Zachary R. Miller

Postdoctoral Researcher | Yale University
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Education

University of Chicago — Chicago, IL
Ph.D. in Ecology and Evolution — 2022
NSF Graduate Research Fellow
Dissertation: *Theoretical approaches to environmental feedbacks and community coexistence*
Advisor: Stefano Allesina

Yale University — New Haven, CT
B.S. in Ecology and Evolutionary Biology (with distinction) & Applied Mathematics — 2017
Magna cum laude
Advisors: Oswald Schmitz and David Vasseur

Professional Appointments

Yale University, Postdoctoral Associate — New Haven, CT
Advisors: Pincelli Hull (Earth & Planetary Science) — 2023 – present
David Vasseur (Ecology & Evolutionary Biology)

University of Illinois, Postdoctoral Research Associate — Urbana, IL
Advisor: James O'Dwyer (Plant Biology) — 2022 – 2023

Publications

Google Scholar: scholar.google.com/citations?user=0IL4BlIAAAAJ (* equal contribution)

refereed journal articles:

Z.R. Miller and S. Allesina (2023). *Habitat heterogeneity, environmental feedbacks, and species coexistence across timescales.* The American Naturalist, 202 (2). DOI: 10.1086/724821

A. Skwara, P. Lemos-Costa, **Z.R. Miller**, and S. Allesina (2022). *Modeling ecological communities when composition is manipulated experimentally.* Methods in Ecology & Evolution, 14 (2). DOI: 10.1111/2041-210X.14028

T. Gibbs, Y. Zhang, **Z.R. Miller**, and J.P. O'Dwyer (2022). *Stability criteria for the consumption and exchange of essential resources.* PLOS Computational Biology, 18 (9). DOI: 10.1371/journal.pcbi.1010521

Z.R. Miller, P. Lechón-Alonso, and S. Allesina (2022). *No robust multispecies coexistence in a canonical model of plant-soil feedbacks.* Ecology Letters, 25 (7). DOI: 10.1111/ele.14027

Z.R. Miller and S. Allesina (2021). *Metapopulations with habitat modification.* PNAS, 118 (49). DOI: 10.1073/pnas.2109896118

D.S. Maynard, **Z.R. Miller**, and S. Allesina (2020). *Predicting coexistence in experimental ecological communities.* Nature Ecology & Evolution, 4. DOI: 10.1038/s41559-019-1059-z

PRE-PRINTS AND WORKS-IN-PROGRESS:

Z.R. Miller*, M. Clenet*, K. Della Libera, F. Massol, and S. Allesina. *Coexistence of many species under a random competition-colonization trade-off.* Pre-print: 10.1101/2023.03.23.533867
—Recommended by PCI Ecology: https://doi.org/10.24072/pci.ecology.100533

P. Lemos-Costa, **Z.R. Miller**, and S. Allesina. *Phylogeny structures species' interactions in experimental ecological communities.* Pre-print: 10.1101/2023.09.04.556236

Z.R. Miller and J.P. O'Dwyer. *Metabolic trade-offs can reverse the resource-diversity relationship.* Pre-print: 10.1101/2023.08.28.555123

C.A. Serván, J.A. Capitán, **Z.R. Miller**, and S. Allesina. *Effects of phylogeny on coexistence in model communities.* Pre-print: 10.1101/2020.09.04.283507

S. Allesina, **Z.R. Miller**, and C.A. Serván. *Intraspecific variation stabilizes classic predator-prey dynamics.* Pre-print: 10.1101/2021.09.27.461947

OTHER REFEREED WORKS:

Z.R. Miller (2019). *Digest: Does sexual conflict complicate a trade-off between fecundity and survival?.* Evolution. DOI: 10.1111/evo.13855

A.J. Mossman*, K.E. Culhane*, **Z.R. Miller***, K.M. Brock, P. Pafilis, and C.M. Donihue (2016). Natrix natrix *(LINNAEUS, 1758) found on the small islet of Tigani (Central Cyclades, Greece).* Herpetozoa, 29.

Teaching

Teaching Assistant

Theoretical Community Ecology (graduate) — University of Chicago, Spring 2021
Guest lecture on statistical methods and models.

