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University of Michigan
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Education

2007 Ph.D. Ecology and Evolutionary Biology
The University of Michigan

2001 A.B. Biology with Specialization in Ecology and Evolution
The University of Chicago
Graduated with General Honors and Special Honors in Biology

Professional Appointments

2019-present Assistant Research Scientist
The University of Michigan
School for Environment and Sustainability
Cooperative Institute for Great Lakes Research

2012-2019 Postdoctoral Researcher/Senior Research Associate (PI status obtained: 2017)
The Ohio State University
Department of Evolution, Ecology, and Organismal Biology

2009-11 Postdoctoral Researcher
Oklahoma State University
Department of Zoology

2007-8 Postdoctoral Researcher
The University of Michigan
Department of Molecular, Cellular, and Developmental Biology

Funding (including research grants, fellowships, and other awards)

2019-2021 Great Lakes Fishery Commission (Fishery Research Program), Moving toward ecosystem-based fisheries management: developing an integrated ecosystem assessment of Lake Erie as a case study, PI with S. Ludsin, J. Hood, and K. Frank ($136,582)

2016-21 National Science Foundation (IOS-1557831), The influence of the prey physiological stress response on predator-prey interactions, primary writer and Co-PI with R. Denver, S. Ludsin, and B. Luttbeg ($652,556)

2016-20 Great Lakes Fishery Commission (Fishery Research Program), Spatial variation in habitat quality as a driver of Lake Erie walleye population dynamics: past, present, and future, Co-PI with N. Aloysius, D. Glover, C. Keitzer, J. Martin, Y. Zhao, and S. Ludsin ($284,691)

2015 The Ohio State University Open Access Fund ($1,000)

2014-16 Ohio Sea Grant College Program, Biennial Large Grant Program, Linking Lake Erie agricultural production to ecosystem services, Co-PI with E. May, S. Gebremariam, J. Martin, and W. Zhang ($199,630)

2012-15 Federal Sport Fish Restoration Program (Ohio DNR, F-69-P, Fish Management in Ohio), A biophysical modeling approach to understanding walleye recruitment in Lake Erie, Co-PI with S. Ludsin (annually renewed; $232,112 total)

2007 Rackham One-Term Dissertation Fellowship, The University of Michigan (tuition and stipend, 1 semester)

2005 Peter Okkelberg Award, The University of Michigan ($1,058)

2004-6 E. S. George Reserve Scholarship, The University of Michigan (3 awards; $8,488 total)

2004 Block Grant, The University of Michigan ($1,257)

2001-5 Regents' Fellowship, The University of Michigan (tuition and stipend, 4 years)

Refereed Publications

In review or in preparation:

Fraker, M. E., Y. Zhao, and S. A. Ludsin. in review. Biophysical drivers of intra- and interannual variation in habitat quality for fish larvae. (Canadian Journal of Fisheries and Aquatic Sciences)

Fraker, M. E., S. C. Keitzer, J. S. Sinclair, N. R. Aloysius, D. A. Dippold, H. Yen, J. G. Arnold, P. Daggupati, M.-V. V. Johnson, J. F. Martin, D. M. Robertson, S. P. Sowa, M. J. White, and S. A. Ludsin. in review. Projecting effects of agricultural conservation practices on stream fish species assemblages and functional trait composition in a changing climate. (Global Change Biology)

Fraker, M. E., B. Luttbeg, S. A. Ludsin, and R. J. Denver. in review. Stress hormone-mediated antipredator morphology improves escape performance in wood frog tadpoles. (American Naturalist)

J. S. Sinclair, K. A. Frank, J. M. Hood, S. A. Ludsin, and **M. E. Fraker**. to be submitted. Multiple stressors induce contrasting responses in the functional trait composition of fish assemblages in Lake Erie.

Fraker, M. E., J. S. Sinclair, K. A. Frank, J. M. Hood, and S. A. Ludsin. to be submitted. Ecosystem trends and drivers of a dynamic, large freshwater lake depend on the chosen perspective.

Ludsin, S. A., X. Zhang, D. M. Mason, S. B. Brandt, M. R. Roman, W. C. Boicourt, **M. E. Fraker**, and M. Costantini. to be submitted. Hypoxia reduces availability of quality habitat for Bay anchovy (*Anchoa mitchilli*) in Chesapeake Bay.

