Christopher M. Heggerud

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Academic Appointments

2025-   **Assistant Professor -** Department of Mathematics, University of Manitoba.

2021-   **Postdoctoral Researcher -** Department of Environmental Science & Policy, University of California, Davis. Hastings Lab (**NSERC PDF**, 2023 - current).

Education

2021   PhD in Applied Mathematics, University of Alberta.

Thesis titled "Modelling phytoplankton across many scales: transient dynamics, human interactions, and niche differentiation in the light spectrum", supervised by Dr. Mark Lewis and Dr. Hao Wang.

2015   Bachelor of Science, Toronto Metropolitan University.

(Formerly Ryerson University) Bachelor of Science with honors in Applied Mathematics with a minor in Medical Physics. Supervised by Dr. Kunquan Lan.

Research Experience

2021-   University of California, Davis [Postdoctoral Research]

Mentored by Dr. Alan Hastings at University of California, Davis, Department of Environmental Science and Policy.

2015-2021   University of Alberta [Research Assistant]

Mentored by Dr. Mark Lewis and Dr. Hao Wang at the University of Alberta, Department of Mathematical and Statistical Sciences.

2014   NSERC [Undergraduate Student Research Award]

Supervised by Dr. Kunquan Lan at Ryerson University, Department of Mathematics.

2013   NSERC [Undergraduate Student Research Award]

Supervised by Prof. Dejan Delic at Ryerson University, Department of Mathematics.

Student Mentorship

2021   Velizar Kirkow (Mathematics)

Co-supervised Velizar Kirkow from University of Exeter who was visiting with a MITACS Globalink Research Internship.

2019   Daniel Jin (Biology)

Co-supervised Daniel Jin for their biology undergraduate research project (BIOL498) at the University of Alberta.

2019   Julian Pavón García (Mathematics)

Co-supervised Julian Pavón García from Eberhard Karls University of Tübingen who was

Publications

14   J. Serpico, B.A. Zambrano-Luna, R. Milne, **C. M. Heggerud**, A. Hastings, H. Wang. Deciphering culprits for cyanobacterial blooms and lake vulnerability in north-temperate lakes, In review (2024)

13.   A. Morozov, U. Feudel, A. Hastings, K.C. Abbott, K. Cuddington, **C. M. Heggerud**, S. Petrovskii, Long-living transients in ecological models: recent progress, new challenges, and open questions. *Physics of Life Reviews*, In press (2024)

12.   **C. M. Heggerud** & A. Hastings, Predicting transient dynamics through the use of empirical dynamical modelling: A case study of anaerobic digestion. *Journal of the Royal Society Interface*, 21**:**20240059 (2024)

11.   K.C. Abbot, **C.M. Heggerud**, YC. Lai, A. Morozov, S. Petrovski, K. Cuddington, & A. Hastings. When and why ecological systems respond to the rate rather than the magnitude of environmental changes. *Biological Conservation,* 292:110494 (2024)

10.   **C. M. Heggerud**, J. Xu, Hao Wang, M. A. Lewis, R. Zurawell, C. Loewen, R. Vinebrooke, & P. Ramazi, Predicting imminent cyanobacterial blooms in lakes using incomplete timely data. *Water Resources Research* 60, 2 (2024)

9.   **C. M. Heggerud**, KY. Lam & H. Wang. Niche differentiation in the light spectrum promotes coexistence of phytoplankton species: a spatial modelling approach. *Journal of Mathematical Biology* 86, 54 (2023)

8.   A. Shen, S. Gao, **C. M. Heggerud**, H. Wang, Z. Ma, & S. Yuan. Fluctuation of growth and photosynthetic characteristics in Prorocentrum shikokuense under phosphorus limitation: Evidence from field and laboratory. *Ecological Modelling*, 479, (2023).

7.   **C. M. Heggerud**, K.C. Abbott, A. Hastings, Transient Dynamics. *Oxford Bibliographies in Ecology*. New York: Oxford University Press, 2023.

