

Laura A. Twardochleb

Fisheries and Wildlife
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Education

(Expected 04/2020)

Ph.D. Fisheries and Wildlife and Ecology, Evolutionary Biology, and Behavior, Michigan State University- East Lansing, MI

Dissertation: Climate effects in freshwater ecological communities: from species interactions to continental biodiversity patterns

Advisor: Phoebe L. Zarnetske

2015

M.S. Aquatic and Fishery Sciences, University of Washington- Seattle, WA

Thesis: Urban development modifies lake food webs in the Pacific Northwest

Advisor: Julian D. Olden

2010

B.S. Ecology and Evolution with Honors, UC Santa Cruz- Santa Cruz, CA

Undergraduate Research: Do Non-Native Crayfish Add Functions or Replace Native Functions in Stream Food Webs?

Advisor: Jonathan W. Moore

Professional Experience

2017-2020

NASA Earth and Space Science Fellow, Michigan State University- East Lansing, MI

Predicting freshwater insect biodiversity across spatial scales at the extent of the continental United States, using remotely sensed measures of climate, land use, and other watershed attributes.

Assembled datasets of over 2.4 million freshwater insect occurrence records and corresponding functional traits for the continental United States.

2016-2018

Visiting Graduate Student, Kellogg Biological Station, Mittelbach Lab- Hickory Corners, MI

Studied the effects of seasonality and temperature on freshwater pond communities using field surveys and laboratory experiments.

2016-2017

Graduate Research Assistant, Michigan State University- East Lansing, MI

Investigated linkages between productivity and biodiversity in aquatic and terrestrial realms using remotely sensed data and continental-scale biodiversity datasets.

2015-2020

Michigan State University Enrichment Fellow- East Lansing, MI

Used field surveys and experiments to identify mechanisms by which climate warming influences freshwater insect physiology and predator-prey interactions.

Developed a theoretical model to investigate how freshwater insect population and community dynamics will respond to climate warming in seasonally-varying environments.

2012-2015

NSF Graduate Research Fellow, University of Washington- Seattle, WA

Investigated effects of urban and agricultural development of lake shorelines and watersheds on the functional diversity of lake littoral macroinvertebrate communities.

Assessed the functional roles of non-native species in lake food webs across a natural-urban watershed gradient.

Conducted a global meta-analysis of the ecological impacts of non-native crayfish on freshwater food webs.

2011

Biological Science Technician, US Geological Survey- Menlo Park, CA

Monitored invertebrate community dynamics in San Francisco Bay estuary.

- 2009-2011 **Lab and Field Technician, UC Santa Cruz, Moore Lab-** Santa Cruz, CA
Quantified the biotic resistance potential of a stream consumer to non-native prey.
Studied impacts of invasive crayfish and forest fire on stream food web processes.
- 2007-2010 **Research Assistant, UC Santa Cruz, Ash Lab-** Santa Cruz, CA
Designed research protocols and analyzed video data for a project investigating
improvements to informal science education for ESL speakers visiting children's exhibits
at the Museum of Science and Industry in Tampa, FL.
- 2007 **Intern, California Wolf Center-** Julian, CA
Animal husbandry and public outreach for a conservation breeding center for the
endangered Mexican Gray Wolf.

Teaching Experience

- 2018 **Lead Organizer**, Graduate Fellowship Writing Workshop Series, MSU
- 2014 **Guest Lecturer**, FISH 423- Aquatic Invasion Ecology, University of Washington
- 2012 **Teaching Assistant**, FISH 101- Water and Society, University of Washington
- 2012 **Guest Lecturer**, FISH 490- Aquatic Microbiology, University of Washington
- 2009 **Peer Tutor**, Animal Physiology and Genetics, UC Santa Cruz

