Christopher Custer, Ph.D.

Hydrologist
Virginia and West Virginia Water Science Center
U.S. Geological Survey

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EDUCATION

Ph.D., Ecology, The Pennsylvania State University, University Park, PA 2024

Dissertation: "Predicting the abundance and distribution of freshwater fishes under global change"

M.S., Statistics, University of Alaska Fairbanks, Fairbanks, AK 2015

Thesis: "An investigation into the effectiveness of simulation-extrapolation for correcting measurement error-induced bias in multilevel models"

B.S., Statistics, University of North Florida, Jacksonville, FL 2013

B.S., Wildlife Ecology and Conservation, University of Florida, Gainesville, FL 2010

EXPERIENCE

Hydrologist 2025 – Present
Virginia and West Virginia Water Science Center
U.S. Geological Survey, Richmond, VA

- Developed a Bayesian hierarchical model to improve the prediction of summed left-censored data, addressing challenges in modeling chemical concentrations with detection limits (motivated by PFAS concentrations in water)
- Applied advanced statistical techniques, such as conditional random fields and LASSO regression, to model harmful algal bloom environmental DNA, providing insights into the drivers of toxin production
- Co-authored manuscript with research hydrologist that estimates storage, residence time and transport processes of a small urban stream using a unique coupled water/chloride mass-balance model
- Consulted with peers to provide statistical expertise to improve research produced within the Science Center

Postdoctoral Research Scholar 2024 – 2025
Department of Applied Ecology
North Carolina State University, Raleigh, NC

- Collaborated with a multidisciplinary team to estimate the abundance and movement patterns of red snapper along the southeastern US Atlantic.
- Developed, summarized, and visualized complex datasets, utilizing advanced programming skills to build and refine statistical models for population estimation.
- Assisted with project coordination by organizing cross-functional meetings, managing timelines, and delegating tasks to team members to ensure project milestones are met.
- Facilitated communication among scientists, providing critical insights to guide research direction and ensure alignment with project goals.

Graduate Research Assistant 2020 – 2024
Pennsylvania Cooperative Fish and Wildlife Research Unit
The Pennsylvania State University, University Park, PA

- Developed a novel statistical model (jsPGA) that improves predictions of future abundances by simultaneously incorporating a species' thermal physiology, spatial autocorrelation, and species dependencies.
- Applied the jsPGA model to predict the effects of future global change scenarios on lake fish communities across the Midwestern USA.
- Quantified the relative importance of biotic and abiotic factors influencing the distribution of stream fish communities across Pennsylvania, USA using a relatively novel technique called conditional random fields.
- Explored the effects of spatial scale and data resolution on predicting stream fish community distributions across Pennsylvania, USA.
- Programmed complex statistical analyses, including conditional random fields and Bayesian hierarchical models, within the software R and Stan environments.
- Used the University's high performance computing cluster, Roar, to fit computationally-intensive statistical analyses in parallel via workload manager software, MOAB and Slurm.

Graduate Teaching Assistant 2022 – 2023
Department of Ecosystem Science & Management
The Pennsylvania State University, University Park, PA

- Assisted with the General Fishery Science (WFS410) lab by teaching students a variety of field and lab techniques, such as backpack electrofishing and ageing otoliths.
- Led the GIS lab session for General Fishery Science (WFS410) which introduces student to using ArcPro to develop maps for their research goals.
- Presented personal research to General Fishery Science (WFS410) students to expose them to graduate-level research.
- Graded writing assignments for the Wildlife Management (WFS447W) course, a writing intensive course for undergraduates.

Graduate Teaching Assistant 2019 – 2020
Department of Mathematics & Statistics
Washington State University, Pullman, WA

- Taught and graded multiple lab sections for Calculus 1 (MATH171) and assisted with proctoring exams and quizzes.
- Taught and graded multiple lab sections for Introduction to Statistical Methods (STAT212).
- Tutored a wide variety of mathematical and statistical coursework within the Math Learning Center provided by the department for all undergraduate students enrolled in a mathematics or statistics course.

Research Analyst 2017 – 2019
United Network for Organ Sharing, Richmond, VA

- Provided data analyses and compiled reports for a number of committees responsible for setting organ transplant policy.
- Programmed complex statistical programs and data queries within the R, SQL, and SAS software environments.
- Collaborated with peers to research and develop novel techniques to advance the research department.
- Presented significant research and policy findings at both internal organizational meetings and the American Transplant Congress conference.

Data Scientist 2015 – 2017
MECLABS Institute, Jacksonville, FL

- Acted as lead data scientist across multiple marketing research partnerships which ranged from Fortune 50 companies to nonprofit organizations.
- Responsible for statistically sound experimental design and data analyses.
- Leveraged analytical and statistical knowledge to create actionable insights for business partners.

Graduate Teaching Assistant 2013 – 2015
Department of Mathematics & Statistics
University of Alaska Fairbanks, Fairbanks, AK

- Taught the Regression and Analysis of Variance lab (STATF401L) which emphasized using software R for appropriate statistical analyses.
- Graded assignments for both lecture and lab of the Regression and Analysis of Variance lab (STATF401L) course.
- Tutored a wide variety of mathematical and statistical coursework within the Math and Stats Lab provided by the department for all undergraduate students enrolled in a mathematics or statistics course.

