

David A. Patterson

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Work Experience:

Program Head for Environmental Watch Program, Science Branch, Fisheries and Oceans Canada, Cooperative Resource Management Institute, Resource Environmental Management, Simon Fraser University, Burnaby, B.C. 2004 to Present.

- Manage a scientific research program that focuses on understanding the impact of freshwater environmental conditions of migration success for Pacific salmon
- Oversee an extensive river temperature monitoring network (real time and logged)
- Responsible for generating seasonal environmental river forecasts for use in sockeye salmon fisheries management
- Research the development of quantitative fish mortality models for fisheries and habitat management (e.g. sockeye salmon mortality models, hydro water releases strategies)
- Oversee a physiology research lab that specializes in tissue assays for assessing energetic state, stress condition, reproductive status, and ion regulation for adult and juvenile salmon
- Conduct and participate in collaborative field research projects specializing in field physiology for Pacific salmon. (e.g. adult salmon thermal ecology, biotelemetry, capture stress, freshwater habitat assessments limiting salmon productive capacity; smolt migrations – See Major Research Projects below)
- Provide scientific advice to DFO resource management, DFO habitat management, and Canada/US Fraser River Panel on the impacts of freshwater factors on the survival of Pacific salmon.
- Pacific region representative on DFO's National Science Freshwater Monitoring Plan
- Write and contribute to primary and technical papers on salmon biology and freshwater habitat issues (See Publications below)

Habitat Research Biologist : Freshwater Habitat Science, Fisheries and Oceans, CRMI, REM, Simon Fraser University. Burnaby, BC. 2000 to 2004.

- Research the impact of temperature and discharge on adult sockeye salmon migration physiology
- Research the impact of parental migration experience on offspring fitness
- Quantitative modeling of environmental forecasts and salmon migration survival estimates

Habitat Research Technician: Fish/Forestry Interaction Program, Fisheries and Oceans Canada, West Vancouver. BC. 1993 to 1999

- Responsible for the implementation of field and laboratory research projects related to impact of forest harvesting on salmon habitat in northern BC.

Major Research Projects: (role; partners; funding source; year)

- Cumulative effects and multiple scales; case studies of the development of habitat-population assessment tools using Fraser River salmon (Principle Investigator; UBC, SFU; Centre of Expertise for Aquatic Habitat Research; 2009-2012)
- Rescue, compilation, archiving and accessing of multi-regional freshwater temperature data (P.I.; DFO science regions; National Science Data Management Committee; 2008-2011)
- Thermal aspects of fish entrainment risk in Kinbasket Reservoir with relevance to other large hydropower facilities in Canada. (P. I.; Carleton, Waterloo, U.of A., BC Hydro; Centre for Expertise on Hydropower impacts on fish and fish habitat; 2010-2013)
- Predicting the magnitude and timeline of climate change effects on spawning migration success for major populations of Fraser River salmon and implications for fisheries. (P.I.; UBC, Rutgers; SEF; 2008-09)
- Evaluation of potential freshwater factors influencing the decline of Early and Late Stuart sockeye salmon (P.I.; DFO Science; SEF; 2007-08)
- Improvements to Environmental Management Models (Project Manager; DFO-PSC, SEF; 2006-08)
- Prediction of migratory and reproductive success in Fraser sockeye (P.I.; PSC; SEF; 2004-05)
- Increasing the sustainability of multi-sector Pacific salmon fisheries in coastal rivers of British Columbia by quantifying and reducing mortality of released fish (Collaborator; Carleton, UBC; NSERC; 2009-2011)
- Genomic tools for fisheries management (Collaborator; UBC; Genomics BC; 2008-12)
- Climate warming and high salmon migration mortality (Collaborator; UBC, DFO, Carleton; NSERC; 2007-11)
- Sockeye salmon hook and release study; physiology and long term survival component (Partner; PSF, UBC, Carleton; PICFI; 2008-2011)
- Seton dam fishway, power house diversion, and Fraser River warming: factors limiting the production of Seton-Anderson watershed sockeye (Partner; UBC, Carleton; BCRP; 2007-08)
- Investigations to determine the cause of early migration behaviour and magnitude of in-river survival and losses above Mission for adult Late-run Fraser River sockeye (Co-investigator; UBC, Carleton, LGL, Kintama; SEF; 2006-07)

