Andrew J Irwin

Department of Mathematics & Statistics, Dalhousie University, Halifax, NS, Canada, B3H 4R2
a.irwin@dal.ca • 506 364 5747 (cell) • www.mmab.ca • mathstat.dal.ca

Research Interests

Computational, mathematical and statistical models in biological oceanography, Biogeography and species habitat models, Macroecology, Models of growth and photosynthesis in algae, Biogeochemistry of the oceans, Applied transcriptomics and genomics, Theoretical ecology and evolution, Population genetics, Evolution of altruism.

Academic Appointments

Member, Centre for Comparative Genomics and Evolutionary Bioinformatics (Jan 2020–)
Professor, Department of Mathematics and Statistics, Dalhousie University (2018–)
Adjunct Professor, Department of Mathematics and Computer Science, Mount Allison University (2018-2021)
Professor, Department of Mathematics and Computer Science, Mount Allison University (2016–2018)
Head, Department of Mathematics and Computer Science, Mount Allison University (2010–16, 2017 January-June)
Distinguished visiting fellow, State Key Lab for Marine Environmental Science, Xiamen University, Xiamen, China (2015 January)
Visiting Researcher, Program in Atmospheres, Oceans, and Climate; Earth, Atmosphere, and Planetary Science, Massachusetts Institute of Technology (2011–12)
Associate professor, Department of Mathematics and Computer Science, Mount Allison University (2010–2016)
Assistant professor, Department of Mathematics and Computer Science, Mount Allison University (2004–2010)
Assistant professor, Ecology and Evolutionary Biology, Graduate Center, City University of New York (2003–2004)
Assistant professor, Biology department, College of Staten Island, City University of New York (2003–2004)
NSERC Post-doctoral associate, Institute of Marine and Coastal Sciences, Rutgers University (2001–2003)
Post-doctoral associate, Dept. of Ecology, Evolution and Natural Resources, Rutgers University (2000–2001)

Education

Ph D, Queen's University, Kingston, Canada, Mathematics (2000) Advisor: Peter D Taylor, Mathematics, Biology, and Education.
B Ed, University of Manitoba, Mathematics and Chemistry (1995)
M Sc, University of British Columbia, Applied Mathematics (1993). Advisor: Bernie D Shizgal, Chemistry.
B Sc, University of Toronto, Chemical Physics and Mathematics (1991) Advisor: Simon J Fraser, Chemical Physics Theory Group

Awards

Distinguished service award, Canadian Association of University Teachers (2018)
Prix Nicole-Raymond Award, Federation of New Brunswick Faculty Associations (2018)

Courses taught

Dalhousie, Mathematics & Statistics
Numerical Analysis, Matrix Theory & Linear Algebra II, Interdisciplinary science statistics, Data Visualization
Mount Allison, Mathematics and Computer Science:
Mathematical modelling; Simulation & modelling, Numerical analysis; Probability & Statistics I & II; Linear Programming; Differential Equations I & II; Calculus I & II, Real Analysis II, Guest lectures for Contemporary Topics in Science
College of Staten Island, City University of New York:
Community ecology; General biology; General biology lab I & II, Graduate scientific communication (Biology)
Various part-time teaching appointments at U Manitoba (1994-95), Dalhousie (1995-96), Queen's (1996-2000).

Refereed Publications (HQP in bold)