6.   V. Kirkow, H. Wang, P. V. Garcia, S. Ahmed, **C. M. Heggerud**, Impacts of a changing environment on a stoichiometric producer-grazer system: a stochastic modelling approach. *Ecological Modelling* 469 (2022).

5.   H. Wang, P. V. Garcia, S. Ahmed, **C. M. Heggerud***, Mathematical comparison and empirical review of the Monod and Droop forms for resource-based population dynamics. *Ecological Modelling* 466 (2022). (*Supervisory Author)

4.   **C. M. Heggerud,** H. Wang, & M. A. Lewis, "Coupling the socio-economic and ecological dynamics of cyanobacteria: Single lake and network dynamics." *Ecological Economics* 194 (2022).

3.   A. Peace, P. C. Frost, N. D. Wagner, M. Danger, C. Accolla, P. Antczak, B. W. Brooks, D. M. Costello, R. A. Everett, K. B. Flores, **C. M. Heggerud,** R. Karimi, Y. Kang, Y. Kuang, J. H. Larson, T. Mathews, G. D. Mayer, J. N. Murdock, C. A. Murphy, R. M. Nisbet, L. Pecquerie, N. Pollesch, E. M. Rutter, K. L. Schulz, J. T. Scott, L. Stevenson, & H. Wang. Stoichiometric Ecotoxicology for a Multisubstance World. *BioScience*: biaa160, (2021).

2. **C. M. Heggerud**, H. Wang, & M. A. Lewis, Transient dynamics of a stoichiometric cyanobacteria model via multiple-scale analysis. *SIAM Journal of Applied Mathematics* 80 (3), 1223–1246 (2020).

1. **C. M. Heggerud,** & K.Q. Lan. Local stability analysis of ratio-dependent predator-prey models with predator harvesting rates. *Applied Mathematics and Computation* 270: 349-357 (2015).

Teaching Experience

2024   University of California, Davis [Instructor]

COSMOS - Mathematical Modeling of Biological Systems – An intensive four-week summer residential school for high school students with high aptitude for careers in STEM.

2022-2023   University of California, Davis [Primary Instructor]

MAT 21A (Differential Calculus) Fall 2022. Sole instructor for ~100 students.
Mathematical Biology Seminar (Co-organizer and instructor on record W2023)

2015–2021   University of Alberta [Teacher's Assistant]

Instructing Labs:
MATH 201 (Differential Equations)
Math 100 (Calculus I)
MATH 102 (Applied Linear Algebra)
Grading:
MATH 201 (Differential Equations)
MATH 334 (Introduction to Differential Equations)
Decimal Robinson Support Centre

2014-2015   Ryerson University [Teacher's Assistant]

Instructing Labs:
MATH 131 (Modern Mathematics I)

2014-2015   The Math Guru [Tutor]

Tutored students of all levels ranging from grade 8 math to first year university math and statistics. With a focus on breaking the "math people"

Awards/Fellowships

2023-2025   NSERC postdoctoral fellowship
Held at UC Davis, supervised by Alan Hastings.

2021   Doctoral Dissertation Award
University of Alberta. Awarded to top 5% of theses in the Faculty of Science.

2020   Alberta Graduate Excellence Scholarship
University of Alberta (Major Award)

2019   Society of Mathematical Biology - Travel Grant
University of Alberta

2019   Faculty of Graduate Studies and Research - Travel Award

University of Alberta

2017/2018   Alberta Innovates - Graduate Student Scholarship
Held at the University of Alberta. (Major Award)

2015/2016   NSERC [Canadian Graduate Scholarship - Masters]
Held at the University of Alberta. (Major Award)

2015   Walter H. Johns Graduate Fellowship
University of Alberta

2015   Dennis Mock Student Leadership Award
Ryerson University

2014   C.Roy Horney Award
Ryerson University

2014   Paul and Anna Maria Bonato Scholarship

Ryerson University

2013 & 2014   NSERC [Undergraduate Student Research Award]
Held at Ryerson University

2013   Howard Kerr Memorial Scholarship
Ryerson University

2012   Math Faculty Scholarship

Ryerson University

Academic & Professional Activities

Upcoming   UC Davis Department of Environmental Science and Policy Diversity, Equity and Inclusion Committee- Postdoc representative

2024-Current   PNAS Journal Club Panelist.