Education

2004 Simon Fraser University, Burnaby, BC
Masters of Science, Biological Sciences

1994 Simon Fraser University, Burnaby, BC
Bachelor of Science: Biology Major
Environmental Toxicology Minor,

Scientific Contributions

Adjunct Professor – School of Resource and Environmental Management, Simon Fraser University

Graduate Student Committee Member:

Jonathan Cummings, MSc. Simon Fraser University

Peter Katinic, MSc. Simon Fraser University

David Roscoe, MSc. University of British Columbia.

Jennifer Burt, MSc. University of British Columbia

Patrick Nadeau, MSc. University of British Columbia

Marika Gale, MSc. Universty of British Columbia

Reviewer:

Canadian Journal Fisheries and Aquatic Sciences

Journal of Fish Biology

Transactions of the American Fisheries Society

North American Journal of Fisheries Management

Primary Publications:

Burt, J., S.G. Hinch, and **D.A. Patterson**. The importance of parentage in assessing temperature effects on fish early life history. Reviews in Fish Biology. *Accepted*.

Cummings, J.W., M.J. Hague, **D.A. Patterson**, and R.M. Peterman. The impact of management objectives and performance measures on model selection for Fraser River sockeye salmon. North American Journal of Fisheries Management. *Accepted*

Donaldson, M.R., T.D. Clark, S.G. Hinch, S.J. Cooke, **D.A. Patterson**, M.K. Gale, and A.P. Farrell. 2010. The consequences of predator and fisheries encounters on free-swimming adult coho salmon (*Oncorhynchus kisutch*). Physiological and Biochemical Zoology *Accepted*.

Donaldson, M.R., S.G. Hinch, **D.A. Patterson**, J. Hills, J.O. Thomas, S.J. Cooke, G.D. Raby, L.A. Thompson, D. Robichaud, K.K. English, and A.P. Farrell.. The consequences of angling and beach seine capture

on the physiology, post-release behaviour and survival of adult sockeye salmon during upriver migration. Fisheries Research. *Accepted*.

- Hruska, K.A., S.G. Hinch, **D.A. Patterson**, Healey, M.C. Egg retention in relation to arrival timing and reproductive longevity in female sockeye salmon (*Oncorhynchus nerka*). Canadian Journal of Fisheries and Aquatic Sciences, *in press*
- Miller, K.M., S. Li, K.H. Kaukinen, N. Ginther, E. Hammill, J.M.R. Curtis, **D.A. Patterson**, T. Sierocinski, L. Donnison, P. Pavlidis, S.G. Hinch, K.A. Hruska, S.J. Cooke, K.K. English, and A.P. Farrell. Genomic signatures predict migration and spawning failure in wild Canadian salmon. Science. *In Press*.
- Roscoe, D.W., S.G. Hinch, S.J. Cooke, and **D.A. Patterson**. Fishway passage and post-passage mortality of up-river migrating sockeye salmon in the Seton River, British Columbia. River Research and Applications *In press*.
- Hague, M. J., M. R. Ferrari, J. R. Miller, **D. A. Patterson**, G. L. Russell, A. P. Farrell, and S. G. Hinch. 2011. Modelling the future hydroclimatology of the lower Fraser River and its impacts on the spawning migration survival of sockeye salmon. Global Change Biology 17(1):87-98.
- Martins, E. G., S. G. Hinch, **D. A. Patterson**, M. J. Hague, S. J. Cooke, K. M. Miller, M. F. Lapointe, K. K. English, and A. P. Farrell. 2011. Effects of river temperature and climate warming on stock-specific survival of adult migrating Fraser River sockeye salmon (*Oncorhynchus nerka*). Global Change Biology 17(1):99-114.
- Bradford, M. J., J. Lovy, 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. Journal of Fish Diseases 33(9):769-779.
- Bradford, M. J., J. Lovy, **D. A. Patterson**, D. A. Speare, W. R. Bennett, A. R. Stobbart, and C. P. Tovey. 2010. *Parvicapsula minibicornis* infections in gill and kidney and the premature mortality of adult sockeye salmon *Oncorhynchus nerka* from Cultus Lake, British Columbia. Canadian Journal of Fisheries and Aquatic Sciences 67(4):673-683.
- Clark, T. D., E. Sandblom, S. G. Hinch, **D. A. Patterson**, P. B. Frappell, and A. P. Farrell. 2010. Simultaneous biologging of heart rates and acceleration, and their relationships with energy expenditure in free-swimming sockeye salmon (*Oncorhynchus nerka*). Journal of Comparative Physiology B: Biochemical, Systemic, and Environmental Physiology 180(5):673-684.
- Cooperman, M. S., S. G. Hinch, G. T. Crossin, S. J. Cooke, **D. A. Patterson**, I. Olsson, A. G. Lotto, D. W. Welch, J. M. Shrimpton, G. Van Der Kraak, and A. P. Farrell. 2010. Effects of experimental manipulations of salinity and maturation status on the physiological condition and mortality of homing adult sockeye salmon held in a laboratory. Physiological and Biochemical Zoology 83(3):459-472.
- Crossin, G. T., S. G. Hinch, S. J. Cooke, **D. A. Patterson**, A. G. Lotto, G. Van Der Kraak, Y. Zohar, U. Klenke, and A. P. Farrell. 2010. Testing the synergistic effects of GnRH and testosterone on the reproductive physiology of pre-adult pink salmon *Oncorhynchus gorbuscha*. Journal of Fish Biology 76(1):112-128.

