

## **Darcy C. Pickard**

Senior Statistician / Systems Ecologist, ESSA Technologies Ltd.

**Suite 300, 1765 West 8th Avenue, Vancouver, B.C. V6J 5C6 Ph: (604) 733-2996**

**Email: dpickard@essa.com**

### **Post-Secondary Education**

- Master of Science (Statistics), Simon Fraser University, 2006
- Bachelor of Science (Major in Statistics, Minor in Ecology), Simon Fraser University, 2002

### **Related Education**

- Salmonid Assessment Techniques, field course in juvenile salmonid ecology and assessment techniques, Bamfield Marine Sciences Center, 2007.
- Program MARK, attended week long course in the use of the software and the theory of Mark-recapture, 2007.

### **Awards**

- NSERC Industrial Postgraduate Scholarship (2004-2006)
- Bamfield Marine Station Scholarship (2007)

### **Professional Experience**

- 2005-current **Senior Statistician / Systems Ecologist**, ESSA Technologies Ltd.,  
Vancouver, B.C.
- 2004-2006 **Teaching Assistant**, Department of Statistics, Simon Fraser University,  
B.C.
- 2005-current **Wildlife Rehabilitation Volunteer**, Wildlife Rescue Association,  
Burnaby, B.C.
- 1997-2004 **Production Supervisor**, BPB, Annacis Island, B.C.  
**Process Control Supervisor**, BPB, Annacis Island, B.C.  
**Quality Supervisor**, BPB, Annacis Island, B.C.  
**Production Foreman**, BPB, Annacis Island, B.C.
- 1997 **Community Organizer**, Green Links, Institute of Urban Ecology of  
Douglas College, New Westminster, B.C.

### **Skills and Certification**

- Pleasure Craft Operators Card, 2007
- Electrofishing safety certificate, 2007

### **Presentations**

- Society for North Western Vertebrate Biology, Stevenson, Washington (oral presentation in 2009)
- Western Division, American Fisheries Society, Portland, Oregon (oral presentation in 2008)
- American Fisheries Society, San Francisco, California (oral presentation in 2007)

- Trinity River Science Symposium, Weaverville California (oral presentation in 2007)
- International Biometric Society, Eastern North American Region, Tampa, Florida (oral presentation in 2006)
- CALFED Science Conference, Sacramento, California (oral presentation in 2006)
- Rocky Mountain Research Station, Seminar Series, Boise, Idaho (oral presentation in 2006)

### Select Project Descriptions

The descriptions below highlight some of Ms. Pickard's recent project experience:

**Adaptive Management for Habitat Enhancement.** *Sonoma County Water Agency, 2010-2011.* Helped the Sonoma County Water Agency develop an adaptive management plan for Dry Creek (a tributary of the Russian River CA), working with both regulatory agencies and outside experts in river restoration, adaptive management and monitoring. My primary role has been in assisting the client in developing appropriate designs for effectiveness and validation monitoring.

**Habitat Capacity Models.** *B.C. Ministry of the Environment, 2008.* Modeled the probability of occurrence of four salmonid species in the Thompson region of the interior of B.C. We used logistic regression to relate the presence of each species to habitat metrics at both the stream reach and the watershed scale. We also used density information from the Field Data Information System (FDIS) dataset for coho, Chinook, bull trout and rainbow trout, to develop intrinsic potential models of the expected productivity of stream reaches for the different key species based on simple field metrics that can also be remotely derived (i.e., gradient, bankful width, valley width). We used a Classification and Regression Tree (CART) approach to determine the best way to split the data into rough intrinsic potential categories based on the simple field metrics.

**Fisheries Sensitive Watersheds.** *B.C. Ministry of the Environment, 2008-present.* Reviewed potential monitoring design approaches that can be applied to landscape level and regional effectiveness monitoring of Fisheries Sensitive Watersheds (FSWs). Developed a draft FSW monitoring framework and FY09-10 workplan listing the necessary steps to successfully develop a statistically valid and cost effective FSW monitoring program. Completed a successful pilot test of the sampling design and monitoring protocols (2011).

**Developing a Framework to Designate Temperature Sensitive Streams in the B.C. Interior.** *BC Forest Science Program, 2008.* Used bootstrap methods to generate probabilities of exceeding temperature thresholds due to shifts in temperature caused by disturbance.

**Sightability of redds in the Middle Fork Salmon River.** *Rocky Mountain Research Station, Boise, current.* Analysis of a five year dataset in the Middle Fork Salmon River, to assess the bias and precision of the method as a surrogate for spawner abundance and to determine if there are environmental predictors that affect the ability to detect redds.

**Technical review of potential impacts of Yukon Queen II operations on salmon.** *Yukon Environmental and Socio-Economic Assessment Board*, 2008. Reviewed and provided feedback for the analyses in the report. Completed a regression analysis looking at the effect of various operational parameters (e.g. boat speed) and landscape parameters (e.g. substrate type) on the average wave run out distance. Completed a logistical regression analysis looking at how the same predictor variables relate to the probability of finding stranded juvenile salmonids.

