

## **EDWARD H. DETTMANN**

Research Environmental Scientist

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B.S., Physics, Tufts University, Medford, MA, 1962

M.S., Physics, University of Wisconsin, Madison, WI, 1964

Ph.D., Physics, University of Wisconsin, Madison, WI, 1971



### Employment:

1986-present      Research Environmental Scientist, Atlantic Ecology Division,  
National Health and Environmental Effects Research Laboratory,  
ORD, USEPA, Narragansett, RI

1982-1986      Chief, Ecology and Environment, Inc., Buffalo, NY

1975-1981      Scientist/Assistant Scientist, Argonne National Laboratory, Argonne, IL

1970-1975      Research and Project Associate, Institute for Environmental Sciences, University of Wisconsin,  
Madison, WI

### Research Expertise and Skills Relative to Agency Needs:

Ed has expertise in analysis and modeling of water quality in marine and freshwater systems. The current focus of his research is eutrophication in estuaries and other coastal waters, and the physical and other factors that determine the sensitivity of these systems to nutrient loading. Recent activities include advising the State of New Hampshire's Department of Environmental Services on development of nutrient criteria for New Hampshire's Great Bay, and participation in a workgroup that is developing nutrient criteria for Florida estuaries and near-coastal waters. He is leader of the Atlantic Ecology Division's Nutrients Research Group.

### Selected Memberships & Appointments:

Member: Estuarine Research Federation, New England Estuarine Research Society, American Geophysical Union

Member: National Estuarine Experts Workgroup (2005–2007)

Member: NHEERL Nutrient Research/Aquatic Stressors Program (2000–2010);

Technical Oversight/Review/Advisory Committees:

Region I Technical Advisory Group for Nutrient Criteria in Estuaries & Coastal Marine Waters (2000- present);

Nutrient Criteria Technical Guidance Committee for Estuarine and Coastal Marine Waters (2000–2001);

Department of Interior CERCLA Type A Damage Assessment Model (1986–1989);

Siting of Massachusetts Water Resources Authority POTW Outfall (1987–1988);

### Selected Publications:

- Madden, C.J., R. Smith, E. Dettmann, J. Kurtz, W. and others. 2010. Estuarine typology development and application. In: Glibert, P.M., C.J. Madden, W. Boynton, D. Flemer, C. Heil, and J. Sharp (eds.), NUTRIENTS IN ESTUARIES A Summary Report of the National Estuarine Experts Workgroup, 2005–2007. Report to U.S. Environmental Protection Agency, Office of Water, Washington DC. pp. 27–42.
- Glibert, P.M., C.J. Madden, E.H. Dettmann, W. Boynton and others. 2010. A framework for developing nutrient criteria. In P.M. Glibert, C.J. Madden, W. Boynton, D. Flemer, C. Heil, and J. Sharp (eds.), NUTRIENTS IN ESTUARIES A Summary Report of the National Estuarine Experts Workgroup, 2005–2007. Report to U.S. Environmental Protection Agency, Office of Water, Washington DC. pp. 43–71.
- Dettmann, E.H. 2008. Turnover time. In S.E. Jørgensen and B. Fath (eds.), Ecological Indicators, Vol. 5 of Encyclopedia of Ecology. Elsevier, Oxford. pp. 3639–3644.
- Dettmann, E.H., L.B. Mason, J.S. Latimer, and others. 2005. Load-response relationships for nitrogen and chlorophyll *a* in coastal embayments. In: Z. Zhu, K. Minami, G. Xing (eds.), Proceedings of 3<sup>rd</sup> International Nitrogen Conference, October 12–16, 2004, Nanjing, China; Science Press USA, Inc., Monmouth Junction, NJ. pp. 531–538.
- Dettmann, E.H. and L.B. Mason. 2004. Relationships between total nitrogen and planktonic chlorophyll *a* in Long Island Sound. In: Van Patten, M. (ed.), Proceedings of Sixth Biennial Long Island Sound Research Conference. October 24–26, 2002, Avery Point, CT, pp. 23–28.
- Dettmann, E.H. 2001. Effect of water residence time on annual export and denitrification of nitrogen in estuaries: a model analysis. *Estuaries* 24(4):481–490.

- Dettmann, E.H. 2001. Additional information on flushing in estuaries. Appendix C in nutrient criteria technical guidance manual: estuarine and marine waters. Report No. EPA-822-B-01-003, U.S. Environmental Protection Agency, Office of Water, Washington D.C.
- Barrera, J., R. Cantilli, I. Davis, E. Dettmann, J. Fisher, D. Flemer, T. Gardner, G. Gibson, D. Hart, J. Latimer, S. Libby, G. Smith, C. Siciliano, and J. Word. 2001. Nutrient criteria technical guidance manual: estuarine and coastal marine waters. Guidance Manual No. EPA-822-B-01-003, U.S. Environmental Protection Agency, Office of Water, Washington DC.
- Walker, H.A., J.S. Latimer, E.H. Dettmann. 2000. Assessing the effects of natural and anthropogenic stressors in the Potomac estuary: implications for long-term monitoring. *Environmental Monitoring and Assessment* 63:237–251.
- Dettmann, E.H., and M.A. Abdelrhman. 1997. Modeling short-term behavior of dredged material disposed in very shallow and very deep coastal waters. In: Delic, G. and M.F. Wheeler (eds.), *Proceedings of USEPA Workshop on Next Generation Environmental Models and Computational Methods (NGEMCOM)*, Society for Industrial and Applied Mathematics, Philadelphia. pp. 109-115.

**Karin M. Kettenring, Assistant Professor**

Ecology Center and Department of Watershed Sciences  
Utah State University  
5210 Old Main Hill, NR 210  
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**EDUCATION:**

Ph.D., Applied Plant Sciences, 2006, University of Minnesota, St. Paul, MN. Dissertation: *Seed ecology of wetland Carex species - implications for restoration*. Advisor: Dr. Susan M. Galatowitsch.

B.A., Biology, 1998, Oberlin College, Oberlin, OH. Advisor: Dr. David Benzing.

**PROFESSIONAL EXPERIENCE:**

*Assistant Professor*, Utah State University, 2008-present.

*Post-doctoral Fellow*, Smithsonian Environmental Research Center with Dr. Dennis Whigham, 2006-8.

*Post-doctoral Researcher*, The Field Museum of Natural History and the Morton Arboretum with Drs. Andrew Hipp and Kevin Feldheim, 2006.

*Graduate Research Assistant*, University of Minnesota with Dr. Susan Galatowitsch, 2000-6.

**COURSES TAUGHT:**

WATS 4310/6310 Wetland Ecology and Management, Department of Watershed Sciences, Utah State University, 2009, 2010

WATS/WILD 6700 Restoration Ecology, Department of Watershed Sciences, Utah State University, 2010.

**GRANTS AND FELLOWSHIPS:**

**Kettenring, K.M.** Restore and maintain native and desired nonnative plant and animal species diversity in terrestrial and aquatic ecosystems. U.S. Forest Service, \$80,000; 2009-2011.

Jordan, T., D. Breitburg, C. Gallegos, E. Johnson, **K.M. Kettenring**, X. Li, M. McCormick, P. Neale, G. Reidel, D. Weller, D. Whigham, M. Erwin, L. Karrh, E. Koch, R. Seitz, T. Targett, D. Wardrop. Predicting impacts of stressors at the land water interface. National Oceanic and Atmospheric Association. \$4,818,081 (KMK \$253,005); 2009-2014.

**Kettenring, K.M.** and D.E. Rosenberg. Allocating scarce water to benefit wetlands and wetland plant communities at the Bear River Migratory Bird Refuge: ecological experiments and optimization modeling. Research Initiation Grant, Utah State University, \$35,335; 2009.