- Donaldson, M. R., S. G. Hinch, **D. A. Patterson**, A. P. Farrell, J. M. Shrimpton, K. M. Miller-Saunders, D. Robichaud, J. Hills, K. A. Hruska, K. C. Hanson, K. K. English, G. Van Der Kraak, and S. J. Cooke. 2010. Physiological condition differentially affects the behavior and survival of two populations of sockeye salmon during their freshwater spawning migration. *Physiological and Biochemical Zoology* 83(3):446-458.
- Hruska, K. A., S. G. Hinch, M. C. Healey, **D. A. Patterson**, S. Larsson, and A. P. Farrell. 2010. Influences of sex and activity level on physiological changes in individual adult sockeye salmon during rapid senescence. *Physiological and Biochemical Zoology* 83(4):663-676.
- Macdonald, J. S., **D. A. Patterson**, M. J. Hague, and I. C. Guthrie. 2010. Modeling the influence of environmental factors on spawning migration mortality for sockeye salmon fisheries management in the Fraser River, British Columbia. *Transactions of the American Fisheries Society* 139(3):768-782.
- Mathes, M. T., S. G. Hinch, S. J. Cooke, G. T. Crossin, **D. A. Patterson**, A. G. Lotto, and A. P. Farrell. 2010. Effect of water temperature, timing, physiological condition, and lake thermal refugia on migrating adult Weaver Creek sockeye salmon (*Oncorhynchus nerka*). *Canadian Journal of Fisheries and Aquatic Sciences* 67(1):70-84.
- Nadeau, P. S., S. G. Hinch, K. A. Hruska, L. B. Pon, and **D. A. Patterson**. 2010. The effects of experimental energy depletion on the physiological condition and survival of adult sockeye salmon (*Oncorhynchus nerka*) during spawning migration. *Environmental Biology of Fishes* 88(3):241-251.
- Roscoe, D. W., S. G. Hinch, S. J. Cooke, and **D. A. Patterson**. 2010. Behaviour and thermal experience of adult sockeye salmon migrating through stratified lakes near spawning grounds: the roles of reproductive and energetic states. *Ecology of Freshwater Fish* 19(1):51-62.
- Cooke, S. J., M. R. Donaldson, S. G. Hinch, G. T. Crossin, **D. A. Patterson**, K. C. Hanson, K. K. English, J. M. Shrimpton, and A. P. Farrell. 2009. Is fishing selective for physiological and energetic characteristics in migratory adult sockeye salmon? *Evolutionary Applications* 2(3):299-311.
- Crossin, G. T., S. G. Hinch, S. J. Cooke, M. S. Cooperman, **D. A. Patterson**, D. W. Welch, K. C. Hanson, I. Olsson, K. K. English, and A. P. Farrell. 2009. Mechanisms influencing the timing and success of reproductive migration in a capital breeding semelparous fish species, the sockeye salmon. *Physiological and Biochemical Zoology* 82(6):635-652.
- Crossin, G. T., S. G. Hinch, D. W. Welch, S. J. Cooke, **D. A. Patterson**, J. A. Hills, Y. Zohar, U. Klenke, M. C. Jacobs, L. B. Pon, P. M. Winchell, and A. P. Farrell. 2009. Physiological profiles of sockeye salmon in the Northeastern Pacific Ocean and the effects of exogenous GnRH and testosterone on rates of homeward migration *Marine and Freshwater Behaviour and Physiology* 42(2):89-108.
- Donaldson, M. R., S. J. Cooke, **D. A. Patterson**, S. G. Hinch, D. Robichaud, K. C. Hanson, I. Olsson, G. T. Crossin, K. K. English, and A. P. Farrell. 2009. Limited behavioural thermoregulation by adult upriver-migrating sockeye salmon (*Oncorhynchus nerka*) in the lower Fraser River, British Columbia. *Canadian Journal of Zoology* 87(6):480-490.
- Hasler, C. T., L. B. Pon, D. W. Roscoe, B. Mossop, **D. A. Patterson**, S. G. Hinch, and S. J. Cooke. 2009. Expanding the "toolbox" for studying the biological responses of individual fish to hydropower infrastructure and operating strategies. *Environmental Reviews* 17(1):179-197.

