

# Christopher M. Heggerud

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## Education

PhD in Applied Mathematics, University of Alberta.

2021

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.

Bachelor of Science, Toronto Metropolitan University.

2015

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

## Academic Appointments

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

## Publications

- a. **C. M. Heggerud** & A. Hastings, Predicting transient dynamics through the use of empirical dynamical modelling: A case study of anaerobic digestion. **(In review)**
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 **(in Press, *Biological Conservation*)**
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).

### Awards/Fellowships

- |             |  |
|-------------|--|
| 2023-2025   | NSERC postdoctoral fellowship<br>Held at UC Davis, supervised by Alan Hastings.                              |
| 2021        | Doctoral Dissertation Award<br>University of Alberta. Awarded to top 5% of theses in the Faculty of Science. |
| 2020        | Alberta Graduate Excellence Scholarship<br>University of Alberta (Major Award)                               |
| 2019        | Society of Mathematical Biology - Travel Grant<br>University of Alberta                                      |
| 2019        | Faculty of Graduate Studies and Research - Travel Award<br>University of Alberta                             |
| 2017/2018   | Alberta Innovates - Graduate Student Scholarship<br>Held at the University of Alberta. (Major Award)         |
| 2015/2016   | NSERC [Canadian Graduate Scholarship - Masters]<br>Held at the University of Alberta. (Major Award)          |
| 2015        | Walter H. Johns Graduate Fellowship<br>University of Alberta   |
| 2015        | Dennis Mock Student Leadership Award<br>Ryerson University   |
| 2014        | C.Roy Horney Award<br>Ryerson University   |
| 2014        | Paul and Anna Maria Bonato Scholarship<br>Ryerson University   |
| 2013 & 2014 | NSERC [Undergraduate Student Research Award]<br>Held at Ryerson University                                   |
| 2013        | Howard Kerr Memorial Scholarship<br>Ryerson University   |

2012 Math Faculty Scholarship  
Ryerson University

## Research Experience

|           |  |
|-----------|--|
| 2021-     | University of California, Davis [Postdoctoral Research]<br>Mentored by Dr. Alan Hastings at University of California, Davis, Department of Environmental Science and Policy. |
| 2015-2021 | University of Alberta [Research Assistant]<br>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]<br>Supervised by Dr. Kunquan Lan at Ryerson University, Department of Mathematics.  |
| 2013      | NSERC [Undergraduate Student Research Award]<br>Supervised by Prof. Dejan Delic at Ryerson University, Department of Mathematics.  |

## Student Mentorship

|      |  |
|------|--|
| 2021 | <b>Velizar Kirkow (Mathematics)</b><br>Co-supervised Velizar Kirkow from University of Exeter who was visiting with a MITACS Globalink Research Internship.                            |
| 2019 | <b>Daniel Jin (Biology)</b><br>Co-supervised Daniel Jin for their biology undergraduate research project (BIOL498) at the University of Alberta.                                       |
| 2019 | <b>Julian Pavón García (Mathematics)</b><br>Co-supervised Julian Pavón García from Eberhard Karls University of Tübingen who was visiting with a MITACS Globalink Research Internship. |

## Teaching

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|---|-----------|
| University of California, Davis [Primary Instructor]                          | 2022-2023 |
| MAT 21A (Differential Calculus) Fall 2022. Sole instructor for ~100 students. |           |
| Mathematical Biology Seminar (Co-organizer and instructor on record W2023)    |           |

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

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

Ryerson University [Teacher's Assistant] 2014-2015  
Instructing Labs:  
MATH 131 (Modern Mathematics I)

## The Math Guru [Tutor]

2014-2015

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”

## Academic & Professional Activities

- Upcoming** UC Davis Department of Environmental Science and Policy Diversity, Equity and Inclusion Committee- Postdoc representative
- 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, <sup>o</sup>Online, <sup>c</sup>Contributed Talks, <sup>L</sup>Lectures

- 2023** Model free methods of predicting transient dynamics<sup>c</sup> - Research talk at the ESA annual meeting.
- 2023** Parameter estimation and model selection<sup>\*L</sup> - 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<sup>\*</sup> - 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<sup>\*</sup> - Invited research talk at the AMS western annual meeting.
- 2023** Model free methods of predicting transient dynamics<sup>\*</sup> - Invited seminar talk at the University of Alberta.
- 2022** Model free methods of predicting transient dynamics<sup>\*</sup> - 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<sup>\*</sup> - 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<sup>\*</sup> - 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\*<sup>O</sup> - 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\*<sup>O</sup> - Seminar talk at Texas Tech University.
- 2021 Coupling the socio-economic and ecological dynamics of cyanobacteria\*<sup>O</sup> - Talk at the BIRS workshop: Mathematics of Human Environmental Systems.
- 2020 Coupling the socio-economic and ecological dynamics of cyanobacteria\*<sup>O</sup> - 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<sup>C</sup> - 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 Biology\*<sup>L</sup> - International Undergraduate Summer Enrichment Program (IUSEP).
- 2019 Multiple-scale analysis of a stoichiometric cyanobacteria model with phosphorus impulses<sup>C</sup> - 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\*<sup>L</sup> - 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<sup>C</sup> - 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**

- 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-Current Protect Our Winters Canada- Science Alliance  
Confirming/discussing science based approaches to combating and advocating for environmental issues affecting outdoor athletes and recreation.
- 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.
- 2014/2015** **Ryerson Undergraduate Mathematics Seminars**  
Co-founder and organizer for the seminars aimed to give undergraduate students experience in seminar presentation skills, as well as give students the opportunity to engage in Mathematics research.
- 2014/2015** **Ryerson Mathematics Course Union [President]**  
Elected by a group of my peers as president in May 2014. My role was to create a community for Undergraduate students in the Mathematics program at Ryerson. I ran several successful events that helped students with academic issues and created a positive social atmosphere within the program.
- 2014/2015** **Ryerson Science Society [Director]**  
Sat on the board of directors as the Ryerson Mathematics representative where we managed, monitored and oversaw affairs within the Ryerson Science Society.
- 2014** **Undergraduate Mathematics Curriculum Advising Committee [Student Representative]** Acted as a Student representative to make sure the students voices are heard at the meetings, and to provide input to the faculty members involved.