**AIMEE H. FULLERTON**

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## EDUCATION

Ph.D., University of Washington
M.S., University of Notre Dame
B.S., Ohio State University

## PROFESSIONAL EXPERIENCE

*Research Fisheries Scientist*. 2002 to present. Ecosystem Analysis Program, Fish Ecology Division, Northwest Fisheries Science Center, NOAA Fisheries, Seattle, WA

*Aquatic Biologist*. 1998 to 2002. Nongame and Endangered Wildlife Program, North Carolina Wildlife Resources Commission, Raleigh, NC

## RESEARCH INTERESTS

My research interests include thermal diversity in streams and the effect of climate change on Pacific salmon and aquatic systems; the spatial structure of aquatic populations, especially those living in stream networks; the relationship between spatiotemporal scale and ecological patterns and processes; the influence of nonindigenous species on native aquatic fauna; and ways that science can contribute to improved decision-making.

## PUBLICATIONS For an updated list, see Google Scholar and ORCiD(0000-0002-5581-3434).

McGill LM, EA Steel, **AH Fullerton**. 2023. Empirical stream thermal sensitivities cluster on the landscape according to geology and climate. *Hydrology and Earth System Sciences Discussions*. https://doi.org/10.5194/hess-2022-428.

Ledger K, Y Su, JY Jeon, **AH Fullerton**, D Kuligowski, T Bennett, K Denton, M McHenry, JH McMillan, J Anderson, TR Seamons, G Pess, KM Nichols, G McKinney, T Seaborn AK Fraik. 2023. Using riverscape genetics to investigate the genetic response of two specie,s and their life-history forms to dam removal. *Frontiers in Ecology and Evolution* 11. https://doi.org/ 10.3389/fevo.2023.1225229.

Liermann M, **AH Fullerton**, G Pess, JH Anderson, S Morley, ML McHenry, M Taylor, J Stapleton, M Elofson, R McCoy, T Bennett. 2023. Modeling timing and size of juvenile Chinook salmon out-migrants at three Elwha River rotary screw traps: a window into early life history post dam removal. *Frontiers in Ecology and Evolution* 11. https://doi.org/ 10.3389/fevo.2023.1240987.

Brown BC, **AH Fullerton**, D Kopp, F Tromboni, AJ Shogren, JA Webb, C Ruffing, M Heaton, L Kuglerová, DC Allen, L McGill, JP Zarnetske, MR Whiles, JB Jones Jr., BW. Abbott. 2023. The music of rivers: the mathematics of waves reveals global structure and drivers of streamflow regime. *Water Resources Research* 59:e2023WR034484. https://doi.org/10.1029/2023WR034484.

Mejia FH, V Ouellet, MA Briggs, SM Carlson, R Casas-Mulet, M Chapman, MJ Collins, SJ Dugdale, JL Ebersole, DM Frechette, **AH Fullerton**, CA Gillis, ZC Johnson, C Kelleher, BL Kurylyk, R Lave, BH Letcher, KM Myrvold, TL Nadeau, H Neville, H Piégay, KA Smith, D Tonolla, CE Torgersen. 2023. Closing the gap between science and management of cold-water refuges in rivers and streams. *Global Change Biology* 29:5482-5508. https://doi.org/10.1111/gcb.16844.

Siegel, JE, **AH Fullerton**, AM FitzGerald, D Holzer, CE Jordan. 2023. Daily stream temperature predictions for free-flowing streams in the Pacific Northwest, USA. *PLoS Water* 2(8):e0000119. https://doi.org/10.1371/journal.pwat.0000119.

**Fullerton, A.H.**, N. Sun, M.J. Baerwalde, B.L. Hawkins, and H. Yan. 2022. Mechanistic simulations suggest riparian restoration can partly offset climate impacts to juvenile salmon. Journal of the American Water Resources Association, https://doi.org/10.1111/1752-1688.13011.

Siegel, JE, **AH Fullerton**, and C Jordan. 2022. Accounting for snowpack and time-varying thermal inertia in statistical models for stream temperature. Journal of Hydrology X 17:100136. https://doi.org/10.1016/j.hydroa.2022.100136.