1. **O Carnicer**, AJ Irwin, ZV Finkel. Traits influence dinoflagellate C:N:P. *European J Phycology*, in press. 10.1080/09670262.2021.1914860
2. **ZK Li**, W Li, **Y Zhang**, **Y Hu**, **R Sheward**, AJ Irwin, ZV Finkel. Dynamic photophysiological stress response of a model diatom to ten environmental stresses. *J Phycol* **57**: 484-495. 10.1111/jpy.13072
3. **Y Liang**, **L Bretherton**, **CM Brown**, U Passow, A Quigg, AJ Irwin, ZV Finkel. Transcriptome-wide responses of aggregates of the diatom *Odontella aurita* to oil. *Mar. Ecol. Prog. Ser.* in press.
4. **Y Zhang**, **Z-K Li**, KG Schulz, **Y Hu**, AJ Irwin, ZV Finkel. Growth-dependent changes in elemental stoichiometry and macromolecular allocation in the coccolithophore *Emiliania huxleyi* under different environmental conditions. *Limnology and Oceanography* in press. 10.1002/lno.11854
5. **N McGinty**, AD Barton, NR Record, ZV Finkel, DG Johns, CA Stock, AJ Irwin (2021) Anthropogenic climate change impacts on copepod trait biogeography. *Global Change Biology* 27: 1431-1442. 10.1111/gcb.15499
6. **Z-K Li**, G Dai, **Y Zhang**, K Xu, **L Bretherton**, ZV Finkel, AJ Irwin, P Juneau, B-S Qiu (2020) Phytosynthetic adaptation to light availability shapes the ecological success of bloom-forming cyanobacterium *Pseudanabaena* to iron limitation. *J Phycol* **56**: 1457-1467. 10.1111/jpy.13040
7. **CM Mutshinda**, ZV Finkel, CE Widdicombe, AJ Irwin (2020) A trait-based clustering for phytoplankton biomass modeling and prediction. *Diversity*, **12**: 295. 10.3390/d12080295
8. **MM Amirian**, I Towers, Z Jovanoski, AJ Irwin (2020) Memory and mutualism in species sustainability: a time-fractional Lotka-Volterra model with harvesting. *Heliyon* **6**(8): e04816. 10.1016/j.heliyon.2020.e04816. arXiv
9. **ZK Li**, W Li, **Y Zhang**, **Y Hu**, **R Sheward**, AJ Irwin, ZV Finkel (2020) Dynamic photophysiological stress response of a model diatom to ten environmental stresses. *J Phycol* in press. 10.1111/jpy.13072
10. ZV Finkel, AJ Irwin (2020) Phytoplankton. In Gargaud et al (eds) Encyclopaedia of Astrobiology. Springer. 10.1007/978-3-642-27833-4_5416-1
11. ZV Finkel, **Y Liang**, **D Nanjappa, L Bretherton**, **CM Brown**, A Quigg, AJ Irwin (2020) A ribosomal sequence-based oil sensitivity index for phytoplankton groups. *Marine Pollution Bulletin*, 151: 110798. 10.1016/j.marpolbul.2019.110798
12. **CM Mutshinda**, AJ Irwin, Mikko J. Sillanpää (2020) A Bayesian framework for robust quantitative trait locus mapping and outlier detection. *Int. J. Biostat.*, in press. 10.1515/ijb-2019-0038
13. **AW Omta**, D Talmy, K Inomura, AJ Irwin, ZV Finkel, D Sher, JD Liefer, MJ Follows (2020) Quantifying nutrient throughput and DOM production by algae in continuous culture. *J theor Biol*, in press.
14. **JC Gradone**, MJ Oliver, AR Davies, A Irwin, C Moffat (2020) Sea Surface Kinetic Energy as a Proxy for Phytoplankton Light Limitation in the Summer Pelagic Southern Ocean. *J Geophys Res: Oceans*, in press. 10.1029/2019JC015646
15. **L Bretherton**, M Kamalanathan, J Hillhouse, ZV Finkel, AJ Irwin, A Quigg (2020) Trait-dependent variability of the response of marine phytoplankton to oil and dispersant exposure. *Marine Pollution Bulletin*, **153**: 110906. 10.1016/j.marpolbul.2020.110906.
16. **JD Liefer**, **A Garg**, **MH Fyfe**, AJ Irwin**, I Benner**, CM Brown, MJ Follows, AW Omta, ZV Finkel (2019) The Macromolecular Basis of Phytoplankton C:N:P Under Nitrogen Starvation. *Front. Microbiol.* 10: 763. 10.3389/fmicb.2019.00763
17. **L Bretherton**, M Kamalanathan, J Genzer, J Hillhouse, S Setta, Y Liang, CM Brown, C Xu, J Sweet, U Passow, ZV Finkel, AJ Irwin, PH Santschi, A Quigg (2019) Response of natural phytoplankton communities exposed to crude oil and chemical dispersants during a mesocosm experiment. *Aquatic Toxicology* **206**: 43-53. GOMRI news story. 10.1016/j.aquatox.2018.11.004
18. **Y Liang**, **J Koester**, **J Liefer**, AJ Irwin, ZV Finkel (2019) Molecular mechanisms of temperature acclimation and adaptation in marine diatoms. *ISME J*. **13**: 2415-2425. 10.1038/s41396-019-0441-9
19. **C Fiset**, AJ Irwin, ZV Finkel (2019) The macromolecular composition of non-calcified marine macroalgae. *J Phycology* **55**: 1361-1369. 10.1111/jpy.12913 Data on Figshare at doi 10.6084/m9.figshare.4248962.v1
20. **C Mutshinda**, C Widdicombe, ZV Finkel, AJ Irwin (2019) Bayesian inference to partition determinants of community dynamics from observational time series. *Community Ecology*, in press.
21. **I Benner**, ZV Finkel, AJ Irwin (2019) Capacity of the common Arctic picoeukaryote Micromonas to adapt to a warming ocean. *Limnology & Oceanography: Letters*. in press. 10.1002/lol2.10133 Data on Figshare at doi 10.6084/m9.figshare.4264499
22. **N McGinty**, AD Barton, NR Record, ZV Finkel, AJ Irwin (2018) Traits structure copepod niches in the North Atlantic and Southern Ocean. *Mar. Ecol. Prog. Ser*. **601**: 109-126. 10.3354/meps12660

