

Clint A.D. Alexander

Professional Overview

Leading edge expertise in quantitative methods enabling comprehensive decision oriented advice in settings pervaded by uncertainty. Repeat successes delivering strong client satisfaction in the areas of multiple-objective water management and software architecture and development. Energetic and creative with exceptional project management, leadership, analytical research, organisational, group facilitation and interpersonal and written communication skills. A firm believer in building clarity over project goals, requirements, and scope, to ensure expectations are managed and satisfied. Able to build a shared understanding of objectives and task process at facilitated meetings with diverse stakeholder groups and communicate technical information to non-specialists to help encourage constructive relationships.

Technical Summary

- *Quantitative Analysis:* decision/risk analysis, adaptive management (AM), Monte Carlo simulation, multiple accounts analysis, weight of evidence analysis.
- *Conceptual Analysis:* influence diagrams, impact hypothesis formulation, looking outward matrices for interdisciplinary linkage, adaptive environmental assessment (model building).
- *Statistics:* survey design, classical and Bayesian statistics, computer intensive methods (Bootstrap), parameter estimation.
- *Software/Programming:* OOD, .NET, Web Services, Visual Basic, MS Office Automation, ADO.NET, SQL, Access, Win API/Registry, S-Plus, Systat, Excel.

Professional Experience

- 1997-present **Sr. Systems Ecologist / Technical Architect**, ESSA Technologies Ltd., Kelowna, BC
- Consultant working on the application of systems methodology to a wide range of multi-objective water and resource management problems in aquatic ecosystems (e.g., fisheries management, fish-forestry, mitigative strategies for hydropower operations). Specialize in the use of quantitative methods that permit the clear identification and credible accounting of key uncertainties (e.g., probabilistic simulation modeling, statistics, decision analysis and adaptive management). The focal problems for these methods have been large-scale watershed restoration programs and socioeconomic/biological trade-off evaluations related to operational modifications at dams and reservoirs in Western North America. Lead software architect for numerous projects. Was rapidly promoted through positions of increasing project management responsibility. Responsibilities include:
- project management;
 - architectural design and development of decision support tools;
 - workshop facilitation (technical);
 - decision, risk, and power analysis;
 - evaluation of sampling (e.g., creel surveys) and experimental designs;
 - development and assessment of appropriate research methods;

- statistical data analysis (using Bayesian, classical and Bootstrap methods); and
- technical writing (e.g., progress, model documentation, final project reports).

Highlights:

- Perhaps the most relevant and state-of-the art example of the value of decision support tools in achieving a better balance amongst water objectives I have contributed to is the Okanagan Fish-Water Management Tool (OKFWM). OKFWM is a software program that is accessible on the internet and can be used by many users simultaneously. The data model that underlies OKFWM automates complex biophysical calculations, incorporates real-time hydrometric data on inflow and water temperature, incorporates kokanee-sockeye emergence timing estimates and simplifies the presentation of results to show how well objectives have been met. The process of developing OKFWM has produced significant technical and cognitive advances in fish/water management in the basin. The result has been to greatly improve in-season water release decisions occurring at Okanagan Lake dam (see: Hyatt and Alexander 2005).
- In my second year, led a team of statisticians, software engineers and testers in the development of a data management and catch estimation system for the Canadian Department of Fisheries and Oceans. Provided ongoing advice on the statistical survey design and software system. Achieved strong client satisfaction (14 follow-up projects).
- Developed first ESSA model showing value of information from adaptive management using an integrated 2-stage decision analysis-simulated AM approach for the management of mountain whitefish in the Columbia River (Canada). Successfully de-escalated issues with difficult stakeholders. See: Alexander et al. 2006.
- Co-facilitated large group of state, federal, and academic specialists in the design of a model to evaluate the benefits of alternative stream restoration experiments in Clear Creek California. Successfully de-escalated issues with difficult stakeholders. Helped realize methodological buy-in from specialists and non-specialists, and secured a second phase project to implement the participants design.
- Co-developed an adaptive management training package (simulation model and training materials) for the BC Ministry of Forests.