- Macdonald, R. W., V. Forsland, R. E. Withler, **D. A. Patterson**, and A. Demsky. 2009. The use of stable oxygen isotope ($\delta^{18}\text{O}$) composition in sockeye salmon body fluid to determine whether a fish has been caught in freshwater. *North American Journal of Fisheries Management* 29(3):560-569.
- Miller, K. M., A. D. Schulze, N. Ginther, S. Li, **D. A. Patterson**, A. P. Farrell, and S. G. Hinch. 2009. Salmon spawning migration: metabolic shifts and environmental triggers. *Comparative Biochemistry and Physiology - Part D: Genomics and Proteomics* 4(2):75-89.
- Nadeau, P. S., S. G. Hinch, L. B. Pon, and **D. A. Patterson**. 2009. Persistent parental effects on the survival and size, but not burst swimming performance of juvenile sockeye salmon *Oncorhynchus nerka*. *Journal of Fish Biology* 75(3):538-551.
- Pon, L. B., S. G. Hinch, S. J. Cooke, **D. A. Patterson**, and A. P. Farrell. 2009. A comparison of the physiological condition, and fishway passage time and success of migrant adult sockeye salmon at Seton River Dam, British Columbia, under three operational water discharge rates. *North American Journal of Fisheries Management* 29(5):1195-1205.
- Pon, L. B., S. G. Hinch, S. J. Cooke, **D. A. Patterson**, and A. P. Farrell. 2009. Physiological, energetic and behavioural correlates of successful fishway passage of adult sockeye salmon *Oncorhynchus nerka* in the Seton River, British Columbia *Journal of Fish Biology* 74(6):1323-1336.
- Tierney, K. B., **D. A. Patterson**, and C. J. Kennedy. 2009. The influence of maternal condition on offspring performance in sockeye salmon *Oncorhynchus nerka*. *Journal of Fish Biology* 75(6):1244-1257.
- Hanson, K.C., Cooke, S.J., Hinch, S.G., Crossin, G.T., **Patterson, D.A.**, English, K.K., Donaldson, M.R., Shrimpton, J.M., Van Der Kraak, G., and Farrell, A.P. 2008. Individual variation in migration speed of upriver-migrating sockeye salmon in the Fraser River in relation to their physiological and energetic status. *Physiol. Biochem. Zool.* **81**(3): 255-268.
- Farrell, A.P., Hinch, S.G., Cooke, S.J., **Patterson, D.A.**, Crossin, G.T., Lapointe, M., and Mathes, M.T. 2008. Pacific salmon in hot water: applying aerobic scope models and biotelemetry to predict the success of spawning migrations. *Physiol. Biochem. Zool.* **81**(6): 697-708.
- Donaldson, M.R., Cooke, S.J., **Patterson, D.A.**, and Macdonald, J.S. 2008. Cold shock and fish. *J. Fish Biol.* **73**(7): 1491-1530.
- Crossin, G.T., Hinch, S.G., Cooke, S.J., Welch, D.W., **Patterson, D.A.**, Jones, S.R.M., Lotto, A.G., Leggatt, R.A., Mathes, M.T., Shrimpton, J.M., Van Der Kraak, G., and Farrell, A.P. 2008. Exposure to high temperature influences the behaviour, physiology, and survival of sockeye salmon during spawning migration *Can. J. Zool.* **86**(2): 127-140.
- Cooke, S.J., Hinch, S.G., Farrell, A.P., **Patterson, D.A.**, Miller-Saunders, K., Welch, D.W., Donaldson, M.R., Hanson, K.C., Crossin, G.T., Mathes, M.T., Lotto, A.G., Hruska, K.A., Olsson, I.C., Wagner, G.N., Thomson, R., Hourston, R., English, K.K., Larsson, S., Shrimpton, J.M., and Van Der Kraak, G. 2008. Developing a mechanistic understanding of fish migrations by linking telemetry with physiology, behavior, genomics and experimental biology: an interdisciplinary case study on adult Fraser River sockeye salmon. *Fisheries* **33**(7): 321-338.
- Cooke, S.J., Hinch, S.G., Crossin, G.T., **Patterson, D.A.**, English, K.K., Healey, M.C., Macdonald, J.S., Shrimpton, J.M., Young, J.L., Lister, A., Van Der Kraak, G., and Farrell, A.P. 2008. Physiological