2024   Mini Symposium Organizer, "Biological Dynamics Across the Many Natural Scales". SIAM life science 2024.

2024   Special Session co-organizer, "Dynamical Systems Modeling for Biological and Social Systems". Joint Mathematics Meeting 2024.

2023/24   Dynamics Days US meeting: Organizing Committee

2023-Current   Member of the advisory committee for the Population Dynamics, Ecology, and Evolution subgroup of the Society of Mathematical Biology.

2022-Current   Co-organizer for the UC Davis Mathematical Biology Seminar.

2023   Mini Symposium co-organizer, "Microbial and ecological dynamics across the many natural scales". Society of Mathematical Biology meeting annual meeting.

2021-Current   Postdoctoral Associate, Center for Population Biology, University of California, Davis.

2021   Banff International Research Station (BIRS) Workshop: Mathematics of Human Environmental Systems. Presenter and active participant.

2019   Mini Symposium co-organizer, "Resource explicit population models". Society of Mathematical Biology meeting annual meeting.

2018   Investigative Workshop on Stoichiometric Ecotoxicology [NIMBioS- Knoxville Tennessee]

Academic Talks

*Invited Talks,OOnline, CContributed Talks, LLectures

2024	Regime shifts and transient dynamics in ecological systems* - Invited research talk in the NOAA FED seminar at the NOAA Southwest Fisheries Science Center in Santa Cruz, CA.
2024	Model free method of predicting transient dynamics* - Invited research talk at SIAM LS 2024
2024	Model free methods of predicting transient dynamics* - Invited research talk at AMS west 2024
2024	Understanding transient crawl-bys in ecological timeseries* & Coupling the socio-economic and ecological dynamics of cyanobacteria*. - Invited research talks at JMM 2024.
2023	Model free methods of predicting transient dynamics[c] - Research talk at the ESA annual meeting.
2023	Parameter estimation and model selection*[L] - Invited by Marissa Baskett to guest lecture for ECL/PBG 233 (Computational Methods in Population Biology, graduate level) at UC Davis.
2023	Model free methods of predicting transient dynamics* - Invited research talk at the SMB annual meeting.
2023	Coupling socio-economic and ecological dynamics of phytoplankton - Sustainable Oceans NRT One-Day Research Symposium
2023	Model free methods of predicting transient dynamics* - Invited research talk at the AMS western annual meeting.
2023	Model free methods of predicting transient dynamics* - Invited seminar talk at the University of Alberta.
2022	Model free methods of predicting transient dynamics* - Invited research talk at the Fields Institute: Workshop on Advances in Mathematical Ecology. Online recording found here.
2022	Mathematical comparison and empirical review of the Monod and Droop forms for resource-based population dynamics* - Invited talk in the CMS 2022 special session: Topics in Mathematical Biology: Theory, Applications and Future Perspectives
2022	Niche differentiation in the light spectrum promotes coexistence of phytoplankton species: a spatial modelling approach* - Invited talk in the CMS 2022 special session: Mathematical Modeling and Analysis in Spatial Ecology and Epidemiology
2022	Understanding transient dynamics using empirical dynamical modelling* - Invited seminar talk at York University
2022	Modelling Phytoplankton Across Many Scales: Transient Dynamics and Human Interactions - Talk in the Mathematical Biology Seminar series at University of California, Davis.
2021	Niche differentiation in the light spectrum promotes coexistence of phytoplankton species: a spatial modeling approach*[O] - Presentation in the mini symposium, "Population dynamics of interacting species", during the 2021 annual Society of Mathematical Biology meeting hosted by University of California, Riverside.
2021	Coupling the socio-economic and transient ecological dynamics of cyanobacteria*[O] - Seminar talk at Texas Tech University.
2021	Coupling the socio-economic and ecological dynamics of cyanobacteria*[O] - Talk at the BIRS workshop: Mathematics of Human Environmental Systems.
2020	Coupling the socio-economic and ecological dynamics of cyanobacteria*[O] - Talk at The Mathematical Biosciences Institute meeting: Life on Planet Earth: Above and Below.