Publications **The first two authors contributed equally.*

8. SM Linzmaier, **LA Twardochleb**, JD Olden, T Mehner, R Arlinghaus. 2018. Size-dependent foraging niches of European Perch *Perca fluviatilis* (Linnaeus, 1758) and North American Yellow Perch *Perca flavescens* (Mitchill, 1814). *Environmental Biology of Fishes* 101 (1), 23-37.
7. Larson, E.R., **Twardochleb, L.A.** & Olden, J.D. 2017. Comparison of trophic function between the globally invasive crayfishes *Pacifastacus leniusculus* and *Procambarus clarkii*. *Limnology* 18 (3), 275-286.
6. **Twardochleb, L.A.** & Olden, J.D. 2016. Human development modifies the functional composition of lake littoral invertebrate communities. *Hydrobiologia* 775 (1): 167-184.
5. **Twardochleb, L. A.**, and J.D. Olden. 2016. Non-native Chinese mystery snail (*Bellamya chinensis*) supports consumers in urban lake food webs. *Ecosphere* 7(5): e01293. 10.1002/ecs2.1293.
4. Kuehne, L.M.*, **Twardochleb, L.A.***, Fritschie, K.J., Mims, M.C., Lawrence, D.J., Gibson, P.P., Stewart-Koster, B., and Olden, J.D. 2014. Practical science communication strategies for graduate students. *Conservation Biology* 28:1225–1235.
3. **Twardochleb, L.A.**, Olden, J.D., and Larson, E.R. 2013. A global meta-analysis of the ecological impacts of non-native crayfish. *Freshwater Science* 32:1367–1382.
2. Moore J.W., Carlson S.M., **Twardochleb L.A.**, Hwan J.L., and Fox J.M. 2012. Trophic Tangles through Time? Opposing Direct and Indirect Effects of an Invasive Omnivore on Stream Ecosystem Processes. *PLoS ONE* 7(11): e50687. doi:10.1371/journal.pone.0050687.
1. **Twardochleb L.A.**, Novak M., and Moore J.W. 2012. Using the functional response of a consumer to predict biotic resistance to invasive prey. *Ecological Applications* 22:1162–1171.

Manuscripts in Review or Revision ***Undergraduate co-author that I mentored.*

2. **Twardochleb, LA**, TR Treacle**, and PL Zarnetske. Foraging strategy mediates ectotherm predator-prey responses to climate warming. *Ecology*.
1. Dahlin, K., Zarnetske, P., Read, Q., **Twardochleb, L.**, Kamoske, A., Cheruvellil, K., Soranno, P. Interactions between biodiversity and ecosystem function among terrestrial and aquatic realms. *Frontiers in Ecology and the Environment*.

Manuscripts in Preparation ***Undergraduate co-author that I mentored.*

4. **Twardochleb, L.A.**, E. Hiltner**, M. Pyne, and P.L. Zarnetske. A freshwater insect occurrence and trait dataset for the continental United States. In prep for *Scientific Data*.

3. PL Zarnetske, Dahlin, KM, Read, QD, **Twardochleb, LA**, Kamoske, A, Cheruvellil, K, Soranno, P, and Luo, L. A decade of aquatic and terrestrial abiotic and biotic watershed attributes in the contiguous United States (2001-2011). In prep for *Scientific Data*.
2. **Twardochleb, LA** and PL Zarnetske. Climate and land use effects on freshwater insect biodiversity vary with spatial scale across the continental United States.
1. **Twardochleb, LA**, PL Zarnetske, and CA Klausmeier. Life-cycle responses to temperature and seasonality determine consumer-resource population dynamics under climate warming.

Competitive Fellowships

2017-2019	NASA Earth and Space Science Fellowship	\$134,107
2015-2020	Michigan State University Enrichment Fellowship	\$80,000
2012-2015	National Science Foundation Graduate Research Fellowship	\$134,000

Research Grants and Scholarships

2018	Travel Grant, Wangeningen University, Netherlands	\$2,015
	MSU Fisheries and Wildlife GSO Travel Grant	\$200
	MSU Graduate School Fellowship	\$3,245
	George H. Lauff Scholarship	\$200
2017	Ball Fisheries and Wildlife Fellowship	\$5,000
	MSU Graduate School Fellowship	\$5,500
2016	MSU, ESPP C-FEW Summer Research Fellowship	\$7,000
	Kellogg Biological Station Graduate Research Fellowship	\$3,000
	George H. Lauff Scholarship	\$1,000
	T. Wayne and Kathryn Porter Graduate Fellowship	\$500
	Kellogg Biological Station Graduate Research Award	\$750
2015	Society for Freshwater Science Endowment Award	\$1,000
	MSU Research Enhancement Award	\$950
	MSU Research Enhancement Award	\$950
2014	UW College of the Environment, Student Travel Award	\$305
2012	American Fisheries Society, Eugene Maughan Scholarship	\$1,500
	Northwest Scientific Association, Student Grant Award	\$1,500

Awards and Honors

2019	Distinguished Graduate Student Speaker for MSU EEBC Seminar Series
2018	MSU Fisheries and Wildlife Graduate Student Symposium, Best Poster Presentation
2013	UW SAFS Graduate Student Symposium, Best Poster Presentation
2010	Phi Beta Kappa Honors, Graduated <i>Cum laude</i> , UC Santa Cruz