**Kettenring, K.M.** Inventory of native *Phragmites* and assessment of nonnative *Phragmites* spread in wetlands in northern Utah. U.S. Fish and Wildlife Service Challenge Cost Share, Utah Wetlands Foundation, and Intermountain West Joint Venture, \$22,000; 2009.

**Kettenring, K.M.**, K. Mercer, J. Hines, and C. Reinhardt Adams. Plant genetic diversity and ecosystem function in wetland restorations – building research capacity through pilot studies. Research Catalyst Grant, Utah State University, \$19,983; 2009.

**Kettenring, K.M.** What is driving the invasion of the non-native plant *Phragmites australis* (common reed) in wetlands in northern Utah? New Faculty Research Grant, Utah State University, \$10,124; 2008-9.

**Kettenring, K.M.** Effects of salinity, flooding, nitrogen and CO<sub>2</sub> on the establishment of native and non-native haplotypes of *Phragmites australis*. Smithsonian Post-doctoral Fellowship, \$77,000; 2006-8.

#### **PUBLICATIONS** (\* student researcher):

##### **Peer reviewed publications:**

**Kettenring, K.M.**, M.K. McCormick, H.M. Baron, and D.F. Whigham. 2010. *Phragmites australis* (common reed) invasion in the Rhode River subestuary of the Chesapeake Bay: disentangling the effects of foliar nutrients, genetic diversity, patch size, and seed viability. *Estuaries and Coasts*, *In press*.

McCormick, M. K., **K. M. Kettenring**, H. M. Baron\* and D. F. Whigham. 2010. Extent and mechanisms of *Phragmites australis* spread in brackish wetlands in a subestuary of the Chesapeake Bay, Maryland (USA). *Wetlands*, *In press*.

Hipp, A.L., **K.M. Kettenring**, K.A. Feldheim, and J.A. Weber. 2009. Isolation of 11 polymorphic tri- and tetranucleotide microsatellite loci in a North American sedge (*Carex scoparia*: Cyperaceae) and cross-species amplification in three additional *Carex* species. *Molecular Ecology Resources* 9: 625-627.

**Kettenring, K. M.**, C. W. Weekley and E. S. Menges. 2009. Herbivory delays flowering and reduces fecundity of *Liatris ohlingerae* (S.F. Blake) B.L. Rob., an endangered, endemic plant of the Florida scrub. *Journal of the Torrey Botanical Society* 136: 350-362.

**Kettenring, K. M.** and D. F. Whigham. 2009. Seed viability and seed dormancy of non-native *Phragmites australis* in suburbanized and forested watersheds of the Chesapeake Bay, USA. *Aquatic Botany*, 91:199-204.

**Kettenring, K.M.** and S.M. Galatowitsch. 2007. Requirements for dormancy break and seed germination vary greatly among 14 species of *Carex* (sedges) from wetlands in mid-continental U.S. *Aquatic Botany* 87: 209-220.

**Kettenring, K.M.** and S.M. Galatowitsch. 2007. Tools for *Carex* revegetation in prairie pothole wetlands: understanding dormancy loss and germination temperature requirements. *Plant Ecology* 193: 157-169.

**Kettenring, K.M.**, G. Gardner, and S.M. Galatowitsch. 2006. Effects of light on *Carex* seed germination. *Annals of Botany* 98: 869-874.

**Kettenring, K.M.**, B.T. Martinez, A.M. Starfield, and W.M. Getz. 2006. Good practices for sharing ecological models. *BioScience* 56: 59-64.

***Manuscripts in revision or review:***

McCormick, M.K., **K.M. Kettenring**, H.M. Baron, D.F. Whigham. *In revision*. Spread of invasive *Phragmites australis* in estuaries with differing degrees of development: Genetic patterns, Allee effects and interpretation. *Journal of Ecology*.

Baldwin, A.H., **K.M. Kettenring** and D.F. Whigham. *In review*. The seed banks of brackish wetlands dominated by the non-native genotype of *Phragmites australis*. *Aquatic Botany*.

**JOURNAL AND GRANT REVIEWING:**

*Conservation Biology, Ecological Restoration, New Phytologist, Plant Ecology, Restoration Ecology, Rangeland Ecology and Management, Wetlands, International Society for Salt Lake Research. NOAA, NSF.*

**PUBLISHED ABSTRACTS (\* student researcher):**

Alminagorta, O.\*, D. Rosenberg, and **K.M. Kettenring**. 2009. System analysis to improve wetland water allocation at the Bear River Migratory Bird Refuge, Utah. World Environmental & Water Resources Congress, Providence, RI.

Downard, R.\*, J. Endter-Wada, and **K.M. Kettenring**. 2009. Keeping wetlands wet: Wetland policies and politics in the Bear River Basin. Ecological Society of America Millennium Conference on water-ecosystem services, drought, and environmental justice, Athens, GA.

Endter-Wada, J., L.W. Welsh\*, R. Downard\*, and **K.M. Kettenring**. 2009. Paradoxes in adapting to droughts – The rationality of locality. Ecological Society of America Millennium Conference on water-ecosystem services, drought, and environmental justice, Athens, GA.

**Kettenring, K.M.**, M.K. McCormick, and D.F. Whigham. 2009. A feedback mechanism for the spread of the invasive plant *Phragmites australis* – increased local genetic diversity and cross pollination can drive viable seed production. Botanical Society of America annual meeting, Snowbird, UT.

**Kettenring, K.M.**, D.F. Whigham, M.K. McCormick, H.M. Baron\*, S.K. Gallagher\*, and A.H. Baldwin. **2009**. Mechanisms of *Phragmites* invasion in the Chesapeake Bay: Disentangling the importance of land-use, disturbances, nutrients, genetic diversity, and viable seed production. Ecological Society of America annual meeting, Albuquerque, NM.

Wardrop, D.H., **K.M. Kettenring**, M.K. McCormick, M.M. Easterling, J. Peterson-Smith, and D.F. Whigham. **2009**. Writing a new story of *Phragmites* invasion: Historical land cover analysis and population studies in three Chesapeake Bay subestuaries. Society of Wetland Scientists annual meeting, Madison, WI.

Baldwin, A.H., **K.M. Kettenring**, and D.F. Whigham. **2008**. Seed banks of brackish *Phragmites* wetlands. Society of Wetland Scientists annual meeting, Washington, D.C.

Baron, H.M.\*, **K.M. Kettenring**, M.K. McCormick, and D.F. Whigham. **2008**. Variation in seed viability, genetic diversity, and foliar nutrients of non-native *Phragmites australis* in the Rhode River, a subestuary of the Chesapeake Bay. Society of Wetland Scientists annual meeting, Washington, D.C.

Gallagher, S.M.\*, **K.M. Kettenring**, and D.F. Whigham. **2008**. The effects of small disturbances on germination and emergence of *Phragmites australis* in brackish wetlands. Ecological Society of America annual meeting, Milwaukee, WI.

Gallagher, S.M.\*, **K.M. Kettenring**, and D.F. Whigham. **2008**. Effects of small disturbances on the emergence of *Phragmites australis* in native wetland plant communities. Wisconsin Wetlands Association annual meeting, Oconomowoc, WI.

**Kettenring, K.M.**, M.K. McCormick, H.M. Baron\*, A.H. Baldwin, and D.F. Whigham. **2008**. The potential for a seed-driven invasion of *Phragmites australis* in developed vs. forested watersheds of the Chesapeake Bay. Ecological Society of America annual meeting, Milwaukee, WI.

McCormick, M.K., **K.M. Kettenring**, H.M. Baron\*, D.F. Whigham. **2008**. Watershed land-use, viable seed production, and genetic diversity of non-native *Phragmites australis* in Chesapeake Bay subestuaries. Atlantic Estuarine Research Society annual meeting, Lewes, DE.

