

Ann Michelle Morrison, Sc.D.
Managing Scientist

Professional Profile

Dr. Ann Michelle Morrison is a Managing Scientist in Exponent's EcoSciences practice. Dr. Morrison has 16 years of experience evaluating the relationship between anthropogenic contamination and health effects to aquatic life and humans. Projects she has been involved with have concerned oil spills, sewage releases, heavy metal contamination, and various industrial and municipal facilities that have generated complex releases to the aquatic environment. Dr. Morrison applies statistical tools to delineate exposure zones, predict the likelihood of contamination events, evaluate net environmental benefits, and determine source apportionment. She uses a broad knowledge of aquatic life and human health to assess risk to these populations.

Dr. Morrison's work has included developing an alternative indicator system for alerting beach bathers of bacteria contamination at Boston Harbor beaches, assessing exposure and injury to marine resources after an oil spill, applying integrated environmental benefit analysis to facilitate remediation discussions, and assisting the Bermuda government assess the health of their near shore environment. She provides technical writing and litigation support as well as data analysis for natural resource damage assessments (NRDA) under the Oil Pollution Act (OPA) and the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as well as for environmental risk assessment.

Academic Credentials and Professional Honors

Sc.D. Environmental Health, Harvard University, School of Public Health, 2004
M.S., Environmental Health, Harvard University, School of Public Health 2001
B.S., Biology, Rhodes College (*cum laude*), 1997

Publications

Mudge S, Morrison AM. Tracking sources of sewage in the environment. *Environmental Forensic Notes* 2010; 9.

Pietari J, Bigham G, Morrison AM. Source tracking for identification of microbial pollution sources. *Environmental Forensic Notes* 2009; 6.

Goldstone JV, Goldstone H.M.H, Morrison AM, Tarrant AM, Kern SE, Woodin BR, Stegeman JJ. Cytochrome P450 1 genes in early deuterostomes (tunicates and sea urchins) and vertebrates (chicken and frog): Origin and diversification of the CYP1 gene family. *Molecular Biology and Evolution*; in press. MBE Advance Access published on-line October 4, 2007.

Morrison AM. 2005. Receiver Operating Characteristic (ROC) Curve Analysis of Antecedent Rainfall and the Alewife/Mystic River Receiving Waters. Boston: Massachusetts Water Resources Authority. Report ENQUAD 2005-04, 2005. 26 p.

Morrison AM, Coughlin K. 2004. Results of Intensive Monitoring at Boston Harbor Beaches, 1996–2004. Boston, Massachusetts Water Resources Authority, Report ENQUAD 2005-05, 76 pp., 2004.

Morrison AM, Coughlin K, Shine JP, Coull BA, Rex AC. Receiver operating characteristic curve analysis of beach water quality indicator variables. *Applied and Environmental Microbiology* 2003; 69:6405–6411.

Coughlin K, Stanley AM. Boston Harbor beach study suggests a change in beach management. *Coastlines* 2001; Issue 11.6.

Coughlin K, Stanley AM. Water quality at four Boston Harbor beaches: Results of intensive monitoring 1996–2000. Boston, Massachusetts Water Resources Authority, Report ENQUAD 2001-18, 46 pp., 2001.

Published Abstracts

Stegeman J, Handley-Goldstone H, Goldstone J, Tarrant A, Morrison A, Wilson J, Kern S. Pantomic studies in environmental toxicology answers, questions and extrapolation. *Journal of Experimental Zoology Part a-Comparative Experimental Biology* 2006; 305A:181–181.

Goldstone JV, Goldstone HMH, Morrison AM, Tarrant A, Kern SE, Woodin BR, Stegeman JJ. Functional evolution of the cytochrome P450I gene family: Evidence of a pre-vertebrate origin. *Marine Environmental Research* 2006; 62:S47–S47.

Handley HH, Goldstone JV, Morrison AM, Tarrant, Wilson JY, Godard CA, Woodin BR, Stegeman JJ. Abstracts from the 12th International Symposium on Pollutant Responses in Marine Organisms (PRIMO 12)—Receptors and Regulation of Cytochrome P450. *Marine Environmental Research* 2004; 58:131+.

Morrison AM, Stegeman JJ. Abstracts from the Twelfth International Symposium on Pollutant Responses in Marine Organisms (PRIMO 12)—Cloning, Expression and Characterization of Cytochrome P450 51: An investigation of CYP51 azole sensitivity in aquatic animals. *Marine Environmental Research* 2004; 58:131+.

Morrison AM, Stegeman JJ. CYP51 azole sensitivity in lower vertebrates and invertebrate. *Drug Metabolism Reviews: Biotransformation and Disposition of Xenobiotics* 2003; 35(2):179.

