

Harry M Ohlendorf

Technology Fellow, Ecological Risk Management

Education

Ph.D. Wildlife Science - Texas A&M University, 1971

M.S. Wildlife Science - Texas A&M University, 1969

B.S. Wildlife Management (Fisheries Option) - Texas A&M University, 1962

Professional Registrations

Certified Wildlife Biologist; The Wildlife Society

Professional Wetland Scientist; Society of Wetland Scientists (1995-2007)

Senior Ecologist; Ecological Society of America (2000-2004)

Distinguishing Qualifications

- More than 39 years of experience in evaluating the impacts of environmental contaminants on wildlife in aquatic and terrestrial ecosystems, including more than 21 years at CH2M HILL and more than 18 years with U.S. Fish and Wildlife Service.
- Recognized as a "Pioneer of Selenium Research" in a book, *Environmental Chemistry of Selenium*, edited by W.T. Frankenberger, Jr., and R.A. Engberg and published by Marcel Dekker, Inc., 1998.
- Completed numerous ecological risk assessments and other ecological evaluations in the areas of fisheries biology and wildlife ecology.
- Provides firm-wide technical guidance in the area of ecological risk assessment and risk management, maintaining an awareness of current guidance being developed by the U.S. Environmental Protection Agency and other agencies and organizations, and helps clients develop cost-effective risk management strategies.
- In 1993-2004, taught 11 3-day classes in ecological risk assessment through University of California Berkeley Extension's Environmental Management Continuing Education Program (along with a USEPA Region 9 risk assessor [most recently Ned Black])
- Received U.S. Geological Survey, Patuxent Wildlife Research Center Special Achievement Award for helping two Center scientists organize and convene a "scientifically-significant contaminants conference that resulted in a recent Society of Environmental Toxicology and Chemistry Special Publication, *Environmental Contaminants and Terrestrial Vertebrates: Effects on Populations, Communities and Ecosystems* (2000)."
- Received two U.S. Fish and Wildlife Service Special Achievement Awards for outstanding performance as a research scientist; also received Nelson-Hooper Award for best technical presentation at meeting of the Western Section of The Wildlife Society.

Relevant Experience

As an environmental scientist, Dr. Ohlendorf's duties include a wide variety of environmental projects, including the planning, implementation, and reporting of site ecological characterizations and surveys, contaminant exposure and effect analyses, risk characterization, and project impact evaluations. He provides firm-wide technical guidance in the area of ecological risk assessment, maintaining awareness of current guidance being developed by the U.S. Environmental Protection Agency and other agencies and organizations. Dr. Ohlendorf began his career with the U.S. Fish and Wildlife Service's Patuxent Wildlife Research Center in Laurel, Maryland, where he served for 7 years as assistant director of the Research Center and was actively involved in pollution ecology research. Subsequently, he was leader of the Pacific Coast Research Station in Davis, California, and studied the pollution ecology of wildlife. For 18 years, Dr. Ohlendorf's research focused on the occurrence and impacts of contaminants in aquatic and terrestrial ecosystems. These studies included the sampling of various wetland and terrestrial food chains and the assessment of the effects observed in higher trophic levels, especially birds; they were conducted in the eastern United States, California, Alaska, and Hawaii. Representative projects for CH2M HILL are summarized below.

- **Rocky Mountain Coal Mining Operations, British Columbia and Alberta.** Provided senior technical oversight and review concerning ongoing and proposed studies as related to exposure, fate, and ecological effects of selenium from coal-mining operations on fish and wildlife as requested by agency-industry working groups for several mines in both provinces. Concerns about selenium in surface waters of western Canada were expressed in 1997 on the basis of elevated selenium concentrations found in surface waters and fish close to coal mines in southeast British Columbia. At the request of the Elk Valley Selenium Task Force (EVSTF), reviewed reports and work plans to provide technical oversight of the work. In 2007-2008, served as a member of the Expert Panel for the EVSTF to evaluate effects of selenium on fish and wildlife of the Elk Valley. Participated in the Expert Workshop held in Vancouver on February 5-6, 2008, and co-authored the Workshop Summary Report, which was released in October 2008. Specific mitigation and management activities were recommended to reduce the risk of impact from selenium on the ecosystems of the area. An Alberta Selenium Working Group (SWG) was established in October 1999 to produce an adaptive framework and approach for the evaluation and management of selenium at the mountain mines. Membership of the SWG includes representatives from provincial and federal governments and from the coal industry. The SWG has managed and directed a number of monitoring and research studies on the source, effects, and fate of selenium in the vicinity of the mines since 1999. Participated as a senior reviewer at a technical workshop on selenium held in Hinton, Alberta in September 2000. A goal of the workshop was to propose and develop a work plan to address data and knowledge gaps. Based on the workshop and subsequent discussions between governmental agencies and industry, biological analysis, off-mine site water quality sampling, on-site water quality monitoring, and investigations of potential sources of selenium are being conducted. Participated as a Science Panel Member in a second workshop for Alberta mountain coal mines in Hinton in June 2005 at the request of the SWG. The goal was to review progress and provide recommendations for future direction of the selenium studies and management options. (9/2000 - 10/2008)

- **Strategic Advisory Panel on Selenium Management for Teck Coal, Alberta and British Columbia.** Mining of steel-making coal increases the release of selenium to the environment. This expert panel was brought together to develop an independent, strategic management plan integrating environmental, social, and business opportunities and risks associated with selenium management and to develop a conceptual implementation plan for individual operations. Dr. Ohlendorf is a member of the panel, focusing on ecological risk management and selenium ecotoxicology. The work of this panel is ongoing, with development of the plan completed in June 2010 and implementation support for Teck Coal to continue through December 2011. (1/2010 – present)
- **SETAC Pellston Workshop: Ecological Assessment of Selenium in the Aquatic Environment, Pensacola, Florida.** This Society of Environmental Toxicology and Chemistry Pellston Workshop brought together 46 key individuals from business, academia, government, and nongovernmental organizations to develop a consensus on the state of the science and a path forward for the assessment of selenium in the aquatic environment. The results included key findings for problem formulation, environmental partitioning, bioaccumulation, trophic transfer, toxic effects, and risk assessment. Dr. Ohlendorf was a steering committee member, participated in Risk Characterization workgroup, and was an editor for the resulting book that was published in April 2010. (11/2007 – 4/2010)
- **Development of a Guide for Site-specific Assessment of Selenium in Aquatic Systems. North American Metals Council - Selenium Working Group.** Selenium is a chemical of concern at many locations across North America and elsewhere, and site-specific conditions are important when evaluating its bioaccumulation and effects in aquatic ecosystems. Dr. Ohlendorf was the senior author in the development of an approach for conducting site-specific assessments of selenium bioaccumulation and effects. The guide prepared for NAMC-SWG describes a phased approach for field and laboratory assessments of selenium bioaccumulation in fish and aquatic-dependent birds that can be applied in different environmental settings with the goal of developing and interpreting a tissue-based selenium value. It recommends the use of decision trees, conceptual models, and data quality objectives toward defining what should be done during the assessment, plus sampling and monitoring procedures for the assessment. First, available tissue or waterborne selenium concentrations should be compared to tissue residue guidelines or adopted water quality criteria/guidelines. When needed, reproductive toxicity testing and assessment of fish populations also should be conducted in the area of interest. The guide also summarizes extensive data on the effects of selenium on fish and bird species. The final guide was approved by the NAMC-SWG, and now also has been published as a critical review article in the journal *Integrated Environmental Assessment and Management*. (3/2007 – 8/2011)
- **Review of Available Technologies for the Removal of Selenium from Water. North American Metals Council - Selenium Working Group.** Dr. Ohlendorf participated in development of an approach and in the review of available technologies for the removal of selenium from water addressing mining, agriculture, power generation, and oil and gas industries. The review evaluated the effectiveness, applicability, limitations, and cost of alternative source control, pollution prevention, and treatment options of selenium-removal technologies. The final report was approved by the North American Metals Council – Selenium Working Group in mid-2010. (7/2009 – 6/2010)