**Kettenring, K.M.** and D.F. Whigham. **2007**. Seed germination and seedling growth of invasive *Phragmites australis* from forested and developed watersheds of the Chesapeake Bay. Ecological Society of America annual meeting, San Jose, CA.

## Theron G. Miller

### Vita

#### ADDRESS

5693 Kingsford Avenue  
Park City, UT 84098  
EMAIL: [theronmiller@q.com](mailto:theronmiller@q.com)

#### EDUCATION

Ph.D. University of Alberta, Environmental Biology and Ecology (Limnology) 2004  
M.Sc. Zoology (Aquatic Toxicology), University of Alberta 1980  
B.S. Fishery Biology (qualified), Utah State University 1976  
B.S. Wildlife Science, Utah State University 1975

#### WORK SUMMARY

**Research Scientist**, Jordan River/Farmington Bay Water Quality Council. (3/2009-present). Jordan River dissolved oxygen/nutrient TMDL development; Continued leadership in directing research toward completion of site-specific nutrient criteria for Great Salt Lake wetlands. My initial contributions to the Jordan River TMDL effort have been to critique existing TMDL development documents, expand the number of participating scientists that have expertise in specific questions within this study, resulting in expanding the scope of work to include measurements of TSS, VSS and sediment stability in the main stem, major tributaries and storm drains and sediment oxygen demand, phytoplankton and periphyton production and respiration rates in the main stem. We are also investigating the influence of phytoplankton and suspended solids entering the Jordan River from eutrophic Utah Lake and using several measures of fishery and aquatic macroinvertebrate habitat quality and suitability. My objectives have been to expand our understanding ecosystem processes so that the source(s) of oxygen depletion are identified, understood and appropriately allocated for restoration efforts. Similarly, my initial investigations have identified severe habitat degradation including channel alteration, diversions, dredging, riparian destruction, excess suspended solids, instability of the inorganic particles (sand, silt and clay) and delivery of considerable amounts of organic debris that dominate the river substrate and cause extremely high measurements of sediment oxygen demand in the lower Jordan River. I am addressing the hypothesis that physical habitat degradation has a greater influence on the degraded fisheries and macroinvertebrate diversity than the dissolved oxygen deficit or from any direct effect from nutrients. I am currently advocating expansion of the TMDL research needs and final report to include the physical habitat degradation and restoration in its scope. Secondly, my original hypothesis that the DO impairment is the result of deposition and decomposition of organic debris from natural riparian vegetation and anthropogenic sources (storm water, yard debris, etc.) and subsequent elevated sediment oxygen demand in the lower Jordan River has thus far been confirmed through in situ measurements of SOD and coarse and fine particulate organic matter and extensive confirmational Qual2Kw modeling.

For the Great Salt Lake wetlands, my research, which began in 2004, initially focused on identifying potential linkages between water column nutrient concentrations and various

indicators of ecological health, biological integrity, and 303(d) beneficial use assessments. After years of research revealed significant uncertainty/ weak relationships between nutrients and various measures of plant, macroinvertebrate and avian community health, studies were expanded to investigate water column and sediment pore water concentrations of metals, sulfide and ammonia within the context of the biogeochemical processes that occur in wetland sediments. These varied processes have been found to mineralize, transform and release considerable quantities of nutrients, sulfides, metals and ammonia into sediment pore spaces and into the water column. Indeed, sulfides, ammonia and some toxic metals exceed their respective freshwater aquatic life criteria and significant loading of ammonia and phosphorus from the sediments have been found to occur. The 2010 field season has focused on the relationship of these sediment-derived toxicants and nutrients to plant and macroinvertebrate community health and abundance and the presence and abundance of preferred dietary components of various species of waterfowl. These measurements are now being assessed with the goal of establishing statistically valid stress/response relationships between these toxicants and various biological metrics and thence, for the purpose of identifying threshold concentrations that are associated with significant adverse ecological responses. Hopefully, in concert with the Utah DWQ, this process will culminate in the development of biological criteria based on multiple lines of evidence that are associated with elevated concentrations of known toxicants as well as suspected adverse affects of elevated nutrient concentrations. These measures will then be evaluated for their suitability for inclusion in a multimetric IBI and with appropriate weightings that will be used to perform the actual assessment against the beneficial uses assigned to the Great Salt Lake wetlands.

**Environmental Scientist**, Utah Division of Water Quality. (1999-3/2009).

Program Manager, nutrient criteria development: responsible for the design of field studies to quantify and analyze ecological responses and thresholds of impairment resulting from nutrient enrichment. This included the ongoing effort to development of metrics and IBIs (index of biological integrity) in stream, lake and wetland environments.

Program Manager, nonpoint source monitoring program. This focuses on TMDL implementation and participating in the design of restoration projects on streams that are habitat or water quality impaired. This included implementation of best management practices for sediment control, livestock restriction, channel stabilization and riparian ecosystem restoration. Long-term monitoring was conducted to evaluate the success of restoration efforts;

Lakes Coordinator, 305(b) and 303(d) assessment and preparation of the Lakes and Reservoirs section of Utah's Integrated Report to Congress. Provided technical support for the TMDL process for 303(d)-listed lakes, including studies that quantify nutrient dissolution from anaerobic sediments, sediment-derived oxygen depletion and optimizing restoration efforts; Served as Co-Program manager of the research project to establish a site-specific selenium standard for Great Salt Lake which included serving as Co-chairman of the Selenium Science Panel. Specific research projects included: investigating selenium speciation within aerobic and anaerobic zones of Great Salt Lake, transport through the Great Salt Lake foodchain, and ultimate environmental fate and potential toxicity to gulls, grebes and American avocets in the Great Salt Lake ecosystem.

**Environmental Consulting; Sole Proprietorship (1997-1999).** Eutrophication and drinking water taste and odor problems in arctic lakes. Installed lake aeration equipment and performed bench-scale tests on various potential remediation practices to remove humic substances and chlorinated trihalomethanes from drinking water in small villages in the high arctic of the Northwest Territories, Canada. I developed a treatment train that oxidized humic acids and reduced THMs to within drinking water standards.

**Research Assistant, (1994-1997).** University of Alberta (Ph.D. Research). Comparison of aeration methods used for winterkill prevention. This included circulation patterns, equipment sizing and measuring and modeling oxygen depletion/re-aeration relationships. Sediment oxygen demand, including the contribution of sediment methane production and oxidation, was measured for inclusion in unique empirical simulation and mechanistic mass balance. Models.

**CEO, Manager, River Valley Fish Ranches, Inc. (1985-1993).** Warm water aquaculture (catfish, goldfish, largemouth bass). Included spawning, rearing, harvesting, marketing and delivery.

**Senior Scientist for Environmental Toxicology (1981-1984)** Science Applications, Inc. Project Manager: Ecosystem response to pollutant concentrations near and exceeding EPA's newly establish water quality criteria (The "Red Book Criteria").

**Senior Scientist for Aquatic Toxicology. (1980-1981)** US EPA, EMSL, Las Vegas. Project Manager. Ecosystem response to pollutant concentrations near and exceeding EPA's water quality criteria (planning and initial phases).

**Research Associate in Limnology, (1978-1980)** University of Nevada, Las Vegas. Nutrient loading and eutrophication in Lake Mead, and an intensive ecological characterization using advanced SCUBA diving techniques to measure periphytic, macroinvertebrate and fishery community characteristics under various flow regimes in the Colorado River below Hoover dam. This research project was performed in order to fulfill NEPA requirements in the evaluation of proposed increases in peaking power discharges from the hydropower units.

**Research Assistant (1976-1978)** M.Sc. Program, University of Alberta. The influence of hardness, alkalinity and pH on copper toxicity to rainbow trout, importance of mucous secretion in resisting copper and acid toxicity, and a possible internal mode of copper toxicity.