**Sampling designs and analyses for assessing the effectiveness of wildlife habitat areas (WHAs).** *B.C. Ministry of the Environment*, 2007-current. Working with field biologists to determine the most appropriate sampling design to measure effectiveness of WHAs for Gopher Snake, Goshawk, and Tailed Frogs. This involved working in the field with the biologists to understand the practical challenges of the methodology, designing and implementing the pilot study, and using this field experience along with the pilot data to determine the most appropriate sampling design, and assisting with the analyses.

**Providing program level monitoring recommendations for completing wildlife resource value effectiveness evaluations.** *B.C. Ministry of the Environment*, 2007-current. Wrote an overall guidance chapter on sampling design for the Forest and Range Evaluation Program guidance document: Protocol for Resource Stewardship Monitoring: Completing Wildlife Resource Value Effectiveness Evaluations. In addition, produced a Monitoring and Evaluation Toolbox for the document.

**Landfire.** *The Nature Conservancy*, 2008. Designing and analyzing an appropriate fractional factorial experimental design to reduce the number of runs necessary in an extensive fire management computer simulation.

**Juvenile Salmonid Outmigrant Monitoring Evaluation.** *Trinity River Restoration Program-North State Resources*, 2008. We completed a review of the field and analytical components of the Trinity River outmigrant monitoring program. We evaluated the past methodology, making recommendations for the future and predicting the time it would take to detect a difference in the abundance of outmigrating smolts (as a result of restoration actions) given the current rotary screw trap methodology.

**Collaborative, System-wide, Monitoring and Evaluation Project (CSMEP),** *Columbia Basin Fish and Wildlife Authority*, 2005-2009. Co-facilitation of the project and providing analytical support including: literature review of fish sampling methods, statistical sampling design, simulation modelling to inform monitoring design and implementation decisions. Developed a simulation model in R that allows for the assessment of different monitoring designs. The designs are assessed by their ability to correctly determine the status of Snake River Spring/Summer Chinook Salmon at the sub-basin level. The model incorporates decision criteria developed by NOAA's National Marine Fisheries Service Technical Recovery Team (TRT) and allows for different sampling protocols within each of the populations in the sub-basin.

**Quantitative evaluation of the Watershed Evaluation Tool.** *Ministry of Environment*, 2007. Completed a classification and regression tree (CART) analysis to help determine which root and high-level indicators have the greatest influence on WET rankings and whether the relative importance of indicators in explaining watershed rankings seem reasonable (i.e., scientifically defensible)?

**Integrated assessment plan for the Trinity River.** *Trinity River Restoration Program*, 2005 – present. Assisted with the development of an Integrated Assessment Plan (IAP) for the Trinity River, providing analytical support including statistical sampling design, simulation modelling to inform adaptive management design and implementation decisions, and detailed advice on specific sampling programs for fish, wildlife, sediment and riparian vegetation. Developed the overall sampling framework for the Trinity River Restoration Program, which incorporates many assessments from different disciplines in an integrated and rigorous design.

**Helping salmon survive climate change.** *Pacific Fisheries Resource Conservation Council*, 2007. The purpose of this project was to synthesize existing and relevant information for BC and develop clear recommendations for helping salmon survive a changing climate. Interacted with a range of restoration managers in B.C. from government, local groups and First Nations in order to obtain information about both successful and unsuccessful restoration projects as well as new ideas for restoration in the face of climate change.

**A workshop to determine research priorities for Eulachon.** *Department of Fisheries and Oceans*, 2007. Provided a background summary and conceptual model of the current hypotheses that propose to explain why Eulachon have been declining in British Columbia in the past few decades. Facilitated a workshop involving a range of participants to review the evidence that exists for each of the proposed hypotheses and then make recommendations for which research questions should be priorities for the Department of Fisheries and Oceans.

**Evaluating the effectiveness of rehabilitation actions in creating fish habitat in the Trinity River.** *Trinity River Restoration Project*, 2006. Created a spatially explicit model of the loss and creation of fish habitat in the Trinity River to act as a tool to evaluate the effectiveness of restoration actions.

**Review of River Monitoring Data and estimating trends in abundance for six species.** 2005-2006: Assessed the statistical methods cited to analyze the data. Wrote the SAS code necessary to extract the data and estimate the annual abundance indices and their variances. Completed trend analyses for the six species of interest, where there appeared to be a change in the slope of the data over time we used piece-wise regression to determine the most likely change point. We developed a list of questions / recommendations / exploratory analyses that address the sampling design and data, all of the findings were summarized in a confidential report.

**Linking salmon-wildlife linkages to waterborne pathogens.** 2006. Completed a before after control impact (BACI) analysis to determine if there is any evidence to suggest that returning salmon to the Capilano watershed affected the percent of samples that tested positive for giardia or cryptosporidium cysts.

## **Selected Publications and Reports**

**Pickard, D.** 2009. Recommendations for the Wildlife Habitat Area (WHA) monitoring protocol for red and blue listed snakes in British Columbia. Report prepared by ESSA Technologies Ltd., Vancouver, B.C. for Kathy Paige, Ecosystems Branch, B.C. Ministry of Environment, Victoria. 13 pp.

