

MICHAEL JAMES BRADFORD

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Citizenship: Canadian.

Education

- 1987-1991 Doctor of Philosophy, McGill University, Montreal, QC. Thesis: 'The role of environmental heterogeneity in the evolution of life history strategies of the striped ground cricket.'
- 1982-1984 Master of Science, Biology, Simon Fraser University. Thesis: 'The use of otolith microstructure to estimate the size and growth of juvenile chinook salmon'.
- 1975-1980 Bachelor of Science, Biology, Simon Fraser University, Vancouver, B.C.

Awards

- 1991 NSERC and FCAR (Quebec) Post-doctoral fellowship (both declined)
- 1990-1991 Max Bell fellowship, McGill University
- 1987-1990 NSERC Post-graduate scholarship
- 1979-1984 Science subvention grant, CDFO; B.C. Packers fisheries scholarship

Recent Work Experience

- 1992- Present Research Scientist, Dept. Fisheries and Oceans. Current research activities:
-Effects of flow regulation on stream ecosystems and salmonid fishes.
-Conservation of threatened salmon populations.
- Ecology of juvenile chinook salmon in the Fraser and Yukon rivers.
- Status of endangered freshwater fish
- 1996-Present Visiting Assistant (1996-1998) and Adjunct Professor, School of Environment and Resource Management, Simon Fraser University. Instructor for graduate class 'Simulation Modeling in Resource Management', graduate student advisor.
- 1984-1987 Research assistant for Dr. R.M. Peterman, Simon Fraser University.

Select Recent Professional Activities

- 2010 Member of expert panel, Pacific Salmon Commission Workshop on the Decline of Fraser River Sockeye Salmon. Nanaimo.

- 2010 Chair, Aquatics Protocol Evaluation Panel, Grand Canyon Adaptive Management Program, Flagstaff Arizona
- 2008 Symposium Chair, AFS Annual Meeting “Hydropower and sustainable fisheries”
- 2007 Project leader, Biological Risk Assessment for Six Invasive Freshwater Fish Species
- 2006 External Reviewer, Canadian Atlantic Salmon Status Review, Moncton NB
- 2006 Invited speaker, Sustainability of the Arctic-Yukon-Kuskokwim salmon fisheries symposium, Anchorage AK.
- 2006 Invited participant, workshop on long-term experimental plan, Grand Canyon Adaptive Management Program, Flagstaff AZ.
- 2004-Present Associate Editor, Canadian Journal of Fisheries and Aquatic Sciences
- 2003-2005 Associate Editor, North American Journal of Fisheries Management
- 2003-2005 Member, Cultus Lake Sockeye Salmon recovery team
- 2003-2005 Member, Interior Fraser Coho Salmon recovery team.
- 1997-Present Member, Salmon Subcommittee, Pacific Science Advice Review Committee, DFO
- 2002 Invited speaker, Oregon salmon habitat restoration workshop, Portland OR.
- 2001 Chair, Protocol Evaluation Panel, Fisheries and Aquatic program review, Grand Canyon Monitoring and Research Center, Flagstaff AZ.
- 2000-2004 Member, NSERC Strategic Grant Team, “New Methods for Forecasting Pacific Salmon Abundances” lead by Dr. Randall Peterman, SFU.

Refereed Publications

- Bradford, M.J., P.S. Higgins, J. Korman and J. Snee. 2011. Does more water mean more fish? Test of an environmental flow release in the Bridge River, British Columbia. *Freshwater Biology*.
- Holt, C.A., and M.J. Bradford. 2011. Evaluating benchmarks of population status for Pacific salmon. *N. Am. J. Fish. Manage.* 31:363-378.
- Bradford, M.J., Lovy, J. and D.A. Patterson. 2010. Infection of gill and kidney of Fraser River sockeye salmon, *Oncorhynchus nerka* (Walbaum), by *Parvicapsula minibicornis* and its effect on host physiology. *J. Fish Diseases* 33:769-779.
- Bradford, M.J., Lovy, J., Patterson, D.A., Speare, D.P., Bennett, W.R., Stobbart, A.R. and Tovey C.P. 2010. *Parvicapsula minibicornis* infections in gill and kidney and the premature mortality of adult sockeye salmon *Oncorhynchus nerka* from Cultus Lake, British Columbia. *Can. J. Fish. Aquat. Sci.* 67:673-683.