1996-1997

Principal Researcher (contract position), Canadian Department of Fisheries and Oceans, Burnaby, BC.

Designed and developed a simulation model to quantitatively assess the performance and risks of alternative spawning escapement and in-river catch allocation policies for Fraser river sockeye given the uncertainties in various population and management estimates. This project included:

- determination of data requirements and methods
- analysis of historical data for the major Fraser River sockeye populations for input into the model
- quantification of the expected performance of different management options for a range of objectives
- progress reports and facilitation of meetings
- development of a user interface for the model
- model documentation and training for DFO staff.

Highlights:

- Invited to give a presentation to senior Department of Fisheries and Oceans staff on the precautionary approach and escapement goals, and lessons learned facilitating groups.
- M.Sc. thesis

1996 **Teaching/Research Assistant** , School of Resource and Environmental Management, SFU, Burnaby, BC

Provided teaching assistance to both graduate level Ecology and Environmental Toxicology students. Duties/functions included:

- design and development of a spreadsheet model to be used by Resource and Environmental Management students in a major Ecology assignment
- demonstrated and assisted students in the use of software associated with toxicology computer labs and tutorials
- assisted the professors in marking student assignments
- conducted literature searches and reviews as directed by the two professors

1995 **Research Assistant / Technician 2**, The University of British Columbia Fisheries Centre, Vancouver, BC.

Investigated several hypotheses about the return migrations and timing of Fraser River sockeye using an existing model. Duties/functions included:

- experimental design
- model enhancement / debugging
- presenting interim findings at group seminars
- the writing of a final manuscript

Education and Training

- **Master of Resource and Environmental Management**, Simon Fraser University, BC (1999). Emphasis on quantitative methods for accounting for uncertainty: DECISION ANALYSIS, ADAPTIVE MANAGEMENT, SIMULATION MODELLING, CLASSIC AND BAYESIAN STATISTICS. MASTER'S THESIS: Contradictory data and the application of the precautionary approach: a case study for setting escapement targets for the Early Stuart run of Fraser River sockeye salmon (*Oncorhynchus nerka*), British Columbia.
- **B.Sc.**, The University of British Columbia, Vancouver, BC (1995). Major: APPLIED ECOLOGY
- *Fluvial Geomorphology: Principles and Practices*, University of California, Riverside University Extension, CA, USA (2004). Field course.

Management Development:

- Facilitation Skills for Leaders, The University of British Columbia, Vancouver, BC, (1999)

Awards:

- Graduate Fellowship (1996)
- Provincial Graduation scholarship (1990)

Publications and Reports

Alexander, C.A.D. 2006. A model-based analysis of gravel augmentation below Whiskeytown Dam, California. Draft report prepared by ESSA Technologies Ltd., Kelowna, B.C. for the Bureau of Reclamation, Shasta Lake, CA. 56 pp.

Alexander, C.A.D. G. Coulson, and J. Mack. 2006. Long-term hosting options for the Okanagan Fish/Water Management Tool version 2.0.000 - feasibility study. Prepared by ESSA Technologies Ltd., Kelowna, BC and the Department of Fisheries and Oceans Canada for the Canadian Okanagan Basin Technical Working Group, Kamloops, BC. 38 pp.

Alexander, C.A.D., C.N. Peters, D.R. Marmorek and P. Higgins. 2006. A decision analysis of flow management experiments for Columbia River mountain whitefish (*Prosopium williamsoni*) management. *Can. J. Fish. Aquat. Sci.* 63: 1142-1156.

Alexander, C.A.D., B. Symonds and K. Hyatt, eds. 2006. The Okanagan Fish/Water Management Tool (v.2.0.000): Guidelines for Apprentice Water Managers. Prepared for Canadian Okanagan Basin Technical Working Group, Kamloops, BC. 127 pp.

ESSA Technologies Ltd. 2006. Fraser River Catch Monitoring Software: User Requirements Review - DRAFT. Prepared by ESSA Technologies Ltd., Vancouver, B.C. for Department of Fisheries and Oceans, Delta, BC. 67 pp.