**Pickard, D.** 2009. Snakes on a lane: Analysis of snake observations on a rural road in southern British Columbia. Report prepared by ESSA Technologies Ltd., Vancouver, BC for Kathy Paige, Ecosystems Branch, BC Ministry of Environment, Victoria. 36 pp.

**Trinity River Restoration Program, ESSA Technologies Ltd.** 2008. Integrated Assessment Plan, Version 0.98 – Sept. 29, 2008. Draft report prepared for the Trinity River Restoration Program, Weaverville, CA. 251 pp.

**Pickard, D. and M. Porter.** 2008. Monitoring and Evaluation Toolbox. Draft report prepared by ESSA Technologies Ltd., Vancouver, B.C. for Kathy Paige, Ecosystems Branch, B.C. Ministry of Environment, Victoria. 51 pp.

**Pickard, D., D. Robinson, M. Porter, and K. Wieckowski.** 2008. Fisheries Sensitive Watershed (FSW) Monitoring Framework and Workplan. Report prepared by ESSA Technologies Ltd. for BC Ministry of the Environment (MOE), Victoria, BC

**Wieckowski, K., D. Pickard, M. Porter, and C. Schwarz.** 2008. A conceptual model for the Fisheries Sensitive Watersheds (FSW) monitoring framework. Report prepared by ESSA Technologies Ltd. for BC Ministry of the Environment (MOE), Victoria, BC. 48 p.

**Porter, M., D. Pickard, K. Wieckowski and K. Bryan.** 2008. Developing Fish Habitat Models for Broad-Scale Forest Planning in the Southern Interior of B.C. Report prepared by ESSA Technologies Ltd. and B.C. Ministry of the Environment (MOE) for B.C. Forest Science Program, PricewaterhouseCoopers, Vancouver, B.C. 92 pp.

**Nelitz, M., K. Wieckowski, and D. Pickard.** 2008. Technical review of potential impacts of Yukon Queen II operations on salmon. Final report prepared by ESSA Technologies Ltd., Vancouver, B.C. for the Yukon Environmental and Socio-Economic Assessment Board, Dawson City, YT. 48 pp.

**Pickard, D. and D.R. Marmorek.** 2007. A Workshop to Determine Research Priorities for Eulachon, Workshop Report. Prepared by ESSA Technologies Ltd., Vancouver, BC for Fisheries and Oceans Canada, Nanaimo, BC. 58 pp.

**Nelitz, M., K. Wieckowski, D. Pickard, K. Pawley, and D.R. Marmorek.** 2007. Helping Pacific salmon survive the impacts of climate change on freshwater habitats:

Pursuing proactive and reactive adaptation strategies. Final report prepared by ESSA Technologies Ltd., Vancouver, B.C. for Pacific Fisheries Resource Conservation Council, Vancouver, B.C. 58 pp + appendices.

**Nelitz, M., D. Carr, and D. Pickard.** 2007. Quantitative evaluation of the Watershed Evaluation Tool. Final report prepared by ESSA Technologies Ltd., Vancouver, B.C. for BC Ministry of Environment, Ecosystem Planning Section, Victoria, B.C.

**Collaborative Systemwide Monitoring and Evaluation Project (CSMEP) - Marmorek, D.R., M. Porter, D. Pickard and K. Wieckowski (eds.).** 2007. Snake River Basin Pilot Study: Volume 1. Prepared by ESSA Technologies Ltd., Vancouver, B.C. on behalf of the Columbia Basin Fish and Wildlife Authority, Portland, OR. 2007. 47 pp.

**Marmorek, D.R., M. Porter, D. Pickard and K. Wieckowski.** 2007. Collaborative Systemwide Monitoring and Evaluation Project (CSMEP) Snake River Basin Pilot Study: Volume 2. Prepared by ESSA Technologies Ltd., Vancouver, B.C. on behalf of the Columbia Basin Fish and Wildlife Authority, Portland, OR. 216 pp.

**Marmorek, D., M. Porter, and D. Pickard.** 2006. Collaborative System wide Monitoring and Evaluation Project, Annual Report. Report for the Columbia Basin Fish and Wildlife Authority, Portland, OR. Prepared by ESSA Technologies Ltd., British Columbia, Canada. 169 pp.

**Pickard, D., L. Greig, and I. Parnell.** 2006. Review of River Monitoring Program Data (27 year time-series) and Analysis of Trends in Relative Abundance for 6 species. Confidential Report. Prepared by ESSA Technologies Ltd., British Columbia, Canada. 169 pp.

**Pickard, D.** 2006. Evaluating the effectiveness of rehabilitation actions in creating fish habitat in the Trinity River. Master's research project, Simon Fraser University. Burnaby, B.C. Available at: <http://www.stat.sfu.ca/people/alumni/Theses/Pickard-2006.pdf>

**Pickard, D. and I. Parnell.** 2005. Comparative summary of the statistical and cost properties of different methods for estimating CSMEP fish performance measures. Collaborative System wide Monitoring and Evaluation Project. Report for the Columbia Basin Fish and Wildlife Authority, Portland, OR. Prepared by ESSA Technologies Ltd., British Columbia, Canada.