

Cameron Freshwater

Aquatic Biologist
Pacific Biological Station
Fisheries and Oceans Canada
Nanaimo, BC, Canada

cameron.freshwater@dfo-mpo.gc.ca
(778) 350-1767

I) EDUCATION

- 2012-2017 Ph.D, Biology, University of Victoria
Dissertation: *Drivers and implications of variation in juvenile sockeye salmon body size, growth, and migratory behavior*
Supervisors: Drs. Francis Juanes and Marc Trudel
***Nominated for Governor General's Gold Medal**
- 2008-2012 B.Sc (Honours), Environmental Biology, Queen's University
Honours thesis: *Ecological correlates of behavioural dominance*
Supervisor: Dr. Paul Martin

II) GRANTS AND FELLOWSHIPS

- 2015-18 Montalbano Scholar's Fellowship (\$30,000)
2015-18 NSERC Graduate Scholarship (\$63,000)
2015 Howard E. Petch Research Scholarship (\$7,500)
2015 Alfred and Adriana Potvin Graduate Scholarship in Ocean Sciences (\$2,780)
2015-18 University of Victoria President's Scholarship (\$12,000)
2014, 2015 W. Gordon Fields Memorial Fellowship (\$2,042)
2013 Dr. Arne H. Lane Graduate Fellowship in Marine Sciences (\$12,000)
2013, 2016 Maureen De Burgh Memorial Scholarship (\$500)
2012-15 University of Victoria Graduate Fellowship (\$36,000)

III) AWARDS

- 2017 Dissertation nominated for CAGS/PROQUEST-UMI Distinguished Dissertation Award
- 2017 Dissertation nominated for Governor General's Gold Medal
- 2014, 2015 Travel Award, University of Victoria Graduate Student Society (\$600)
- 2014 Travel Award, Dr. Patrick Gregory Fund (\$500)
- 2013 Travel Award, North Pacific Marine Science Organization (\$170)
- 2010-12 Queen's University Dean's List

IV) PEER-REVIEWED PUBLICATIONS

1. **Freshwater, C.**, S.C. Anderson, K.R. Holt, A.-M. Huang, and C.A. Holt. Weakened portfolio effects constrain management effectiveness for population aggregates. *Ecological Applications*, *submitted*.
2. **Freshwater, C.**, M. Trudel, T. Beacham, S. Gauthier, S.C. Johnson, C.-E. Neville, and F. Juanes. 2019. Individual variation, population-specific behaviours, and stochastic processes shape marine migration phenologies. *Journal of Animal Ecology*, 88:67-78. DOI: 10.1111/1365-2656.12852.
3. **Freshwater, C.**, B.J. Burke, M.D. Scheuerell, S.C.H. Grant, M. Trudel, and F. Juanes. 2018. Ecological drivers of covariance in productivity among Fraser River sockeye salmon conservation units. *Canadian Journal of Fisheries and Aquatic Sciences*, 75:1346-1356. DOI: <https://doi.org/10.1139/cjfas-2017-0251>
4. **Freshwater, C.**, M. Trudel, T.D. Beacham, S.C.H. Grant, S.C.C. Johnson, C.-E. Neville, S. Tucker, and F. Juanes. 2017. Density dependent effects on juvenile sockeye salmon size, growth, and migration during early marine rearing. *Marine Ecology Progress Series*, 579:97-110. DOI: <https://doi.org/10.3354/meps12279>
5. Martin, P., **C. Freshwater**, and C. Ghalambor. 2017. The outcomes of most aggressive interactions among closely related bird species are asymmetric. *PeerJ*, 5:e2847. DOI: 10.7717/peerj.2847
6. **Freshwater, C.**, M. Trudel, T.D. Beacham, L. Godbout, C.-E. Neville, S. Tucker, and F. Juanes. 2016. Divergent migratory behaviours associated with body size and ocean entry phenology in juvenile sockeye salmon. *Canadian Journal of Fisheries and Aquatic Sciences*, 73:1723-1732. DOI: <https://doi.org/10.1139/cjfas-2015-0425>
7. **Freshwater, C.**, M. Trudel, T.D. Beacham, L. Godbout, C.-E. Neville, S. Tucker, and F. Juanes. 2016. Disentangling individual- and population-scale processes within a latitudinal size-gradient in sockeye salmon. *Canadian Journal of Fisheries and Aquatic Sciences*, 73:1190-1201. DOI: <https://doi.org/10.1139/cjfas-2015-0344>
8. **Freshwater, C.**, M. Trudel, T.D. Beacham, C.-E. Neville, S. Tucker, and F. Juanes. 2015. Validation of daily increments and a marine entry check in the otoliths of sockeye salmon. *Journal of Fish Biology*, 87:169-178. DOI: 10.1111/jfb.12688
9. Favaro, B., D.C. Claar, C.H. Fox, **C. Freshwater**, J.J. Holden, A. Roberts, and UVic Research Derby. 2014. Trends in extinction risk for imperiled species in Canada. *PloS One* 9(11):e113118. DOI: <https://doi.org/10.1371/journal.pone.0113118>
10. **Freshwater, C.**, C. Ghalambor, and P. Martin. 2014. Repeated patterns of trait divergence between closely related dominant and subordinate bird species. *Ecology*, 95:2334-2345. DOI: <https://doi.org/10.1890/13-2016.1>