ESSA Technologies Ltd. 2006. Sacramento River Flow Management Collaboration System (SacFMC): Preliminary Design. Prepared for The Nature Conservancy, Chico, CA. 70 pp.

ESSA Technologies Ltd. 2006. The Okanagan Fish/Water Management Tool (OKFWM) (v.2.0.000) - System Documentation. Prepared by ESSA Technologies Ltd., Kelowna, BC for the Canadian Okanagan Basin Technical Working Group, Kamloops, BC. 79 pp.

Trinity River Restoration Program, ESSA Technologies Ltd. and North State Resources. 2006. Integrated Monitoring and Evaluation Plan - Preliminary Draft. Jan 2006. Draft report Trinity River Restoration Program, Weaverville, CA. 263 pp.

Alexander, C.A.D. 2005. Unsanctioned, partially monitored First Nations sockeye fisheries on the Lower Fraser River, 2004 . Final report prepared by ESSA Technologies Ltd., Vancouver, B.C. for Department of Fisheries and Oceans, Delta, BC. 30 pp.

Alexander, C.A.D. and K. Hyatt, eds. 2005. The Okanagan Fish/Water Management Tool (OKFWM): Record of Design (v.1.0.001). Prepared for Canadian Okanagan Basin Technical Working Group, Kamloops, BC. 157 pp.

Alexander, C.A.D. and P. Méra. 2005. Summary of visioning and scoping workshop held March 3–4 2005, Vancouver BC. Prepared by ESSA Technologies Ltd., Vancouver, B.C. for Nechako Fisheries Conservation Program, Vanderhoof, BC. 27 pp.

Alexander, C.A.D., Symonds, B. and K. Hyatt, eds. 2005. The Okanagan Fish/Water Management Tool (v.1.0.001): Guidelines for Apprentice Water Managers. Prepared for Canadian Okanagan Basin Technical Working Group, Kamloops, BC. 114 pp.

ESSA Technologies Ltd. 2005. The Okanagan Fish/Water Management Tool (OKFWM): System Documentation (v.1.0.001) DRAFT. Prepared by ESSA Technologies Ltd., Vancouver, BC for the Canadian Okanagan Basin Technical Working Group, Kamloops, BC. 67 pp.

ESSA Technologies Ltd. 2005. Sacramento River Decision Analysis Tool: Workshop Backgrounder. Prepared for The Nature Conservancy, Chico, CA. 75 pp.

Hyatt, K. and C.A.D. Alexander. 2005. The Okanagan Fish-Water Management (OKFWM) Tool: Results of a 25 year retrospective analysis. Prepared for Canadian Okanagan Basin Technical Working Group, Kamloops, BC. 23 pp.

Trinity River Restoration Program. 2005. Conceptual models and hypotheses for the Trinity River Restoration Program. Draft report prepared for the Trinity River Restoration Program, Weaverville, CA. 133 pp.

Alexander, C.A.D. 2004. Riparian Initiation, Scour and Chinook Egg Survival Models for the Trinity River. Notes from a Model Review Meeting held September 3-5, 2003. Draft report prepared by ESSA Technologies Ltd., Vancouver, BC for McBain and Trush, Arcata, CA. 29 pp.

Environmental Water Program, California Bay-Delta Authority. 2004. Environmental Water Program Pilot Flow Augmentation Project: Concept Proposal for Flow Acquisition on Lower Clear Creek. Draft report prepared by Stillwater Sciences, Berkeley CA with report sections authored by ESSA Technologies. 54pg.

Marmorek, D.R., I.J. Parnell, M. Porter, C. Pinkham, C.A.D. Alexander, C.N. Peters, J. Hubble, C.M. Paulsen and T.R. Fisher. 2004. A multiple watershed approach to assessing the effects of habitat restoration actions on anadromous and resident fish populations. Prepared by ESSA Technologies Ltd., Vancouver, B.C. for Bonneville Power Administration, Portland, OR. 420 pp.

Trinity River Restoration Program. 2004. Trinity River Restoration Program Scientific Framework Review & Development Workshop: Background. Report prepared for the Trinity River Restoration Program, Weaverville, CA. 91 pp.

