: Modeling Study of PCB Contamination in the Housatonic River. Prepared for U.S. Army Corps of Engineers and U.S. Environmental Protection Agency. DCN GE-122304-ACMG. [co-author]

- Galbraith, H., R. Jones, R.A. Park, J.S. Clough, S. Herrod-Julius, B. Harrington, and G. Page. 2003. Global Climate Change and Sea Level Rise: Potential Losses of Intertidal Habitat for Shorebirds. In *Ecological Forecasting: New Tools for Coastal and Marine Ecosystem Management*. NOAA Technical Memorandum NOS NCCOS 1 (Vallette-Silver and Scavia eds). Silver Springs, MD.
- Park, R.A., and J.S. Clough. 2003. *AQUATOX for Windows: A Modular Fate and Effects Model for Aquatic Ecosystems: Perfluoroalkylated Surfactant and Estuarine Versions, Addendum to Release 2 Technical Documentation*. EPA Contract 68-C-98-010.
- Weston (Weston Solutions, Inc.). 2002. Responsiveness Summary to Peer Review of the Modeling Framework Design and Quality Assurance Project Plan: Modeling Study of PCB Contamination in the Housatonic River. Prepared for U.S. Army Corps of Engineers and U.S. Environmental Protection Agency. DCN GE-053102-ABAQ. [co-author]
- Galbraith, H., R. Jones, R.A. Park, J.S. Clough, S. Herrod-Julius, B. Harrington, and G. Page. 2002. Global Climate Change and Sea Level Rise: Potential Losses of Intertidal Habitat for Shorebirds. *Waterbirds* 25:173-183.
- Beach, R.B., J.S. Clough, P.M. Craig, A.S. Donigian, R.A. McGrath, R.A. Park, A. Stoddard, S.C. Svirsky, and C.M. Wallen. 2000. *Quality Assurance Project Plan--Modeling Study of PCB Contamination in the Housatonic River*. Prepared for U.S. Environmental Protection Agency, Region I, Boston, MA.
- Weston (Roy F. Weston, Inc.). 2000. Quality Assurance Project Plan -- Modeling Study of PCB Contamination in the Housatonic River. Prepared for the U.S. Army Corps of Engineers and U.S. Environmental Protection Agency. DCN GE-100500-AADY. [co-author]