2020	Modeling Cyanobacteria: Transient and social-ecological dynamics* - Seminar talk hosted by Dr. Rebecca Tyson at the University of British Columbia, Okanagan.
2019	Transient dynamics of a stoichiometric cyanobacteria model[C] - Talk at the Seventh International Conference on Mathematical Modeling and Analysis of Populations in Biological Systems (ICMA VII) at Arizona State University.
2019	Multiple-scale analysis of a stoichiometric cyanobacteria model with phosphorus impulses* - Presentation in the mini symposium, "Resource explicit population models", during the 2019 annual Society of Mathematical Biology meeting at the Université de Montréal.
2019	Perturbation Theory for Uses in Mathematical Biolgy*[L] - International Undergraduate Summer Enrichment Program (IUSEP).
2019	Multiple-scale analysis of a stoichiometric cyanobacteria model with phosphorus impulses[C] - Talk at Levin Fest (A symposium at the intersection of mathematics and biology to celebrate the conferral of UVic Honorary Doctor of Science to Dr. Simon Levin) at the University of Victoria.
2019	Slow Manifold and Perturbation theory in Mathematical Biology*[L] - Invited by Hao Wang to guest lecture for MATH570 (Mathematical Biology, graduate level) at U of Alberta.
2018	Stoichiometric Modeling and Multi-Scale Dynamics of Cyanobacteria* - Talk at the 6th Butler memorial conference on Differential Equations and Population Dynamics at the University of Alberta.
2018	Stoichiometric Modeling and Multi-Scale Dynamics of Cyanobacteria[C] - Talk at the 2018 annual CAIMS meeting hosted by Ryerson University.
2015	Ratio-Dependence in Predator Prey Dynamics - First talk of the Undergraduate Mathematics Seminar series at Ryerson University.

Outreach & other relevant activities

2022-Current	Protect Our Winters Canada- Science Alliance
	Confirming/discussing science based approaches to combating and advocating for environmental issues affecting outdoor athletes and recreation.
2023	Ecological Society of America 2023 annual meeting volunteer activities
	A mentor to the workshop "think like a modeler". Judge for Lotka and Volterra awards. Mentor for CV writing workshop.
2022	Mentor for the UC Davis Ecology and Evolution Graduate Preview Program.
2022	Ecological Society of America's Black Ecologists, Early Career, and Inclusive Ecology Sections panel discussion: 'Writing Diversity and Inclusion Statements'
2021-Current	Member of the Joint Baskett, Schreiber, Hastings, etc Lab meetings.
	Active member of the Marissa Baskett, Sebastian Schreiber, Alan Hastings and other joint lab meetings. I contribute to the group in various ways including, but not limited to, organization, research inputs, and presenting my own research.
2021-Current	Member of the Alan Hastings Research Lab.
	Active member of Alan Hastings research group contributing to the group in various ways including, but not limited to, organization, research inputs, writing of DEI statements, and presenting my own research.
2020	MEOPAR webinar: 'BIPOC experiences in STEM: Confronting racism in academia'
2015-2021	Member of the Lewis Research Group
	I was an active member of the Mark Lewis research group contributing to the group in various ways including, but not limited to, organizing events, research inputs, writing of DEI statements, and presenting my own research.

2015-2021	**Member of the Hao Wang Interdisciplinary Lab for Mathematical Ecology & Epidemiology**
	I was an active member of Hao Wang's ILMEE contributing to the group in various ways including, but not limited to, organizing events, research feedback, and presenting my own research.
2015-2020	**Department of Mathematical and Statistical Sciences Math Outreach**
	Volunteer in math outreach at various events, including outreach to rural high schools.
2015-2020	**Math Fair & Unfair**
	Assisted in the University of Alberta event for elementary and junior high aged students, encouraging interest in mathematics through games and other activities.