Alexander, C.A.D. 2003. First Nation sockeye catch estimates in the mid-Fraser River, 2002, with results of an impact analysis on the reduction of 24-hour effort surveys and aerial overflights. Prepared by ESSA Technologies Ltd., Vancouver, BC for the Canadian Department of Fisheries and Oceans, BC Interior Area Division, Kamloops, BC. 76 pp. + appendix.

ESSA Technologies Ltd. 2003. Phase 1: User Needs Assessment and Design Recommendations. Development of an Aquatic and Terrestrial/Riparian Data Management System. Design Document. Prepared by ESSA Technologies Ltd., Vancouver, BC for BC Hydro, Burnaby, BC. 41 pp.

ESSA Technologies Ltd. 2003. Multi-Watershed Approach to Increase Learning from Columbia Basin Watershed Restoration Projects - Data Analysis Plan for Selected Sub-basins. Draft report prepared by ESSA Technologies Ltd., Vancouver, B.C. for Bonneville Power Administration, Portland OR. 137 pp.

Alexander, C.A.D. 2002. 2001 First Nation catch estimates on the Lower Fraser River and recommended improvements for future aerial-access creel surveys. Prepared by ESSA Technologies Ltd., Vancouver, BC for Department of Fisheries and Oceans, Lower Fraser River Area Office, Delta, BC. 46 pp.

Alexander, C.A.D. 2002. First Nation sockeye catch estimates in the mid-Fraser River, 2001. Prepared by ESSA Technologies Ltd., Vancouver, BC for the Canadian Department of Fisheries and Oceans, BC Interior Area Division, Kamloops, BC. 58 pp.

Alexander, C.A.D. 2002. Training Course: Management and Evaluation of River Catch and Effort Information for Lower and Mid-Fraser River Aerial-Roving-Access Creel Surveys (for MERCI 3 software system). Prepared by ESSA Technologies Ltd., Vancouver, BC. 60 pp.

Alexander, C.A.D. 2001. First Nation sockeye catch estimates in the mid-Fraser River, 2000, with results of model-based comparisons of catch obtained from alternative ratio estimators for catch per unit effort. Prepared by ESSA Technologies Ltd., Vancouver, BC for The Canadian Department of Fisheries and Oceans, Fraser River Division, Delta, BC. 86 pp. + appendices.

Alexander, C.A.D. 2001. Management and evaluation of river catch and effort information – Upper Fraser River version: Training course notes (final draft). Prepared by ESSA Technologies Ltd., Vancouver, BC. 68 pp.

Alexander, C.A.D. 2001. 2000 Native Catch Estimates on the Lower Fraser River and Recommended Improvements for Future Aerial-Access Creel Surveys. Prepared by ESSA Technologies Ltd., Vancouver, BC for Department of Fisheries and Oceans, Fraser River/Interior Area Office, Delta BC. 67 pp.

Alexander, C.A.D. 2000. 1999 Native Catch Estimates on the Lower Fraser River and Recommended Improvements for Future Aerial-Access Creel Surveys. Prepared by ESSA Technologies Ltd., Vancouver, BC for The Canadian Department of Fisheries and Oceans, Fraser River/Interior Area Office, Delta BC. 57 pp.

Alexander, C.A.D. 2000. 1999 Native Catch Estimates on the Upper Fraser River and Recommended Improvements for Future Aerial-Roving Creel Surveys. Prepared by ESSA Technologies Ltd., Vancouver, BC for The Canadian Department of Fisheries and Oceans, Fraser River/Interior Area Office, Delta BC. 46 pp. + appendices.

Alexander, C.A.D. 2000. Unsanctioned, partially monitored First Nations Fisheries on the Lower Fraser River: A conservation risk. Prepared by ESSA Technologies Ltd., Vancouver, BC for the Canadian Department of Fisheries and Oceans, Fraser River / Interior Area Office, Delta, BC. 23 pp.