Torgersen, C.E., C. Le Pichon, **A.H. Fullerton**, S. J. Dugdale, J. J. Duda, F. Giovannini, E. Tales, J. Belliard, P. Branco, N. E. Bergeron, M. L. Roy, D. Tonolla, N. Lamouroux, H. Captra, and C. V. Baxter. 2021. Riverscape approaches in practice: perspectives and applications. *Biological Reviews* 97:481-504. https://doi.org/10.1111/brv.12810.

Yan, H., N. Sun, **A.H. Fullerton**, and M.J. Baerwalde. 2021. Implications of changing climate for stream temperature and fish growth potential in a snow-influenced watershed. *Environmental Research Letters*. https://doi.org/10.1088/1748-9326/abf393.

Armstrong, J., **A.H. Fullerton**, J.L. Ebersole, J.R. Bellmore, C. Jordan, I. Arismendi, and B. Penaluna. 2021. The significance of warm habitat to the growth regime of coldwater fishes. *Nature Climate Change*. https://dx.doi.org/10.1038/s41558-021-00994-y.

Marsha, A., E.A. Steel, and **A.H. Fullerton**. 2021. Modeling thermal metrics of importance for fish by species and life stage. *Freshwater Science*. https://doi.org/10.1086/713038.

Brown, B., **A. H. Fullerton**, D. Kopp, F. Tromboni, A. J. Shogren, J. A. Webb, C. Ruffing, M. J. Heaton, L. Kuglerova, D. C. Allen, L. McGill, J. P. Zarnetske, M. R. Whiles, J. B. Jones, B. W. Abbott. 2021. The music of rivers: how the mathematics of waves reveals global drivers of streamflow regime. *Earth and Space Science Open Archiv*e. https://doi.org/10.1002/essoar.10507854.1.

Torgersen, C. E., **A.H. Fullerton**, Z. Johnson, F. Mejia, A. Gendaszek, A. Shirk, S.Y. Lee, R. Rautu, A. Ege, J. Casola, and C. Raymond. 2021. Stream temperature handbook: a primer on data and models. https://cig.uw.edu/our-work/decision-support/stream-temperature-handbook/.

Hawkins, B. L., **A. H. Fullerton**, B. L. Sanderson, and E. A. Steel. 2020. Individual-based simulations suggest mixed impacts of warmer temperatures and a non-native predator on Chinook salmon. *Ecosphere* 11:e03218, https://doi.org/10.1002/ecs2.3218.

Lee, S.Y., **A.H. Fullerton**, N. Sun, and C. E. Torgersen. 2020. Projecting spatiotemporally explicit effects of climate change on stream temperature: a model comparison and implications for coldwater fishes. *Journal of Hydrology* 588: 125066, https://doi.org/10.1016/j.jhydrol.2020.125066.

McGill, L.M., E.A. Steel, J.R. Brooks, R.T. Edwards, and **A.H. Fullerton**. 2020. Elevation and spatial structure explain most surface-water isotopic variation across five Pacific Coast basins. *Journal of Hy*drology 583: 124610, https://doi.org/10.1016/j.jhydrol.2020.124610.

Mejia, F. H., C. E. Torgersen, E. K. Berntsen, J. R. Maroney, J. M. Connor, **A. H. Fullerton**, J. L. Ebersole, and M. S. Lorang. 2020. Longitudinal, lateral, vertical and temporal thermal heterogeneity in a large impounded river: implications for cold-water refuges. *Remote Sensing* 12(9): 1386, https://doi.org/10.3390/rs12091386.

Steel, E.A., A. Marsha, **A.H. Fullerton**, J.D. Olden, N.K. Larkin, S.Y. Lee, and A. Ferguson. 2019. Thermal landscapes in a changing climate: biological implications of water temperature patterns in an extreme year. *Canadian Journal of Fisheries and Aquatic Sciences*, https://doi.org/10.1139/cjfas-2018-0244.

**Fullerton, A.H.,** C.E. Torgersen, J.J. Lawler, E.A. Steel, J.L. Ebersole, and S.Y. Lee. 2018. Longitudinal thermal heterogeneity in rivers and refugia for coldwater species: effects of scale and climate change. *Aquatic Sciences* 80: 1-15. https://doi.org/10.1007/s00027-017-0557-9.