**Fishery Biologist (1976)** US Bureau of Reclamation. Evaluation and reporting on aquatic resources of Gila, San Pedro and Little Colorado Rivers in Arizona to fulfill NEPA requirements for the study of potential dam sites.

## **TEACHING EXPERIENCE**

Aquatic Ecology, Introduction to Biology, Human Anatomy and Physiology  
(Utah Valley State College (1994), Salt Lake Community College (1993-1994, Western Arizona Community College (1991-1993)

## **SYNERGISTIC ACTIVITIES, PAST AND PRESENT**

Chair, Utah Interagency Nonpoint Source Monitoring Workgroup

Chair, Farmington Bay Technical Advisory Committee

Co-chair, Great Salt Lake Selenium Science Panel and co-program manager

Program Manager, Nutrient criteria development for Utah streams, lakes and wetlands

Program Manager, Beneficial use assessment methods development, Farmington Bay,

Farmington Bay wetlands and other Great Salt Lake wetlands  
Program Manager, Utah's nonpoint source and stream restoration success monitoring  
Manager and researcher for 305(b)/303(d) Beneficial Use Assessment for Utah's lakes  
Member, North American Lake Management Society  
Member, Water Environment Association of Utah  
Member, Jordan River TMDL Technical Advisory Committee

## **AREAS OF INTEREST AND RESEARCH**

Nutrient dynamics in lakes, streams and wetlands and quantitative thresholds of ecological impairment as mandated by Federal Clean Water Act Sections 303(d) and 305(b). Sediment biogeochemical processes involved in organic matter decomposition and associated oxygen consumption; and the dynamics of chemical reduction and release of nutrients, toxic metals, sulfides and ammonia and their resultant influence on the aquatic biota of rivers and wetlands. Wetlands beneficial use assessment methods development; critical links between nutrient and toxics concentrations and important indicators of ecological health and beneficial use support. Primary efforts are focused on whether nutrients discharged from the seven POTWs along the Wasatch front and significant nonpoint sources are impairing the beneficial uses of the Jordan River (determining the cause(s) of the oxygen deficit in the lower Jordan River). Similarly, focus is on identifying the relative contribution between upstream (watershed) sources of nutrients vs the re-dissolution of sediment-derived nutrients. Finally, sorting out the relative importance of nutrients vs sediment-derived toxic metals, sulfides and ammonia in influencing ecological structure and function; Focus is on the plant and macroinvertebrate communities and their essential contribution to supporting the diverse waterfowl and shorebird populations that depend upon Farmington Bay and other Great Salt Lake wetlands.

## **PUBLICATIONS**

- Miller, T.G. and W. C. Mackay. 1980. The effect of pH, hardness, and alkalinity on the toxicity of copper to rainbow trout. *Water Research* 14:129-133.
- Miller, T.G. and W.C. Mackay. 1982. Relationship of secreted mucus to copper and acid toxicity. *Bulletin of Environmental Contamination and Toxicology*. 28:(1)68-70.
- Miller, T.G. and W.C. Mackay. 1983. Evidence for an internal mechanism of copper toxicity. *Comparative Anatomy and Physiology*. 76-C: 95-98.
- Miller, T.G., S.M. Melancon and T.W. LaPoint. 1986. Use of effluent toxicity tests in predicting the effect of metals on receiving stream invertebrate communities. IN: *Environmental hazard assessment of effluents*. Society of Environmental Toxicology and Chemistry. Special Publications, Pergamon Press. pp. 265-281.
- McCord, S.M., G. Schladow and T.G. Miller. 2000. Modeling artificial aeration kinetics in ice covered lakes. *J. Environ. Engin. ASCE* 126(1):21-31.
- Miller, T.G., W.C. Mackay and D.W. Walty. 2001. Under-ice water movements induced by mechanical surface aeration and air injection. *Lake and Reservoir Manage.* 17(4):263-287.
- Miller, T.G. and W.C. Mackay. 2003. Optimizing artificial aeration for winterkill prevention. *Lake and Reservoir Manage.* 19(4):355-368.
- Miller, T.G. and W.C. Mackay. Efficiency and effect on lake metabolism of air injection and

surface mechanical aeration. Lake and Reservoir Manage. (in preparation)  
Miller, T.G. and W.C. Mackay and D.W. Smith. Methane production and oxidation impedes the effectiveness of winter lake aeration. (in preparation).

## **REPRESENTATIVE AND RELEVANT REPORTS**

### (RECENT)

- Miller, T.G. and K. Schwalme. Oxygen gradients, limnological effects and cost-efficiency of two lake aeration methods used for winterkill remediation. First annual report to Alberta Fish and Wildlife Service. Edmonton. 1995. 105 p.
- Miller, T.G. and W.C. Mackay. A comparison of mechanical surface aeration and point release air injection used to prevent winterkill in Alberta. Second Annual report to Alberta Fish and Wildlife Service. Edmonton. 1996. 64 p.
- Miller, T.G. Review of water quality problems and potential benefits from lake aeration at Fort McPherson, Northwest Territories. Report for Municipal and Community Affairs, Government of the Northwest Territories. 1998. 34 p.
- Miller, T.G. Identifying the source and possible solutions to trihalomethane formation at Fort McPherson, NWT. Report for Municipal and Community Affairs, Government of the Northwest Territories. June 9, 2000. 22 pages
- Miller, T.G. The success of various treatment alternatives to reduce trihalomethanes in a municipal water supply. Report for Municipal and Community Affairs, Government of the Northwest Territories. February, 2001. 27 pages.
- Miller, T.G. Chalk Creek restoration, Section 319 progress report. Report for Utah State Division of Water Quality and US EPA Region VIII Nonpoint Source Program. July, 2002. 77 pages.
- Miller, T.G. and H.M. Hoven. Ecological and beneficial use assessment of Farmington Bay wetlands: Assessment methods development. Report to US EPA, Region 8. 2007. 51. Pages.

### (EARLIER)

- Miller, T.G. Methods for data acquisition for site-specific water quality criteria for aquatic life. Report for U.S. EPA, Environmental Monitoring Systems Laboratory, Las Vegas. 1982. 85 p.
- Miller, T.G., S.M. Melancon and J. Janik. The impact of toxic metals on receiving streams: Prickly Pear Creek, Montana. Report submitted to U. S. EPA. 1982. 83 p.
- Miller, T.G., S.M. Melancon and J. Janik. The impact of toxic metals on receiving streams: Silver Bow Creek, Montana. Report submitted to U.S. EPA 1982. 72 p.
- Miller, T.G., S. M. Melancon and J. Janik. The impact of toxic metals in receiving streams: Tar Creek, Oklahoma. Report submitted to U.S. EPA. 1982. 90 p.
- Miller, T.G., S. Melancon and J. Janik. The impact of toxic metals in receiving streams: Leon Creek, Texas. Submitted to U.S. EPA. 1982. 82 p.
- Miller, T.G. Iowa ammonia toxicity study, Iowa River. Progress Report for Criteria and Standards Division, U.S. EPA. Washington, D.C. 1982. 74 p.
- Miller, T.G., M. Fillinger and J. Zuckerman. Demonstration of the site-specific criteria modification process: South Fork of the Crow River, Hutchinson, Minnesota. Report for

- U.S. EPA. Washington, D.C. 1983. 76 p.
- Miller, T.G. and J. Zuckerman. Demonstration of the site-specific criteria modification process: Mill Creek, Clinton, Iowa. Report to U.S. EPA. Washington, D.C. 1983. 82 p.
- Miller, T.G., M. Fillinger and J. Zuckerman. Demonstration of the site-specific criteria modification process: Iowa River, Marshalltown, Iowa. Report to U.S. EPA. Washington D.C. 1983.
- Miller, T.G., M. Fillinger and J. Zuckerman. Demonstration of the site-specific criteria modification process: Mingo Creek, Tulsa, Oklahoma. Report to U.S. EPA Washington D.C. 1983. 51 p.
- Miller, T.G. and M. Fillinger. Demonstration of the site-specific criteria modification process: Boggy and Skeleton Creeks, Enid, Oklahoma. Report to U.S. EPA, Washington D.C. 1983. 58 p.
- Miller, T.G. and M. Fillinger. Demonstration of the site-specific criteria modification process: Selzers Creek, Ponchatoula, Louisiana. Report to U.S. EPA, Washington, D.C. 1983. 65 p.
- Miller, T.G. and M. Fillinger. Site-specific criteria modification for lindane in Salt Creek, near Lincoln, Nebraska. Report to U.S. EPA, Washington, D.C. 1983. 71 p.
- Jenkins, K., T.G. Miller and D. Brown. The impact of toxic metals on the aquatic biota and cytosolic metal distribution in trout collected from Prickly Creek, Montana. Report to U.S. EPA, Washington, D.C. 1983.