23. PA Ajani, **N McGinty**, ZV Finkel, AJ Irwin (2018) Phytoplankton realised niches track changing oceanic conditions at a long-term coastal station of Sydney Australia. *Frontiers in Marine Science*. 5: 285. 10.3389/fmars.2018.00285
24. **J Liefer**, **A Garg**, D Campbell, AJ Irwin, ZV Finkel (2018) Nitrogen starvation induces distinct photosynthetic responses and recovery dynamics in diatoms and prasinophytes. *PLOS One*. e0195705. 10.1371/journal.pone.0195705
25. AJ Irwin, ZV Finkel (2018) Phytoplankton functional types: a trait perspective. In Kirchman, Gasol eds., Microbial Ecology of the Oceans, 3rd edition. Wiley. bioRxiv preprint 10.1101/148312
26. **W Xiao**, X Liu, AJ Irwin, E Laws, L Wang, B Chen, Y Zeng, B Huang (2018) Climate warming and eutrophication combine to restructure phytoplankton communities. *Water Research*, **128**: 206-216.
27. **CM Mutshinda**, ZV Finkel, CE Widdicombe, AJ Irwin (2017) Phytoplankton traits from long-term oceanographic time-series. *Marine Ecology Progress Series* **576**: 11-25. 10.3354/meps12220 bioRxiv preprint 10.1101/148304
28. Schofield, N Waite, K Coleman, Z Finkel, M Montes Hugo, A Irwin, T Miles, N Couto, H Ducklow, A Kahl, G Saba, AF Carvalho (2017) Decadal variability in coastal phytoplankton community composition along a changing West Antarctic Peninsula. *Deep Sea Research I*, **124**: 42-54. 10.1016/j.dsr.2017.04.014
29. **C Fiset, J Liefer**, AJ Irwin, ZV Finkel (2017) Methodological biases in estimates of macroalgal macromolecular composition. *L&O Methods*. In press. 10.1002/lom3.10186
30. **AW Omta**, **D Talmy**, D Sher, ZV Finkel, AJ Irwin, MJ Follows (2017) Extracting phytoplankton physiological traits from batch and chemostat culture data. *Limnology & Oceanography Methods*. In press. 10.1002/lom3.10172
31. **AD Barton**, AJ Irwin, ZV Finkel, CA Stock (2016) Anthropogenic climate change drives shift and shuffle in North Atlantic phytoplankton communities. *Proc. Nat. Acad. Sci. USA* **113**: 2964-2969. 10.1073/pnas.1519080113
32. **CM Mutshinda**, ZV Finkel, CE Widdicombe, AJ Irwin (2016) Ecological equivalence of species within phytoplankton functional groups. *Functional Ecology* **30**: 1714-1722. 10.1111/1365-2435.12641
33. ZF Finkel, MJ Follows, AJ Irwin (2016) Size-scaling of macromolecules and chemical energy content in the eukaryotic microalgae. *J Plank. Res.***38**: 1151-1162. 10.1093/plankt/fbw057
34. ZV Finkel, MJ Follows, **J Liefer**, **CM Brown**, **I Benner**, AJ Irwin (2016) Phylogenetic diversity in the macromolecular composition of microalgae. *PLoS ONE* **11**(5): e0155977. 10.1371/journal.pone.0155977
35. **EA Kerrigan**, AJ Irwin, ZV Finkel (2015) Community and population changes in diatom size structure in a subarctic lake over the last two centuries. *Peer J* **3**: e1074. 10.7717/peerj.1074
36. AJ Irwin, ZV Finkel, F Müller-Karger, L Troccoli Ghinaglia (2015) Reply to Brun: A fingerprint of evolution revealed by shifts in realized phytoplankton niches in natural populations. *Proc. Nat. Acad. Sci. USA*. **112**: E5255. 10.1073/pnas.1514396112
37. AJ Irwin, ZV Finkel, F Müller-Karger, L Troccoli Ghinaglia (2015) Phytoplankton adapt to changing ocean environments. *Proc. Nat. Acad. Sci. USA*. **112**: 5762-66. 10.1073/pnas.1414752112
38. D Tchernov, DF Gruber, AJ Irwin (2014) Isotopic fractionation of carbon in the coccolithophorid *Emiliania huxleyi*, *Mar. Ecol. Prog. Ser.*, **508**: 53-66. 10.3354/meps10840
39. **Y Wu**, DA Campbell, AJ Irwin, DJ Suggett, ZV Finkel (2014) Ocean acidification enhances the growth rate of larger diatoms. *Limnology and Oceanography*, **59**(3): 1027-34. 10.4319/lo.2014.59.3.1027
40. **CM Mutshinda**, ZV Finkel, AJ Irwin (2014) Identifying environmental drivers of species abundance using Bayesian variable selection. *Ecological Modelling*. **269**: 1-8. 10.1016/j.ecolmodel.2013.07.025
41. MJ Oliver, A Irwin, M Moline, W Fraser, D Patterson, O Schofield, J Kohut (2013) Adélie Penguin Foraging Behavior Affected by Local Tides. *PLoS One* **8**: e55163.
42. **CM Mutshinda**, L Troccoli-Ghinaglia, ZV Finkel, FE Müller-Karger, AJ Irwin (2013) Environmental control of the dominant phytoplankton in the Cariaco basin: a hierarchical Bayesian approach. *Marine Biology Research* **9**: 247-261.
43. **ME Cimino**, WR Fraser, AJ Irwin, MJ Oliver (2013) Satellite data identify decadal trends in the quality of Pygoscelis penguin chick-rearing habitat. *Global Change Biology* **19**: 136-148.
44. **SC Sharpe**, **JA Koester**, **M Loebl**, AM Cockshutt, DA Campbell, AJ Irwin, ZV Finkel (2012) Influence of cell size and DNA content on growth rate and photosystem II function in cryptic species of *Ditylum brighwellii*. *PLoS One* **7**: e52916.
45. AJ Irwin, **AM Nelles**, ZV Finkel (2012) Phytoplankton niches estimated from field data. *Limnology and Oceanography* 57(3): 787-797.