Published:

Dippold, D. A., N. Aloysius, S. C. Keitzer, H. Yen, J. G. Arnold, P. Daggupati, **M. E. Fraker**, J. F. Martin, D. M. Robertson, S. P. Sowa, M.-V. V. Johnson, M. J. White, and S. A. Ludsin. in press. Forecasting the combined effects of anticipated climate change and agricultural conservation practices on fish recruitment dynamics in Lake Erie. Freshwater Biology.

Brown, T., **M. E. Fraker**, and S. A. Ludsin. 2018. Space use of predatory larval dragonflies and tadpole prey in response to chemical cues. American Midland Naturalist 181:53-63.

DeVanna Fussell, K. M., R. E. H. Smith, **M. E. Fraker**, and 17 co-authors. 2016. A perspective on needed research, modeling, and management approaches that can enhance Great Lakes fisheries management under changing ecosystem conditions. Journal of Great Lakes Research 42:742-753.

Brodnik, R.*, **M. E. Fraker***, E. J. Anderson, L. Carreon-Martinez, K. M. DeVanna, B. J. Fryer, D. D. Heath, J. M. Reichert, and S. A. Ludsin. 2016. Combining microsatellite data with dispersal trajectories of larvae reveals novel stock structure and demographically-important population connectivity in a freshwater fish. Canadian Journal of Fisheries and Aquatic Sciences 73:416-426. *co-first authors

DuFour, M. R., C. J. May, E. F. Roseman, S. A. Ludsin, C. S. Vandergoot, J. J. Pritt, **M. E. Fraker**, J.J. Davis, J. T. Tyson, J. G. Miner, E. A. Marschall, and C. M. Mayer. 2015. Portfolio theory as a management tool to guide conservation and restoration of multi-stock fish populations. Ecosphere 6:art296.

Fraker, M. E., E. J. Anderson, K.-Y. Chen, J. J. Davis, K. M. DeVanna, M. R. DuFour, E. A. Marschall, C. J. May, C. M. Mayer, J. G. Miner, K. L. Pangle, J. J. Pritt, E. F. Roseman, J. T. Tyson, Y. Zhao, and S. A. Ludsin. 2015. Variation in larval advection and early life history of Lake Erie walleye (*Sander vitreus*): insights from an individual-based biophysical model. Journal of Great Lakes Research 41:830-845.

Fraker, M. E., E. J. Anderson, R. Brodnik, L. Carreon-Martinez, K. M. DeVanna, B. J. Fryer, D. D. Heath, J. M. Reichert, and S. A. Ludsin. 2014. Particle backtracking improves breeding subpopulation discrimination and natal-source identification in mixed populations. PLoS ONE 10:e0120752.

Fraker, M. E. and B. Luttbeg. 2012. A spatially explicit model of predator-prey space games. Oikos 121:1935-1944.

Fraker, M. E. and B. Luttbeg. 2012. Predator-prey space use and the spatial distribution of predation events. Behaviour 149:555-574.

Fraker, M. E. 2010. Risk perception and anti-predator behavior of wood frog (*Rana sylvatica*) tadpoles:a comparison with green frog (*Rana clamitans*) tadpoles. Journal of Herpetology 44:390-398.

Fraker, M. E., V. Cuddapah, S. A. McCollum, R. A. Relyea, J. Hempel, and R. J. Denver. 2009. The behavioral and endocrine stress response of tadpoles to a chemical cue of predation secreted by conspecifics. Hormones and Behavior 55: 520-529.

Fraker, M. E. 2009. Predation risk assessment through chemical cues produced by multiple prey. Behavioral Ecology and Sociobiology 63: 1397-1402.

Fraker, M. E. 2009. The effect of prior experience on a prey's current perceived risk. Oecologia 158: 765-774.

Fraker, M. E. 2009. The perceptual ability of tadpoles limits the accuracy of their predation risk assessment. Behaviour 146: 1025-1036.

Fraker, M. E. 2008. The influence of the circadian rhythm of green frog (*Rana clamitans*) tadpoles on their antipredator behavior and the strength of the nonlethal effects of predators. American Naturalist 171: 545-552.

Fraker, M. E. 2008. The effect of hunger on the strength and duration of the anti-predator behavioral response of green frog (*Rana clamitans*) tadpoles. Behavioral Ecology and Sociobiology 62: 1201-1205.