PUBLICATIONS

Custer, C.A., J.S. North, E.M. Schliep, M.R. Verhoeven, D. Link, G.J.A. Hansen, and T. Wagner. Climate-driven declines in abundance across thermal guilds in fish communities of 11,000 temperate lakes. *In review: Diversity and Distributions.*

Chanat, J.G. and **C.A. Custer**. A 10-year continuous daily simulation of chloride flux from a suburban watershed in Fairfax County, Virginia, USA. *In review: Environmental Modeling & Assessment.*

Custer, C.A., J.S. North, E.M. Schliep, M.R. Verhoeven, G.J.A. Hansen, and T. Wagner. 2024. Predicting fish responses to climate change using a joint species, spatially dependent physiologically guided abundance model. Ecology, e4362.

Custer, C.A., D.P. Fischer, G. Smith, A. Henning, M.K. Schall, M.K. Shank, T.A. Wertz, and T. Wagner. 2024. Quantifying the relative importance of biotic and abiotic factors in landscape-based models of stream fish distributions. Community Ecology, 1-52.

North, J.S., E.M. Schliep, G.J.A. Hansen, H. Kundel, **C.A. Custer**, P. McLaughlin, and T. Wagner. 2023. Accounting for spatiotemporal sampling variation in joint species distribution models. Journal of Applied Ecology, 00, 1-16.

Wagner, T., E.M. Schliep, J.S. North, H. Kundel, J.K. Ruzich, **C.A. Custer**, and G.J.A. Hansen. 2023. Predicting climate change impacts on poikilotherms using physiologically guided species abundance models. Proceedings of the National Academy of Sciences: 15: e2214199120

PRESENTATIONS

Oral presentations

Custer, C.A., B.J. Reich, J.A. Buckel, K. Pacifici, E.M. Schliep, and N.J. Hostetter. Estimation of US Atlantic Red Snapper Abundance using Bayesian spatial modeling. 154th Annual Meeting of the American Fisheries Society 2024, Honolulu, HI.

Hansen, G.J.A., **C.A. Custer**, J.S. North, E.N. Schliep, M.R. Verhoeven, D. Link, H.K. Masui, and T. Wagner. Projected warming and fish community responses in lakes of the Midwestern United States. 154th Annual Meeting of the American Fisheries Society 2024, Honolulu, HI.

Wagner, T., **C.A. Custer**, J.S. North, E.N. Schliep, M.R. Verhoeven, and G.J.A. Hansen. Predicting fish responses to climate change using a joint species, spatially dependent physiologically guided abundance model. 154th Annual Meeting of the American Fisheries Society 2024, Honolulu, HI.

Custer, C.A., J.S. North, E.M. Schliep, H.K. Masui, M.R. Verhoeven, G.J.A. Hansen, and T. Wagner. jsPGA: Improving predictions under future climate change scenarios. 153rd Annual Meeting of the American Fisheries Society 2023, Grand Rapids, MI (Virtual presentation).

Custer, C.A., J.S. North, E.M. Schliep, H.K. Masui, M.R. Verhoeven, G.J.A. Hansen, and T. Wagner. jsPGA: Improving predictions under future climate change scenarios. Northeast Association of Fish & Wildlife Agencies Conference 2023, Hershey, PA.

Custer, C.A, D. Fischer, A. Henning,D. Hintz, M.K. Schall, M.K Shank, G. Smith, T. Wertz, and T.Wagner. 2022. Quantifying the roles of biotic and abiotic factors structuring stream fish communities. Keystone Coldwater Conference & PA Chapter of the American Fisheries Society 2022, State College, PA.

Hansen, G.J.A., **C.A. Custer**, H. Kundel, J.S. North, J.S. Read, , E.M. Schliep, and T. Wagner. The importance of water temperature in governing lake fish abundance across a landscape of diverse lakes. Midwest Fish and Wildlife Conference 2022.

Custer, C.A., K. Ladin, J. Entwistle , and E.J. Gordon. Racial/ethnic and socio-economic disparities: single versus multi-organ transplant tecipients. American Transplant Congress 2019, Boston, MA.

Custer, C.A., J. Entwistle , K. Ladin, L. Cartwright, and E.J. Gordon. Multi-organ transplant results in lower patient and graft survival than kidney alone transplant. American Transplant Congress 2019, Boston, MA.

Poster presentations

Custer, C.A., J.S. North, E.M. Schliep, G.J.A. Hansen, H. Kundel, J.K.R. Nelson, and T. Wagner. jsPGA: Developing a joint species, spatially dependent physiologically guided abundance model to improve predictions under future climate change scenarios. Southern Division of American Fisheries Society Annual Meeting 2023, Norfolk, VA.

Custer, C.A., R.J. Carrico, T.L. Pruett. Can national data predict which older kidney donors are more likely to yield higher eGFR 1-year post-transplant? American Transplant Congress 2019, Boston, MA.