correlates of coastal arrival and river entry timing in late summer Fraser River sockeye salmon (*Oncorhynchus nerka*) Behav. Ecol. **19**(4): 747-758.

- Patterson, D.A.**, Skibo, K.M., Barnes, D., Hills, J.A., and Macdonald, J.S. 2007. The influence of water temperature on time to surface for adult sockeye salmon carcasses and the limitations in estimating salmon carcasses in the Fraser River, British Columbia. N. Amer. J. Fish. Manage. **27**(3): 878-884.
- Miller, K.M., Kaukinen, K.H., Li, S., Farrell, A.P., and **Patterson, D.A.** 2007. Expression profiling of Fraser River late-run sockeye salmon: migration physiology uncovered using cDNA microarray technology *In* Sockeye Salmon Evolution, Ecology, and Management. Edited by C.A. Woody. American Fisheries Society Symposium, Bethesda, Maryland. pp. 101-103.
- Crossin, G.T., Hinch, S.G., Cooke, S.J., Welch, D.W., Batten, S.D., **Patterson, D.A.**, Van Der Kraak, G., Shrimpton, J.M., and Farrell, A.P. 2007. Behaviour and physiology of sockeye salmon homing through coastal waters to a natal river. Mar. Biol. **152**(4): 905-918.
- Young, J.L., Hinch, S.G., Cooke, S.J., Crossin, G.T., **Patterson, D.A.**, Farrell, A.P., Van Der Kraak, G., Lotto, A.G., Lister, A., Healey, M.C., and English, K.K. 2006. Physiological and energetic correlates of en route mortality for abnormally early migrating adult sockeye salmon (*Oncorhynchus nerka*) in the Thompson River, British Columbia Can. J. Fish. Aquat. Sci. **63**(5): 1067-1077.
- Wagner, G.N., Kuchel, L.J., Lotto, A.G., **Patterson, D.A.**, Shrimpton, J.M., Hinch, S.G., and Farrell, A.P. 2006. Routine and active metabolic rates of migrating adult wild sockeye salmon (*Oncorhynchus nerka* Walbaum) in seawater and freshwater. Physiol. Biochem. Zool. **79**(1): 100-108.
- Magnoni, L.J., **Patterson, D.A.**, Farrell, A.P., and Weber, J.-M. 2006. Effects of long-distance migration on circulating lipids of sockeye salmon (*Oncorhynchus nerka*). Can. J. Fish. Aquat. Sci. **63**(8): 1822-1829.
- Cooke, S.J., Hinch, S.G., Crossin, G.T., **Patterson, D.A.**, English, K.K., Shrimpton, J.M., Van Der Kraak, G., and Farrell, A.P. 2006. Physiology of individual late-run Fraser River sockeye salmon (*Oncorhynchus nerka*) sampled in the ocean correlates with fate during spawning migration Can. J. Fish. Aquat. Sci. **63**(7): 1469-1480.
- Cooke, S.J., Hinch, S.G., Crossin, G.T., **Patterson, D.A.**, English, K.K., Healey, C.G., Shrimpton, J.M., Van Der Kraak, G., and Farrell, A.P. 2006. Mechanistic basis of individual mortality in Pacific salmon during spawning migrations. Ecology **87**(6): 1575-1586.