Fraker, M. E. and S. D. Peacor. 2008. Statistical tests for biological interactions: a comparison of permutation tests and analysis of variance. Acta Oecologia 33: 66-72.

Fraker, M. E. 2008. The dynamics of predation risk assessment: responses of anuran larvae to chemical cues of predators. Journal of Animal Ecology 77: 638-645.

Fraker, M. E., J. W. Snodgrass, and F. Morgan. 2002. Differences in growth and maturation of blacknose dace (*Rhinichthys atratulus*) across an urban-rural gradient. Copeia 2002: 1122-1127.

<u>Final Reports</u> (non-refereed)

Glover, D., **M. E. Fraker**, S. C. Keitzer, and E. A. Marschall. 2016. Modeling the effects of climate change on anadromous fish populations in the Connecticut River. Final Report. NOAA Fisheries (National Marine Fisheries Service). Project IJ10-15.

May, E., **M. E. Fraker**, S. Gebremariam, J. Martin, and W. Zhang. 2016. Linking agricultural production and Great Lakes ecosystem services: modeling and valuing the impacts of harmful algal blooms in Lake Erie. Ohio Sea Grant College Program. Project R/ME-038.

May, C. J., **M. E. Fraker**, and S. A. Ludsin. 2016. The influences of hydrodynamics, early growth, and larval movement on walleye recruitment in the western basin of Lake Erie. Final Report. Ohio DNR. Project FADR67.

Fraker, M. E. and S. A. Ludsin. 2015. A biophysical modeling approach to understanding walleye recruitment in Lake Erie. Final Report. Ohio DNR. Project FADR69.

<u>Presentations</u> (invited and contributed)

2020 Ecosystem trends and drivers of a dynamic, large freshwater lake depend on the chosen perspective. Association for the Sciences of Limnology and Oceanography and Society for Freshwater Science Joint Meeting, Madison, Wisconsin. (contributed oral presentation; meeting cancelled)

2020 Lake Erie ecosystem trends and drivers during 1969-2018. NOAA-GLERL All Hands meeting, Ann Arbor, Michigan. (invited oral presentation)

2019 Stress hormone-mediated antipredator morphology improves escape performance in wood frog tadpoles, Ecological Society of America Annual Meeting, Louisville, Kentucky. (contributed oral presentation)

2019 Developing an integrated ecosystem assessment of Lake Erie fisheries, International Association of Great Lakes Research Annual Meeting, Brockport, New York. (contributed oral presentation)

2019 Individual- to ecosystem-level responses to the abiotic and biotic environment in freshwater systems, Murray State University, Department of Biological Sciences. (invited oral presentation)

2019 Individual- to ecosystem-level responses to the abiotic and biotic environment in freshwater systems, Kennesaw State University, Department of Ecology, Evolution, and Organismal Biology. (invited oral presentation)

2019 Individual- to ecosystem-level responses to the abiotic and biotic environment in freshwater systems, Emporia State University, Department of Biological Sciences. (invited oral presentation)

2019 Individual- to ecosystem-level responses to the abiotic and biotic environment in freshwater systems, St. Bonaventure University, Biology Department. (invited oral presentation)

2017 Linking stress physiology to the expression of the anti-predator phenotype, Lund University (Sweden), Department of Biology. (invited oral presentation)

2016 Spatial variation of impacts of ecosystem change on habitat quality for a Lake Erie fish, Ecological Society of America Annual Meeting, St. Petersburg, Florida. (contributed oral presentation)

2016 Spatial variation of impacts of ecosystem change on habitat quality for a Lake Erie fish, 40th Annual Larval Fish Conference, Solomons, Maryland. (contributed oral presentation)

2015 The role of environmental heterogeneity in individual-level variation in performance, University of Mississippi, Department of Biology. (invited oral presentation)

2015 Hydrodynamic backtracking improves stock discrimination capability in Lake Erie yellow perch, Lake Erie-Inland Waters Annual Research Review, Columbus, Ohio. (invited oral presentation)

2014 Biophysical drivers of walleye recruitment variation in Lake Erie, International Association of Great Lakes Research Annual Meeting, Hamilton, Ontario. (invited oral presentation)

2014 The role of biophysical processes in the early life history of Great Lakes fish, Western Michigan University, Department of Biology. (invited oral presentation)