- **Confidential Client, Evaluation of Selenium and Arsenic at a Mining Complex, AZ.** Conducted a comprehensive study of selenium and arsenic concentrations and their fate and potential effects on human and ecological receptors, including livestock grazing on areas affected by mining activities for a confidential client in northeastern Arizona. The study evaluated historical as well as recently collected sampling data, and compared selenium and arsenic levels in soils and overburden materials from the site to the general levels in the western U.S., evaluated surface coal mining effects on selenium and arsenic levels in various environmental media (including soil, water, air, plants, and animals), and assessed the potential biological and human health risks of exposure to these elements. Concentrations of selenium and arsenic in native soil and overburden samples from the site were similar to those found in comparable geologic samples from other areas in the western U.S. Sampling of several reclaimed areas, native vegetation in areas downwind from mining activities, and native vegetation in reference areas away from the mining activities, showed that average selenium and arsenic concentrations in plants from all areas were well within acceptable levels for sheep, other livestock, and wildlife diets. Air quality analysis showed no biologically significant effects of selenium or arsenic on the soils or plants, compared to reference soil or washed and unwashed plant samples. Groundwater quality monitoring data indicated that mining has not caused significant impacts to selenium or arsenic concentrations in the alluvial or shallow aquifers. Surface water quality data indicated that mining activities have not significantly affected selenium or arsenic concentrations in any of the surface water bodies, and concentrations in the whole-body largemouth bass and green sunfish studied were within acceptable limits for fish-consuming wildlife. Concentrations of selenium and arsenic detected in soil, surface water, air, plants, fish, and livestock were used to estimate human exposure and potential risks to human health at the mining complex. The results of the risk assessment indicated that even under a “high” exposure scenario, selenium intake by humans would be below the adverse effect level and arsenic intake levels would be similar to those from average drinking water throughout the U.S. In evaluating selenium and arsenic concentrations in blood, muscle, liver, kidney, and heart samples of local sheep and goat herds, no adverse effects were found. Average selenium and arsenic concentrations in forage plants growing downwind from the mining operations and in reclaimed areas were significantly below expected problem-causing levels. Husbandry practices and parasites were observed that could explain the difficulties reported by some animal owners. (8/1995 - 12/1998)
- **Kennecott Utah Copper Corporation North Zone Wetlands Selenium Evaluation, UT.** The Kennecott Utah Copper Corporation (KUCC) North Zone Wetlands (wetlands) located south of Great Salt Lake were the subject of a remedial investigation and a feasibility study that resulted in an EPA Record of Decision (ROD) in 2002. The ROD includes a wetlands monitoring program that requires annual sampling of invertebrates from the various ponds within the wetlands to assess the effectiveness of remedial actions. The objectives of the wetlands monitoring are to determine concentrations of selenium and other chemicals in the wetlands water, sediments, and invertebrate tissues with the overall goal of ensuring that migratory birds are not at risk from chemical exposure. Monitoring results during 2004-2007 indicated continued exceedance of the 5 and 10 mg/kg dry weight (dw) tissue selenium action levels in invertebrates from some portions of the wetlands despite site remediation and relatively low selenium concentrations in sediment and water. At KUCC’s request, CH2M HILL analyzed the wetlands monitoring data to provide an interpretation of the

dataset with particular focus on understanding why some invertebrates have unexpectedly high concentrations of selenium, and provided recommendations for enhancing current operations and monitoring practices. CH2M HILL's reanalysis of the monitoring data resulted in recommendations for an enhanced monitoring effort and focused studies to be conducted during 2008. CH2M HILL then developed a detailed plan for that assessment and participated in monitoring to help explain continuing elevated concentrations of selenium in tissues of the wetlands biota. Results showed that selenium concentrations in the tissues of aquatic had declined over time but remain high relative to ROD-specified goals for invertebrates at selected locations. Several factors appear to enhance selenium bioaccumulation in the wetlands and suggest that there are discrete differences in bioavailability of selenium in the different pond environments. Based on data review, pond groupings indicate basic differences in bioavailability that go beyond simple associations of tissue selenium with concentrations in inorganic media. CH2M HILL provided recommendations for actions specific to ponds with elevated selenium levels. Subsequently, at KUCC's request, Dr. Ohlendorf provided documentation to support a proposed egg selenium threshold concentration to be used for monitoring of the wetlands. KUCC proposed using bird egg selenium concentration as a performance standard for the wetlands remedial action in lieu of the current requirement to monitor and evaluate selenium concentrations in invertebrates in the remediated wetlands. Because the ultimate goal of those remedial actions is to protect migratory birds that feed and nest in the wetlands, and because egg selenium is a more readily assessed measure of exposure and effects than the selenium concentration in their diet (invertebrates), there is a valid basis for using bird egg selenium concentration as the performance standard to determine the effectiveness of site remediation. (1/2008 -present)

- **Development of a Site-specific Standard for Selenium in Open Waters of Great Salt Lake, UT.** The Great Salt Lake (GSL) is a unique terminal lake located adjacent to a rapidly growing metropolitan area in Utah. The open waters of the GSL are protected for their current beneficial uses through the application of a narrative criteria clause in the state water quality standards. The Utah Department of Environmental Quality (DEQ) initiated a process in 2004 to develop a site-specific numeric water quality standard for selenium for the open waters of the GSL to balance protection of the GSL's unique ecology and beneficial uses with burgeoning development. The process the DEQ initiated included the formation of a Great Salt Lake Water Quality Steering Committee and a Science Panel to identify the studies required, manage the studies and finally recommend a site-specific standard. The Steering Committee provided a forum for stakeholders to assist in guiding the process of developing numeric standards for the lake. This group consisted of federal and state regulatory agencies, other public entities, conservation organizations, recreation groups, and industrial users of the lake. The Science Panel, composed of nine members representing federal and state regulatory agencies, industry and academia, advised the DEQ and Steering Committee and provided overall technical direction and review for the program. A partnership of researchers – including local and national experts from education and industry – collaborated with the DEQ, the Steering Committee, and the Science Panel to complete the studies required to provide essential information for derivation of the site-specific standard for selenium in the open waters of GSL. Studies to assess concentrations and effects of selenium in five species of birds; measure concentrations of selenium in water, seston, brine shrimp, and brine flies; measure selenium loads entering the GSL; and

measure flux of selenium from water to other media were completed. Information from these studies was used to “populate” the elements of a comprehensive conceptual model for the GSL to describe sources, loads, transfer factors, and concentrations of selenium in important resources of the lake (e.g., birds and their food webs) that was used to establish the site-specific standard for selenium. Follow-on and studies for implementation of the standard are continuing. (2/2006 – present)

- **Selenium in Newport Bay Watershed, CA.** In the Newport Bay watershed, selenium derived from ancient marine sediments in local foothills accumulated over the last several thousand years in an area known as the Swamp of the Frogs. This ancient swamp, though now drained and filled, has become an almost limitless source of selenium because of the high water table in the area. Virtually any activity that mobilizes groundwater to the surface has the potential to increase selenium contamination of surface waters in the Newport Bay watershed. Activities associated with increased urbanization of the watershed result in passive and active discharges of selenium-laden groundwater into surface waters (e.g. drainage ditches, flood control channels with weep holes, and development and maintenance dewatering activities). Selenium levels in the watershed widely exceed the California Toxics Rule (CTR) criterion (5 µg Se/L), but the actual impacts to fish and birds in the watershed, and the Newport Bay ecosystem in general, are unknown at this time. To address issues related to selenium and certain other constituents in the watershed, EPA issued a Toxics TMDL in 2002. The Santa Ana Regional Water Quality Control Board (Regional Board) adopted a general National Pollutant Discharge Elimination System (NPDES) permit that acknowledges that while current groundwater levels exceed the CTR limit, a feasible treatment technology does not exist to lower the levels in the discharges to the CTR standard. Therefore, the Order incorporates an alternative compliance approach by authorizing the formation of a Working Group and the implementation of a Work Plan to develop a comprehensive understanding of and management plan for selenium in groundwater-related inflows in the watershed. Specifically, the work under the plan is investigating the extent of ecosystem impacts, examining Best Management Practices (BMPs) and treatment technologies that can reasonably be applied throughout the watershed to reduce the inputs of selenium, developing a management program (i.e. a trading, offset, or mitigation program) for selenium in the watershed, and if developing a site-specific objective for selenium for the Newport Bay watershed. (7/2005 – present)
- **Department of Water Resources, Ecological Restoration Plan for Salton Sea, CA.** Served as technical lead for evaluation of selenium-related as well as other organic and inorganic contaminant issues pertinent to future restoration of Salton Sea as part of the Environmental Restoration Study and Programmatic Environmental Impact Report. The main focus was on selenium, because it is a recognized problem that has resulted in issuance of human health advisories related to fish consumption and it occurs in wildlife food chains at levels of concern. Other inorganic and organic contaminants also were of concern for evaluation of restoration alternatives for this large watershed. This evaluation included review and synthesis of all selenium-related information and data for the Salton Sea, identification of data gaps and ways of filling those gaps, sampling and analyses as well as laboratory studies to address data needs, understanding and description of selenium biogeochemistry as it may relate to evaluation of management alternatives, evaluation of treatment technologies for selenium removal, and identification of management approaches for