Computing Skills for Biologists (graduate) — University of Chicago, Winter 2020
Worked closely with 25 students in project-based course. Guest lecture on advanced programming practices (Python-based).

Principles of Population Genetics (graduate) — University of Chicago, Winter 2019
Led quantitative review sessions and weekly paper discussions.
Developed probability review materials used in future course iterations.

Fundamentals of Biological Data Analysis (undergraduate) — University of Chicago, Fall 2018
Worked closely with 20 students in project-based course. Guest lectures on scientific visualization and principle component analysis.

Other Teaching

Software Carpentry, Workshop Instructor and Organizer — University of Chicago, 2019 – 2022
Led 2-3 workshops annually on programming basics (R-based), version control, and Unix shell. Collaborated with instructor team to design and adapt lesson plans.

Statistical Theory and Methods, Peer Tutor — University of Chicago, 2019 – 2021
Hosted weekly tutorials for Biology PhD students taking statistics coursework.

Linear Algebra Tutorial, Invited Lecturer — ICTP (virtual), Dec. 2020
Designed and led linear algebra tutorial for Winter School on Quantitative Systems Biology.

Quantitative Biology Bootcamp, Course Assistant — University of Chicago / MBL, Sept. 2019
Supported week-long intensive course for incoming students across all Biology PhD programs. Led sessions on population genetics and programming skills (R-based).

Invited Talks and Seminars

Penn State University | **Theoretical Biology Seminar**, University Park, PA — Oct. 2023
upcoming

University of California Davis | **Center for Population Biology Seminar**, Davis, CA — Jan. 2023
Theoretical approaches to environmental feedbacks and community coexistence

Princeton University | **Lewis-Sigler Scholars Day Symposium**, Princeton, NJ — Nov. 2022
Minimal models for complex plant-soil feedbacks

University of Chicago | **Sarah Cobey Lab Group Meeting**, Chicago, IL — March 2022
Host heterogeneity, immune imprinting & strain coexistence: Insights from metapopulation models

Stanford University | **Eco-Evo Lunch Seminar**, Virtual — March 2021
Coupled metapopulation dynamics with patch memory and modification

Princeton University | **Theoretical Ecology Lab Tea**, Virtual — Feb. 2021
Coupled metapopulation dynamics with patch memory and modification

Evolutionary and Ecological Systems Biology Seminar (hosted at MIT), Virtual — June 2020
Predicting coexistence in experimental ecological communities

University of Chicago | **Neuroscience Theory Group**, Chicago, IL — April 2019
Modeling complex networks as intersection graphs

Yale University | **Invited EEB Senior Thesis Symposium**, New Haven, CT — May 2017
Elemental cycling, physiological stress, and ecosystem functioning: Confronting a stoichiometrically-explicit model with data

Conference Presentations

Ecological Society of America (ESA) Annual Meeting, Montreal, QC — Aug. 2022
Theoretical foundations of multispecies coexistence maintained by plant-soil feedbacks
Invited for organized session: "Integrating the frontiers of plant-soil feedback research"

Ecological Society of America (ESA) Annual Meeting, Virtual — Aug. 2021
Coupled metapopulation dynamics with patch memory and modification
Slides: https://zacharyrmiller.netlify.app/img/esa_2021_slides.pdf

Ecological Society of America (ESA) Annual Meeting, Virtual — Aug. 2020
Testing the predictive value of phylogeny for community productivity
Video: https://zacharyrmiller.netlify.app/talk/esa_2020/video

Ecological Society of America (ESA) Annual Meeting, Louisville, KY — Aug. 2019
Predicting coexistence in experimental ecological communities
Slides: https://doi.org/10.7490/f1000research.1117379.1

REU Research Symposium | **University of Delaware**, Lewes, DE — Aug. 2015
Characterizing the sources and structure of genetic diversity in a model of mutualism exploitation

Fellowships and Awards

Best Dissertation Award in Ecology & Evolution | **University of Chicago** — 2023

Center for Population Biology Postdoctoral Fellowship | **UC Davis** – *declined* — 2023

NSF Graduate Research Fellowship – $102,000 — 2019 – 2022

Edgar J. Boell Prize | Yale University 2017
"Awarded annually to a senior for excellence in biology"