Marsha, A., E.A. Steel, **A.H. Fullerton**, and C. Sowder. 2018. Monitoring riverine thermal regimes on stream networks: insights into spatial sampling designs from the Snoqualmie River, WA. *Ecological Indicators* 84: 11-26. https://doi.org/10.1016/j.ecolind.2017.08.028.

**Fullerton, A.H.,** B.J. Burke, J.J. Lawler, C.E. Torgersen, J.L. Ebersole, and S.G. Leibowitz. 2017. Simulated juvenile salmon growth and phenology respond to altered thermal regimes and stream network shape. *Ecosphere* 8(12):e02052. https://doi.org/10.1002/ecs2.2052.

Steel, E.A., T.J. Beechie, C.E. Torgersen, and **A.H. Fullerton**. 2017. Envisioning, quantifying, and managing thermal regimes on river networks. *BioScience* 67: 506-522. https://doi.org/10.1093/biosci/bix047.

**Fullerton, A.H**., S. Anzalone, P. Moran, D. Van Doornik, T. Copeland, and R. Zabel. 2016. Setting spatial conservation priorities despite incomplete data for characterizing metapopulations. *Ecological Applications* 26:2560-2580. https://doi.org/10.1002/eap.1411.

**Fullerton, A.H.**, C.E. Torgersen, J.J. Lawler, R.N. Faux, E.A. Steel, T.J. Beechie, J.L. Ebersole and S.G. Leibowitz. 2015. Rethinking the longitudinal stream temperature paradigm: region-wide comparison of thermal infrared imagery reveals unexpected complexity of river temperatures. *Hydrological Processes* 29: 4719-4737. https://doi.org/10.1002/hyp.10506.

Steel, E.A., A. Tillotson, D.A. Larsen, **A.H. Fullerton**, K.P. Denton, and B.R. Beckman. 2012. Beyond the mean: The role of variability in predicting ecological effects of stream temperature on salmon. *Ecosphere* 3(11):104. https://doi.org/10.1890/ES12-00255.1.

**Fullerton, A.H.**, S.T. Lindley, G.R Pess, B.E. Feist, E.A. Steel, and P. McElhany. 2011. Human influence on the spatial structure of threatened Pacific salmon metapopulations. *Conservation Biology* 25:932-944. https://doi.org/10.1111/j.1523-1739.2011.01718.x.

**Fullerton, A.H.**, K.M. Burnett, E.A. Steel, R.L. Flitcroft, G.R. Pess, B.E. Feist, C.E. Torgerson, D.J. Miller, and B.L. Sanderson. 2010. Hydrological connectivity for riverine fishes: measurement challenges and research opportunities. *Freshwater Biology* 55:2215-2237. https://doi.org/10.1111/j.1365-2427.2010.02448.x.

**Fullerton, A.H.**, A. Steel, Y. Caras, and I. Lange. 2010. Effects of spatial pattern and economic uncertainties on freshwater habitat restoration planning: a simulation exercise. *Restoration Ecology* 18(S2):354-369. https://doi.org/10.1111/j.1526-100X.2009.00620.x.

**Fullerton, A.H.**, D. Jensen, A. Steel, D. Miller, and P. McElhany. 2010. How certain are salmon recovery forecasts? A watershed-scale sensitivity analysis. *Environmental Modeling & Assessment* 15:13-26. https://doi.org/10.1007/s10666-008-9185-z.

Steel, A., R. Hughes, **A. Fullerton**, S. Schmutz, J. Young, M. Fukushima, S. Muhar, M. Poppe, B. Feist, C. Trautwein, H. Shimazaki, and B. Sanderson. 2010. Are we meeting the challenges of landscape scale riverine research? A review. *Living Reviews in Landscape Ecology*. http://landscaperesearch.livingreviews.org/Articles/lrlr-2010-1/.