Presentations

Morrison AM, Kane Driscoll S, McArdle, M, Menzie C. Integrated environmental benefit analysis of sediment remediation thresholds. 32nd Annual Society of Environmental Toxicology and Chemistry (SETAC) Meeting, Boston, MA, November 14–17, 2011.

Kierski M, Morrison AM, Kane Driscoll S, Menzie C. A multi-site model to estimate the toxicity of PAH contaminated sediments at MGP sites. 32nd Annual Society of Environmental Toxicology and Chemistry (SETAC) Meeting, Boston, MA, November 14–17, 2011.

Kierski M, Morrison AM, Kane Driscoll S, Menzie C. Use of receiver operating characteristic curve analysis to estimate ecological risk zones as part of an ecological risk assessment. 31st Annual Society of Environmental Toxicology and Chemistry (SETAC) Meeting, Portland, OR, November 7–11, 2010.

Morrison AM, Coughlin K, Rex A. Bayesian network predictions of Enterococcus exceedences at four Boston Harbor beaches. Water Resources Conference 2008, Amherst, MA, April 8, 2008.

Stegeman J, Handley-Goldstone H, Goldstone J, Tarrant A, Morrison A, Wilson J, Kern S. Pantomic studies in environmental toxicology answers, questions and extrapolation. 15th International Congress of Comparative Endocrinology, Boston, MA, 2005.

Goldstone JV, Goldstone HMH, Morrison AM, Tarrant A, Kern SE, Woodin BR, Stegeman JJ. Functional evolution of the cytochrome P450I gene family: Evidence of a pre-vertebrate origin. 13th International Symposium on Pollutant Responses in Marine Organisms (PRIMO 13), Alessandria, Italy, June 2005.

Morrison AM, Stegeman JJ. CYP51 azole sensitivity in lower vertebrates and invertebrate. 12th North American Meeting of the International Society for the Study of Xenobiotics, Providence, RI, October 12–16, 2003.

Morrison AM, Stegeman JJ. Cloning, expression and characterization of Cytochrome P450 51: An investigation of CYP51 azole sensitivity in aquatic animals. 12th International Symposium, Pollutant Responses in Marine Organisms, Tampa, FL, May 2003.

Handley HH, Goldstone JV, Morrison AM, Tarrant AM, Wilson JY, Godard CA, Woodin BR, Stegeman JJ. 12th International Symposium, Pollutant Responses in Marine Organisms, Tampa, FL, May 2003.

Morrison AM, Coughlin KA, Shine JP, Coull BA, Rex AC. Receiver operating characteristic curve analysis of beach water quality indicator variables. Pathogens, Bacterial Indicators, and Watersheds: Treatment, Analysis, Source Tracking, and Phase II Stormwater Issues. New England Watershed Association, Milford, MA, May 14, 2003.

Stanley AM, Coughlin KA, Shine JP, Coull BA, Rex AC. Receiver operating characteristic analysis is a simple and effective tool for using rainfall data to predict bathing beach bacterial water quality. 102nd General Meeting, American Society for Microbiology, Salt Lake City, UT, May 2002.

Coughlin K, Stanley AM. Five years of intensive monitoring at Boston harbor beaches: Overview of beach water quality and use of the Enterococcus standard to predict water quality. Massachusetts Coastal Zone Marine Monitoring Symposium, Boston, MA, May, 2001.

Smith SR, Grayston LM, Stanley AM, Webster G, McKenna SA. CARICOMP coral reef monitoring: A comparison of continuous intercept chain and video transect techniques. Scientific Aspects of Coral Reef Assessment, Monitoring and Management, National Coral Reef Institute (NCRI), Nova Southeastern University, Ft. Lauderdale, FL, 1999.

Project Experience

Dr. Morrison has been involved in numerous complex projects relating to environmental contamination and potential risk to humans and biological resources in the affected environment.

Selected Current and Recent Projects

- Deepwater Horizon Oil Spill: Provided support pertaining to natural resource damage assessment.
- Manufactured Gas Plants (MGP; Wisconsin): Developed a risk zone model that was used to select site-specific toxicity thresholds.
- Developed a risk model of the relative cost and human and environmental risk associated with aging infrastructure in the electric power industry.
- Heavy metal contamination of a natural waterway: Conducted an integrated environmental benefit analysis for remediation alternatives.
- Oil refineries (New Jersey): Provided support to reconstruct historical activities pertaining to an on-site waterway.

Risk Assessments and Natural Resource Damage Assessments

Developed decision management products for beach water quality stakeholders using statistical data analysis tools such as receiver operating characteristic (ROC) curves and Bayesian networks to improve public beach advisories related to elevated fecal bacteria.

