

# Jonathan S. Clough



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## PROFILE

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 EPA's AQUATOX** bioaccumulation, toxicant fate, and effects model. Since 1998, Mr. Clough has been applying **bioaccumulation models** for EPA Region 1 in support of the Modeling Study of PCB Contamination in the Housatonic River. He has been **developing and applying SLAMM** (Sea Level Affecting Marshes Model) since 1998. Mr. Clough **founded Warren Pinnacle Consulting, Inc. in 2001**.

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## EDUCATION

**B.A. Environmental Studies (Honors)**, Brown University, 1994. *(4.0 GPA)*  
**B.A. Economics**, Brown University, 1994. *(Omicron Delta Epsilon Honor Soc.)*  
**Phillips Academy, Andover MA**, Class of 1989. *(Cum Laude Honors Society)*

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## SELECTED PROJECTS

### **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. [Link to Project Report.](#)

### **2015-Present, NY State Energy Research and Development Authority**

"Integrating SLAMM results and stakeholder priorities to define marsh adaptation strategies." This project is developing tools to prioritize adaptation strategies for the preservation of infrastructure and environmental capital. The project incorporates and refines results from the 2012-2015 NYSERDA project. Results will integrate policy makers' priorities with model results within decision-making metrics.

### **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. [Project Page](#)

### **2013-2014, New England Interstate Water Pollution Control Commission**

Performed a marsh-habitat migration study for the entirety of coastal Connecticut to identify adaptation strategies including land acquisition and marsh restoration. Project included integrated uncertainty analysis and provides GIS results. [Project Page](#)

### **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 Environmental**

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**

Evaluated the AQEA Foodchain Model application to the Hudson River. Analysis includes model benchmarking, source code examination, diagnostics, 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**

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.

**2004-2011, US EPA via AQUA TERRA Consultants**

Produced and taught one-day and three-day hands-on workshops on the AQUATOX model. Produced course materials for hands-on, laboratory-based training. Highly favorable attendee reviews were received. Three-day course has been taught throughout the country including Seattle WA, Austin TX, Philadelphia PA, Washington DC, Chicago IL, Portland, OR and Santa Clara CA. In 2015, returned to Portland OR.

**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 new 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 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

**1995-1996, Served as Research Assistant at Abt Associates, Bethesda MD**

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.

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## SKILLSET

Nearly 20 years of experience programming environmental models using object-Pascal, C++, FORTRAN, cloud computing and parallel processing.

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## SELECTED PUBLICATIONS

- Glick, P., Clough, J., Polaczyk, A., Couvillion, B., and Nunley, B. (2013). "Potential Effects of Sea-Level Rise on Coastal Wetlands in Southeastern Louisiana." *Journal of Coastal Research*, 63(sp1), 211–233.
- 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 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.
- 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]
- 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
- 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.