**Fullerton, A.H.**, A. Steel, Y. Caras, M. Sheer, P. Olson, and J. Kaje. 2009. Putting watershed restoration in context: Alternative future scenarios influence management outcomes. *Ecological Applications* 19(1):218-235. https://doi.org/10.1890/07-1040.1.

Jensen, D., A. Steel, **A. Fullerton**, and G. Pess. 2009. Impact of fine sediment on egg-to-fry survival of Pacific salmon: A meta-analysis of published studies. *Reviews in Fisheries Science* 17(3):348-359. https://doi.org/10.1080/10641260902716954.

Steel, E.A., T.J. Beechie, M. Ruckelshaus, **A.H. Fullerton**, P. McElhany, and P. Roni. 2009. Mind the gap: Uncertainty and model communication between managers and scientists. H. Michael, C. Steward, and E. Knudsen, eds. *American Fisheries Society Symposium* 71:357-372.

Steel, E. A., **A. H. Fullerton**, Y. Caras M. B. Sheer, P. Olson, D. Jensen, J. Burke, M. Maher, and P. McElhany. 2008. A spatially explicit decision support system for watershed-scale management of salmon. *Ecology and Society* 13:2. http://www.ecologyandsociety.org/vol13/iss2/art50/.

**Fullerton, A.H.**, T. J. Beechie, S. E. Baker, J. E. Hall, and K. A. Barnas. 2006. Regional patterns of riparian characteristics in the Columbia River basin, Northwestern USA: applications for restoration planning. *Landscape Ecology* 21():1347-1360. https://doi.org/10.1007/s10980-006-0017-8.

Beechie, T., E. Buhle, M. Ruckelshaus, **A. Fullerton**, and L. Holsinger. 2006. Hydrologic regime and the conservation of salmon life history diversity. *Biological Conservation* 130(4):560-572. https://doi.org/10.1016/j.biocon.2006.01.019.

**Fullerton, A. H.** and G. A. Lamberti. 2006. A comparison of habitat use and habitat-specific feeding efficiency by Eurasian ruffe (*Gymnocephalus cernuus*) and yellow perch (*Perca flavescens*). *Ecology of Freshwater Fish* 15(1):1-9. https://doi.org/10.1111/j.1600-0633.2005.00114.x.

Kolar, C. S., **A. H. Fullerton**, K. M. Martin, and G. A. Lamberti. 2002. Interactions among zebra mussl shells, invertebrate prey, and Eurasian ruffe or yellow perch. *Journal of Great Lakes Research* 28(4): 664-673. https://doi.org/10.1016/S0380-1330(02)70612-6.

**Fullerton, A.H.**, G. A. Lamberti, D. M. Lodge, and F.W. Goetz. 2000. Potential for resource competition between Eurasian ruffe and yellow perch: growth and RNA responses in laboratory experiments. *Transactions of the American Fisheries Society* 129(6):1331-1339. https://doi.org/10.1577/1548-8659(2000)129%3C1331:PFRCBE%3E2.0.CO;2.

**Fullerton, A.H.**, J. E. Garvey, R. A. Wright, and R. A. Stein. 2000. Overwinter growth and survival of largemouth bass: interactions among size, food, origin, and winter severity. *Transactions of the American Fisheries Society* 129(1):1-12. https://doi.org/10.1577/1548-8659(2000)129%3C0001:OGASOL%3E2.0.CO;2.

Wright, R. A., J. E. Garvey, **A. H. Fullerton**, and R. A. Stein. 1999. Predicting how winter affects energetics of age-0 largemouth bass: How do current models fare? *Transactions of the American Fisheries Society* 128(4): 603-612. https://doi.org/10.1577/1548-8659(1999)128%3C0603:PHWAEO%3E2.0.CO;2.

**Fullerton, A.H.**, G. A. Lamberti, D. M. Lodge, and M. B. Berg. 1998. Prey preferences of Eurasian ruffe and yellow perch: comparison of laboratory results with composition of Great Lakes benthos. *Journal of Great Lakes Research* 24(2):319-328. https://doi.org/10.1016/S0380-1330(98)70823-8.

## RECENT PRESENTATIONS (First author)

Multiscale considerations in the physics and ecology of riverine thermal regimes. Joint-plenary at EPA thermal complexity workshop webinar, virtual.