Alexander, C.A.D., D.R. Marmorek, and C.N. Peters. 2000. Applying decision analyses to whitefish management in the Columbia River: Is it worth varying flows to reduce key uncertainties? Model description and preliminary results. Prepared by ESSA Technologies Ltd., Vancouver, BC for BC Hydro, Burnaby, BC. 52 pp. and appendices.

Alexander, C.A.D., D.R. Marmorek, and C.N. Peters. 2000. Clear Creek Decision Analysis and Adaptive Management Model: Results of a Model Design Workshop held January 24th-26th 2000. Draft report prepared by ESSA Technologies Ltd., Vancouver, BC for CALFED Bay-Delta Program, 1416 Ninth Street, Suite 1155 Sacramento, CA 95814, 96 pp. and appendices.

Marmorek, D. and C.A.D. Alexander. 2000. Adding rigor to the CALFED concept of adaptive management: briefing document for a model design workshop for Clear Creek. Meeting to be held January 24th, 25th, and 26th in Redding, California. Prepared by ESSA Technologies Ltd., Vancouver, BC for Clear Creek Workshop Participants. 16 pp. + appendices.

Alexander, C.A.D. 1999. Contradictory data and the application of the precautionary approach: a case study for setting escapement targets for the Early Stuart run of Fraser River sockeye salmon (*Oncorhynchus nerka*), British Columbia. Rep. No. 237. Master=s thesis, School of Resource and Environmental Management, Simon Fraser University, Burnaby, BC.

Alexander, C.A.D. 1999. 1998 Native Catch Estimates on the Upper Fraser River. Prepared by ESSA Technologies Ltd., Vancouver, BC for The Canadian Department of Fisheries and Oceans, Fraser River Division, New Westminster BC. 68 pp. and appendices.

Alexander, C.A.D. 1999. Contradictory data and the application of the precautionary approach: a case study for setting escapement targets for the Early Stuart run of Fraser River sockeye salmon, British Columbia. March 15 - 17, 1999, Richmond, BC. page 31 of program.

Marmorek, D.R., I. Parnell, C.N. Peters, and C.A.D. Alexander (compls./eds.). 1999. PATH: Scoping of candidate research, monitoring and experimental management actions: concurrently reducing key uncertainties and recovering stocks. Working draft prepared by ESSA Technologies Ltd., Vancouver, BC. 232 pp.

Pinkham, C. and C.A.D. Alexander. 1999. MERCI: Management and Evaluation of River Catch Information - User=s Guide. Prepared for the Department of Fisheries and Oceans by ESSA Technologies Ltd., Vancouver, BC. 110 pp.

Alexander, C.A.D. 1998. 1998 Native catch estimates on the lower Fraser River. Prepared by ESSA Technologies Ltd., Vancouver, BC for the Canadian Department of Fisheries and Oceans, Fraser River Division, New Westminster BC. 52 pp.

Alexander, C.A.D, T.M. Webb, and D.R. Marmorek. 1998. The Fish Forestry Interaction Project - Management Model (FFIP-MM): Preliminary Model Description and Application to Carnation Creek, British Columbia. Prepared by ESSA Technologies Ltd., Vancouver, BC, and Lookfar Solutions, Tofino, BC. 50 pp.

Alexander, C.A.D. and D.R. Marmorek. 1998. The Nechako Fisheries Conservation Program (NFCP): The Last 10 Years and the Next 10 Years. Report on a workshop held February 24th and 25th, Vancouver, British Columbia, Canada. Prepared by ESSA Technologies Ltd., Vancouver, BC. 65 pp.

Alexander, C.A.D. and D.R. Marmorek. 1998. The Fish Forestry Interaction Project - Management Model (FFIP-MM): A model overview. Prepared by ESSA Technologies Ltd., Vancouver, BC. 16 pp.

Alexander, C.A.D. 1997. Using decision analysis as a framework for responding to changes in timber supply due to climate change. *Unpublished Manuscript*.

Alexander, C.A.D. 1995. Computer simulations examining the contribution of ocean currents and pre-migration temperature responses on sockeye salmon return timing. Paper presented at the American Fisheries Society North Pacific International Chapter annual meeting, held April 5 - 7, Vancouver, BC. page 14 of program.