#### **SELECTED PAPERS PRESENTED AT SCIENTIFIC MEETINGS**

Environmental factors influencing the benthic community of the Colorado River below Hoover Dam. Arizona-Nevada Academy of Science, Twenty-fourth annual Meeting. April 10-12, 1980.

The effect of depth, substrate and current velocity on the invertebrate community and razorback sucker (*Xyrauchen texanus*) distribution in the Colorado River below Hoover Dam. Ecological Society of America. 1980 Annual Meeting. September 3-4, 1980. Las Vegas.

Longitudinal zonation of the benthic invertebrates below Hoover Dam. Invited paper to the Symposium on the Ecology of Lotic Ecosystems. Hosted by the Savannah River Ecology Laboratory. Institute of Ecology - University of Georgia, U.S. Department of Energy and the National Environmental Research Program. October 19-20, 1980.

An evaluation of techniques to establish site-specific criteria for toxic metals; with A. Rubin. Paper presented at the annual meeting of the American Society for Testing and Materials. October 13-14, 1981. St. Louis, Missouri.

The influence of a toxic metal discharge on the aquatic biota of Prickly Pear Creek, Montana; with S.M. Melancon. Invited paper presented at the workshop for the effect of Trace Metals on Aquatic Ecosystems. Sponsored by Carolina Power and Light Company and Electric Power Research Institute. March, 23-24, 1982. Raleigh, North Carolina.

Use of effluent toxicity tests in predicting the effect of metals on receiving stream invertebrate

communities. Invited paper to the Workshop for Hazard Evaluation of Complex Effluents (Annual Pelstan Meetings). Sponsored by the Society for Environmental Toxicology and Chemistry. August 23-28, 1982. Cody, Wyoming.

Site-specific criteria modification: field modification of water quality criteria. Water Pollution Control Federation Annual Meeting. October 4-8, 1982. St. Louis, Missouri.

State-of-the-art techniques for determining biological and chemical quality of streams. Invited paper to the workshop on "water quality in the 1980's", Sponsored by the Colorado Water Congress. October 15-16, 1982. Denver, Colorado.

Aeration efficiency of surface mechanical aeration and point release air injection in winterkill lakes: A progress report. Invited paper to: Alberta-Saskatchewan Joint fisheries Staff meeting. June 15-16, 1995. Lloydminster, Alberta.

Comparing the efficiency of air injection and surface aeration used to prevent winterkill in Alberta lakes. Presented at the 18th International Symposium. North American Lake Management Society. Nov. 10-13, 1998. Banff, Alberta.

The effect of methane oxidation on aeration efficiency in winterkill lakes in Northern Alberta. Presented at the 19<sup>th</sup> International Symposium. North American Lake Management Society. November 18-21. 1999. Reno, Nevada.

#### **RECENT SCIENTIFIC COLLABORATORS**

W.C. Mackay, University of Alberta  
Heidi Hoven, Institute for Watershed Sciences  
Tonya Dombrowski, SWCA Environmental Consultants  
Leland Myers, Manager, Central Davis Sewer District  
John Cavitt, Weber State University  
Sam Rushforth, Utah Valley State College  
Larry Gray, Utah Valley State College  
Wayne Wurtsbaugh, Utah State University  
Don Hayes, University of Utah  
Ramesh Goel, University of Utah  
Sanwat Chaduri, University of Utah, State Health Laboratory  
Sharook Madon, CH2MHill  
William Johnson, University of Utah

## Resume

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### EDUCATION

1987 Ph.D., Zoology & Physiology, University of Wyoming  
1971 M.S., Fishery Biology, Michigan State University  
1969 B.S., Fishery Biology, Michigan State University

### EXPERIENCE

2003 - Present Aquatic Ecologist and Owner, HAF, Inc., Centennial, Wyoming.  
1992 - 2003 Principal, The Cadmus Group, Inc., Laramie, Wyoming.  
1980 - 1992 Vice President and Principal, Western Aquatics, Inc., Laramie, Wyoming.  
1974 - 1980 Research Associate, Environmental Sciences Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee.  
1971 - 1974 Fisheries Biologist, U. S. Peace Corps, Tropical Fish Culture Institute, Buga, Valle, Colombia, South America.  
1969 - 1971 Research Assistant, Department of Fisheries and Wildlife and Institute of Water Research, Michigan State University, East Lansing, Michigan.

### PROFESSIONAL AFFILIATIONS

Western Coalition of Arid States (WESTCAS)

### EXPERTISE

- Dr. Parkhurst's areas of expertise include aquatic ecology, fishery biology, aquatic toxicology and ecological risk assessment. He has over 35 years of professional experience.
- He has conducted numerous ecological assessments on fish, invertebrates, aquatic plants, and aquatic habitat. These studies have included evaluations of the effects of nutrients, toxic chemicals, metals, habitat alteration, and sedimentation on aquatic life.

- He has been involved in developing and evaluating state-of-the-science ecological assessment protocols for evaluating the risks of nutrients, toxic chemicals, metals, and physical stressors, such as sedimentation, to aquatic life.
- He has conducted numerous laboratory toxicity tests, *in situ* bioassays, and field studies on fish, invertebrates, and plants.
- Substances studied have included nutrients, metals, pesticides, organic chemicals, ammonia, sediments, acid rain, and effluents from smelters, mines, hazardous waste sites, power plants, municipal wastewater treatment plants, reservoirs, refineries, and oil fields.

## DESCRIPTIONS OF RECENT PROJECTS

- **Guidance on Developing Nutrient Criteria for Protecting Designated Uses of Water Bodies.** For the Federal Water Quality Coalition, Dr. Parkhurst was the lead author of a report that provides guidance for deriving scientifically defensible nutrient criteria based on defined relationships among designated uses of water bodies, response variables, and nutrients. The guidance uses multinomial models for determining Chl *a* levels that optimize the support of multiple, competing designated uses.
- **Methods for Developing Site-Specific Nutrient Criteria.** For the Water Environment Research Foundation (WERF), Dr. Parkhurst helped develop methods for deriving site-specific nutrient criteria for lakes and reservoirs, rivers and streams, and estuaries. These methods complement EPA's guidance for developing eco-regional nutrient criteria. The methods include three, increasingly detailed and data intensive, tiers of procedures.
- **Expert Report, Nutrient Ecology and Water Quality Objectives for Nutrients in the Santa Margarita River System.** This report reviewed the state-of-the-science of nutrient ecology in the Santa Margarita River system in Southern California and the development of water quality objectives for nutrients in the Santa Margarita River system.
- **An Ecological Evaluation of the Effects from Fidelity's MPDES Discharges to Aquatic Life in the Tongue River.** For Fidelity Exploration and Production Company, Dr. Parkhurst led a study that evaluated the effects of coal bed natural gas discharges on benthic macroinvertebrates and periphyton in the Tongue River, MT. The study evaluated ambient toxicity, effluent toxicity, aquatic chemistry, benthic macroinvertebrate community health and periphyton community health.