- Bradford, M.J., A. von Finster and P., Milligan. 2009. Freshwater life history, habitat, and the production of chinook salmon from the upper Yukon basin. In C. Kruger and C Zimmerman (eds) Sustainability of the Arctic-Yukon-Kuskokwim salmon fisheries. Amer. Fish. Soc. Symp.70.
- Bradford, M.J. and Heinonen J.S. 2008 Low flows, instream flow needs and fish ecology. Canadian Water Resources Journal 33:165-180.
- Decker, A.S., Bradford M.J. and P.S. Higgins. 2008. Rate of biotic colonization following flow restoration below a diversion dam in the Bridge River, British Columbia. Rivers: Research and Management 24:876-883.
- Bradford, M.J., Duncan, J. and J.W. Jang. 2008. Downstream migrations of juvenile salmon and other fishes in the upper Yukon River. Arctic 6:255-264.
- Pestes, L.R., R.M. Peterman, M.J. Bradford and C.C. Wood. 2008. Bayesian decision analysis for evaluating management options to promote recovery of a depleted salmon population. Conservation Biology 22:351-361.
- Bodtker, K.M., R.M. Peterman and M.J. Bradford. 2007. Accounting for uncertainty in estimates of escapement goals for Fraser River sockeye salmon based on productivity of nursery lakes in British Columbia, Canada. N. Amer. J. Fish. Management 27(1):286-302.
- Mossop, B. and M.J. Bradford. 2006. Using thalweg profiling to assess and monitor juvenile salmon (*Oncorhynchus spp.*) habitat in small streams. Can. J. Fish. Aquat. Sci. 63:1515-1525.
- Maxwell, M.R, Peterman, R.M., Bradford, M.J. and E.A. MacIsaac. 2006. A Bayesian analysis of biological uncertainty for a whole-lake fertilization experiment for sockeye salmon in Chilko Lake, British Columbia, and implications for the benefit-cost ratio. N. Am. J. Fish. Manage. 26(2):418-430
- Bradford, M.J., J. Korman and P.S. Higgins. 2005. Using confidence intervals to estimate the response of salmon populations to experimental habitat alterations. Can. J. Fish. Aquat. Sci. 62:2716-2726.
- Mossop, B. and M.J. Bradford. 2004. Importance of large woody debris for juvenile chinook salmon habitat in small boreal forest streams in the upper Yukon River basin, Canada. Can. J. For. Res. 34:1955-1936.
- Perry, R.W., M.J. Bradford and J.A. Grout. 2003. Effects of disturbance on contribution of energy sources to growth of juvenile chinook salmon (*Oncorhynchus tshawytscha*) in boreal streams. Can. J. Fish. Aquat. Sci. 60:390-400.
- Knowler, D.J., B.W. Macgregor, M.J. Bradford and R.M. Peterman. 2003. Valuing freshwater salmon habitat on the west coast of Canada. J. Environmental Management. 69:261-273.
- MacGregor, B.W., R.M. Peterman, B.J. Pyper, and M.J. Bradford. 2002. A decision analysis framework for comparing designs of projects to enhance Pacific salmon. N. Am. J. Fish. Management 22:509-527.
- Bradford, M.J., S. Moodie, J. Grout. 2001. Use of a small non-natal stream of the Yukon River by juvenile chinook salmon, and the role of ice conditions in their survival. Can. J. Zool. 2043-2054.
- Bradford, M.J. and P.S. Higgins. 2001. Habitat, season, and size-specific variation in daily activity patterns of juvenile chinook salmon (*Oncorhynchus tshawytscha*) and steelhead trout (*O. mykiss*). Can. J. Fish. Aquat. Sci. 58:365-374
- Bradford, M.J., B. J. Pyper and K.S. Shortreed. 2000. Biological responses of sockeye salmon to the fertilization of Chilko Lake, British Columbia. N. Am. J. Fish. Manage. 20:661-671.
- Roff, D.A. and M.J. Bradford, 2000. A quantitative genetic analysis of phenotypic plasticity of diapause induction in the

