Randle F. Baker, M.Sc. R.P. Bio.

Areas of Specialization

Ecological Risk Assessment

Aquatic Ecology/Fisheries

Marine Biology

Environmental Impact Assessment

Education

1983 M.Sc. (Zoology)
University of Manitoba

1980 B.Sc. (Honors Zoology)
University of Manitoba

Professional Memberships

Association of Professional Biologists of BC #944
Science Advisory Board of British Columbia

Employment History

2001 - Present Partner and Senior Ecologist
Azimuth Consulting Group Partnership, Vancouver, BC

2000 – 2001 Principal
Aqualibrium Environmental Consulting Inc. Vancouver, BC

1996 – 2000 Senior Aquatic Ecologist
EVS Environment Consultants North Vancouver, BC

1987 -1996 Senior Aquatic Ecologist
North/South Consultants Inc. Winnipeg, MB

1987 – 1988 Fish and Marine Mammal Mgt Biologist
Department of Fisheries and Oceans, Winnipeg, MB

Randy Baker is an aquatic ecologist with nearly 30 years of experience in various types of assessments, such as ecological risk, contaminated sites and environmental impact. He has participated in more than 150 investigations in such diverse environments as the Arctic, central and western Canada, South America, Southeast Asia and the Indian Ocean. With his extensive experience, Randy brings the following expertise:

- Ability to manage, direct and/or participate as an ecologist on inter-disciplinary, complex multi-year, risk-based investigations with significant human health and ecological implications.
- Specialized knowledge in environmental fate and transport of mercury released from historic mining operations
- Produced numerous studies to support ecological risk assessments of metals
- Managed and directed studies to support sophisticated mercury modeling studies in reservoirs
- Coordinated studies to assess impacts of several large hydroelectric development projects in northern Canada
- Examined linkages between contaminants present in water and sediment and implications on lower trophic level biota, fish and marine mammals in the context of hydroelectric dams

Randy recently published a paper demonstrating the use and efficacy of non-destructive tissue extraction techniques for tissue mercury analysis of fish. This method has since been adopted by Environment Canada as part of their guidance in conducting Environmental Effects Assessments at all metal mines.

Experience

- ***Ecological Risk Assessment***

Project manager and senior ecologist for an ecological risk assessment of the Sa Dena Hes Lead Zinc Mine, Yukon Territory – Initiated in fall 2012, this is a three year program to use risk-based findings from metals concentrations in soils, vegetation, ground and flying insects and small mammals to determine the boundaries and extent of remediation of tailings ponds, adits, and waste rock piles at the mine to minimize ecological risk, principally to large mammals (moose, deer, caribou).

Project manager and aquatic ecologist / ecological risk assessor as part of an interdisciplinary team conducting a human and ecological risk assessment of the Island Mountain Gold Project (1934 – 1967) near Wells BC. Historic mining practices and tailings deposition caused considerable soil and sediment contamination in Jack of Clubs Lake, Willow River, lake foreshore and around the town of Wells. This is a large, ongoing project that has utilized soil, sediment, surface and groundwater chemistry and modeling, tissue sampling (e.g., insets, vegetation, fish), food chain modeling, and habitat assessment and weighting to support a detailed ERA investigation with the objective of remediation to minimize risks to human and ecological health. The largest challenge of the project is balancing cost with benefit of remedial works.

Project manager and senior ecologist for sophisticated studies on mercury-contaminated Pinchi Lake, BC. Historic mining practices caused mercury contamination of water, sediments, soil and aquatic and terrestrial biota. Mobilization and cycling of inorganic and methyl mercury in the lake were quantitatively modeled based on sediment, pore water, surface water, benthos, zooplankton, and fish. We recently completed a comprehensive terrestrial ERA of the Pinchi Mine, in association with a Technical Working Group that included local First Nations to determine the best options for management and remediation of the site.

