Jonathan S. Clough

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warren pinnacle consulting, inc.

PROFILE

Jonathan Clough founded Warren Pinnacle Consulting, Inc. in 2001. Mr. 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 EPA's AQUATOX** bioaccumulation, toxicant fate, and effects model. Since 1998, Mr. Clough has been applying **bioaccumulation models** for EPA Regions 1 and 2 in support of Superfund modeling studies in the Housatonic River, the Grasse River, the Hudson River, the Lower Passaic River, Newark Bay, and Newtown Creek. He has been **developing and applying SLAMM** (the Sea Level Affecting Marshes Model) since 1998.

SELECTED PROJECTS

2016-Present, EPA Region 2 through WSP—Newark Bay
Reviewed and applied bioaccumulation models of 2,3,7,8 TCDD, Total PCBs, and other COCs for the Newark Bay Superfund site. Examined BSAF models vs. mechanistic options. Modified the Arnot and Gobas 2004 model to support migration, updated bioenergetics, and automated calibration. Applied the bioaccumulation model to calculate acceptable sediment levels based on human-health and ecological risks.

2016-Present, EPA Region 2 through CDM Smith—Lower Passaic River
Provided oversight for, and suggested significant modifications to, an industry-created bioaccumulation model for the Lower Passaic River. Vetted all model inputs, linkage data, and assumptions. Created suite of alternative model calibrations to examine the potential impact on model outputs. Provided feedback on model calibration reports.

2016-2021, EPA Region 2 through CDM Smith—Newtown Creek
Examined industry-created bioaccumulation model for Newtown Creek. Considered tradeoffs between simpler and more complex models. Considered the relevance of a bioaccumulation model for the site given input and data uncertainty, and expected model usage.

2016-Present, EPA ORD through General Dynamics Information Technology
Added the AQUATOX model to the EPA Hydrological Micro Services program. Created a mapping interface, and linked the model to National Water Model for stream-network modeling. Linkage to HAWQS/SWAT for water-quality modeling is ongoing.

2016-2018, EPA ORD through General Dynamics Information Technology
Updated EPA AQUATOX bioaccumulation model to version 3.2, modernizing the interface and allowing for command-line usage and text-based input and output files.

2015-2017, NY State Energy Research and Development Authority
Led project: "Integrating SLAMM results and stakeholder priorities to define marsh adaptation strategies." Developed tools to prioritize adaptation strategies for the preservation of infrastructure and environmental capital. Incorporated and refines results from a 2012-2015 NYSERDA project. Results integrated policy makers' priorities with model results to produce decision-making metrics.

2012-2015, NY State Energy Research and Development Authority
Applied SLAMM to the entire coast of NY. High-resolution model application (5m x 5m cells) includes dynamic accretion modeling based on site-specific data and the Marsh Equilibrium Model of James Morris. A full stochastic uncertainty analysis was completed with maps of uncertainty results.

2013-2015, Gulf Coast Prairie Landscape Conservation Cooperative
SLAMM was applied to the entire Gulf Coast of the US creating a seamless set of landcover projections. Mechanistic marsh-accretion feedbacks were applied. SLAMM model results were used to assess the impact of SLR on focal species.

2008-2015, US Fish and Wildlife Service
Applied SLAMM model (Sea Level Affecting Marshes Model) to over 120 USFWS National Wildlife Refuges in Regions 1, 4, 5, and 8 in support of comprehensive conservation plan production. Produced significantly-optimized 64-bit version of SLAMM under a separate contract. Produced SLAMM Infrastructure module.

1995-2014, US EPA via AQUA TERRA Consultants & Horsley Witten Group
Produced the EPA AQUATOX bioaccumulation model, releases 2, 3, and 3.1 and performed user support, for U.S. EPA Office of Science and Technology.

1998-2015, US EPA via Weston Solutions and Avatar—Housatonic River
Calibrated, Validated, and applied the 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. Ran the model to evaluate remedial alternatives.

2010-2011, US EPA Region 2 via Louis Berger – Hudson River
Evaluated AQEA Foodchain Model application to the Hudson River. Model benchmarking, source-code review, sensitivity analysis, and comments to EPA.

2011-2012, Exponent
Programmed the newest version of the FishRand Migration bioaccumulation model, a spatially explicit model with a Gobas bioaccumulation engine written in object C++.

2010-2012, US EPA via AECOM – Grasse River
Evaluated the AQEA Foodchain Model application for the Grasse River in support of USEPA Region 2 through AECOM. Work performed includes model benchmarking, diagnostics, model-to-data comparisons, examination of alternative calibration, and critical evaluation of the 2010 Analysis of Alternatives document.

2007, EPA Office of Science and Technology via AQUA TERRA
Implemented and successfully tested Di Toro's Sediment Diagenesis model as a component of AQUATOX.

2001-2002, **EPA Office of Science and Technology via AQUA TERRA**
Developed the AQUATOX extension for the BASINS GIS modeling system for the. Output from the GIS interface, HSPF and SWAT models are automatically linked to AQUATOX through this interface.

1998-2002, EPA Region 2 via R.F. Weston Consultants
Developed and applied the AQUATOX model in support of the Modeling Study of PCB Contamination in the Housatonic River. Expanded dimensionality of AQUATOX to allow simulation of multiple linked river segments simultaneously. Model designed to link with the EFDC and HSPF models to complete the Housatonic River analysis

EDUCATION

B.A. Environmental Studies (Honors), Brown University, 1994.
B.A. Economics, Brown University, 1994. *(Omicron Delta Epsilon Honor Soc.)*
Phillips Academy, Andover MA, Class of 1989. *(Cum Laude Honors Society)*

SKILLSET

25 years of experience programming environmental models using C#, RStudio, C++, object-Pascal, FORTRAN, Leaflet, cloud computing and parallel processing.

SELECTED PUBLICATIONS

Propato, M., Clough, J. S., and Polaczyk, A. (2018). "Evaluating the costs and benefits benefits of marsh-management strategies while accounting for uncertain sea-level rise and ecosystem response." *PloS one*, 13(8).

Clough, J. S., Blancher II, E. C., Park, R. A., Milroy, S. P., Graham, W. M., Rakocinski, C. F., Hendon, J. R., Wiggert, J. D., and Leaf, R. (2017). "Establishing nearshore marine injuries for the Deepwater Horizon natural resource damage assessment using AQUATOX." *Ecological Modelling*, 359, 258–268.

Clough, J. S., Polaczyk, A. L., and Propato, M. (2016). "Modeling the Potential Effects of Sea-Level Rise on the Coast of New York: Integrating Mechanistic Accretion and Stochastic Uncertainty." *Environmental Modelling & Software*.

Clough, J. S., Blancher, E. C., Park, R. A., and Goecker, M. (2015). "Estimating Productivity Loss Attributed to Deepwater Horizon for Alabama Nearshore Environments." Alabama Department of Conservation and Natural Resources

Carleton, J. N., R. A. Park, and J. S. Clough 2009. Ecosystem Modeling Applied to Nutrient Criteria Development in Rivers. *Environmental Mgmt.* 44 (3) 485-492.

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 Environmen*t. 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.

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]

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

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.