- Wagner, G.N., Hinch, S.G., Kuchel, L.J., Lotto, A.G., Jones, S.R.M., **Patterson, D.A.**, Macdonald, J.S., Van Der Kraak, G., Shrimpton, J.M., English, K.K., Larsson, S., Cooke, S.J., Healey, M.C., and Farrell, A.P. 2005. Metabolic rates and swimming performance of adult Fraser River sockeye salmon (*Oncorhynchus nerka*) after a controlled infection with *Parvicapsula minibicornis* Can. J. Fish. Aquat. Sci. **62**(9): 2124-2133.
- Shrimpton, J.M., **Patterson, D.A.**, Richards, J.G., Cooke, S.J., Schulte, P.M., Hinch, S.G., and Farrell, A.P. 2005. Ionregulatory changes in different populations of maturing sockeye salmon *Oncorhynchus nerka* during ocean and river migration. J. Exp. Biol. **208**(21): 4069-4078.
- Cooke, S.J., Crossin, G.T., **Patterson, D.A.**, English, K., Hinch, S.G., Young, J.L., Alexander, R., Healey, M.C., and Farrell, A.P. 2005. Coupling non-invasive physiological and energetic assessments with

telemetry to understand inter-individual variation in behaviour and survivorship of fish: development and validation of a technique. *J. Fish Biol.* **67**(5): 1342-1358.

Patterson, D.A., Macdonald, J.S., Hinch, S.G., Healey, M.C., and Farrell, A.P. 2004. The effect of exercise and captivity on energy partitioning, reproductive maturation and fertilization success in adult sockeye salmon. *J. Fish Biol.* **64**(4): 1039-1059.

Cooke, S.J., Hinch, S.G., Farrell, A.P., Lapointe, M., Jones, S.R.M., Macdonald, J.S., **Patterson, D.A.**, Healey, M.C., and Van Der Kraak, G. 2004. Abnormal migration timing and high en route mortality of sockeye salmon in the Fraser River, British Columbia. *Fisheries* **29**(2): 22-33.

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Patterson, D.A. 2004. Relating the Sockeye Salmon (*Oncorhynchus nerka*) Spawning Migration Experience with Offspring Fitness: A Study of Intergenerational Effects. Master of Science. **135**. Department of Biological Sciences, Simon Fraser University, Burnaby, B.C.

Lapointe, M., Cooke, S.J., Hinch, S.G., Farrell, A.P., Jones, S., Macdonald, S., **Patterson, D.A.**, Healey, M.C., and Van Der Kraak, G. 2003. Late-run sockeye salmon in the Fraser River, British Columbia, are experiencing early upstream migration and unusually high rates of mortality - what is going on? 2003 Georgia Basin/Puget Sound Research Conference, Vancouver, BC, pp. 1-14.