Developed an integrated environmental benefit analysis (IEBA) for a lead contaminated river. This analysis used site-specific data to evaluate the costs and benefits of two different remediation options that were being considered. The IEBA was successfully used by the client to negotiate a higher remediation goal than original proposed by the state Department of Environmental Protection.

Performed receiver operating characteristic (ROC) curve analyses of site-specific polycyclic aromatic hydrocarbon (PAH) toxicity data to assess the relationship between PAH concentration and toxicity at three ecological risk assessment projects in Wisconsin. The curves were used to identify site-specific toxicity thresholds for PAH concentration in sediment that were indicative of various zones of toxicity (no toxicity, low toxicity, and high toxicity), with very limited misidentification of sediments.

Provided research support to calculate site-specific no adverse effect level (NOAEL) and low adverse effect level (LOAEL) concentrations for mammals and birds for use in a baseline ecological risk assessment in Wisconsin.

Performed receiver operating characteristic (ROC) curve analysis of national mercury toxicity data to assess the relationship between mercury concentration and toxicity. The curves were also used to identify a threshold mercury concentration for sediment that is indicative of likely toxicity, with very limited misidentification of sediments that are not toxic.

Assembled and analyzed data and reviewed remedial investigations to conduct a screening-level ecological risk assessment for sediment, surface water, and ground water for a site in Connecticut. The chemicals considered were total petroleum hydrocarbons (TPH), metals, and PAHs.

Reviewed species lists and created summary descriptions of organisms that could be potentially impacted by dam construction on a high-altitude river in the Caribbean. This information was important to develop the risk assessment from dam construction.

Researched the toxicity of malathion to fish to support a technical review of the National Marine Fisheries biological opinion for the registration of pesticides containing malathion.

Environmental Forensics Projects

Performed document review, information management, and technical writing for numerous complex projects that dealt with historical petroleum contamination and multiple site owners in several types of environmental media.

Reviewed documents, assembled data, and researched metal concentrations associated with crude oil and railroads in support of a Superfund project in Oklahoma.

Examined the correlation of multiple contaminants (PAHs, metals) with PCB congeners at a historically contaminated site in Alabama to identify the likely origins of the PCB contamination.

Performed statistical analysis to determine source contribution in a chemical fingerprinting case at a Superfund site in Washington that involved hydrocarbons in water, sediment, and groundwater.

Human Health Projects

Organized, managed, and simplified a complex database of field sampling reports for a litigation case in Louisiana regarding human air exposure to PAHs.

Performed data analysis and document review for a Superfund site in Oklahoma. The analyses used hydrocarbon chromatograms and limited PAH and metal data to identify the likely sources of contamination.

Researched and compiled screening-level human health inhalation toxicity values for refinery-related gases for an overseas project.

Developed a questionnaire and related database for industrial hygiene surveys to support regulatory compliance for a highly specialized industry.

Ecological and Toxicity Studies

Conducted surveys to assess the health of coral reefs, seagrass beds, and mangrove swamps in the nearshore environment of Bermuda. Projects included area-wide habitat surveys as well as targeted sites potentially impacted by a heavy metals dump, hot water effluent from an incinerator, sedimentation from cruise ship traffic, and chronic release of raw sewage. In addition to ecological surveys, water quality was assessed through measurements of trace metals in water, sediment, and coral tissue.

Surveyed juvenile coral recruitment in the Florida Keys to evaluate if marine protected areas (MPA)s provide a benefit to coral recruitment.

Studied cytochrome P450 family enzymes, including CYP51 and CYP1, examining their sensitivity to environmental chemicals and their evolution through molecular biology and biochemistry approaches.

Prior Experience

- Senior Scientist, Sole Proprietor, Morrison Environmental Data Services, 2004–2007
- Data Analyst, ETI Professionals, 2005
- Scientist, NIH Toxicology Training Grant, Harvard School of Public Health, 2000–2004
- Guest Student, Woods Hole Oceanographic Institution, Stegeman Lab, 2001–2004
- Science Intern, Massachusetts Water Resources Authority, 03–05/2000, 10/2000–10/2001
- Research technician, Bermuda Biological Station for Research, Inc., Benthic Ecology Research Program (BERP), Bermuda, 01/1998–09/1999, 06–08/2000
- Research Intern, Bermuda Biological Station for Research, Inc., Benthic Ecology Research Program (BERP), Bermuda, 05/1997–12/1997
- NSF Research Experience for Undergraduates Fellowship, Bermuda Biological Station for Research, Inc., Benthic Ecology Research Program (BERP), Bermuda, 08–11/1996

Professional Affiliations

- American Chemical Society—ACS
- Society of Environmental Toxicology and Chemistry—SETAC
 - North Atlantic Chapter of SETAC