Invited Seminar Presentations ***Undergraduate co-author that I mentored.*

3. **L. Twardochleb.** 12/2019. A freshwater insect occurrence and trait database for the continental United States. Oregon Department of Environmental Quality, Eugene, OR.
2. **L. Twardochleb.** 10/2019. Climate effects in freshwater ecological communities: from species interactions to continental biodiversity patterns. Distinguished Graduate Student Speaker, MSU Ecology, Evolutionary Biology and Behavior Program Seminar Series, East Lansing, MI.
1. **L. Twardochleb,** T. Treakle**, and P. Zarnetske. 2018. Predator-prey interactions in a warming world will depend on predator foraging strategy and thermal performance. Michigan Natural Features Inventory, Lansing, MI.

Presentations at Scientific Conferences **Undergraduate co-author that I mentored.

10. **L. Twardochleb**, E. Hiltner**, M. Pyne, and P. Zarnetske. 2019. A freshwater insect occurrence and trait database for the continental United States. Society for Freshwater Science Meeting, Salt Lake City, UT. (oral)
9. Hiltner, E. **, **L. Twardochleb**, and P. Zarnetske. 2019. An ecological trait database of North American freshwater invertebrates for the assessment of climate change effects on streams. The Stewardship Network Meeting, East Lansing, MI. (poster)
8. **L. Twardochleb**, T. Treakle**, and P. Zarnetske. 2018. Predator-prey interactions in a warming world will depend on predator foraging strategy and thermal performance. Ecological Society of America Meeting, New Orleans, LA. (oral)
7. T. Treakle**, **L. Twardochleb**, and P. Zarnetske. 2018. Climate Change, Faster Species, and Food Webs. Ecological Society of America Meeting, New Orleans, LA. (poster)
6. **L. Twardochleb**, Q. Read, P. Zarnetske, E. Hiltner**, K. Dahlin, K. Cheruvilil, P. Soranno and A. Kamoske. 2018. Scaling relationships between freshwater insect diversity and the terrestrial environment. Society for Freshwater Science Meeting, Detroit, MI. (poster)
5. **LA Twardochleb**. 2018. Predator-prey interactions in a warming world will depend on predator foraging strategy and thermal performance. Predator-Prey Interactions Gordon Research Conference, Ventura, CA. (poster)
4. **LA Twardochleb** and JD Olden. 2014. Effects of Non-Native Chinese Mystery Snail (*Bellamya chinensis*) on Food Webs of Urban Lakes: Prey Resource or Trophic Cul-de-Sac? Joint Aquatic Sciences Meeting, Portland, OR. (oral)
3. **LA Twardochleb** and JD Olden. 2013. Interactive Effects of Chinese Mystery Snail (*Bellamya chinensis*) and Urbanization on Lake Food Webs of Washington State, Washington Lake Protection Association Meeting, Vancouver, WA. (poster)
2. Beakes, M., C. Cois, N. Retford, **L. Twardochleb**, and J.W. Moore. Fire, Fish, and Food Webs. 2011. American Fisheries Society 140th Annual Meeting, Seattle, WA. (oral)
1. Moore, J.W., **L.A. Twardochleb**, and M. Novak. 2011. Trophic Cascades, Detrital Dynamics, and Biotic Resistance: Roles of Crayfish in California Streams. American Fisheries Society 140th Annual Meeting, Seattle, WA. (oral)

Other Presentations **Undergraduate co-author that I mentored.

9. **LA Twardochleb** and PL Zarnetske. 2019. Climate and land use effects on freshwater insect diversity in the continental United States, MSU Fisheries and Wildlife Graduate Research Symposium, East Lansing, MI. (oral)
8. **LA Twardochleb**. 2018. Predator-prey interactions in a warming world will depend on predator foraging strategy and thermal performance. MSU Fisheries and Wildlife Graduate Research Symposium, East Lansing, MI. (poster)
7. **LA Twardochleb**. 2017. Forecasting the effects of climate warming on freshwater food webs in Michigan. Kellogg Biological Station Brown Bag Seminar, Hickory Corners, MI. (oral)
6. J Wahl** and **L Twardochleb**. 2017. Investigating *Daphnia pulex* locomotion in light of global warming. Kellogg Biological Station Undergraduate Research Symposium, Hickory Corners, MI. (poster)
5. **LA Twardochleb**. 2016. Forecasting the effects of climate warming on freshwater food webs in Michigan. MSU Ecology, Evolutionary Biology, and Behavior Program Colloquium, East Lansing, MI. (oral)
4. **LA Twardochleb**. 2016. Forecasting the effects of climate change on freshwater food webs in Michigan. Michigan State University, Environmental Science and Policy Program, Climate, Food, Energy, Water Symposium, East Lansing, MI. (oral)
3. J Ventzke** and **L Twardochleb**. 2016. Freshwater predator foraging traits in a warming world. Kellogg Biological Station Undergraduate Research Symposium and MSU Undergraduate Research and Arts Forum, Hickory Corners, MI. (poster)