46. **HM van Tol**, AJ Irwin, ZV Finkel (2012) Macroevolutionary trends in silicoflagellate skeletal morphology: the costs and benefits of silicification. *Paleobiology*, **38**(3): 391-402.
47. Schofield, SM Glenn, MA Moline, M Oliver, A Irwin, Y Chao, M Arrott (2012) Ocean observatories and information: Building a global ocean observing network. In Earth System Monitoring. J Orcutt [ed], pp. 319-336. 10.1007/978-1-4614-5684-1_14
48. **ZP Mei**, ZV Finkel, AJ Irwin (2011) Modeling the allometry of growth and C:N stoichiometry of phytoplankton using a variable quota model. *Mar. Ecol. Prog. Ser.*, **434**: 29-43. 10.3354/meps09149
49. **BZ Chen**, AJ Irwin, ZV Finkel (2011) Biogeographic distribution of diversity and size-structure of organic-walled dinoflagellate cysts. *Mar. Ecol. Prog. Ser.* **425**: 35-45. 10.3354/meps08985
50. AS Quigg, ZV Finkel, AJ Irwin (2011) Testing the evolutionary inheritance of elemental stoichiometry in phytoplankton. *Proc. R. Soc. Lond. B.* **278**: 526-534. 10.1098/rspb.2010.1356
51. ZV Finkel, KA Matheson, KS Reagan, AJ Irwin (2010) Genotypic and phenotypic variation in diatom silicification under paleooceanographic conditions. *Geobiology*. 10.1111/j.1472-4669.2010.00250.x
52. AJ Irwin and MJ Oliver (2009) Are ocean deserts getting larger? *Geophysical Research Letters* **36**: L18609. 10.1029/2009GL039883
53. **ZP Mei**, ZV Finkel, AJ Irwin (2009) Light and nutrient availability affect the size-scaling of growth in phytoplankton. *J theor Biol*, **259**: 582-588. 10.1016/j.jtbi.2009.04.018
54. ZV Finkel, **C Jacob-Vaillancourt**, AJ Irwin, ED Reavie, JP Smol (2009) Environmental control of diatom community size structure varies across aquatic ecosystems. *Proc R Soc B*, **276**: 1627-1634. 10.1098/rspb.2008.1610 (cover)
55. AJ Irwin and ZV Finkel (2008) Mining a sea of data: deducing environmental controls of remote-sensed chlorophyll. *PLOS One* **3**(11): e3836. 10.1371/journal.pone.0003836.
56. MJ Oliver and AJ Irwin (2008) Objective ocean global biogeographic provinces. *Geophysical Research Letters*, **35**: L15601. 10.1029/2008GL034238.
57. **C Six**, ZV Finkel, AJ Irwin, DA Campbell (2007) Light variability illuminates niche-partitioning among oceanic picocyanobacteria. *PLOS One*, **2**(12): e1341. 10.1371/journal.pone.0001341.
58. ZV Finkel, **J Sebbo**, M Katz, AJ Irwin, O Schofield, S Feist-Burkhardt, J Young, P Falkowski (2007) A universal driver of macroevolutionary change in the size of phytoplankton over the Cenozoic. *Proceedings of the National Academy of Sciences USA*, **104**(51): 20416-20420. 10.1073/pnas.0709381104
59. I Berman-Frank, AS Quigg, ZV Finkel, AJ Irwin, L Haramaty (2007) Nitrogen-fixation strategies and Fe requirements in cyanobacteria *Limnology and Oceanography*. **52**(5): 2260-2269.
60. AJ Irwin, ZV Finkel, O Schofield and PG Falkowski (2006) Scaling-up from size-dependent physiology to the size structure of phytoplankton communities, *J Plank Res*, **28**: 459-471. 10.1093/plankt/fbi148
61. JA Raven, ZV Finkel, AJ Irwin (2005) Picophytoplankton: Bottom-up and top-down controls on ecology and evolution. *Vie et Milieu* **55**: 209-215.
62. T Shi, TS Bibby, L Jiang, AJ Irwin, PG Falkowski (2005) Constraints on protein interactions on evolution of photosynthetic genes in cyanobacteria. *Mol. Bio. & Evol.* **22**: 2179-2189.
63. C Dutech, VL Sork, AJ Irwin, PE Smouse, FW Davis (2005) Gene flow and fine-scale genetic structure in a wind pollinated tree species, *Quercus lobata* (Fagaceaee), *Am. J. Bot.* **92**: 252-261.
64. Schofield, T Bergmann, M Oliver, AJ Irwin, G Kirkpatrick, WP Bissett, C Orrico and MA Moline (2004) Inverting inherent optical signatures in the nearshore coastal waters at the Long Term Ecosystem Observatory. *J. Geophys. Res.* **109**(C12): S04.
65. MJ Oliver, S Glenn, JT Kohut, AJ Irwin, OM Schofield, MA Moline and WP Bissett (2004) Bioinformatic Approaches for Objective Detection of Water Masses on Continental Shelves. *J Geophys. Res.*, **109**(C07): S04.
66. ZV Finkel, AJ Irwin, and O Schofield (2004) Resource Limitation Alters the 3/4 Size Scaling of Metabolic Rates in Phytoplankton. *Marine Ecology Progress Series*, **273**: 269-279.
67. A Quigg, ZV Finkel, AJ Irwin, Y Rosenthal, T-Y Ho, JR Reinfelder, O Schofield, FMM Morel and P Falkowski (2003) The evolutionary inheritance of elemental stoichiometry in marine phytoplankton. *Nature* **425**: 291-294.
68. AJ Irwin, J Hamrick, M-J Godt, and PE Smouse (2003) A multi-year estimate of the effective pollen donor pool for *Albizia julibrissin*. *Heredity* **90**: 187-194.
69. AJ Irwin and PD Taylor (2001) Evolution of altruism in stepping-stone populations with overlapping generations. *Theo. Pop. Biol.* **60**: 315-325.
70. ZV Finkel and AJ Irwin (2001) Light absorption by phytoplankton and the filter amplification correction: cell size and species effects. *J. Exp. Mar. Biol. & Ecol.* **259**: 51-61.