- Powles, H., M.J. Bradford, R.G. Bradford, W.G. Doubleday, S. Innes, C.D. Levings. 2000. Assessing and protecting endangered marine species. ICES J. Marine. Sci. 57:669-676.
- Bradford, M.J., R.A. Myers and J.R. Irvine. 2000. Reference points for coho salmon harvest rates and escapement goals based on freshwater production. Can J. Fish. Aquat. Sci. 57:677-686.
- Bradford, M.J. and J.R. Irvine. 2000. Land use, fishing, climate change, and the decline of Thompson River, British Columbia, coho salmon. Can. J. Fish. Aquat. Sci. 57:13-16.
- Bradford, M.J. 1999. Temporal and spatial trends in the abundance of coho salmon smolts from western North America. Trans. Am. Fish. Soc. 128:840-846.
- Roff, D.A. and M.J. Bradford. 1998. The evolution of shape variation in the dimorphic cricket, *Allonemobius socius*. Heredity 80:446-455
- Myers, R.A., G. Mertz, J.M. Bridson and M.J. Bradford. 1998. Simple dynamics underlie sockeye salmon (*Oncorhynchus nerka*) cycles. Can. J. Fish. Aquat. Sci. 55:2355-2364
- Myers, R.A., M.J. Bradford, G. Mertz and J.M. Bridson. 1997. Estimating delayed density-dependent mortality in sockeye salmon, *Oncorhynchus nerka*: a meta-analytic approach. Can. J. Fish. Aquat. Sci. 54:2449-2462
- Bradford, M.J. and G.C. Taylor. 1997. Variation in dispersal behaviour of newly emerged chinook salmon (*Oncorhynchus tshawytscha*) from the upper Fraser River system, British Columbia. Can. J. Fish. Aquat. Sci. 54:1585-1592.
- Bradford, M.J. 1997. Experimental study of stranding of juvenile salmonids on gravel bars and in sidechannels during rapid flow decreases. Regulated Rivers: Research and Management 13:395-401
- Bradford, M.J., G.C. Taylor and J.A. Allan. 1997. Empirical review of coho salmon smolt abundance and the prediction of smolt production at the regional level. Transactions of the American Fisheries Society 126:49-64
- Bradford, M.J. and D.A. Roff. 1997. Seasonality, uncertainty and insect dormancy: an empirical model of diapause strategies in the cricket *Allonemobius socius*. Ecology 78:441-452.
- Bradford, M.J. and G. Cabana. 1997. Interannual variation in stage-specific survival rates and the causes of recruitment variation. In R.C. Chambers and E.A. Trippel (eds.) Early life history and recruitment in fish populations. Chapman and Hall, New York.
- Higgins. P.S. and M.J. Bradford. 1996 Evaluation of a large-scale fish salvage to reduce the impacts of a controlled flow reduction in a regulated river. North American Journal of Fisheries Management 16:666-673.
- Roff, D.A. and M.J. Bradford. 1996. The quantitative genetics of fecundity and wing dimorphism in the cricket *Allonemobius socius*. Heredity 76:178-185.
- Bradford, M.J. 1995. Comparative analysis of Pacific salmon survival rates. Can. J. Fish. Aquat. Sci. 52:1327-1338.
- Bradford, M.J. and D.A. Roff. 1995. Genetic and phenotypic sources of life history variation along a cline in voltinism in the cricket *Allonemobius socius*. Oecologia 103:319-326.
- Bradford, M.J., G.C. Taylor, J.A. Allan and P.S. Higgins. 1995. Stranding of juvenile coho salmon and rainbow trout during rapid flow decreases in simulated winter conditions. North American Journal of Fisheries Management 15:473-479.