Project manager and senior ecologist for the Bridge-Seton Metals and Contaminant Program 2000, 2008 and 2011. Under terms of the WUP guidelines on behalf of the Comptroller of Water Rights, Azimuth collected water, sediment and fish tissue for metals and mercury analysis from Seton Lake, Carpenter Reservoir, Downton Reservoir and Bridge River in 2000 and 2008. The objective was to determine if sediment-bound metals had accumulated within Carpenter Reservoir and were entering the food web and/or posing health risks to food resources utilized by the Stl'atl'imx First Nation. We have recently developed a long-term monitoring program to track changes in metals throughout the system. This has begun with water quality monitoring and will continue with sediment and fish, with participation by Stl'atl'imx members.

Senior ecologist / risk assessor and project manager for an investigation of the Polaris Mine on Little Cornwallis Island, NT in support of mine closure. Major responsibilities include ecological and fisheries surveys of the freshwater and marine receiving environments to determine impacts of lead and zinc contamination, effluent plume delineation, toxicity testing and coordination of Environmental Effects Monitoring (EEM) studies under the Metal Mining Effluent Regulations (MMER). Risk assessment tools and techniques were used to support decision making and risk management decisions to support mine closure.

Ecological risk assessor and senior aquatic ecologist for decommissioning and risk assessment studies pertaining to the Teck Cominco Sullivan Mine in southeastern BC. Roles include data collection, analysis, assessment and reporting of aquatic toxicity, stream periphyton and benthic ecology, fish health assessment and habitat data. Regulatory agency and public stakeholder group liaison for this multi-year project is an important component of this work.

Senior ecologist to the United Nations Industrial Research Organization (UNIDO) in a pilot program to reduce global mercury exposure and contamination as a result of small-scale mining in six developing countries. Co-author of a book

entitled "*Protocols for Environmental and Health Assessment of Mercury Released by Artisanal and Small-scale Miners*" (ISBN 92-1-106429-5 http://www.unido.org/index.php?id=o50870). This book has been used to guide risk assessment procedures and harmonize international efforts to assess mining and environmental Hg contaminated hotspots at small-scale gold mining operations. Randy was responsible for implementation of the GMP objectives in Lao PDR, Sulawesi and Kalimantan, Indonesia.

Project manager for a three-year (1999-2002) BC Hydro Strategic Environmental Initiatives Program (SEIP) to determine the extent and longevity of mercury contamination in Williston Reservoir, BC. In association with Tetra Tech Inc., Ontario, a sophisticated mechanistic model was adapted and applied to Williston Reservoir, BC. The objective was to determine possible long-term temporal trends in fish mercury concentrations, which has implications for management and consumption of fish in this reservoir.

- ***Environmental Impact Assessment and Monitoring***

Project manager and senior scientist responsible for addressing issues related to mercury methylation and bioaccumulation as part of the Environmental Impact Assessment of the proposed Site C Clean Energy Project on the Peace River in northern BC. Recently completed in December 2012, Azimuth has been responsible for producing five key documents to BCH: 1) Mercury dynamics in reservoirs and the Canadian Reservoirs Comparison Matrix; 2) Wildlife Risk Assessment from Methylmercury Exposure; 3) Reservoir Mercury Modeling Technical Report; 4) Human Health Risk Assessment; and 5) Integrated summary in the EIS to determine the magnitude and duration of changes to methylmercury in environmental media should the Site C project proceed. This document informed the WRA and HHRA. Further details are confidential at this time.

Senior advisor to Golder Associates and mercury in Wabamun Lake, Alberta – Randy was the senior advisor to Golder Associates and Alberta Environment and Water to provide expertise in study design, field execution, data analysis and interpretation to determine if mercury released from coal fired generating stations have contributed to changes in mercury concentrations in northern pike of Wabamun Lake Alberta.

Advisor to BC Hydro to provide perspective on mercury concentrations of fish collected from the Falls River Reservoir and Ecstall River, 2006. In addition, fish mercury data for Dolly Varden collected in 1996 from McKnight Lake and Brown Lake were re-examined to provide a bigger picture perspective on fish mercury concentrations in this area and to provide guidance to the Lax Kw'Alaams First Nation.