NSF Research Experiences for Undergraduates – $6,000 2016
Supplement to DEB-1354762 (Yale University)

NSF Research Experiences for Undergraduates – $5,500 2015
REU site OCE-1460963 (University of Delaware)

Summer Environmental Fellowship | Yale University – $1,500 2014

Freshman Summer Research Fellowship | Yale University – $3,400 2014

Finalist (not awarded)

Schmidt Science Fellows (1 of 6 nominees across all sciences at UChicago) 2023

Lewis-Sigler Scholars | Princeton University 2023

Environmental Fellows, High Meadows Institute | Princeton University 2023

Professional Service

Student Seminar Chair, Department of Ecology and Evolution — University of Chicago
Organized and hosted weekly student research seminars. Organized selection and hosting of student-invited speakers for departmental seminars. — 2020 – 2021

Panelist on Peer Review, Department of Ecology and Evolution — University of Chicago
Discussed peer-reviewing process, best practices, and strategies with graduate students and postdocs. — Sep. 2021

PhD Admissions Committee Member, Department of Ecology and Evolution — University of Chicago
Evaluated and interviewed PhD applicants as a student representative on departmental admissions committee. Solicited, summarized, and presented student input to faculty. — 2018 – 2019

Co-President, Yale Ecology and Evolutionary Biology Undergraduates Society — Yale University
Organized department outreach events, field trips, and social activities. — 2016 – 2017

Journal Peer Reviewer
The American Naturalist, Ecography, Ecology Letters, Journal of Mathematical Biology, Oikos, Methods in Ecology and Evolution, Nature Ecology & Evolution, New Phytologist, PLOS Computational Biology

Grant Peer Reviewer
NSF DEB - Population & Community Ecology (ad hoc reviewer, 2023)

Mentorship

Dillon Max | University of Illinois, undergraduate research — 2023 – present
Sylvia Gimbel | University of Illinois, undergraduate research — 2022 – present
Pablo Lechón-Alonso | University of Chicago, graduate research — 2020 – 2022
Ricardo Muñiz Trejo | University of Chicago, graduate community mentor — 2020 – 2021

Outreach

Young Scholars Program, University of Illinois Chicago — Chicago, IL
Guest speaker on "Randomness and rainforests" for summer mathematics program. — July 2021

Volunteer Tutor, Strive Tutoring (2018-2019) and Tutoring Chicago (2020-2021) — Chicago, IL
Provided one-on-one instruction and support for local K-12 students (weekly). — 2018 – 2021

Panelist, Women in STEM Symposium — Chicago, IL
Panelist on research careers and opportunities for Chicago-area women in STEM. — March 2019

Exam Writer and Grader, UChicago Science Olympiad — Chicago, IL
Mentored undergraduate Science Olympiad chapter through writing and grading ecology and herpetology exams for high school invitational. — 2018 – 2019

Staff Writer, Yale Scientific Magazine — New Haven, CT
Authored articles on scientific research for a general audience. — 2013 – 2016
Select articles available at http://www.yalescientific.org/author/zacharymiller/.

Event Volunteer, Resonance — New Haven, CT
Guided high school students through events, tours, and group discussions on Yale campus. — 2014 – 2016

Event Volunteer, Science on Saturdays — New Haven, CT
Led science demonstrations and hands-on activities for local K-8 students. — 2013 – 2015

Workshops and Working Groups

Understanding and Predicting Pathogen Communities (PATHOCOM) Annual Meeting — New York, NY — Sep. 2023
Attended as external collaborator (PI: Detlef Weigel; ERC Synergy Grant 9514444)

Merging Statistical Theory and Analyses at the Interface of Microbial and 'Macrobial' Ecology — Montreal, QC — Aug. 2022
Invited working group (PI: Mathew Leibold; NSF Award number: 2224331)

Data and Models in Ecology & Evolution — Orsay, France — July 2019
Funded summer school at Institut Pascal, Université Paris-Saclay

Skills, Certifications, and Memberships

Natural languages: English (native), Spanish (limited)

Programming languages: R (expert); Python, Java, MATLAB (proficient); C (limited)

Other computing: LaTeX, Git, Mathematica

Certifications: Software Carpentry Instructor

Professional Memberships: Ecological Society of America