reducing bird exposures to harmful levels of selenium. The end result of these related tasks were evaluated for various restoration alternatives (using an ecological risk assessment approach) in the development of an overall restoration plan for the Salton Sea. The Department of Water Resources and the Department of Fish and Game are currently evaluating suitability of some portions of the Salton Sea for creation of Species Conservation Habitat to provide habitat for species that otherwise will be unable to forage in the Sea because their food resources will be eliminated by high salinity of the water. Dr. Ohlendorf is serving as a technical reviewer and consultant for this assessment (6/2004 – present)

- **Ecological and Human Health Risk Assessment Project for a confidential client in the Midwest.** This project included the sampling and analysis of selenium, several metals, and other potential contaminants resulting from the handling and disposal of fly ash at a coal-fired power plant. Project scope includes support during data collection, data analysis, evaluation of exposure pathways, chemical speciation, ecological risk assessment and human health risk assessment. In addition, Dr. Ohlendorf provided technical support for the client during development of a Habitat Conservation Plan for an endangered bird species that forages and nests at the facility. (7/2007 – present)
- **Biological and Water Quality Study and Ecological Risk Assessment for a confidential client in the Midwest.** This project included an assessment of fish and invertebrate communities and the sampling and analysis of fish and invertebrates for selenium in a river receiving effluent discharged from an oil refinery. Project scope included all aspects of data collection, data analysis, evaluation of exposure pathways, and assessment of selenium effects in the river. (7/2009 – 10/2010)
- **Chevron Refinery, Selenium Management in the Richmond Refinery Water Enhancement Wetland, Richmond, CA.** For this refinery, which treats some of its process water in the Richmond Refinery Water Enhancement Wetland (RRWEW) before discharging to San Francisco Bay, selenium concentrations were high enough for the San Francisco Bay Regional Water Quality Control Board to express concern and require further study. Developed a study approach and conducted a study of bird use and reproduction to meet the Water Board's concerns as well as those of US Fish and Wildlife Service, California Department of Fish and Game, and the Audubon Society. Study found that the RRWEW received significant bird use, and hatching success was better than at reference sites from other studies. This occurred despite elevated levels of selenium in bird eggs. Study results characterized the fate and evaluated ecological effects of selenium and mercury in the wetland. Results of the study supported continued use of the RRWEW for water treatment while conducting further study and monitoring on a reduced scale to identify selenium bioaccumulation pathways. Assisted the refinery in developing a 5-Year Management Plan and monitored the success of changes in operation of the RRWEW. Monitoring results showed that selenium exposure of birds was reduced by more than 70 percent as a result of operational changes. As a result, the refinery was able to continue using the RRWEW to reduce costs of water treatment. (3/1994 – 12/2004)
- **U.S. Bureau of Reclamation, Ecological Risk Assessments for Kesterson Reservoir, CA.** Conducted an ecological risk assessment for Kesterson Reservoir, which had become contaminated with selenium through the disposal of agricultural subsurface irrigation drainage water. Assessment was conducted in 1992-1993 to determine whether the client

needed to consider other management practices for the site in the foreseeable future. It included analysis of ecological succession, food-chain relationships, dietary exposure, and risk characterization for 20 years into the future, using modeling and Monte Carlo simulations. The assessment indicated that there was no significant risk to terrestrial animals, but aquatic birds could be adversely affected during years of very heavy rainfall when surface water pools (which would be contaminated by selenium dissolved from the soil) would persist into the spring breeding season. Another ecological risk assessment was conducted in 2000 to update previous work based on additional years of biological and hydrological monitoring. The conclusions of this risk assessment validated the earlier predictions and provided much more detail concerning the levels of risk for terrestrial wildlife and aquatic birds. The overall conclusion was that risks of adverse effects were low, and recommended a reduced level of monitoring for the site. (5/1990 - 6/2007)

- **U.S. Bureau of Reclamation, Grassland Bypass Project Monitoring, CA.** Developed a detailed monitoring program to enable the project Oversight Committee to determine and assess potential effects of the Grasslands Bypass project in Merced County, CA. This project has removed contaminated agricultural drainage from approximately 90 miles of conveyance channels that supply water to several state and federal wildlife areas. The goal of the project is to make water from those sources acceptable for use in the wildlife areas by segregating agricultural drainage from good quality water that can be used for wetland management. Agricultural drainage water is routed through the San Luis Drain and Mud Slough to discharge more directly to the San Joaquin River. The main focus was on the transport and fate of selenium and other inorganics that are mobilized by agricultural drainage. The monitoring program has documented the effectiveness of the project in meeting its goal. (6/1993 - 12/1998)
- **U.S. Fish and Wildlife Service, Confirmatory Sampling and Ecological Risk Assessment for Bolsa Chica Lowlands, CA.** The main focus of this complex, large project was to conduct sampling and to perform an ecological risk assessment for the 1,200-acre Bolsa Chica Lowlands in Orange County. Additionally, the project identified acceptable disposal options (ocean disposal versus on-land disposal) for several restoration plans. This work characterized contamination within the Lowlands and established cleanup criteria for portions of the property affected by previous activities, primarily oil and gas production, and urban runoff. More than 430 active and abandoned oil wells exist on the property, along with associated pipelines, roads, former tank farms, and other related facilities. Storm drainage enters from nearby urbanized areas. Chemicals of potential ecological concern include metals, polycyclic aromatic hydrocarbons, volatile organic compounds, polychlorinated biphenyls (PCBs), organochlorine insecticides and herbicides, and organophosphate insecticides. Because PCBs were detected in previous sampling, the work included analyzing and evaluating PCB congeners that may pose an ecological risk, if present. Once contamination was fully characterized and risk assessment-based cleanup levels were established, contaminated areas in the Phase I restoration area were remediated, and the Lowlands are being restored to provide a mix of tidal coastal wetland habitats and non-tidal seasonal ponds. (8/1997 - 5/2005)
- **U.S. Environmental Protection Agency, Region 10, Ecological Risk Assessment for the Coeur d'Alene Basin of Northern Idaho and Eastern Washington.** Completed a multi-year, complex ecological risk assessment evaluating impacts of mining within the Coeur d'Alene

Basin of northern Idaho, and continue to provide support to USEPA as related to remediation of contamination in the Basin. The basin has been subjected to high levels of metals contamination since mining began in the upper basin in the 1880s. The entire basin of the South Fork of the Coeur d'Alene River downstream into Washington is included in the study area. The risk assessment was conducted as part of the remedial investigation / feasibility study to assist the USEPA in determining cleanup requirements for the basin. Habitats range from upper-elevation watersheds to lower-gradient streams, floodplain lakes, Coeur d'Alene Lake, and associated upland and riparian areas. Metals in soils, sediment, and water affect survival, growth, and reproduction of a wide range of terrestrial, aquatic, and semi-aquatic receptors exposed to them. Received an "Outstanding" performance rating from USEPA for this work. Currently assisting USEPA in coordination/consolidation of biological monitoring programs for the Basin to facilitate ongoing monitoring to document changes in environmental conditions. (3/1997 - present)