2. **LA Twardochleb** and JD Olden. 2014. Do Anthropogenic Stressors Drive Functional Trait Convergence of Littoral Macroinvertebrate Assemblages? School of Aquatic and Fishery Sciences, Graduate Student Symposium, University of Washington, Seattle, WA. (oral)
1. **LA Twardochleb** and JD Olden. 2013. Interactive Effects of Chinese Mystery Snail (*Bellamya chinensis*) and Urbanization on Lake Food Webs of Washington State, School of Aquatic and Fishery Sciences, Graduate Student Symposium, University of Washington, Seattle, WA. (poster)

Outreach

- 2019 Activity Leader, Graduate Women in Science, Middle School Girls Math and Science Day, East Lansing, MI
- 2018 Volunteer, Graduate Women in Science, Middle School Girls Math and Science Day
- 2015 Science Olympiad Coach, Invasive species event, East Lansing High School, MI
- 2013-2015 Freshwater Conservation Exhibit Lead/Organizer, PAWS on Science Husky Weekend at Seattle Pacific Science Center, Seattle, WA

Outreach and Science Communication Training

- 2018 Science Communication Workshop at ESA Annual Meeting, New Orleans, LA
- 2018 MSU Fisheries and Wildlife Outreach and Engagement Course
- 2015 MSU Outreach and Engagement Workshop
- 2014 COMPASS Science Communication Workshop at University of Washington

Mentoring

Michigan State University

- 2018 Minali Bhatt, Honors College Professorial Assistant
Erika Ralston, Honors College Professorial Assistant
Project: An ecological trait database of North American freshwater invertebrates.
- 2017-2019 Ethan Hiltner, CANR Undergraduate Research Assistant
Project: An ecological trait database of North American freshwater invertebrates.
- 2017 Tyler Treacle, REU Student
Jacob Wahl, MSU Undergraduate Research Apprentice
Project: Effects of climate warming on ectotherm movement.
- 2016-2018 Collin Love, Undergraduate
Arpita Nayak, Honors College Professorial Assistant
Faith Slubowski, Honors College Professorial Assistant
Project: Seasonal dynamics of pond food webs
- 2016 Jessie Ventzke, Undergraduate Research Apprentice
Project: Freshwater Predator Foraging Traits in a Warming World.

University of Washington

- 2013-2014 Meghan Rosewood, Undergraduate
Project: The effects of littoral habitat alteration on macroinvertebrate functional feeding group diversity in Washington Lakes.
- 2013 Marina Krasnovid, Undergraduate
Project: Stable isotope analysis of lake fish, and species identification of aquatic plants.
- 2012 Leslie (Siwei) Chen, Undergraduate
Project: Benthic invertebrate diversity across a gradient of lake urbanization.
- 2011 Andrea Wong, American Fisheries Society Hutton Scholars Program
Project: New Zealand Mud Snail distribution in Lake Washington.

Service

Michigan State University

2016-2018 Council of Graduate Students Representative for Fisheries and Wildlife
2017-2018 College of Agriculture and Natural Resources Curriculum Committee
2016-2017 College of Agriculture and Natural Resources Graduate Fellowship Committee
2015-2016 Graduate Student Representative for Fisheries and Wildlife Advisory Committee
University of Washington
2012-2013 American Fisheries Society UW Graduate Student Chapter Secretary

Other Professional Training

2018 Short course: Modelling population dynamics with physiologically structured population models. The Graduate School for Production Ecology and Resource Conservation, Wageningen University, Netherlands.
2015 Short course: Graduate Workshop on Environmental Data Analytics. University of Colorado, Boulder.

Manuscript Reviewer

Bioinvasions Records, Biological Invasions, Hydrobiologia, Ecology, Freshwater Biology, Freshwater Science, Oecologia, Royal Society Open Science, Scientific Reports

Research Skills

Programming Languages: R, Mathematica

Analytical skills: theoretical modeling of population and community dynamics, maximum likelihood estimation and numerical optimization, meta-analysis, multivariate statistical analysis

Society Membership

Ecological Society of America, Society for Freshwater Science