Senior ecologist for all aquatic studies (1997 – 2009) in support of environmental baseline and EIA related work for Cumberland Resources Ltd., Meadowbank Gold Project, Nunavut. Senior author for all aquatic ecological components of the comprehensive EIA and No Net Loss (NNLP) of habitat plan. Designed a comprehensive aquatic environment management and monitoring program (AEMP) for the 10-year life of the mine. This property has since been acquired by Agnico-Eagle Mines (AEM). Randy continued his role as senior ecologist during current construction of the mine site, including all-weather access road monitoring, AEMP studies, a complete fish-out program and implementation of a NNLP to address habitat loss of a tailings impoundment.

With SENES Consultants, was senior aquatic ecologist for environmental impact assessments of the Brandon and Selkirk, MB Thermal Generating Stations required for upgrading and life extension to 2005. Key components included: mapping of thermal plumes; assessing seasonal vulnerability and relationship between intake volume and impingement and entrainment of fish species; environmental monitoring and mitigation.

Senior ecologist for more than 40 studies conducted between 1988-1996 relating to the Environmental Impact Assessment (EIA) of Manitoba Hydro's cancelled, 1330 MW Conawapa

Generating Station on the Nelson River. Coordinated and conducted studies on: impacts of reservoir creation and downstream flow regulation on aquatic biota; lower trophic level studies; water chemistry; fish habitat quantification and utilization in the Nelson River; fish movements; population dynamics; mercury concentrations in fish; estuarine hydrodynamics; and marine mammal (beluga and seals) investigations.

- **Aquatic Ecology/Fisheries**

Randy recently developed and tested a non-destructive technique to harvest muscle from live fish for the analysis of mercury (*Transactions of American Fisheries Society 2004; Vol. 133*). The procedure has been accepted and applied in mercury surveys of fish in Canada and the USA. Environment Canada has adopted this technique into their guidance to harvest tissue for mercury and metals analysis as part of the federal EEM program for metal mines.

Co-author of comprehensive guidelines for the protection and restoration of fish, and fish habitat during construction and/or operation of a variety of industrial development activities in central and northern Canada for the Department of Fisheries and Oceans. Objectives were to design and implement guidelines to protect, mitigate and/or restore fish habitat for 36 fish species found in central and northern Canada.

- ***Marine Biology***

*Senior ecologist to Wardrop Engineering for an environmental investigation of the Churchill River estuary and nearshore Hudson Ba*y – In advance of a large (1.2 million m^3) dredging project, dredge and disposal areas of the seabed were mapped and described using underwater video and supplemented with acoustic data to determine bedforms, habitat features and distribution of benthic biota. Bottom sediments were collected and analyzed for contaminants to determine the magnitude of contamination of dredge areas and implications for the disposal area. Artificial reef structures were designed and installed as a mitigation feature for lost habitat due to ocean disposal.

Consultant to Department of Fisheries and Oceans Canada – Senior ecologist participating in physical/chemical oceanographic studies to collect water and zooplankton as part of the 1998 Department of Fisheries and Oceans Joint Ocean Ice Studies (JOIS) as part of the US Science Council's SHEBA (Surface Heat Budget of the Arctic) in the high Arctic to support global climate change models. Data were collected from more than 50 stations ranging from western Baffin and Ellesmere Island, west through the central high Arctic and the Northwest Passage via M'Clure Strait and the Beaufort Sea.

Senior biologist for inter-disciplinary oceanographic and biological studies of the Nelson and Churchill River estuaries at Hudson Bay, 1988 - 1996. Differences in species composition, distribution, and abundance of lower trophic levels, fish, and marine mammals were related to changes in hydraulic, chemical, and seasonal conditions of the estuary. Designed and initiated a four year monitoring study (1995 - 1998) of the Nelson River estuary to evaluate differences in zooplankton species composition and abundance at discrete stations in relation to tides.