- **Net Environmental Benefit Analysis to Support Engineering Evaluation/Cost Analysis for a Former Skeet Range, Naval Weapons Station Seal Beach, CA.** A skeet range constructed in the late 1960s at Naval Weapons Station Seal Beach was operated for about 25 years. Skeet range activities resulted in widespread distribution of solid lead shot and broken clay targets in upland and saltmarsh habitats. Subsequent to findings of potential risk to ecological receptors in the initial screening-level ecological risk assessment (ERA), a Tier II ERA was conducted to provide a more detailed site-specific evaluation of ecological risk on which to base risk management decisions and develop preliminary remediation goals. Results of the Tier II ERA indicated that lead and antimony in soil and sediment pose risks to birds and mammals, lead shot poses risks to birds, and lead and antimony in sediment pose risks to sediment invertebrates. No risks to soil invertebrates or plants were identified. Because portions of the site lie within the Seal Beach National Wildlife Refuge and provide habitat for the federally endangered light-footed clapper rail and the state-endangered Belding's savannah sparrow (also a federal candidate species), habitat loss due to remedial activities was a concern. A Net Environmental Benefits Analysis (NEBA) was therefore conducted. NEBA provides an analytical framework to quantify and compare the ecosystem service benefits and/or losses associated with a remedial action. This analysis supplements the evaluation criteria currently used in Feasibility Studies and Engineering Evaluations/Cost Analyses. NEBA is particularly useful at sites such as the skeet range when one or more of the proposed remedial actions (e.g., excavation and disposal) may cause additional natural resource injury. Ultimately, NEBAs such as this one provide quantifiable metrics for robust decision-making, are consistent with the policy and direction from natural resource agencies, display benefits for the public, demonstrate environmental sustainability, and contribute to better environmental management and greater environmental stewardship at lower costs. (5/2003 - 1/2011)
- **U.S. Air Force, Natural Resource Management Plan, Ecological Risk Assessment, Field Sampling Plan, and Feasibility Study for Former McClellan Air Force Base, Sacramento, CA.** Served as senior reviewer for the development of a natural resource management plan to guide usage, management, conservation, and development of McClellan Air Force Base according to Air Force goals for managing natural resources. The plan was intended to be used as a road map for the management of natural resources, based on an interdisciplinary approach to ecosystems management. Served as senior advisor/reviewer for the Scoping

Level/Tier 1 Ecological Risk Assessment to support the Initial Parcel Feasibility Study for the former McClellan AFB. Effort included conducting the risk assessment and interacting with resource and regulatory agencies to gain support for the report and its conclusions. Served as senior advisor/reviewer for the development of a Basewide Vernal Pool Field Sampling Plan/ Health and Safety Plan (FSP/HSP) for the former McClellan AFB. Effort included reviewing the results of a Scoping Level/Tier 1 Ecological Risk Assessment that focused on impacts of Installation Restoration Program sites across the Base on vernal pools, developing a FSP/HSP to conduct sampling in the vernal pools, and interacting with resource and regulatory agencies to gain support for the FSP/HSP. Served as senior technical lead for ecological aspects of the Ecological Sites Feasibility Study that is evaluating the appropriate level of remediation to be conducted in ecologically sensitive habitats on the facility. (1994 – 11/2010)

- **U.S. Department of Energy, Ecological Risk Assessment for the Hanford Site, WA.** Provided senior technical oversight and review for the River Corridor Baseline Risk Assessment (RCBRA) project, which is a post-remediation risk assessment being performed to address residual risks from chemical and radiological releases from waste sites along the Columbia River Corridor of the Hanford Site in eastern Washington State. Now managed by the U.S. Department of Energy, Richland Operations Office (DOE-RL), the Hanford Site produced and processed plutonium throughout the Manhattan Project and Cold War. In addition, research and development activities related to radionuclides were performed at the site. These activities resulted in high volumes of chemical and radiological releases to the environment. The Site is listed on the National Priorities List under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), and the operational focus has shifted to facilities decommissioning, waste disposal, environmental remediation, and risk assessment. The RCBRA is a multi-step project that includes the compilation of existing data, preparation of a risk assessment work plan, identification of issues and data gaps through the data quality objective (DQO) process, identification of appropriate human and environmental receptors and endpoints, development of sampling and analysis plans (SAPs), data collection and analysis, consideration of fate and effects of chemical and radiological hazards, and calculation of risks based on specified endpoints. The project included the 100-B/C Pilot Project Risk Assessment, the 100 Area and 300 Area Component, and the Columbia River Component (which considers the entire downstream drainage pathway), with the current focus on areas potentially affected by former reactors along the Columbia River. Results of data collection, analysis, and risk evaluation for all three efforts will be combined in a final risk assessment report to help determine whether additional remedial actions are needed. (11/2003 – present)
- **Confidential Client, vicinity of Martinez-Pittsburg, CA.** Currently providing ecological characterization and ecological risk assessment support to an industrial client along the shoreline of Suisun Bay where site activities apparently contributed to contamination of soil/sediment. Ecological surveys have been completed and the work plan for completion of an ecological risk assessment has been approved by the California Department of Toxic Substances Control; human health and ecological risk assessments are currently being completed for the site. (5/2007 – present)

- **Central Utah Water Conservancy District, Central Utah Project Potential Impacts of Contaminants on Fish and Wildlife, UT.** At request of the Central Utah Water Conservancy District, prepared a study plan for analysis of mobilization and potential impacts by toxic substances (especially selenium) and conducted field sampling to implement an environmental contaminants study. The study included the identification of relevant ecological endpoints for evaluating possible impacts of contaminants on fish and wildlife and the appropriate measurements to be made for conducting the evaluation. This study evaluated current levels of environmental contaminants in water, sediment, and biota, and potential impacts to water quality and to the biological community resulting from toxic substances mobilized or redistributed as a result of proposed projects in two areas: the Uinta Basin in northeastern Utah and the Spanish Fork/Nephi area south of Provo. Selenium is of primary concern because it has been found most frequently at elevated levels in western states during the U.S. Department of the Interior's National Irrigation Water Quality Program. (6/1993 - 3/2000)
- **U.S. Air Force, Ecological Survey and Ecological Risk Assessment for Elmendorf Air Force Base, Anchorage, AK.** Conducted an ecological survey of the entire base through a reconnaissance-level survey and review of available literature and reports to identify potential ecological receptors for several contaminated sites in various habitats. In addition, conducted an ecological risk assessment for one of the operable units, where petroleum products leaking from a pipeline into the areas along a stream had been identified as the primary concern. The phased approach used in this project proved very cost-effective, and the overall project was considered by reviewers as an example of how risk assessments should be conducted. (6/1992 - 3/1993)
- **U.S. Air Force, Ecological Risk Assessment for Tatalina Long Range Radar Station, near McGrath, AK.** Conducted the ecological risk assessment for organic and inorganic contaminants at several sites within and near this remote radar site in southwestern Alaska as part of the remedial investigation / feasibility study. Work included development of the work plan and sampling plan, conducting field surveys, and evaluating results as part of the overall team. Habitats ranged from high-elevation tundra to lowland riverine areas along the Kuskokwim River; receptors ranged from large mammals (such as caribou and moose) to plants and fish. (1/1997 - 10/1998)
- **U.S. Navy/Southwest Division, Ecological Risk Assessments for Marine Corps Base Camp Pendleton, CA.** Conducted ecological risk assessments at four groups of sites that had been used for various military activities. The objective of these assessments was generally to determine whether environmental contaminants were present at concentrations that were potentially harmful to plants, fish, or wildlife present at the sites. Threatened or endangered species were of particular concern at several sites. In accordance with current guidance, the ecological risk assessments were phased to reduce overall costs while still obtaining all the necessary information. Through careful planning of bioassays at selected sites, it was possible to determine that most sites were unlikely to cause adverse effects. However, the risk assessments indicated a need for remediation at several sites because of high concentrations of herbicides, organochlorine insecticides, diesel fuel, or metals. Remediation has been completed or is ongoing for several sites. (5/1991 - 10/1999)