71. AJ Irwin and PD Taylor (2000) Evolution of dispersal in a stepping-stone population with overlapping generations. *Theo. Pop. Biol.* **58**: 321–328.
72. PD Taylor, AJ Irwin, and T Day (2000) Inclusive fitness in finite deme-structured and stepping-stone populations. *Selection*. **1**: 153-163.
73. PD Taylor and AJ Irwin (2000) Overlapping generations can promote altruistic behaviour. *Evolution* **54**: 1135-1141.
74. ZV Finkel and AJ Irwin (2000) Modelling size-dependent photosynthesis: light absorption and the allometric rule. *J. theor. Biol.* **204**: 361-369.
75. AJ Irwin and PD Taylor (2000) Heterozygous advantage and the evolution of female choice. *Evolutionary Ecology Research*. **2**: 119-128.
76. AJ Irwin and BD Shizgal (1995). A discrete velocity model for relaxation of anisotropic distribution functions, *Rarefied Gas Dynamics*, **19**: 654-651.
77. NC Kenkel and AJ Irwin (1994) Fractal analysis of dispersal, *Abstracta Botanica*, **18**(2), 79-84.
78. AJ Irwin, SJ Fraser, and R Kapral (1990) Stochastically induced coherence in bistable systems, *Phys. Rev. Lett.*, **64**, 2343-2346
79. AJ Irwin, SJ Fraser, and R Kapral (1990) *Phys. Rev. Lett.*, **65**, 3357.
80. AJ Irwin and SJ Fraser (1990) Cellular automaton model of chemical wave propagation on fractals, *J. Chem. Phys.*, **93**, 3471-3483.

Evidence of impact

- 3800+ citations in Google Scholar; h-index 35. i-10 index 51. Google Scholar: user=wFFLMuUAAAAJ
- Three papers reviewed in Faculty of 1000 (f1000biology.com): Irwin & Finkel (2008) *PLoS One,* Irwin et al (2006) *J Plank Res,* Raven et al (2005) *Vie et Milleu*
- Finkel & Irwin (2000) was featured in a mini-review by Raven & Kübler (2002) *J Phycol.* **38**: 11-16.
- BBC news online. Feb. 23, 2016. Mark Kinver, Environment reporter: Climate stirring change beneath the waves. http://www.bbc.com/news/science-environment-35631223. Reports on: Barton et al. PNAS (2016)
- The Carbon Brief Blog. April 20, 2015. Robert McSweeney. Tiny marine plants could amplify Arctic warming by 20% new study finds. Reports on findings in Irwin et al. PNAS (2015).
- Research visit to Antarctica featured in Mount Allison alumni magazine and promotional literature (2012).
- Laura Dillman. June 2008. Building better climate models using biotechnology. Coverage of CFI award and lab open house with colleagues Drs. Doug Campbell, Amanda Cockshutt and Zoe Finkel. In: Moncton *Times and Transcript* and *BioAtlantech*.
- Melanie Jollymore. Summer 2006. Global warming and the carbon sink. *Progress Research and Discovery* Magazine. Globe and Mail insert.

Recent International Working Groups and Workshops

Statistical models of phytoplankton biogeography and temporal dynamics. *Joint Simons Marine Collaboration.* Zoom with 120 participants. October 2020.

Explaining gradients in Gradients II: statistical models of breakpoints. SCOPE-Gradients workshop. Seattle WA. 15-17 October 2019.

Using current phytoplankton communities to anticipate climate induced restructuring. *Ancient DNA from the Seafloor to Predict the Fate of Plankton in a Future Ocean: Challenges and Opportunities in Paleogenomics.* Harvard University. May 2018.

Inferring niches and traits from *in situ* data. *Modeling marine microbial diversity.* NYC. Simons Foundation. May 2018.

Statistical models of phytoplankton traits and the challenges of interpreting field data. Bergen, Norway. FILAMO workshop on Obstacles in communication between field, lab, and modeling work. August 2017.

Computational modeling of marine microbial systems. NYC. Simons Foundation. New approaches to statistical modeling of plankton from species to communities. January 2017.