- **Evaluation of Grab Sample Data for Assessing Attainment of Chronic Aquatic Life Water Quality Criteria for Toxics.** Dr. Parkhurst was the lead investigator for a study that analyzed the use of grab sample data for assessing compliance with chronic water quality criteria. The study evaluated whether the results of a small number (e.g., 1-4) of grab samples should be used to evaluate compliance with chronic water quality criteria.
- **Demonstration of Risk-Based Approaches for Water Quality Regulation in the Jordan River, UT.** For the Water Environment Research Foundation, in cooperation with Salt Lake City Public Utilities and other wastewater treatment facilities that discharge to the Jordan River, Dr. Parkhurst developed ecological risk-based permit limits and demonstrated how they could be used to improve water quality management for the Jordan River.
- **Scientific Advisory Group, Water Quality Research Project.** Dr. Parkhurst was a member of the Scientific Advisory Group (SAG) for the Water Quality Research Project (WQRP). The WQRP is a research project funded by US EPA to Pima County Wastewater Management Department, Tucson, AZ, to study water quality issues unique to the Arid West. As a member of the SAG, Dr. Parkhurst reviewed competitive research proposals, research project results and project reports. These projects included characterization of habitats in effluent dominated waters in the Arid West and evaluation of water quality criteria for the Arid West.
- **Biological Assessments.** Parkhurst has conducted biological assessments to evaluate the effects of discharges to streams in AL, AZ, CO, MT and WY. They included evaluations of aquatic habitat, riparian habitat, benthic macroinvertebrates, fish, attached and floating algae, aquatic macrophytes, flow, and water quality.
- **Risk Assessment of the Potential Effects of Hazardous Air Pollutants Emitted from Secondary Lead Smelters to Aquatic and Terrestrial Biota.** For US EPA, Dr. Parkhurst evaluated the ecological risks of metals and organic chemicals emitted from four secondary lead smelters. Media evaluated included air, soils, water, sediments, forage, and fish. Receptors evaluated included soil invertebrates, plants, aquatic life, benthic invertebrates, and terrestrial wildlife. This project included the evaluation of aquatic and terrestrial, plant and animal toxicity data for all of the chemicals of concern.
- **Evaluation of the Toxicity of Treated Acid Mine Drainage to Pinal Creek, AZ.** For the Pinal Creek Group, Dr. Parkhurst conducted a series of studies to evaluate the toxicity of treated acid mine drainage on Pinal Creek near Globe, Arizona. These studies include whole effluent and ambient toxicity tests and evaluation of benthic macroinvertebrates and aquatic habitat in Pinal Creek.

- **Use Attainability Analysis for the Fish Consumption Use in Pinal Creek, Gila County, Arizona.** For the Pinal Creek Group, Dr. Parkhurst conducted a Use Attainability Analysis to determine whether fish consumption was an existing or potentially attainable use in Pinal Creek. Aquatic habitat, water quality and fish were sampled in the perennial portion of the creek from the Lower Pinal Creek Water Treatment Plant to the Salt River. Habitat Suitability Index models were used to evaluate the suitability of habitat in the creek for three fish species, including green sunfish, yellow bullhead, and desert sucker.
- **Evaluation of the Comparative Risks from Pesticide Toxicity and Habitat Change from Flow Augmentation in Salado Creek, TX.** For the Water Environment Research Foundation (WERF), Dr. Parkhurst applied aquatic ecological risk assessment methods he developed for WERF to evaluate the comparative risks of the pesticide diazinon and low stream flows on aquatic life in Salado Creek, San Antonio, TX. This project included the evaluation of extant aquatic toxicity data for diazinon, several metals and ammonia, and the effects of changes in instream flows on aquatic habitat. Treated municipal effluent is being used to augment stream flows in Salado Creek, which is a small urban stream. The project compared the effects of flow augmentation on fish and invertebrate habitat with the potential risks of toxic contaminants present in the effluent and ambient stream water. Risks before flow augmentation and after flow augmentation were quantified and compared to estimate the “net” risks of flow augmentation.
- **Development of Methods for Quantifying the Ecological Risks of Toxic Chemicals to Aquatic Biota.** This two-year project for the Water Environment Research Foundation involved the development and validation of a state-of-the-science protocol for assessing the aquatic ecological risks of chemicals in surface waters, wastewaters, and sediments. The protocol includes methods for Tier 1, screening-level risk assessments, and Tier 2, quantitative, probabilistic risk assessments. The methods are applicable to single and multiple chemicals, including metals, pesticides, and other organic and inorganic chemicals. The methods include user-friendly Windows software.
- **Development and Validation of Methods for Evaluating the Net Ecological Risks from Site Contamination and Site Remediation.** Dr. Parkhurst was the Principal Investigator for a two-year research project funded by the U.S. Department of Energy (DOE) that developed and evaluated ecological risk assessment and stakeholder analysis methods for use in assessing risks and prioritizing remediation activities at DOE facilities. The methods assess risks from multiple physical, biological, chemical, and radionuclide stressors in both aquatic and terrestrial environments. They include protocols for screening-level risk assessments and probabilistic risk assessments. Guidance is provided for using the results of ecological risk assessments for risk-based decision making. A

case study is included, which evaluated risks of mercury and PCBs to aquatic and terrestrial biota in the East Fork Poplar Creek watershed, near Oak Ridge, TN. It also included a comparison of the risk reductions to be gained from several remediation alternatives.

- **Whole Effluent Toxicity Testing Methods: Accounting for Variance.** Dr. Parkhurst was co-principal investigator for two projects for the Water Environment Research Foundation (WERF) that quantified the variability in toxicity tests used in WET testing and ambient water testing. Case studies were used to show how knowledge of this variability can be used to evaluate reasonable potential for WET and to interpret compliance with WET limits in National Pollutant discharge Elimination System (NPDES) permits. Data used to evaluate the accuracy and precision in WET test endpoints were derived from reference toxicity tests. A national data base of reference WET tests for nine species using a variety of EPA standard protocols and reference toxicants was compiled. A random effects model is used to calculate variance components including between-laboratory variability, within-laboratory variability, variability as a function of toxicant concentration, and random error. Additionally, intralaboratory variability was examined using general linear modeling (GLM) techniques and creative graphical outputs. Case studies, and associated WET effluent test results, were compiled. The data were used to examine the impact of incorporating WET test variability into regulatory compliance decisions.

## **PUBLICATIONS**

Warren-Hicks, W. B. Parkhurst, and S. Qian. 2006. Accounting for Toxicity Test Variability in Evaluating WET Test Results. Project 00-ECO-1, Water Environment Research Foundation, Alexandria, VA.

Warren-Hicks, W., B. Parkhurst, M. Smart, and S. Bartell. 2005. Technical Approaches for Setting Site-Specific Nutrient Criteria. Project 99-WSM-3, Water Environment Research Foundation, Alexandria, VA.

Warren-Hicks, W., B. J. Parkhurst, Butcher, J. B. 2002. In: Species Sensitivity Distributions in Ecotoxicology. Leo Posthuma, Glenn Suter, Theo Trass, eds., Lewis Publishers, New York.

Parkhurst, BR. 2001. Using WERF's Aquatic Ecological Risk Assessment Tool To Improve the Effectiveness of Water Quality Management. Project 97-HHE-2, Water Environment Research Foundation, Alexandria, VA.