V) OTHER PUBLICATIONS

1. Naumann, C., J.P.W. Robinson, **C. Freshwater**, E. Hertz, D. Stormer, A. Teffer, and F. Juanes. 2014. Review of Overfishing: What Everyone Needs to Know. *Fisheries*, 39:222.
2. Bourdon, R., M. Carrasquilla, B. Collicut, **C. Freshwater**, A. Martin, J.P.W. Robinson, and F. Juanes. 2014. Review of The Biology of Sharks and Rays. *Journal of Fish Biology*, 84:1266-1267.
3. **Freshwater, C.**, J.P.W. Robinson, C. Naumann, E. Hertz, D. Stormer, A. Teffer, and F. Juanes. 2013. Review of Scientific Communication for Natural Resource Professionals. *Fish and Fisheries*, 14:235-236.

VI) RESEARCH AND WORK EXPERIENCE

- 2019-present *Aquatic Biologist (Ecosystem Science—Fisheries and Oceans Canada)* – Dr. Jacquelynne King
Developed program to study interactions between resident killer whales and prey species, particularly Chinook salmon, in designated critical habitat.
- 2017-2019 *Visiting Post-doctoral Fellow (Quantitative Assessment Methods Section—Fisheries and Oceans Canada)* – Dr. Carrie Holt, Ms. Kendra Holt, and Ms. Ann-Marie Huang
Assisted in designing a management strategy evaluation process to inform recovery plans for depleted Pacific salmon conservation units. Responsible for developing closed-loop simulations that could be used to identify harvest control rules robust to variability associated with dynamic environmental conditions, mixed stock fisheries, and data limited scenarios. Experience engaging with fisheries managers and various stakeholders to identify conservation and socio-economic objectives.
- 2012 – 2017 *Biology PhD (University of Victoria)* – Drs. Francis Juanes and Marc Trudel
Experience rearing animals in laboratory settings, performing microstructure and -chemistry analyses on otoliths, sampling from large research vessels, writing research proposals, performing quantitative analyses in R statistical software, publishing peer-reviewed papers, and presenting scientific conclusions to diverse audiences.
- 2016 – Fall *Visiting researcher (NOAA Northwest Fisheries Science Center)* – Drs. Brian Burke and Mark Scheuerell
Quantified population-specific trends in sockeye salmon productivity and identified management implications. Experience manipulating large datasets and developing state-space models in the MARSS package.
- 2016 – Spring *Field team leader (Fisheries and Oceans Canada)* – Ms. Chrys Neville
Field team leader for juvenile salmon purse seine survey in Strait of Georgia (see field technician entry below). Coordinated with captain of chartered commercial vessel to direct crew of 3 fishermen and 2 science technicians. Responsible for selecting sampling locations, managing sample collection and processing, and distributing collected data to collaborators.
- 2015-17 *Research contractor (Fisheries and Oceans Canada)* – Dr. Lyse Godbout
Collaborated with Fisheries and Oceans scientists to test the relationship between BC sockeye salmon productivity and early life history characteristics. Prepared and analyzed otoliths to collect data on individual growth, size, and migratory rate.
- 2013-17 *Field technician (Fisheries and Oceans Canada)* – Ms. Chrys Neville and Dr. Marc Trudel
Participated in research surveys aboard large vessels targeting juvenile Pacific salmon in nearshore waters. Surveys were designed to assess stock-specific distribution, health, and abundance. Experience operating fishing gear and oceanographic sampling equipment, pelagic species identification, fish dissection, and sample processing.
- 2011-12 *Field technician (Queen's University)* – Dr. Philina English and Dr. Paul Martin
Collected data on community composition, behavioural interactions, population size, and production of songbirds and nightjars. Experience included mist netting, radio telemetry, habitat mapping, bird censuses, and plant/insect community identification.
- 2009-10 *Lab technician (Paratechs Corporation)* – Dr. Angie Martin

Worked to develop biopesticides to treat eastern tent caterpillar outbreaks and to magnify anti-fungal properties of carrion beetle secretions. Experience with polymerase chain reaction, fungal culturing, and rearing insects.