Global Changes in Marine Plankton Diversity and Productivity. Leipzig, Germany. A workshop funded by the Synthesis Centre of Biodiversity Science (sDiv) at the German Center for Integrative Biodiversity Research (iDiv). PIs: Aleksandra Lewandowska and Boris Worm. Nov. 29-Dec. 4 2015.

Modeling Marine Microbes. Sackville NB. Gordon and Betty Moore PI working group (participants from MIT, Haifa, ANU, Mount Allison). Meeting organizer. June 2015.

Macromolecular pools: models and measurements. Haifa, Israel. A planning meeting of the Follows, Sher and Finkel research groups. Sept. 8-11, 2013.

Workshop on *Representation of phytoplankton physiology in marine ecosystem models*. Exeter, UK. Invited by James Clark, College of Life & Env. Sci., U. of Exeter. Dec. 13-14, 2012.

Meeting of the Palmer Long Term Ecosystem Research Network working group. Twin Bridges, Montana. At Polar Oceans Research. June 2012

Selected Research Presentations

Phytoplankton biogeography in a changing world. CGEB, Dalhousie University. March 18, 2021

Phytoplankton biogeography in a changing world. Health and Ecology Modelling, Department of Mathematics and Statistics, University of Strathclyde. March 17, 2021

Statistical modelling of species-rich communities: connecting species to communities. Simons CBIOMES Annual meeting. Zoom. June 8-10, 2020.

Quantifying plankton niches using observational data. Marine Biological Association, Plymouth UK. July 2019.

Statistical analysis of the macromolecular determinants of growth rate, CBIOMES annual meeting, Simons Foundation Flatiron Institute, NYC, May 2019.

Marine Microbial Macroecology, Statistics collaborative research group, AARMS, Dalhousie, May 2019.

Parameter estimation for ordinary differential equations: Bayesian methods with Stan, CBIOMES workshop, MIT, Boston, January 2019.

Predicting phytoplankton biomass in the Bay of Fundy, Harmful Algae Symposium, Bedford Institute of Oceanography, Dartmouth NS, January 2019.

Modeling microbial ecology in a dynamic ocean. Mathematics & Statistics, Dalhousie University, September 2017 (invited).

Using field data to reduce uncertainty in models of phytoplankton dynamics and biogeography. FILAMO workshop, Bergen, Norway. August 2017 (invited).

Trait-based approaches to ocean life, August 2017, Bergen, Norway.
- Phytoplankton traits from long-term oceanographic time-series.
- Stability of traits across broad geographical ranges (with **N McGinty**)

ASLO Annual Meeting, Feb 2017, Honolulu, HI
- Phytoplankton traits from long-term oceanographic time-series.
- Phylogenetic and differences and size scaling in the macromolecular composition of microalgae (with Z Finkel)
- Macromolecular composition of macroalgae (with **C Fiset**, Z Finkel)
- Niches are determined by trophic level in North Atlantic and Southern Ocean calanoid copepods (with **N McGinty**, Z Finkel, A Barton, N Record)
- Size and phylogenetic differences in macromolecular composition in response to nitrogen starvation (with **J Liefer, I Benner, CM Brown, A Garg, M Fyfe**, Z Finkel)
- Transcriptome-wide responses to temperature in diatoms (with **Y Liang, J Koester**, ZV Finkel)
- The interaction between bacteria and phytoplankton in response to oil and corexit in mesocosm experiments (with **S Setta, E Whitaker, J Genzer, L Bretherton, S Doyle, C Brown**, J Sylvan, ZV Finkel, A Quigg)

Gulf of Mexico Research Conference, Jan 2017, New Orleans, LA
- Response of natural phytoplankton communities to oil and dispersant exposure, quantified though 18S rRNA and metatranscriptomic responses (with ZV Finkel, AS Quigg)
- The interaction between bacteria and phytoplankton in response to oil and corexit in mesocosm experiments (with **S Setta, E Whitaker, J Genzer, L Bretherton, S Doyle, CM Brown**, J Sylvan, ZV Finkel, A Quigg.)

Gordon Research Conference. Marine Microbes. June 2016. Girona, Spain.
- Modeling phytoplankton growth with functional group and species level traits

AGU/ASLO Ocean Science, Feb 2016, New Orleans LA
- Ecological equivalence of species within phytoplankton functional types.

An interaction between light and temperature on the growth of Arctic phytoplankton (**I Benner**, Z Finkel).
Second Xiamen Marine Ecology Symposium (XMAS-2). Jan 2015. Xiamen University, Xiamen, China.
Invited plenary talk. Phytoplankton realized niches: estimation, projections, and stability.
Shantou University. Jan 2015. Shantou, Guangdong, China.
Phytoplankton realized niches: estimation, projections, and stability.
Canadian Society of Ecology & Evolution. May 2014. Montréal PQ.
Testing the stability of realized niches of phytoplankton in response to a changing climate.
Gordon Research Conference. Global Ocean Change. July 2014, Waterville NH.
Testing the stability of realized niches of phytoplankton in response to a changing climate.
AGU/ASLO Ocean Sciences, Feb 2014, Honolulu HI
Testing the stability of realized niches of phytoplankton in response to a changing climate.
Adélie penguin foraging location predicted by tidal regime switching in a changing climate (with MJ Oliver, MA Moline, W Fraser, D Patterson)
Estimating the response of North Atlantic Phytoplankton communities to climate change (with **A Barton**, ZV Finkel, CA Stock)
Biogeochemical and ecological consequences of phytoplankton community composition along a melting West Antarctic Peninsula (with OM Schofield, G Saba, ZV Finkel, H Ducklow.)