- **U.S. Navy/Southwest Division, National Wildlife Refuge Contaminants Study at Seal Beach Naval Weapons Station and National Wildlife Refuge, CA.** Conducted a study to assess levels of contamination in sediments and biota at the Seal Beach National Wildlife Refuge (NWR), which occupies a portion of the Naval Weapons Station. Ecological endpoints identified for the estuarine habitat on the refuge focused mainly on the protection of least terns and clapper rails, two endangered species that feed and nest in the salt marsh habitat of the refuge. Samples of fish, snails, crabs, other invertebrates, and sediment were collected throughout the refuge and analyzed for inorganic and organic contaminants. Fish and invertebrate species were selected on the basis of their importance in the diet of least terns and clapper rails. Chemical analytical results were evaluated to determine whether contaminant levels in the food chain are likely to cause adverse effects in terns, rails, or other species feeding in the marsh. The results indicate there should be no significant impacts to those species, but monitoring is warranted, especially because of changes in physical oceanography and currents as a result of the construction of mitigation ponds in the NWR. (2/1992 - 8/1995)
- **U.S. Army, Chena River Aquatic Assessment for Fort Wainwright, Fairbanks, AK.** Conducted (with assistance of a subcontractor) the Chena River Aquatic Assessment to evaluate effects on aquatic organisms as a result of fuel seepage from Fort Wainwright into the river. Evaluation included community surveys of benthic invertebrates, generally following Rapid Bioassessment Protocols, supplemented with deployment of artificial substrates to characterize organisms that colonize them as well as laboratory bioassays. Results of the aquatic assessment were used to conduct an ecological risk assessment that is part of the post-wide risk assessment for Fort Wainwright. Following completion of the risk assessment, bioassays were conducted with four different organisms using sediment or porewater to evaluate their utility in monitoring the success of site remediation. Results were used to determine the preferred strategy for a cost-effective monitoring program. (4/1997 - 11/2003)
- **U.S. Army, Ecological Risk Assessment and Feasibility Study for Eagle River Flats on Fort Richardson, Anchorage, AK.** Led ecological team for work conducted at Eagle River Flats (ERF), located on Fort Richardson. In preparation for Fort Richardson being added to the NPL, CH2M HILL was contracted to prepare a comprehensive evaluation report (CER) for ERF. The ERF site became an OU under CERCLA when the facility was listed and a Federal Facilities Agreement for Fort Richardson was negotiated in 1994. The ERF is an estuarine salt marsh that has been used as the primary ordnance impact area for Fort Richardson since 1949. Past practices at the ERF involving white phosphorus have caused sediment contamination that has contributed to large numbers of waterfowl deaths at the site. The CER reviewed and evaluated various studies and investigations completed from 1982 through 1993. Subsequently, completed the ecological risk assessment for ERF and participated with the feasibility study team to evaluate alternative remediation measures that could be applied to reduce risks to waterfowl resulting from exposure to white phosphorus. (6/1994 - 9/1998)
- **Confidential Client, Restoration-based Natural Resource Damage Assessment at a Mine Site, NM.** Currently serving as a key technical team member, on behalf of the owner/operator of a large metals mine site, in conducting an evaluation of injuries to

natural resources as the result of mining activities. The mine site and associated tailings facility are located along a river in a relatively remote area that is highly mineralized. The focus of the effort is to determine to what degree the condition of the aquatic and terrestrial environment has been affected by mining, as opposed to background conditions (i.e., regional mineralization and associated metals at naturally-occurring elevated concentrations) that are not due to mining activities. The client and the Natural Resource Trustees wish to move toward restoration, rather than litigation and financial settlement of damage claims under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). Toward that end, we are working closely and effectively with the Trustees and their contractor to systematically review the extensive available information concerning soil, sediment, and water quality as well as associated biological resources in the aquatic and terrestrial environment. Conditions on and downstream from the site are being evaluated in comparison to background (reference) conditions to segregate mining-related effects from natural conditions, and we expect to determine a reasonable level of restoration to compensate for injuries that may be attributed to mining activities. (10/2002 - 2007)

- **U.S. Fish and Wildlife Service, Interpretive Guidelines for Department of the Interior's National Irrigation Water Quality Program, Portland, OR.** At the request of the USFWS, assisted in developing interpretive guidelines for contaminants in wetlands for the Department of the Interior's National Irrigation Water Quality Program. This Program was conducted from 1985 to 1998 in areas throughout the western United States to evaluate the potential impacts of irrigation drainage on downstream wetlands. The Department conducted sampling and analyses of environmental media, including water, sediment, and biota (plants, invertebrates, fish, and wildlife). Reviewed the scientific literature, published reports, and available databases to develop guidelines for arsenic, copper, zinc, DDT-related compounds, and salinity. The main focus of the guidelines is on levels of these chemicals that do not cause adverse effects and on threshold effect levels, especially as related to documented effects under field conditions. The results were presented in text and tables that lend themselves to evaluating the effects of these chemicals under a variety of field settings, and were later published by the Department. (8/1996 - 7/1998)
- **Chevron Chemical Company, Ecological Support Services for Richmond Facility, CA.** Participated as lead wildlife ecologist on the Richmond Wetlands Creation Project Phase 1 Conceptual Design, in which we evaluated potential conversion of some of the facility's stormwater ponds to constructed wetlands. Designs were developed that provided environmental enhancement of the ponds to create a mosaic of estuarine habitats within several ponds. Served as task leader for the Castro Creek Biological Assessment/Monitoring effort, which included characterization of vegetation along Castro Creek in the vicinity of the site. In the Fertilizer Ponds Wetlands Feasibility Study, evaluated the feasibility of converting the three ponds to wetlands. Lead the Ecological Risk Assessment activities required by the 1996 Site Cleanup Requirements Order and subsequently served as senior reviewer for ecological aspects of the Corrective Action Report in 1999-2000. In addition, conducted ecological risk assessments for a set of stormwater ponds to be closed under one of two different future land-use scenarios and for adjacent salt-marsh that is potential habitat for special-status species. The main focus of this project was on agricultural chemicals that had been manufactured at the Chevron facility and were found in soil, sediment, and surface as well as groundwater at the site. (6/1997 - 2004)

- **Union Sanitary District, Hayward Marsh Mercury Bioaccumulation Study, CA.**
Conducted a study of mercury bioaccumulation in Hayward Marsh, a constructed treatment wetland that receives secondary effluent from a municipal treatment plant and inflow from San Francisco Bay to create estuarine habitat. The study was requested by the San Francisco Bay Regional Water Quality Control Board because measurable levels of mercury were detected in water. The endpoints defined for this study focused on protection of aquatic wildlife from adverse effects of mercury through dietary exposure. The study examined levels of mercury in various components of the food chain and in bird eggs as well as muskrats to evaluate the probability of adverse effects in wildlife. Results of the study were compared to levels of mercury bioaccumulation in other freshwater and estuarine environments. Conclusions were that mercury in the wastewater was not accumulating to significant levels in wildlife using the marsh. These results allowed the client to reduce further sampling to periodic monitoring, rather than conducting more intensive studies of potential impacts of mercury. Thus, the definition of ecological endpoints and the design of the study plan provided a cost-effective evaluation of the Regional Board's concerns.
(3/1994 - 10/1996)

Previous Experience

Leader, Pacific Coast Research Station, Davis, CA (Under Patuxent Wildlife Research Center, U.S. Fish and Wildlife Service [USFWS]); 1980- 1990

Served as project coordinator for research on effects of agricultural drainwater on wildlife and leader of a team of scientists conducting research on San Francisco Bay. Conducted studies of the effects of agricultural drainwater contaminants on food chains and aquatic birds, and integrated ecosystem studies to evaluate the effects of agricultural, industrial, and municipal contaminants on migratory waterfowl populations in San Francisco Bay. Discoveries related to agricultural drainwater contamination (especially as related to selenium) led to extensive publicity of the findings (including publication in National Geographic, numerous other magazines and newspapers, as well as national television [including 60 Minutes] and radio [including interview on National Public Radio] coverage). It also inspired a broad field of research on the effects of selenium in fish and wildlife, and caused extensive re-evaluation of water management policies throughout the western United States.