- Bradford, M.J. 1994. Trends in the abundance of chinook salmon from the Nechako River, British Columbia. *Can. J. Fish. Aquat. Sci.* 51:965-973.
- Bradford, M.J. and D.A. Roff. 1993. Bet-hedging and phenotypic plasticity in the diapause strategies of the cricket *Allonemobius fasciatus*. *Ecology* 74:1129-1135.
- Bradford, M.J., P.A. Guerette and D.A. Roff. 1992 Testing adaptive hypotheses of cricket ovipositor length. *Oecologia* 93:263-267.
- Bradford, M.J. 1992. Strength and precision of recruitment predictions from the early life stages of marine fishes. *Fishery Bulletin* 90:439-453.
- Bradford, M.J. and G.H. Geen. 1992. Growth estimates from otolith increment widths of juvenile chinook salmon (*Oncorhynchus tshawytscha*) reared in varying environments. *Journal of Fish Biology* 41:825-832.
- Bradford, M.J. 1991. Effects of ageing errors on recruitment time series reconstructed from sequential population analysis. *Can. J. Fish. Aquat. Sci.* 47:555-559.
- Bradford, M.J. and R.M. Peterman. 1989. Incorrect parameter estimates used in virtual population analysis (VPA) generate spurious trends in reconstructed abundances. In R.J. Beamish and G.A. McFarlane (eds.) *Effects of ocean variability on recruitment and an evaluation of parameters used in stock assessment models*. *Can. Spec. Publ. Aquat. Sci.* 108.
- Peterman, R.M., M.J. Bradford, N.C.H. Lo and R.D. Methot. 1988. Contribution of early life stages to interannual variability in recruitment of northern anchovy (*Engraulis mordax*). *Can. J. Fish. Aquat. Sci.* 45:8-16.
- Peterman, R.M. and M.J. Bradford. 1987. Wind index and mortality index of a marine fish, the northern anchovy, (*Engraulis mordax*). *Science* 235:354-356.
- Bradford, M.J. and R.M. Peterman. 1987. Maternal size may explain positive correlations between age at maturity of parent and offspring sockeye salmon (*Oncorhynchus nerka*), p. 90-100. In H.D. Smith, L. Margolis and C.C. Wood (eds.). *Sockeye salmon, population biology and management*. *Can. Spec. Publ. Fish. Aquat. Sci.* 96.
- Peterman, R.M., M.J. Bradford and G.H. Kruse. 1987. Simulation model of English sole (*Parophrys vetulus*) in Washington and Oregon coastal waters. *Can. J. Fish. Aquat. Sci.* 44:1870-1878.
- Peterman, M.J. and M.J. Bradford. 1987. Statistical power of trends in fish abundance. *Can. J. Fish. Aquat. Sci.* 44:1879-1889.
- Peterman, R.M., M.J. Bradford. 1987. Density-dependent growth of English sole (*Parophrys vetulus*) in Washington and Oregon coastal waters. *Can. J. Fish. Aquat. Sci.* 43:48-53.
- Peterman, R.M., M.J. Bradford and J.L. Anderson. 1986. Environmental and parental influences on age at maturity in sockeye salmon (*Oncorhynchus nerka*) from the Fraser River, British Columbia. *Can. J. Fish. Aquat. Sci.* 42:269-274.
- Bradford, M.J. and G.H. Geen. 1987. Size and growth of juvenile chinook salmon back-calculated from otolith growth increments. P 453-461 in R.C. Sommerfelt and G.E. Hall (eds.). *The age and growth of fish*. Iowa State Univ. Press. Ames, IA.
- Shardlow, T., R. Hilborn, R.M. Peterman, G.J. Steer and M.J. Bradford. 1985. Density dependent catchability coefficients. *Trans. Amer. Fish. Soc.* 114:436-440.

Geen G.H., J.D. Neilson and M.J. Bradford. 1985. Effects of pH on the early development and growth and otolith microstructure of chinook salmon. *Can. J. Zool.* 63:22-27.

OTHER PUBLICATIONS

- Peterman R.M., D. Marmorek, B. Beckman, M. Bradford, N. Mantua, B.E. Riddell, M. Scheuerell, M. Staley, K. Wieckowski, J.R. Winton, C.C. Wood. 2010. Synthesis of evidence from a workshop on the decline of Fraser River sockeye. June 15-17, 2010. A Report to the Pacific Salmon Commission, Vancouver, B.C.
- Pon, L.B., Tovey, C.P., Bradford, M.J., MacLellan, S.G., and Hume, J.M.B. 2010. Depth and thermal histories of adult sockeye salmon (*Oncorhynchus nerka*) in Cultus Lake in 2006 and 2007. Can. Tech. Rep. Fish. Aquat. Sci. 2867: iii + 39 p.
- Bradford, M.J., Hume, J.M.B., Withler, R.E., Lofthouse, D., Barnetson, S. Grant, S., Folkes, M., Schubert, N., Huang, A-M. 2010. Status of Cultus Lake sockeye salmon. DFO Can. Sci. Advis. Sec. Res. Doc. 2010/nnn. vi + xx p.
- Brown, T.G., Runciman, B., Bradford, M.J. and Pollard, S. 2009. A biological synopsis of yellow perch (*Perca flavescens*). Can. Man. Rept. Fish. Aquat. Sci. 2887.
- Brown, T.G., Runciman, B., Pollard, S., Grant, A.D.A., and M.J. Bradford. Biological synopsis of smallmouth bass (*Micropterus dolomieu*). Can. Man. Rept. Fish. Aquat. Sci. 2887.
- Bradford, M.J., C.P. Tovey and Herborg, L.M. 2008. Biological Risk Assessment for Yellow Perch (*Perca flavescens*) in British Columbia. Canadian Science Advice Secretariat Res. Doc 2008:073.
- Bradford, M.J., C.P. Tovey and Herborg, L.M. 2008. Biological Risk Assessment for Northern Pike (*Esox lucius*), Pumpkinseed (*Lepomis gibbosus*), and Walleye (*Sander vitreus*) in British Columbia. Canadian Science Advice Secretariat Res. Doc 2008:074.
- Tovey, C.P., M.J. Bradford and Herborg, L.M. 2008. Biological Risk Assessment for Smallmouth Bass (*Micropterus dolomieu*) and Largemouth bass (*Micropterus salmoides*) in British Columbia. Canadian Science Advice Secretariat Res. Doc 2008:075.
- Bradford, M.J., J. Amos, C.P. Tovey, J.M.B. Hume, S. Grant, and B. Mossop. 2007. Abundance and migratory behaviour of northern pikeminnow (*Ptychocheilus oregonensis*) in Cultus Lake, British Columbia and implications for predator control. Can. Tech. Rept. Fish. Aquat. Sci. 2723.
- Bradford, M.J. and C.C. Wood. 2004. A review of biological principles and methods involved in setting minimum population sizes and recovery objectives for the September 2004 drafts of the Cultus and Sakinaw Lake sockeye salmon and Interior Fraser coho salmon recovery plans. Canadian Scientific Advisory Secretariat Res. Doc. 2004/128
- Hatfield, T, Lewis, A., Ohlsen, D. and M.J. Bradford 2004. Development of instream flow thresholds as guidelines for reviewing proposed water uses. Report to the Province of British Columbia.
- Cultus Sockeye Recovery Team. 2004. National recovery strategy for sockeye salmon (*Oncorhynchus nerka*), Cultus Lake population, in British Columbia. National Recovery Strategy No. XXX. Recovery of Nationally Endangered Wildlife (RENEW). Ottawa, Ontario, 57 pp.
- Interior Fraser Coho Recovery Team. (2004). National recovery strategy for coho salmon (*Oncorhynchus kisutch*) in the Interior Fraser River watershed, British Columbia, Consultative Draft. 124 pp
- Mossop, B. and M.J. Bradford. 2004. Effects of marine and freshwater environmental variables on the survival rates of Thompson River coho salmon. Contract report to Randall Peterman, SFU.
- Bradford, M.J. and T. Hatfield. 2004. Development of instream flow screening tool and guidelines for small hydro in the