Training of Highly Qualified Personnel

Supervision of post-doctoral research associates
Tufail Malik (2007–09), Bingzhang Chen (2009–10), Yaping Wu (2010–11), Crispin Mutshinda Mwanza (2011–13, 15-16, 17–), Andrew Barton (2012–13), Julie Koester (2012–14), Nils Güzlow (2014–2015), Ina Benner (2014–2018), Justin Liefer (2014–2018), Niall McGinty (2015–20), Yue Liang (2016–2019), Ruby Hu (2017–), Deepak Nanjappa (2017-19), Zhi-Ping Mei (2007–10, 2017–19), Zheng-Ke Li (2017–), Rosie Sheward (2017–18), Vinitha Ebenezer (2018–), Yong Zhang (2018–19), Joe Siddons (2019–)

Primary graduate advisor for
John Foryoh, M. Sc., Environmental Science, College of Staten Island (2003–2004).
Jonathan Bradet-Legris, M. Sc., Statistics, Dalhousie University (2018–2020)
Mohammad Amirian Matlob, Ph. D., Mathematics, Dalhousie University (2020–)
Brian Beardsall, Ph.D. Biomathematics and Bioinformatics (2020-)

Advisory committee member for
Carol DeMartinis, M. Sc., Biology, College of Staten Island (2003–2004)
Jarrod Santora, Ph. D., Biology, Graduate Center, City University of New York (2003–2007)
Matthew Grossi, M. Sc., Oceanography, University of Delaware (2009–10)
Megan Cimino, Ph. D., Oceanography, University of Delaware (2010–2016)
Karl Langman, M. Sc., Oceanography, Dalhousie University (2013, external examiner)
Mark Thomas, M. Sc., Mathematics & Statistics, Acadia University (2015, external examiner)
Cole Murphy, M. Sc., Biology, Mount Allison University (2016–2016)
Joseph Gradone, M. Sc., Oceanography, University of Delaware (2017–2019)
Logan Gray, Ph. D., Oceanography (2019-2024)
Claire Boteler, Ph. D., Statistics (2020-2024)
Nuwanthi Samarasinghe, Ph. D., Oceanography (2020-2024)
K C Pramir, Ph. D., Oceanography (2020-2024)

Supervision of undergraduate research students:
Cali Park (2021), Yinjie Meng (2020), Zonglin Wu (2020), Jacob Miller (2020), Thomas Finet (2020), Curran McConnell (2019), Michael Freund (2019), Mirelle Naud (2019-2020, co-advisor), Jonathan Bradet-Legris (2018), Michael Bradet-Legris (2017), Thomas Hammond (2017), Justin Laforest (2017), Catherine Fiset (2015, 2016, 2017 honours), Nick Manuel (2013), Andrew MacLean (2013), Liz Kerrigan (2011, co-advisor), Andrew Nelles (2010, USRA), Helena van Tol (2010, 2011 USRA, co-advisor), Greg Legere (2009, with Dan Vogel), Pam Sargent (2009, USRA; 2011), Susan Sharpe (2009, 2010, co-advisor), Nicole McMillan (2009, USRA), Daniel Blanchette

(2009), Vivien Ha Nguyen (2007), Karsten Hempel (2006), Steven Murray (2005; 2006), Jenny Tennent (2005), Mariel Caliandro (2004)

External Grants and Awards

Simons Foundation. Taxonomic and environmental controls of macromolecular and elemental stoichiometry of the North Pacific Ocean: Modelling and Synthesis. Part of Simons Collaboration on Ocean Process Ecology (SCOPE) – Gradients. Award ID 721235. (2020-2024) US$407,972.

Ocean Frontier Institute. The Northwest Atlantic Biological Carbon Pump. Lead PI ZV Finkel. Joint investigator with 17 other PIs. (2020-2024) Total 4.0m. My share $84,000.

Gulf of Mexico Research Initiative. Towards a synthesis of processes and pathways of marine oil snow formation. RVP 6. Joint with ZV Finkel and 8 other lead investigators. (2018-2019) Total 2.5m USD. Mount Allison share $200,000.

Simons Foundation. Statistical modeling of microbial communities: niches, traits, and interactions. Part of Simons Collaboration on Computational Biogeochemical model of marine ecosystems (CBIOMES), (2017-2022) $1,003,000.

NSERC Discovery. Plankton biogeography and responses to climate change. (2015-22) $40,000/a.

NSERC Accelerator. Awarded together with NSERC Discovery grant. (2015-18) $40,000/a.

NBIF (New Brunswick Innovation Fund). Research assistantship initiative "Assessing the biotechnical potential of algae" (2016) $15,000 (50% collaborator with ZV Finkel.)

NRC IRAP CtO. Statistical analysis and time-series forecasting with Fiddlehead Technologies (Moncton, NB). (2016) $5,000.