Assistant Director, Patuxent Wildlife Research Center, USFWS, Laurel, MD; 1973-1980

Assisted in the formulation, guidance, and direction of a major facility conducting extensive research in the broad field of wildlife biology, assuming responsibilities as delegated by the Director in both research-related and management-related functions. Reviewed research plans prior to initiation and advised the Director on the validity and pertinence of study areas, experimental design, techniques to be used, and procedures to be followed. Reviewed scientific manuscripts and assisted in their editing as required. Also continued to conduct research on the effects of environmental contaminants on wildlife and published results in scientific journals. Studies were conducted throughout the United States, including Alaska and Hawaii. Represented the Center in its numerous work relationships with other Federal, State, and private research and non-research organizations. For example, I led a delegation of scientists traveling to the Soviet Union for a 2-week scientific exchange visit, and hosted the Soviet delegation for their return visit to the U.S.

Wildlife Research Biologist, Patuxent Wildlife Research Center, USFWS, Laurel, MD; 1971-1973

Conducted research on the effects of environmental contaminants on wildlife and published results in scientific journals. Studies were focused mainly on fish-eating birds, which are highly exposed to many kinds of contaminants, and were conducted throughout the eastern U.S.

Membership/Activities in Professional Organizations

- Cooper Ornithological Society
- Society of Environmental Toxicology and Chemistry (Editorial Board 1987-1989 and 2007-2010; Pre-doctoral Fellowship Selection Committee 1989)
- The Wildlife Society (including Wildlife Toxicology Working Group Chair, 2010-2011)
- Waterbird Society
- Wilson Ornithological Society

Other Related Activities:

- Serve as a technical reviewer for the San Francisco Bay Regional Monitoring Program's Exposure and Effects Pilot Study to develop suitable monitoring approaches for long-term assessment of environmental contaminant trends and effects for the Bay
- Served as a peer reviewer for USEPA's Methodology for a National Consultation on 304(a) Aquatic Life Criteria under the Endangered Species Act
- University of California, Ecotoxicology Program; External Advisory Committee member 1990-1995
- Served on graduate committees for two Ph.D. (Miguel Mora, Scott Ogle), two M.S. (Diane Boellstorff, Paul Martin), and one MPVM (Joy Jackman) students at U.C. Davis; one M.S. (Martha Williams) student at San Francisco State University; and one M.S. (Carol Schuler) student at Oregon State University

Honors and Recognition

- Received recognition for quality work from many clients; recent examples include the following:
 - Letter of appreciation from U.S. Fish and Wildlife Service for "extraordinary work on the Bolsa Chica Lowlands Project . . . contribution of your knowledge and skills . . . are a primary reason that this project continues to be successful." 2005
 - Letter of appreciation from ChevronTexaco for "excellent support and high-quality work we have received from you and your staff over the years . . . especially valued your expertise on selenium toxicity, avian monitoring and constructed wetlands, as well as you and your staff's professionalism, resourcefulness, hard work and dedication to completing these sometimes complex and challenging projects. . ." 2003
 - "Outstanding" performance rating from U.S. EPA Region 10 for "completion of a state-of-the-art ecological risk assessment" (task I led, plus other tasks led by others) 2002
- Received letter of appreciation from California Regional Water Quality Control Board for assistance in providing training to their staff on "environmental risk assessment" 2004

- U.S. Geological Survey, Patuxent Wildlife Research Center Special Achievement Award for helping two Center scientists organize and convene a “scientifically-significant contaminants conference that resulted in a recent Society of Environmental Toxicology and Chemistry Special Publication, *Environmental Contaminants and Terrestrial Vertebrates: Effects on Populations, Communities and Ecosystems* (2000).”
- Recognized as a "Pioneer of Selenium Research" in a book, "*Environmental Chemistry of Selenium*," edited by W.T. Frankenberger, Jr., and R.A. Engberg and published by Marcel Dekker, Inc. 1998
- Featured as project manager in article (“Timeless Values Steer Today’s Service”) in 50th Anniversary CH2M HILL Reports issue for work done for Peabody Western Coal, 1996
- Received commendation letter from U.S. Department of the Interior Assistant Secretary for Water and Science and Assistant Secretary for Fish and Wildlife and Parks for playing “an especially significant role” in the Department’s gaining California State Water Resources Control Board approval for proposed cleanup actions at Kesterson Reservoir, 1988
- U.S. Fish and Wildlife Service (USFWS) Special Achievement Award for conducting research of exceptional scientific merit, providing technical services for other units of the USFWS, and representing the Patuxent Wildlife Research Center outside the USFWS, 1986
- Nelson-Hooper Award for best technical presentation at meeting of the Western Section of The Wildlife Society, 1984
- USFWS Special Achievement Award for sustained performance as a research scientist in production of high-quality research products, 1981
- Letter of appreciation from Roger Sumner Babb, Regional Solicitor for the U.S. Department of the Interior, Northeast Region, for technical support on issues related to effects of highways and a waste disposal site adjacent to the Patuxent Wildlife Research Center, 1980
- Letter of appreciation from John M. Murphy, Chairman of U.S. House of Representatives Committee on Merchant Marine and Fisheries, for testimony presented (on behalf of USFWS) pertaining to ocean disposal of dredge spoil at the Committee’s hearing held on May 21, 1980

Publications and Presentations

Dr. Ohlendorf is the author of more than 85 papers in the fields of environmental toxicology and vertebrate ecology (including 12 book chapters and 2 books edited/co-edited). He also has presented more than 80 papers at scientific meetings and symposia, many as an invited participant. In addition, he has presented statements concerning effects of contaminants on fish and wildlife at a U.S. House of Representatives, Merchant Marine and Fisheries Committee hearing in 1980 and on the effects of environmental contaminants in San Francisco Bay waterfowl at a 1986 hearing of the House of Representatives Interior and Insular Affairs Committee, Subcommittee on Water and Power. Recent and representative publications and presentations are listed below.

With S. Swanson et al. “Building Stakeholder Engagement in Sustainable Solutions - the Strategic Advisory Panel on Selenium Management.” A.B. Fourie, M.Tibbett, and A. Beersing, eds., *Mine Closure 2011. Proceedings of the Sixth International Conference on Mine Closure Volume 2, 18-21 September, Alberta, Canada*, Pp. 189-196. Australian Centre for Geomechanics, Perth. 2011.

"Selenium, Salty Water, and Deformed Birds." J. Elliott, C. Bishop, and C. Morrissey, eds., *Emerging Topics in Ecotoxicology: Principles, Approaches and Perspectives*, Pp. 325-357. Springer, New York, NY. 2011. (invited contribution).

With S. Covington, et al. "Conducting Site-specific Assessments of Selenium Bioaccumulation in Aquatic Systems." *Integrated Environmental Assessment and Management* 7:314-324. 2011.

With E.R. Byron, et al. "Predictive Modeling of Selenium Accumulation in Brine Shrimp in Saline Environments." *Integrated Environmental Assessment and Management* 7:478-482. 2011.

With G.H. Heinz. "Selenium in Birds." W.N. Beyer and J.P. Meador, eds., *Environmental Contaminants in Biota: Interpreting Tissue Concentrations*, Second Edition, Pp. 669-701. CRC Press/Taylor and Francis Group, Boca Raton, FL. 2011. (invited contribution).

With P.M. Chapman, et al. *Ecological Assessment of Selenium in the Aquatic Environment*. CRC Press, Boca Raton, FL. 2010.

"Bird Migration/Movement, Tissue Selenium, and Implications for Effects." Presented at the Annual Meeting of the Society of Environmental Toxicology and Chemistry, Portland, OR. 2010.

With T. Sandy, et al. "Review of Available Technologies for the Removal of Selenium from Water." Presented at the Annual Meeting of the Society of Environmental Toxicology and Chemistry, Portland, OR. 2010.

With E. Byron, et al. "Predictive Modeling of Selenium Accumulation in Brine Shrimp in Saline Environments." Presented at the Annual Meeting of the Society of Environmental Toxicology and Chemistry, Portland, OR. 2010.