Filling a data need: daily regional stream temperature predictions to inform salmon recovery planning. Southwest Fisheries Science Center seminar.

We must *turn and face the strange*, as fish encounter serial disturbances and global *ch-ch-ch-changes*. Plenary at Oregon Chapter of the American Fisheries Society conference, virtual.

Mechanistic simulations suggest riparian restoration can partly offset climate impacts to juvenile salmon. American Water Resources Conference, Snohomish Recovery Planning Technical Committee, and Mississippi State University, virtual.

Synthesizing stream temperature research for managing thermal habitats for Pacific salmon. Upper Columbia Science Conference, Wenatchee, WA.

Advances, insights, and ecological application of thermal research in Pacific Northwest rivers. American Geophysical Union meeting, San Francisco, CA.

Pacific salmon in hot water: past, present and future of thermal diversity in rivers. NWFSC Science Symposium & One-NOAA Webinar.

Resilient responses by Pacific salmon to climate change require diverse thermal landscapes. Oregon American Fisheries Society conference, Portland, OR.

Incorporating spatial heterogeneity in temperature into climate vulnerability assessments for coastal Pacific rivers. North Pacific Landscape Conservation Cooperative Webinar.

Assessing longitudinal thermal connectivity for Pacific salmonids. Specialty conference of the American Water Resources Association, Snowbird, UT.

Managing (cold) water for salmon and people. University of Oregon, Water Science Seminar, Corvallis, OR.

Spatiotemporally variable thermal landscapes and implications for Pacific salmon in a changing climate. MtnClim Conference, Leavenworth, WA.

Perspectives on the riverscape concept. Riverscape Ecology workshop, Antony, France.

Network shape influences the strength of growth and phenology responses to climate change in juvenile salmon. International Statistical Ecology Conference, Seattle, WA.

Spatio-temporal complexity of stream temperature and potential consequences for salmon. Seminar, Northwest Fisheries Science Center, Seattle, WA & Southwest Fisheries Science Center, Santa Cruz, CA.

## RECENT SERVICE & PROFESSIONAL DEVELOPMENT

NOAA West Leadership Development Program 2023-4; Detail as acting Team Lead in the NWFSC Ecosystem Analysis Program; NWFSC Internal Grants Program Director FY22-24 and review panel FY17-19; Seattle University Environmental Science Program Advisory Board; Washington State Instream Flows Science Panel; SESYNC Coldwater refuges workshop participant; Co-hosted a workshop on Pacific salmon bioenergetics modeling; Co-chaired special session on climate and biological connectivity at AWRA, AFS, and IALE conferences; Guest lectured at local universities; Regular peer review for journals; NWFSC research visioning and planning process; NOAA Western Regional (Climate) Action Plan Implementation Team; Snoqualmie Science Coordination and Advisory Team; Ad hoc advisory for natural resource managers on coldwater resources;

NSF-sponsored Resiliency Coordination Network's Spatial Analysis Workgroup; Technical Advisory Team on riparian science for WDFW; Mentored Hollings Scholars, interns, volunteers, and graduate students.

## RECENT FUNDING

An e-Library of salmon ecology relationships to support life cycle modeling of Pacific salmon. NOAA National Protected Species Toolbox Initiative

Impacts of climate change on coldwater habitat, and implications for native salmonid populations: An assessment and resilience plan. Snoqualmie Tribe.

Workshop: Scaling up from individual-based models of organismal physiology to populations and ecosystem management. California State University.

Competing water use in the face of climate change: integrated analysis to support water resource planning for extreme events. NOAA, PNNL.

Handbook: Using data and models to assess impacts and adapt to climate change. Focus: current and future stream temperatures. Northwest Climate Adaptation Science Center.

Elwha floodplain and fisheries monitoring support. Elwha-Sklallam Tribe.

Monitoring paired air and stream temperature in the Snoqualmie and Wenatchee watersheds, WA. NWFSC, USFS.

Incorporating spatial heterogeneity in temperature into climate vulnerability assessments for coastal Pacific streams. North Pacific Landscape Conservation Cooperative.