2014 Biophysical drivers of walleye recruitment variation in Lake Erie, Lake Erie-Inland Waters Annual Research Review, Columbus, Ohio. (invited oral presentation)

2013 The use of hydrodynamic backtracking as a tool for studying population connectivity, Ecological Society of America Annual Meeting, Minneapolis, Minnesota. (contributed oral presentation)

2013 A coupled biophysical model of walleye recruitment in western Lake Erie, International Association of Great Lakes Research Annual Meeting, West Lafayette, Indiana. (invited oral presentation)

2013 A coupled biophysical model of walleye recruitment in western Lake Erie, Lake Erie-Inland Waters Annual Research Review, Columbus, Ohio. (invited oral presentation)

2012 Predator-prey space games: a general model and empirical patterns, The Ohio State University, Department of Evolution, Ecology, and Organismal Biology. (invited oral presentation)

2011 An individual-based model of predator-prey space games, Evolution 2011, Norman, Oklahoma. (contributed oral presentation)

201 Connecting predation risk assessment to prey behavior, The Ohio State University, School of Natural Resources and the Environment. (invited oral presentation)

2010 Connecting predation risk assessment to prey behavior, The University of Tulsa, Department of Biological Science. (invited oral presentation)

2010 Connecting predation risk assessment to prey behavior, Oklahoma State University, Department of Zoology. (invited oral presentation)

2007 Predation risk assessment and the anti-predator behavioral dynamics of larval anurans, The University of Michigan, Department of Ecology and Evolutionary Biology. (invited oral presentation)

2006 The effect of circadian rhythms on anti-predator behavior in green frog (*Rana clamitans*) tadpoles, Ecological Society of America Annual Meeting, Memphis, Tennessee. (contributed oral presentation)

2005 Some effects of short term temporal variation in predation risk on the behavior of green frog (*Rana clamitans*) tadpoles, Ecological Society of America Annual Meeting, Montreal, Quebec. (contributed poster)

2005 Some effects of short term temporal variation in predation risk on the behavior of green frog (*Rana clamitans*) tadpoles, Midwest Ecology and Evolution Conference, Carbondale, Illinois. (contributed oral presentation)

Teaching Experience

Winter, 2016 Guest Lecturer, EEOB 3410, Introduction to Ecology, The Ohio State University

Fall, 2015 Instructor of Record, EEOB 8896, Scientific Writing, The Ohio State University

Winter, 2014 Guest Lecturer, EEOB 3410, Introduction to Ecology, The Ohio State University

Spring, 2008 Instructor of Record, Biology 171, Introductory Biology: Ecology and Evolutionary Biology, The University of Michigan

Fall, 2006 Lab Coordinator (Graduate Student Instructor, GSI), Biology 282, Field Ecology, The University of Michigan

Winter, 2006 GSI, Biology 162, General Biology, The University of Michigan

Fall, 2005 Lab Coordinator (GSI), Biology 282, Field Ecology, The University of Michigan

Winter, 2005 GSI and Guest Lecturer, Biology 281, General Ecology, The University of Michigan

Fall, 2004 Lab Coordinator (GSI), Biology 282, Field Ecology, The University of Michigan

Fall, 2002 GSI, Biology 282, Field Ecology, The University of Michigan

Winter, 2002 GSI, Biology 162, General Biology, The University of Michigan

Student Mentorship

September 2019-present

Undergraduate: Lauren Payne (2020-21, PitE Honor's thesis)

Master's: Group project: Emily Dusicska, Rae Green, Carol Rosenbaum, Xinjie Wu, and Kathy Sun (2020-21)

CIGLR Great Lakes Summer Fellows: Anisha Shrestha (2020, co-mentored with Russ Miller), Brenna Friday (2020)

2004-September 2019

High school: LaCarr Trent (2015), Kenton Colvin (2016)

Undergraduate: Sarah Szymanski (2004), Jon Falk (2005), Christine Balmes (2005-6), Sarah Seiter

(2006), Sara Koelsch (2013-15), Jacob Lebamoff (2016), Taylor Brown (2016-18; Honor's thesis), Derek Huck (2017), Kaitlyn Scott (2017), Molly Kotick (2018-19, Honor's thesis),

Masters: Thesis: Anna Moyer (2009-11), Reed Brodnik (2013-15);
PhD: David Dippold (2016-2020)