Salvito, D.T., H.E. Allen, B.R. Parkhurst, and W.J. Warren-Hicks. 2001. Comparison of trace metals in the intake and discharge water of power plants using "clean" techniques. Water Environment Research. Vol. 73, No. 1, pp. 24-29.

Warren-Hicks, W.J., B. Parkhurst, D. Moore. 2000. Whole Effluent Toxicity Test Variability: Partitioning Sources of Variability. *Environmental Toxicology and Chemistry*. Vol. 19, No. 1, pp. 94-104.

Moore, D., W. J. Warren-Hicks, W.J., and B. Parkhurst 2000. Intra- and Inter-Treatment Variance. *Environmental Toxicology and Chemistry*, Vol. 19, No. 1, pp. 105-112.

Moore, D.R.J., B. Sample, G. Suter, B. Parkhurst, and S. Teed 1999. Risk-based decision making: The East Fork Poplar Creek Case Study. *Environmental Toxicology and Chemistry* 18: 2954-2958.

Moore, D.R.J., B. Sample, G. Suter, B. Parkhurst, and S. Teed 1999. A probabilistic risk assessment of the effects of methylmercury and PCBs on mink and kingfishers along East Fork Poplar Creek, Tennessee. *Environmental Toxicology and Chemistry* 18: 2941-2953.

Parkhurst, B.R. et al. 1998. Communicating the results of uncertainty analyses for ecological risk assessments. In: Warren-Hicks, W.J., and D. Moore, eds. *Uncertainty Analysis in Ecological Risk Assessment: Pellston '95*. SETAC Press, Pensacola, FL.

Parkhurst, B., S. Christensen, R. Goldstein, B. Neely, and K. Solomon. 1998. Chapter 3. Model selection considerations in fate-and-effects analysis. In: *Ecological Risk Assessment Decision-support System: A Conceptual Design*. K.H. Reinert, S.M. Bartell, and G. R. Biddinger, Eds. SETAC Press, Pensacola, FL.

Parkhurst, B.R., Warren-Hicks, W.J., and Creager, C.S. 1997. Methods for Assessing Watershed-Scale Aquatic Risks for Multiple Stressors. In: *Environmental Toxicology and Risk Assessment: Modeling and Risk Assessment (6th Volume, ASTM STP 1317, F.J. Dwyer, T.R. Doane, and M.L. Hinman, Eds.)*, American Society for Testing and Materials.

Parkhurst, B.R., W.J. Warren-Hicks, R.D. Cardwell, J. Volosin, T. Etchison, J.B. Butcher, and S.M. Covington. 1996. *Aquatic ecological risk assessment: A multi-tiered approach*. Water Environment Research Foundation, Alexandria, VA.

Parkhurst, B.R. 1996. Predicting Receiving Water Impacts from Effluent Toxicity. Pp. 309-321 In: *Whole Effluent Toxicity Testing: An Evaluation of Methods and Prediction of Receiving Systems Impacts*. D.R. Grothe, K.L. Dickson, and D.K. Reed-Judkins (Eds.) SETAC Special Publication, SETAC Press, Pensacola, Florida. 346 pp.

Warren-Hicks, W.J. and B.R. Parkhurst. 1996. Issues in Whole Effluent Toxicity Test Uncertainty Analysis. Pp 180-189 In: *Whole Effluent Toxicity Testing: An Evaluation of Methods and Prediction of Receiving Systems Impacts*. D.R. Grothe, K.L. Dickson, and D.K. Reed-Judkins (Eds.) SETAC Special Publication, SETAC Press, Pensacola, Florida. 346 pp.

Parkhurst, B.R. 1995. Are single species toxicity test results valid indicators of effects to aquatic communities? In J. Cairns and B.R. Niederlehner (editors). *Ecological Toxicity Testing: Scale, Complexity, and Relevance*. Lewis Publishers, Boca Raton, FL.

Parkhurst, et al. 1995. Aquatic ecological risk assessment improves water quality decision making. *Water, Environment and Technology* 7(11):39-43.

Cardwell, R.D., B.R. Parkhurst, W. Warren-Hicks, and J.S. Volosin. Aquatic ecological risk. *Water Environment & Technology*. 5(4):47-51.

Parkhurst, B.R., W. Warren-Hicks, and L.E. Noel. 1992. Performance characteristics of effluent toxicity tests: summarization and evaluation of data. *Environmental Toxicology and Chemistry* 11:771-791.

Warren-Hicks, W. and B.R. Parkhurst. 1992. Performance characteristics of effluent toxicity tests: variability and its implications for regulatory policy. *Environmental Toxicology and Chemistry* 11:793-804.

Parkhurst, B.R., and D.I. Mount. 1991. The water quality-based approach to toxics control: narrowing the gap between science and regulations. *Water, Environment, and Technology* 3(12):45-47.

Parkhurst, B.R., and H. Olem. 1991. Lake and reservoir management. *Research Journal, Water Pollution Control Federation* 63(4):543-550.

Parkhurst, B.R., H.L. Bergman, J. Fernandez, D.D. Gulley, J.R. Hockett and D.A. Sanchez. 1990. Inorganic monomeric aluminum and pH as predictors of acidic water toxicity to brook trout (*Salvelinus fontinalis*). *Canadian Journal of Fisheries and Aquatic Sciences* 47(8):1631-1640.

Porcella, D.B., J.W. Anderson, S. Banerjee, E.S. Bender, W.J. Birge, M. Lesis and B.R. Parkhurst. 1986. Discussion synopsis: biological effects testing of effluents. Pages 123-131 in H.L. Bergman, R.A. Kimerle and A.W. Maki (editors). *Environmental Hazard Assessment of Effluents*. Pergamon Press, Elmsford, NY.

Parkhurst, B.R. 1986. The role of fractionation in hazard assessments of complex effluents. Pages 92-106 in H.L. Bergman, R.A. Kimerle and A.W. Maki (editors). *Environmental Hazard Assessment of Effluents*. Pergamon Press, Elmsford, NY.

Parkhurst, B.R., R.G. Elder, J.S. Meyer, D.A. Sanchez, R.W. Pennak and W.T. Waller. 1984. An environmental hazard evaluation of uranium in a Rocky Mountain stream. *Environmental Toxicology and Chemistry* 3(1):113-124.

Cushman, R.M., D.K. Brown, N.T. Edwards, J.M. Giddings and B.R. Parkhurst. 1982. Ecotoxicity of coal gasifier solid wastes. *Bulletin of Environmental Contamination and Toxicology* 28:39-45.

Parkhurst, B.R. 1982. Book review of "Aquatic Invertebrate Bioassays" edited by A.L. Buikema, Jr. and John Cairns, Jr. ASTM Special Publication 715, American Society for Testing and Materials. Philadelphia, PA. *Transactions of the American Fisheries Society* 111(6):789-791.

Parkhurst, B.R., A.S. Bradshaw, J.L. Forte and G.P. Wright. 1981. The chronic toxicity to *Daphnia magna* of acridine, a representative azaarene present in synthetic fuel products and wastewaters. *Environmental Pollution* 24:21-30.

Parkhurst, B.R., J.L. Forte and G.P. Wright. 1981. Reproducibility of a life cycle toxicity test with *Daphnia magna*. *Bulletin of Environmental Contamination and Toxicology* 26:1-8.

Parkhurst, B.R., J.S. Meyer, G.M. DeGraeve and H.L. Bergman. 1981. A reevaluation of the toxicity of coal conversion process waters. *Bulletin of Environmental Contamination and Toxicology* 26:9-15.

Brand, J.I., J.A. Klein, B.R. Parkhurst and T.K. Rao. 1981. Mutagenicity and toxicity of treated aqueous effluents from coal conversion processes. *Proceedings of the 35th Annual Purdue Industrial Waste Conference*, West Lafayette, IN.