Pacific Region. Pp 71-72 in Randall, R.G. et al. eds. Science technology transfer workshop- science contributions towards improving fish habitat management. CSAS Proceedings Series 2004/10.

- Jang, J. and M.J. Bradford. Yukon River Juvenile Chinook and Chum Salmon Out-Migration Timing and Sampling Characteristics as Determined Using a Rotary Auger Trap, 2002. Contract report to the Yukon River Panel. Whitehorse YT.
- Bradford, M.J., and five coauthors. 2001. Report of the Aquatic Protocol Evaluation Program Panel. For: Grand Canyon Monitoring And Research Center, Protocols Evaluation Program. 43pp.
- Irvine, J.R. and M.J. Bradford. 2000. Declines in the abundance of Thompson River coho salmon in the interior of southern British Columbia, and Canada's coho recovery plan In L. Darling (editor). Proceedings Biology and Management of Species and Habitats At Risk conference, 15 – 19 February, 1999, University College of the Cariboo, Kamloops, B.C. B.C. Environment, Wildlife Branch, Victoria, B.C. and University College of the Cariboo, Kamloops. B.C.
- Irvine, J.R., R. E. Bailey, M. J. Bradford, R. K. Kadowaki, and W. S. Shaw. 1999 Assessment of Thompson River/Upper Fraser River Coho Salmon. Can. Stock Assess. Secretariat Res. Doc. 99/128.
- Bradford, M.J. 1998. A risk assessment for Thompson River coho salmon. Canadian Stock Assessment Secretariat Report 98/92.
- Bradford, M.J. 1997. Partitioning mortality in Pacific salmon. In RL Emmett and MH Schiewe (eds.). Estuarine and ocean survival of Northeastern Pacific Ocean. NOAA/NMFS-NWFSC-29.
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- Taylor, G.C., J. A. Allan and M.J. Bradford. 1995. Juvenile chinook sampling data, Slim Creek, and Fraser River mainstem, British Columbia, 1994. Can. Data Rept. Fish. Aquat. Sci. 964
- Allan, J.A., Taylor, G.C., and M.J. Bradford. 1995. Juvenile chinook sampling data, Chilcotin watershed, British Columbia, 1994. Can. Data Rept. Fish. Aquat. Sci. 942
- Bradford, M.J. and G.C. Taylor. 1995. An update on methods for measuring the intragravel environment of incubating salmon eggs and larvae. Can. Tech. Rept. Fish. Aquat. Sci. 2025.
- Taylor, G.C., J. A. Allan and M.J. Bradford. 1994. Juvenile chinook sampling data, Slim Creek, British Columbia, 1993. Can. Data Rept. Fish. Aquat. Sci. 942
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