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Technical Reports:

Thompson, L. A., V. Baudry, B. Moore, M. J. Hague, D. Senciall, S. Mercer, and **D. A. Patterson**. 2010. A standardised process for the rescue, archival and quality control of historic water temperature data for the Fraser River Watershed, British Columbia. Canadian Technical Report of Fisheries and Aquatic Sciences 2863:1-50.

Cooke, S. J., G. T. Crossin, S. G. Hinch, **D. A. Patterson**, A. P. Farrell, J. M. Shrimpton, K. K. English, D. W. Welch, and G. Van Der Kraak. 2009. Early migration of sockeye salmon: physiological and energetic correlates of behaviour and fate in coastal environments. Pages 37-40 *in* S. G. Hinch, and J. Gardner, editors. Proceedings of the Conference on Early Migration and Premature Mortality in Fraser River Late-Run Sockeye Salmon. Pacific Fisheries Resource Conservation Council, Forest Sciences Centre, University of British Columbia.

Cooke, S. J., G. T. Crossin, S. G. Hinch, **D. A. Patterson**, A. P. Farrell, J. M. Shrimpton, K. K. English, D. W. Welch, G. Van Der Kraak, K. C. Hanson, and J. L. Young. 2009. Consequences of early entry on late-run sockeye salmon: focus on riverine migration. Pages 68-70 *in* S. G. Hinch, and J. Gardner, editors. Proceedings of the Conference on Early Migration and Premature Mortality in Fraser River Late-Run Sockeye Salmon. Pacific Fisheries Resource Conservation Council, Forest Sciences Centre, University of British Columbia.

- Cooperman, M. S., S. G. Hinch, G. T. Crossin, I. Olsson, A. G. Lotto, S. J. Cooke, **D. A. Patterson**, A. P. Farrell, and D. W. Welch. 2009. Experimental test of the osmoregulation hypothesis for the abnormal migration timing of Fraser River late-run sockeye. Pages 52-55 in S. G. Hinch, and J. Gardner, editors. Proceedings of the Conference on Early Migration and Premature Mortality in Fraser River Late-Run Sockeye Salmon. Pacific Fisheries Resource Conservation Council, Forest Sciences Centre, University of British Columbia.
- Farrell, A. P., C. G. Lee, M. F. Steinhausen, T. Clark, E. Eliason, T. Mathes, L. B. Pon, G. T. Crossin, S. G. Hinch, S. J. Cooke, and **D. A. Patterson**. 2009. Adult salmon in hot water: adaptation, physiology and behaviour. Pages 74-76 in S. G. Hinch, and J. Gardner, editors. Proceedings of the Conference on Early Migration and Premature Mortality in Fraser River Late-Run Sockeye Salmon. Pacific Fisheries Resource Conservation Council, Forest Sciences Centre, University of British Columbia.
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- Hague, M., and **D. A. Patterson**. 2009. Predicting the magnitude and timeline of climate change effects on spawning migration success for major populations of Fraser River salmon and implications for fisheries: SEF Final Report. Prepared by Department of Fisheries and Oceans, Science Branch.
- Hinch, S. G., S. Larsson, G. T. Crossin, T. Mathes, G. N. Wagner, S. J. Cooke, A. P. Farrell, K. K. English, D. W. Welch, S. Jones, and **D. A. Patterson**. 2009. Adult salmon in hot water: migration thermal experiments. Pages 70-73 in S. G. Hinch, and J. Gardner, editors. Proceedings of the Conference on Early Migration and Premature Mortality in Fraser River Late-Run Sockeye Salmon. Pacific Fisheries Resource Conservation Council, Forest Sciences Centre, University of British Columbia.
- Patterson, D. A.**, M. Hague, J. A. Hills, and M. R. Donaldson. 2009. Fraser River environmental conditions for late-run sockeye. Pages 61-64 in S. G. Hinch, and J. Gardner, editors. Proceedings of the Conference on Early Migration and Premature Mortality in Fraser River Late-Run Sockeye Salmon. Pacific Fisheries Resource Conservation Council, Forest Sciences Centre, University of British Columbia.
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