Millemann, R.E., B.R. Parkhurst and N.T. Edwards. 1981. Toxicity to *Daphnia magna* and terrestrial plants of solid waste leachates from coal conversion processes. Pages 237-247 in D.D. Mahlum, R.H. Gray and W.D. Felix (editors). *Coal Conversion and the Environment*. Technical Information Center, U.S. Department of Energy Symposium Series 54. Conf-801039 (NTIS Report No. DE82000105).

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Millemann, R.E., and B.R. Parkhurst. 1980. Comparative toxicity of solid waste leachates to *Daphnia magna*. *Environment International* 4:255-260.

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Southworth, G.R., B.R. Parkhurst and J. Beauchamp. 1979. Accumulation of acridine from water, food and sediment by fathead minnows, *Pimephales promelas*. *Water, Air and Soil Pollution* 12:331-341.

Parkhurst, B.R., C.W. Gehrs and I.B. Rubin. 1979. Value of chemical fractionation for identifying the toxic components of complex aqueous effluents. Pages 122-130 in L.L. Marking and R.A. Kimerle, (editors). *Aquatic Toxicology*. ASTM STP 667. American Society for Testing and Materials, Cleveland, OH.

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Parkhurst, B.R. 1971. An ecological evaluation of a thermal discharge. Part V. The distribution and growth of the fish populations along the western shore of Lake Erie at Monroe, Michigan, during 1970. Technical Report Number 17, Thermal Discharge Series. Institute of Water Research, Michigan State University, East Lansing, MI. (NTIS Report No. PB240 7111/256).

## PRESENTATIONS

Parkhurst, B.R. and D. Pillard. 2009. An Ecological Evaluation of the Effects from Fidelity's MPDES Discharges to Aquatic Life in the Tongue River. Powder River Basin Coal Bed Natural Gas Interagency Working Groups, Wildlife, Aquatics and Hydrology Research Meeting, December 2-3, 2009

Parkhurst, B.R. 2007. Nutrient Criteria: Why and How? Western Coalition of Arid States, November 1, 2007. Scottsdale, AZ.

Parkhurst, B.R. 2006. Ecological Risk Assessment: Current Topics in the USA. 5<sup>th</sup> International Symposium On Environmental Quality, May 22 to 24, 2006, Porto Alegre, Brazil.

Parkhurst, B.R. 2004. A site-specific evaluation of EPA's proposed chronic water quality criterion for selenium. Annual Meeting, Society of Environmental Chemistry and Toxicology, Portland, OR.

Parkhurst, B.R., and William Warren-Hicks. 2003. Alternatives to EPA's methods for calculating reasonable potential for WET: Case studies. Annual Meeting, Society of Environmental Chemistry and Toxicology, Austin, TX.

Parkhurst, B., M. Smart, S. Bartell, and W. Warren-Hicks. Site-specific nutrient criteria: An alternative to EPA's Eco-regional nutrient criteria. 2002. Annual Meeting, Society of Environmental Chemistry and Toxicology, Salt Lake City, UT.

Parkhurst, B.R. 1999 Evaluating Net Ecological Risks of Using Treated Municipal Wastewater to Augment Stream Flow. Annual Meeting, Water Environment Federation, New Orleans, LA.

Parkhurst, B. R., and J. Kennedy. 1999. An Example Demonstration of Using Risk-Based Approaches for Water Quality Regulation. Annual Meeting, Society of Environmental Chemistry and Toxicology, Philadelphia, PA.

Parkhurst, B. R., and J. Kennedy. 1998. Applying Ecological Risk Assessments to Environmental Decision Making on a Watershed Scale: Effects of Habitat Changes on Sandhill Cranes Staging on the Platte River, NE. Annual Meeting, Society of Environmental Chemistry and Toxicology, Charlotte, NC

Parkhurst, B.R. 1997. Comparison of Ecological Risks from Contamination and Remediation at Hazardous Waste Sites. 1997 Annual Meeting, Rocky Mountain Chapter of the Society for Environmental Toxicology and Chemistry, Laramie, WY.

Parkhurst, B.R. and D. Salvito. 1996. WET Limits for Power Plants Using Once-Through Cooling: Methods for Estimating "Net" Toxicity. 1996 Annual Meeting of the Society for Environmental Toxicology and Chemistry, Washington, DC.

Parkhurst, B.R., William Warren-Hicks, and Clayton Creager. 1996. Modification of the WERF Methodology for Aquatic Ecological Risk Assessment for Assessing Watershed-scale Aquatic Risks, Water Environment Federation Conference, Watershed '96, Baltimore, MD.

Parkhurst, B.R., W. Warren-Hicks, and T. Etchison. 1995. How Clean Is Clean Enough? Use of Aquatic Ecological Risk Assessment to Help Answer this Question. Water Environmental Federation Specialty Conference, Cincinnati, OH.

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Parkhurst, B.R., W. Warren-Hicks, and T. Etchison. 1994. Estimating the Aquatic Ecological Benefits of Reductions in Metals' Concentrations in Streams Impacted by Mining. 1994 Annual Meeting of the Society for Environmental Toxicology and Chemistry, Denver, CO.

Parkhurst, B.R., and J.W. Appling. 1994. Effects of metal mixtures on human health and aquatic life: Similarities and differences. 1994 Annual Meeting of the Society for Environmental Toxicology and Chemistry, Denver, CO.

Parkhurst, B.R. 1993. Environmental toxicology (ecotoxicology) test methods and their applications to superfund. Presented to EPA Region 3, Aug. 25, Philadelphia, PA.

Parkhurst, B.R., B. Warren-Hicks, and R.D. Cardwell. WERF methodology for aquatic ecological risk assessment. 1993. Presented at Water Environment Federation, 66th Annual Conference, October 3-7, Anaheim, CA.

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Parkhurst, B.R., M.D. Marcus and L.E. Noel. 1990. When is effluent toxicity correlated with ecological effects? Presented at the 11th Annual Meeting of the Society of Environmental Toxicology and Chemistry, Crystal City, VA.

Parkhurst, B.R. and J.G. Aronson. 1989. Site-specific considerations for implementation of biomonitoring. Presented at the Annual Meeting of the Texas Water Pollution Control Federation, February 23, 1989, Arlington, TX.

Parkhurst, B.R., H.L. Bergman, J. Fernandez, D.D. Gulley and J.R. Hockett. 1989. Evaluation of the *in situ* toxicity of acidic surface waters to brook trout. Presented at the Tenth Annual Meeting of the Society of Environmental Toxicology and Chemistry, October 28 to November 2, 1989, Toronto, Ontario, Canada.

Parkhurst, B.R. and W. Warren-Hicks. 1988. What is the role of environmental toxicology in assessing the ecological impacts of Superfund Sites? Presented at the Ninth Annual Meeting of the Society of Environmental Toxicology and Chemistry, November 13-17, 1988, Arlington, VA.

Parkhurst, B.R. and D. Gulley. 1987. Evaluation of laboratory bioassay-based models for predicting the *in situ* toxicity of acidic waters to brook trout. Presented at the Eighth Annual Meeting of the Society of Environmental Toxicology and Chemistry, November 9 - 12, 1987, Pensacola, FL.

Parkhurst, B.R., J. Fernandez, D. Gulley and H.L. Bergman. 1986. Effects of fluoride, humic acid, and temperature on the toxicity of acidity and aluminum to brook trout fry. Presented at the Seventh Annual Meeting of the Society of Environmental Toxicology and Chemistry, November 2 - 5, 1986, Alexandria, VA.

Parkhurst, B.R. and M.D. Marcus. 1985. Documented impacts of acid rain on North American fisheries: extrapolation to Colorado and Wyoming. Presented at the 1985 Annual Meeting of the Colorado-Wyoming Chapter of the American Fisheries Society, Laramie, WY.

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