MITACS Accelerate. Biooptical analyses of site-specific phytoplankton productivity (with D Campbell). (2013) $15,000 (awarded but not funded due to internal reasons at Haida Research Development Corporation).

NBIF Research assistantship initiative (2013) $5,000.

NSERC Discovery. Trait-based phytoplankton models in a changing world. (2010-2015) $23,000/a.

NSERC RTI. Field-Deployable Fluorescence Induction Instrument for analyzing Phytoplankton (with D. Campbell, Z. Finkel, Y. Huot). (2010) $34,814

Ace-Net (Atlantic Computational Excellence Network). (2009-11) Post-doctoral Fellowship. $40,000 over two years.

NASA Biodiversity. Satellite driven studies of climate mediated changes in Antarctic food-webs (08-BIODIV-29) (2009/05-2012/04) US$747,880. Collaborator with M Oliver (University of Delaware) *et al*.

NBIF Emerging Projects. Development of biotechnology tools for the investigation of molecular and physiological controls on the biogeographical distribution of phytoplankton (2008-09) $30,000.

MITACS (Mathematics of Information Technology and Complex Systems). Industrial post-doc internship with Environmental Proteomics, NB (2008) $15,000.

NASA Terrestrial Ecology & Biodiversity. Bioinformatic mapping of ocean biogeochemical provinces (05-TEB/05-33). (2006-2009) $491,214. Co-investigator with O Schofield, M Oliver (Rutgers University). My share US$25,500.

NBIF. Research assistantship initiative (2005) $10,000 (with ZV Finkel). My share $5,000.

NSERC Discovery GSC18. Ecologically informed biogeochemical modelling of the oceanic carbon cycle. (2005-2010) $18,500/a.

NSERC Post-doctoral fellowship. (2001-2003) $70,000.

Internal Grants and Awards

Dalhousie start-up award (2018-22) $100,000

Provost's Curricular Innovation Grant. Computer-enhanced student activities for math courses (2012-13) $3,000

Marjorie Young Bell Faculty Scholar (2010-2012) $20,000

Paul Paré Research Excellence Award (2010) $2,500, (2014) $4,000

Mount Allison University Start-up grant (2004) $5000; (2008) $11,500

Marjorie Young Bell. Conference travel award (2005) $1500; (2006) $1500; (2008) $1000

Vice-president's curricular innovation grant. An interdisciplinary course in mathematical modelling (2007-08) $5,000

Research and Creative Activity committee. Analysis and modelling of remote-sensed observation of oceanic photosynthesis. (2006) $5,250

Petro-Canada Young Innovator Award (Mount Allison). Predicting pCO_2 in the surface ocean (2005) $3,000

Professional Staff Congress – City University of New York Research Award. Remote sensing the size structure of phytoplankton communities and implications for the ecological role of primary production. (2004) $4,840

Dean's faculty research stipend. College of Staten Island (2004) $2,000

College of Staten Island & City University of New York Start-up grant (2003) $38,000

Service

Institutional

- Dalhousie University, Mathematics & Statistics Department
  - Science Atlantic departmental representative and coordinator (2020-21)
  - Various LTA search committees (2020. 2021)
- Mount Allison University, Mathematics & Computer Science Department
  - Coordinator, Departmental self-study report for External review (2008, 2017); Department Head (2010–16, 2017 Jan-June)
- Mount Allison University Committees
  - Judicial (2006–09; As chair 2009–11, 2012–14); Senate (2008–11, 15-18); Academic computing (2008–11); Curriculum renewal—distribution credits (2008); Summer Judicial (2009–11); Emeriti appointments (2009–11); Equity Panel (2012–14, 16–17); Tenure and Promotion (2014–16); Committee on Committees (2014–17)
- Mount Allison Faculty Association
  - Donations committee (2005–2007); Collective bargaining team (2010–11); Chief negotiator for interest arbitration (2014-16); *Ad hoc* Union-Employer side-table negotiation committees (2015, 2016), President (2015-17), Career development review committee (2017-18), Past-president (2017-18)
- University Club of Sackville
  - Treasurer (2006–2009); Board member at large (2009–2010, 2014), President (2015), Past-president (2016–2017)

Regional and National

- Science Atlantic, Math, Stats, and Computer Science annual meeting conference chair (2012)
- Canadian Mathematics Society, Electronic Services Committee (2011–14)
- ACEnet Advanced Computing Institute (ACI), Steering committee (2013-15)
- NSERC, Evolution and Ecology Evaluation Group (EG 1503), panel member (2016-2019)

International

- Co-organizer of contributed session at ASLO 2017 (Honolulu), ASLO 2008 (St John's).
- Steering committee member for Simons Collaboration on Computational BIOgeochemical model of Marine EcosystemS (SC CBIOMES) (2017-2022).
- Simons Collaborative Marine Atlas Project (CMAP) advisory committee. simonscmap.com. (2021–)
- Reviewer for numerous journals, including: *Biogeosciences, eLife, Global Change Biology, Journal of theoretical Biology, Journal of Phycology, Journal of Plankton Research, Limnology & Oceanography, Nature Climate Change, PLoS ONE, Proceedings National Academy of Sciences USA, Proceedings of the Royal Society, London, B, Progress in Oceanography*, International grant reviews: NASA, NERC, NSF, ETH Zurich.