With A. Redman, et al. "Evaluating Selenium Bioaccumulation and Potential Effects in the Ottawa River, OH under Present-day and Proposed Future Selenium Loading Conditions." Presented at the Annual Meeting of the Society of Environmental Toxicology and Chemistry, Portland, OR. 2010.

"Bird Migration/Movement, Tissue Selenium, and Implications for Effects." Presented at the Annual Meeting of The Wildlife Society, Snowbird, UT. 2010.

With S. Covington, et al. "Approaches for Site-specific Assessment of Selenium in Aquatic Systems at Mine Sites." Presented at the Annual Meeting of the Society for Mining, Metallurgy & Exploration, Phoenix, AZ. 2010.

With E.R. Byron, et al. "Site Assessment for Development of a Tissue-based Site-specific Objective for Selenium." Presented at the Annual Meeting of the Society of Environmental Toxicology and Chemistry, New Orleans, LA. 2009.

With S.N. Luoma, et al. "Ecosystem-scale Biodynamic Model Assists Development of a Tissue-based Site-specific Objective for the Newport Bay Watershed, California." Presented at the Annual Meeting of the Society of Environmental Toxicology and Chemistry, New Orleans, LA. 2009.

With P.M. Chapman, et al. "Ecological Assessment of Selenium in the Aquatic Environment." Presented at the Annual Meeting of the Society of Environmental Toxicology and Chemistry, New Orleans, LA. 2009.

With P.M. Chapman, et al. "A Conceptual Selenium Management Model." *Integrated Environmental Assessment and Management* 5:461-469. 2009.

With J. DenBleyker, et al. "Development of a Site-specific Standard for Selenium in Open Waters of Great Salt Lake, Utah." A. Oren, D. Naftz, P. Palacios, and W.A. Wurtsbaugh, eds. *Saline Lakes around the World: Unique Systems with Unique Values*. Natural Resources and Environmental Issues, Volume XV, Pp. 23-36. S.J. and Jessie E. Quinney Natural Resources Research Library, Logan, UT. 2009.

With G.H. Heinz. "Selenium in Birds." Presented at the Annual Meeting of the Society of Environmental Toxicology and Chemistry, Tampa, FL. 2008.

With S. Covington, et al. "Development of a Guide for Site-specific Assessment of Selenium in Aquatic Systems." Presented at the Annual Meeting of the Society of Environmental Toxicology and Chemistry, Tampa, FL. 2008.

With W.O. Moellmer, et al. "Development of a Site-specific Standard for Selenium in Open Waters of Great Salt Lake, Utah." Presented at the Annual Meeting of the Society of Environmental Toxicology and Chemistry, Milwaukee, WI. 2007.

With T.S. Pulley, et al. "Ecological Risk Assessment for Selenium in the Evaluation of Restoration Alternatives for Salton Sea, California." A.J. Clemmens and S.S. Anderson, eds. *Proceedings of U.S. Committee on Irrigation and Drainage Fourth International Conference on Irrigation and Drainage*, Pp. 97-116. October 3-6, Sacramento, CA. 2007.

With B. Thompson, et al. "Biological Effects of Anthropogenic Contaminants in the San Francisco Estuary." *Environmental Research* 105:156-174. 2007. (invited contributor).

With E. Byron. "Diffusive Flux of Selenium between Lake Sediment and Overlying Water: Assessing Restoration Alternatives for the Salton Sea." *Lake and Reservoir Management* 23:630-636. 2007.

With T.S. Pulley, et al. "Ecological Risk Assessment for Selenium in the Evaluation of Restoration Alternatives for Salton Sea, California." Presented at the Annual Meeting of the American Geophysical Union, San Francisco, CA. 2006.

With E. Byron. "Selenium Flux and Speciation from Lake Sediment as Influenced by Quality of the Overlying Water: Evaluating Restoration Alternatives for the Salton Sea." Presented at the Annual Meeting of the American Geophysical Union, San Francisco, CA. 2006.

With W.O. Moellmer, et al. "Development of a Site-specific Standard for Selenium in Open Waters of Great Salt Lake, Utah." Presented at the Annual Meeting of the American Geophysical Union, San Francisco, CA. 2006.

With T.S. Pulley, et al. "Ecological Risk Assessment for Selenium in the Evaluation of Restoration Alternatives for Salton Sea, California." Presented at the Annual Meeting of the Society of Environmental Toxicology and Chemistry, Montreal, Quebec. 2006.

With P.M. Chapman, et al. "A Comprehensive Selenium Management Model for Coal Mining." Presented at the Annual Meeting of the Society of Environmental Toxicology and Chemistry, Montreal, Quebec. 2006.

With E. Byron. "Selenium Flux and Speciation from Lake Sediment as Influenced by Quality of the Overlying Water: Evaluating Restoration Alternatives for the Salton Sea." Presented at the

Annual Meeting of the Society of Environmental Toxicology and Chemistry, Montreal, Quebec. 2006.

"Exposure to/Toxicity of Selenium in the Environment." Presented at Selenium Summit: Problems and Solutions for the West, Sponsored by California Department of Water Resources, Water Education Foundation, U.S. Bureau of Reclamation, U.S. Fish and Wildlife Service, and U.S. Geological Survey, Costa Mesa, CA. 2005. (invited presentation).

"Selenium in the Environment." Presented at Selenium Summit: Problems and Solutions for the West, Sponsored by California Department of Water Resources, Water Education Foundation, U.S. Bureau of Reclamation, U.S. Fish and Wildlife Service, and U.S. Geological Survey, Costa Mesa, CA. 2005. (invited presentation).

With C.S. Gorbics and M.A. Eisert. "Ecological Risk Assessment from Site Screening to Restoration of the Bolsa Chica Lowlands, California." Presented at the Annual Meeting of the Society of Environmental Toxicology and Chemistry, Baltimore, MD. 2005.

With K.J. Nielsen. "Ecological Risk Assessment for Lennar Mare Island, A Former Naval Station." Presented at the Annual Meeting of the Society of Environmental Toxicology and Chemistry, Portland, OR. 2004.

"Ecotoxicology of Selenium." D.J. Hoffman, B.A. Rattner, G.A. Burton, Jr., and J. Cairns, Jr., eds. *Handbook of Ecotoxicology*, Second Edition, Pp. 465-500. Lewis Publishers, Boca Raton, FL. 2003. (invited contribution).

With E.R. Byron, et al. "Ecological Risk Assessment Example: Waterfowl and Shorebirds Feeding in Ephemeral Pools at Kesterson Reservoir, California." D.J. Hoffman, B.A. Rattner, G.A. Burton, Jr., and J. Cairns, Jr., eds. *Handbook of Ecotoxicology*, Second Edition, Pp. 985-1014. Lewis Publishers, Boca Raton, FL. 2003. (invited contribution).

With R.M. Burgess, et al. "Toxicity of Chena River Sediments at Fort Wainwright, Alaska." Presented at the Annual Meeting of the Society of Environmental Toxicology and Chemistry, Austin, TX. 2003.

"The Birds of Kesterson Reservoir: A Historical Perspective." *Aquatic Toxicology* 57:1-10. 2002. (invited contribution for a special edition of this journal).

With A.D. Lemly. "Regulatory Implications of Using Constructed Wetlands to Treat Selenium-Laden Wastewater." *Ecotoxicology and Environmental Safety* 52:46-56. 2002.

With G.M. Santolo, E.R. Byron, and M. Delamore. "Ecological Risk Assessment for Site Management Decision-making at Kesterson Reservoir, California." Presented at the Annual Meeting of the Society of Environmental Toxicology and Chemistry, Salt Lake City, UT. 2002.

With E.R. Byron, et al. "Selenium Reduction through Adaptive Management of a Treatment Wetland. Presented at the Annual Meeting of the Society of Environmental Toxicology and Chemistry, Baltimore, MD. 2001.

With A.D. Dailey. "An Overview of the Coeur d'Alene Basin Ecological Risk Assessment." Presented at the Annual Meeting of the Society of Environmental Toxicology and Chemistry, Baltimore, MD. 2001.

