

Applied Biomonitoring
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Applied Biomonitoring is an environmental consulting firm specializing in innovative, state-of-the-art environmental monitoring and assessment services coupled with timely client communication and scientific credibility. We have conducted numerous field studies to support projects for federal regulatory agencies, state and local authorities (including Maine DEP) and private industry.

Michael H. Salazar, Principal of Applied Biomonitoring, has been a leader in state-of-the-art environmental monitoring methodology with over 30 years of experience. Michael Salazar, in collaboration with his associate Sandra Salazar, have the ability to provide clients a wide range of environmental services, including monitoring and assessment, work plan development, experimental planning and design, data analysis and interpretation, peer review, and meeting facilitation. Our primary area of expertise is analysis and interpretation of tissue, water and sediment chemistry data with respect to chemical bioavailability and associated effects on aquatic organisms.

Applied Biomonitoring is recognized as a national and international expert in characterizing and understanding the processes of bioaccumulation and associated biological effects. We are also leaders in conducting field bioassays with caged bivalves. This unique experience and expertise to design, plan, and conduct in-situ field assessments has been developed over the past 30 years by conducting more than 40 transplant studies.

In addition to services directly associated with monitoring and assessment, Applied Biomonitoring has conducted numerous peer reviews, prepared countless technical reports and guidance manuals, and provided oversight and management on many high-profile projects. Applied Biomonitoring has the unparalleled capability of conducting on-the-spot literature searches for many environmental issues. An electronic database of over 15,000 citations with an emphasis on exposure and effects measurements and assessment techniques is maintained at the Applied Biomonitoring offices.

Our primary fields of experience and expertise include:

- Work plan & criteria development
- Environmental monitoring & assessment
- Bioaccumulation & bioeffects interpretation
- In-situ field studies with caged bivalves
- Ecological risk and damage assessment
- Sediment evaluation
- Teaching & technology transfer
- Meeting facilitation
- Electronic database & literature summaries
- In-situ temperature monitoring

Environmental Monitoring & Assessment

Applied Biomonitoring has provided an extensive review of the EPA Region 10 Interim Sediment Quality Guidelines for tributyltin (TBT) and participated in a number of discussion groups to evaluate that document and is frequently contacted by the Seattle districts of EPA and the COE for technical guidance. We have been contracted by EPA to evaluate updates of Ambient Water Quality Criteria for TBT, cadmium, and copper, and contracted by Environment Canada to review two TBT assessment documents. As part of a project to evaluate the potential effects of ammonia for the City of Winnipeg using caged bivalves, Applied Biomonitoring conducted an intensive review of the EPA Ambient Water Quality Criteria for ammonia. Most recently, Applied Biomonitoring has focused on bivalve bioaccumulation, bioeffects, and pathways of exposure for metals. We have developed extensive working expertise on the relative differences in metal accumulation among various marine and freshwater mussel species.

Field Bioassays, Field Monitoring and Toxicity Testing

Applied Biomonitoring is a recognized leader in the development of *in-situ* monitoring techniques that permit synoptic collection of chemical exposure and biological effects data. Since the first pilot study conducted in 1973, Mr. Salazar has conducted 60 transplant studies using 18 marine, estuarine, and freshwater bivalve species. Results of these studies have been used by the US Navy in their risk assessment for TBT, NOAA and the US EPA in their evaluations of Superfund sites in Puget Sound, Washington; Tampa, Florida, Sault Ste. Marie, Michigan, and the Sudbury River in Massachusetts, and most recently by the Washington State Department of Natural Resources for a programmatic evaluation of herring stocks in Puget Sound.

The *in-situ* transplant approach has become a well-established monitoring tool accepted by both industry and regulatory agencies. Both Mr. and Mrs. Salazar have developed the standard protocols for conducting field studies with caged bivalves. This extensively peer reviewed document appeared for the first time in American Society for Testing and Materials (ASTM) 2001 Annual Book of Standards. The methods have also been accepted by the American Public Health Association in their Standard Methods for the Examination of Water and Wastewater, and Environment Canada for monitoring pulp and paper and mining effluents. Applied Biomonitoring has worked with scientists at Environment Canada's St. Lawrence Center for the past 6 years to develop environmental monitoring and assessment systems for endocrine disrupting chemicals. Biomarkers have been developed to quantify estrogenic effects and a benthic cage was developed to assess long-term effects under environmentally realistic conditions.

Relevant Project List:

- Lynn Lake Peer Review (2009)
- Duwamish River Mussel Study (2009)
- Motiva Oil Spill Assessment & Review (2006, 2007)
- Blanchard Seafood Study (2006)
- Puget Sound Naval Shipyard Caged Mussel Study (2005)
- Devil's Lake Canal Diversion (2005)
- Lynn Lake, Manitoba, Canada Caged Mussel Study (2004, 2005, 2009)

- Review of TBT Documents for Environment Canada (2004)
- Review of EPA Ambient Water Quality Criteria for Copper (2003)
- Kennebec River, ME Caged Mussel Study (2003)
- Androscoggin River, ME Caged Mussel Study (2003)
- Santa Barbara Shell Mound Study (2003)
- Bear Creek, WA Mussel Study (2003)
- Capitol Regional District Tissue Residue Effects Database (2002)
- San Diego Bay Dietary Copper Study (2002)
- Montreal Dietary Copper Study (2002)
- Developing a Benthic Cage for Long-term, In-situ Tests with Freshwater and Marine Bivalves (2002)
- Bonney Lake Fluoride (2002)
- Assessing Acute WET Test Variability (2001)
- Assist in Sampling Plan Development and Interpret Tissue Residues of PAHs (2001)
- PCB Site Monitoring (2001, 2002, 2003)
- Port Valdez Monitoring (2001)
- Review of Interlaboratory Variability Study, EPA Short-term Chronic & Acute Whole Effluent Toxicity Test Methods (2001)
- Environmental Monitoring for Sewage Treatment Plant (2001)
- Review of EPA Ambient Water Quality Criteria for Cadmium (2000)
- Caged Mussel Study in Augusta, ME (2000)
- Caged Clam Study at Sault Ste. Marie, MI (2000)
- Potential Toxicity and Risk to Aquatic Organisms and Human Health from Exposure to Fiberglass (2000)
- Caged Mussel Study at Cherry Point, WA (1998, 1999, 2000)
- City of Winnipeg Ammonia Study, Winnipeg, MB, Canada (1999)
- Environment Canada Effluent Monitoring Studies, Montreal, Canada (1999, 2000, 2001, 2002, 2003, 2004)
- Technical Review of Biomonitoring Study Work Plan for MCCDC Quantico, VA (1999)
- Critique of San Francisco Estuary Institute Mussel Watch (1999)
- Review of EPA Tissue Residue Effects Database (1998)
- Caged Bivalve Pilot Study at Port Alice, Vancouver Is, BC (1997)
- Caged Bivalve Pilot Study at Port Valdez, AK (1997)
- Critical Evaluation of Bivalve Mollusc Biomonitoring (1997)
- Review of EPA Ambient Water Quality Criteria for TBT (1997)