Service

2019 Judge, 71st Annual Ohio Academy of Science State Science Day, Columbus, Ohio

2019 Organized class visits on aquatic ecology with Jessica Florea, New Albany High School, Ohio

2018 Organizer/Presenter, Annual 6th Graders' AEL Field Trip, The Ohio State University

2018 Presenter, Museum of Biological Diversity Annual Open House, The Ohio State University

2017 Organizer/Presenter, Annual 6th Graders' AEL Field Trip, The Ohio State University

2017 Judge, 69th Annual Ohio Academy of Science State Science Day, Columbus, Ohio

2017 Presenter, Museum of Biological Diversity Annual Open House, The Ohio State University

2016 Organizer/Presenter, Annual 6th Graders' AEL Field Trip, The Ohio State University

2016 Judge, Blaxter Award, 40th Annual Larval Fish Conference, Solomons, Maryland.

2015 Organizer/Presenter, Annual 6th Graders' AEL Field Trip, The Ohio State University

2015 Judge, 67th Annual Ohio Academy of Science State Science Day, Columbus, Ohio

2015 Judge, 2015 NMS Undergraduate Research Forum, The Ohio State University

2014 Organizer/Presenter, Annual 6th Graders' AEL Field Trip, The Ohio State University

2014 Initiated weekly Behavioral Ecology Discussion Group, The Ohio State University

2014 Judge, student presentations, IAGLR Annual Meeting, Hamilton, Ontario

2014 Judge, 66th Annual Ohio Academy of Science State Science Day, Columbus, Ohio

2013 Organizer/Presenter, Annual 6th Graders' AEL Field Trip, The Ohio State University

2013 Judge, student presentations, IAGLR Annual Meeting, West Lafayette, Indiana

2013 Judge, Denman Undergraduate Research Forum, The Ohio State University

2012 Organizer/Presenter, Annual 6th Graders' AEL Field Trip, The Ohio State University

2006-7 Mentor, EEB Graduate Mentorship Program, The University of Michigan

2004 Coordinator, EEB Lunch Seminar series, The University of Michigan

Peer reviewing

September 2019-present

Journals: Ecological Modeling (2), Oecologia

2005-September 2019

Granting agencies: Great Lakes Fishery Trust, National Science Foundation, Natural Sciences and Engineering Research Council of Canada, Ohio Sea Grant

Book: Trophic Ecology (Garvey, J. E.)

Journals: Acta Herpetologica, Acta Oecologica, American Naturalist, Animal Behaviour, Animal Cognition, Annales Zoologica Fennici, Aquatic Ecology, Behaviour, Behavioral Ecology, Behavioral Ecology and Sociobiology, Biological Journal of the Linnean Society, Biology Letters, Canadian Journal of Fisheries and Aquatic Sciences, Canadian Journal of Zoology, Ecology and Evolution, Ecological Modelling, Ecosphere, Ethology, Ethology Ecology and Evolution, Evolutionary Biology, Frontiers in Biology, General and Comparative Endocrinology, Global Change Biology, The Herpetological Journal, Hydrobiologia, Journal of Animal Ecology, Journal of Biosciences, Journal of Chemical Ecology, Journal of Comparative Psychology, Journal of Great Lakes Research, Journal of Herpetology, Landscape Ecology, Marine and Freshwater Behaviour and Physiology, North American Journal of Fisheries Management, Oecologia, Oikos, PeerJ, Reviews in Fisheries Science and Aquaculture, Transactions of the American Fisheries Society

Training and Workshops

2013 Bayesian Hierarchical Modeling, The Ohio State University
2006-7 Preparing Future Faculty, The University of Michigan

Professional Membership

American Society of Naturalists, Ecological Society of America, International Association for Great Lakes Research, Society for the Study of Amphibians and Reptiles

References

Dr. Earl Werner (Ph.D. advisor)
Professor Emeritus
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Dr. Stuart Ludsin (Postdoctoral supervisor)
Professor
Aquatic Ecology Laboratory
The Ohio State University
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Columbus, Ohio 43212-1156
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Dr. Barney Luttbeg (Postdoctoral supervisor)
Associate Professor
Department of Zoology
Oklahoma State University
501 Life Sciences West
Stillwater, Oklahoma 74078-3052
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Dr. Robert Denver (Postdoctoral supervisor)
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Department of Ecology and Evolutionary Biology
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