With B.E. Sample, T.A. Pulley, and A.D. Dailey. "Weight-of-Evidence Assessment of Ecological Risks to Wildlife in the Coeur d'Alene Basin." Presented at the Annual Meeting of the Society of Environmental Toxicology and Chemistry, Baltimore, MD. 2001.

With L.B. Saban, D. Heinle, and A. Dailey. "Aquatic Ecological Risks Weight-of-Evidence Related to Metals Contamination in the Coeur d'Alene Basin." Presented at the Annual Meeting of the Society of Environmental Toxicology and Chemistry, Baltimore, MD. 2001.

With P.H. Albers and G.H. Heinz. "*Environmental Contaminants and Terrestrial Vertebrates: Effects on Populations, Communities, and Ecosystems.*" Proceedings of a Symposium on that subject held at University of Maryland, College Park, MD, October 19-21, 1998. Co-editor of book published by SETAC Press, Pensacola, FL. 2000.

With W.R. Gala. "Selenium and Chevron Richmond Refinery's Water Enhancement Wetland: A Response to A.D. Lemly, 1999." *Human and Ecological Risk Assessment* 6:903-905. 2000.

With E.R. Byron, et al. "A Selenium Exposure Model for Waterfowl and Shorebirds Feeding in Seasonal Rainwater Pools at Kesterson Reservoir, CA." Presented at the Annual Meeting of the Society of Environmental Toxicology and Chemistry, Nashville, TN. 2000.

With L. Saban, B.E. Sample, et al. "Calculation of PCB Cleanup Goals Using Future Risk Scenarios at Tern Island, French Frigate Shoals." Presented at the Annual Meeting of the Society of Environmental Toxicology and Chemistry, Nashville, TN. 2000.

With B.E. Sample, et al. "Ecological Risk Assessment for Marine Birds and Mammals at Tern Island, a Former U.S. Coast Guard LORAN Station." Presented at the Annual Meeting of the Society of Environmental Toxicology and Chemistry, Nashville, TN. 2000.

With B.E. Sample, et al. "Evaluation of Risks to the Endangered Green Sea Turtle at a Former U.S. Coast Guard LORAN Station." Presented at the Annual Meeting of the Society of Environmental Toxicology and Chemistry, Nashville, TN. 2000.

"Selenium Was a Time Bomb." *Human and Ecological Risk Assessment* 5:1181-1185. 1999. (invited contribution).

With R.L. Knight and R.H. Kadlec. "The Use of Treatment Wetlands for Petroleum Industry Effluents." *Environmental Science and Technology* 33:973-980. 1999.

With M.A. Castleberry, et al. "Ecological Risk Assessment for Restoration of the Bolsa Chica Lowlands, California." Presented at the Annual Meeting of the Society of Environmental Toxicology and Chemistry, Philadelphia, PA. 1999.

"Evaluating Bioaccumulation in Wildlife Food Chains." A. dePeyster and K.E. Day, eds., *Ecological Risk Assessment: A Meeting of Policy and Science*, Pp. 65-109. Society of Environmental Toxicology and Chemistry. Pergamon Press, New York, NY. 1998.

With D.J. Hoffman, C.M. Marn, and G.W. Pendleton. "Association of Mercury and Selenium with Altered Glutathione Metabolism and Oxidative Stress in Diving Ducks from the San Francisco Bay Region, USA." *Environmental Toxicology and Chemistry* 17:167-172. 1998.

With R.L. Hothem, D.G. Lonzarich, and J.E. Takekawa. "Contaminants in Wintering Canvasbacks and Scaups from San Francisco Bay, California." *Environmental Monitoring and Assessment* 50:67-84. 1998.

With R.M. Burgess, et al. "Chena River Aquatic Assessment, Fort Wainwright, Alaska." Presented at the Annual Meeting of the Society of Environmental Toxicology and Chemistry, Charlotte, NC. 1998.

With E.R. Byron, et al. "Selenium Bioaccumulation and Exposure in an Ephemeral Pool Environment." Presented at the Annual Meeting of the Society of Environmental Toxicology and Chemistry, Charlotte, NC. 1998.

With E.R. Byron, et al. "Avian Reproductive Success and Selenium Bioaccumulation in a Constructed Wetland Receiving Treated Refinery Effluent." Presented at the Annual Meeting of the Society of Environmental Toxicology and Chemistry, Charlotte, NC. 1998.

With M.A. Castleberry, et al. "Ecological Risk Assessment for Restoration of the Bolsa Chica Lowlands, California." Presented at the Annual Meeting of the Society of Environmental Toxicology and Chemistry, Charlotte, NC. 1998.

"Toxicological Effects of Selenium on Birds." Presented at symposium on Understanding Selenium in the Aquatic Environment, sponsored by Kennecott Utah Copper, March 6-7, 1997. (invited participant).

With E. Byron and G. Santolo. "Patterns of Selenium Bioaccumulation in Freshwater Invertebrates of Kesterson Reservoir." Presented at the Annual Meeting of the Society of Environmental Toxicology and Chemistry, San Francisco, CA 1997.

With G. Santolo and J. Yamamoto. "Risk Assessment for Terrestrial Birds at Kesterson Reservoir." Presented at the Annual Meeting of the Society of Environmental Toxicology and Chemistry, San Francisco, CA. 1997.

With S. Schwarzbach and R. Hothem. "Mercury in Avian Eggs from San Francisco Bay." Presented at the Annual Meeting of the Society of Environmental Toxicology and Chemistry, San Francisco, CA. 1997.

"Selenium." A. Fairbrother, L.N. Locke, and G.L. Hoff, eds., *Noninfectious Diseases of Wildlife*, 2nd edition, Pp. 128-140. The Iowa State University Press, Ames. 1996. (invited contribution).

With S.M. Bartell. "Kesterson Reservoir Ecological Risk Assessment: A Case Study." R. V. Kolluru et al., eds., *Risk Assessment and Management Handbook for Environmental, Health, & Safety Professionals*, Pp. 11.1-11.13. McGraw-Hill Inc., New York, NY. 1996. (invited contribution).

"Ecological Risk Assessment for Constructed Wetlands." Presented at symposium on Constructed Wetlands in Cold Climates: Design, Operation, and Performance, held in Niagara-on-the-Lake, Ontario, June 4-5, 1996, and published in symposium proceedings. (invited participant).

With G. Santolo and J. Maughan. "Wildlife Toxicology Contributions toward Site Remediation Decision-Making." Presented at the Annual Meeting of the Society of Environmental Toxicology and Chemistry, Washington, DC. 1996. (invited participant).

With S.P. Long and E.R. Byron. "Joint Use of Laboratory Bioassays and Field-Collected Invertebrates to Evaluate Toxicity and Contaminant Bioaccumulation." Presented at the Annual Meeting of the Society of Environmental Toxicology and Chemistry, Washington, DC. 1996.

"Ecological Risk Assessment for Kesterson Reservoir, California." Presented at Workshop on Toxicological Foundations of Ecological Risk Assessment at Annual Meeting of the Society of Toxicology, Anaheim, CA. 1996. (invited participant).

With G.M Santolo. "Kesterson 1985 to Present." Presented at the National Irrigation Water Quality Program Phase 4 Bi-annual Meeting, San Diego, CA. 1996. (invited participant).

"Selenium Toxicity in Waterfowl: The Kesterson Experience." *Proceedings of a National Symposium: Selenium in the Environment: Essential Nutrient, Potential Toxicant*, Pp. 11-19. Sponsored by University of California Division of Agriculture and Natural Resources, Cooperative Extension; BioTech Associates Limited, Inc.; Schering-Plough Animal Health. Sacramento, CA, May 31 - June 2, 1995. (invited contribution).

With R.L. Hothem. "Agricultural Drainwater Effects on Wildlife in Central California." D.J. Hoffman, B.A. Rattner, G.A. Burton, Jr., and J. Cairns, Jr., eds. *Handbook of Ecotoxicology*, Pp. 577-595. Lewis Publishers, Boca Raton, FL. 1995. (invited contribution).

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