VII) OTHER ACTIVITIES

- Reviewer for manuscripts submitted to: *Canadian Journal of Fisheries and Aquatic Sciences*; *Ecology of Freshwater Fish*; *Estuarine, Coastal and Shelf Science*; *Fish and Fisheries*; *Fisheries Oceanography*; *Journal of Fish Biology*; *North American Journal of Fisheries Management*; *The Auk*; *Transactions of the American Fisheries Society*
- Organizing committee for Canadian Society for Ecology and Evolution annual meeting (2017)
- Vancouver Island Regional Science Fair judge (2016, 2017)
- Guest science speaker at St. Andrews High School, Victoria BC (2016)
- Executive for BC student sub-unit of the Western Division of the American Fisheries Society (2015-17)
- Chair of social (2015) and finance committees (2013) for University of Victoria biology department annual graduate student symposium
- Trained five technicians in salmon otolith preparation and microstructure analysis
- Active in University of Victoria's cross-disciplinary Ecology Discussion Group and EcoStats Help Group (2013-2017)
- Co-organized University of Victoria's first Research Derby (2013)
- Instructed bi-weekly at University of Victoria's summer Science Venture Camp (2013)

VIII) CONFERENCE PRESENTATIONS

- 2018 *Individual variation and population-specific behaviours shape sockeye salmon phenologies*. Pacific Salmon Ocean Ecology Meeting. Newport, OR.
- 2017 *Ecological drivers of covariance among Fraser River sockeye salmon populations*. Canadian Society for Ecology and Evolution Annual Meeting. Victoria, BC.
- *Meeting Co-organizer**
- 2017 *Ecological drivers of covariance among Fraser River sockeye salmon populations*. Pacific Salmon Ocean Ecology Meeting. Seattle, WA.
- 2017 *Ecological drivers of covariance among Fraser River sockeye salmon populations*. Pacific Ecology and Evolution Conference. Bamfield, B.C.
- 2016 *Density dependence in juvenile sockeye salmon: Divergent effects during freshwater and marine rearing*. North Pacific Marine Science Organization (PICES) Annual Meeting. San Diego, CA.
- 2016 *Density dependent effects during early marine residency in juvenile sockeye salmon*. Pacific Salmon Ocean Ecology Meeting. Juneau, AK.
- 2015 *Divergent marine migratory strategies in juvenile sockeye salmon*. American Fisheries Society Annual Meeting. Portland, OR.
- 2015 *Estimating marine residency using microstructure and chemistry in juvenile sockeye salmon otoliths* (poster). Pacific Salmon Ocean Ecology Meeting. Victoria, BC.
- 2014 *Effects of individual and population processes on migratory size distributions*. International Otolith Symposium. Mallorca, Spain.
- 2014 *A race north: Explaining a latitudinal gradient in sockeye body size*. Pacific Salmon Ocean Ecology Meeting. Santa Cruz, CA.

- 2014 *A race north: Explaining a latitudinal gradient in sockeye body size*. Pacific Ecology and Evolution Conference. Bamfield, BC.
***Honourable Mention, Best Talk**
- 2013 *A race north: Explaining a latitudinal gradient in sockeye body size*. University of Victoria Graduate Student Symposium. Victoria, BC.
***Meeting Co-organizer**
- 2013 *A race north: Explaining a latitudinal gradient in sockeye body size*. Ecology and Evolution Retreat. Brackendale, BC.
***Meeting Co-organizer**
- 2013 *A race north: How size, age, and growth influence a gradient in sockeye body size*. North Pacific Marine Science Organization (PICES) Annual Meeting. Nanaimo, BC.
- 2013 *Fueling a race to the north*. Pacific Ecology and Evolution Conference. Bamfield, BC.

IX) TEACHING EXPERIENCE AND LECTURES

- 2015 Guest Lecture, BIOL 461, Fisheries Ecology and Management, University of Victoria. Fishing gears and selectivity.
- 2015 Guest Lecture, BIOL 461, Fisheries Ecology and Management, University of Victoria. Marine productivity and fisheries.
- 2013-15 Teaching Assistant, BIOL 461, Fisheries Ecology and Management, University of Victoria.
- 2013-15 Teaching Assistant, BIOL 345, Animal Behaviour, University of Victoria.
- 2015 Teaching Assistant, BIOL 329, Vertebrates of BC, University of Victoria.
- 2014 Guest Lecture, BIOL 470, Methods in Food Web Ecology, University of Victoria. Detecting ontogenetic niche shifts with stable isotopes.
- 2014 Guest Lecture, BIOL 220, Topics in Organismal Biology, University of Victoria. Pacific salmonids life history diversity and evolution.
- 2012-14 Teaching Assistant, BIOL 190, General Biology, University of Victoria.
- 2013 Guest Lecture, BIOL 461, Fisheries Ecology and Management, University of Victoria. Life history and fisheries management of Pacific salmonids.
- 2013 Teaching Assistant, BIOL 307, Chordate Zoology, University of Victoria.