MARA FREILICH

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EDUCATION

MIT-WHOI Joint Program, Doctor of Philosophy in Physical Oceanography *expected May 2021*
Thesis: "Vertical Fluxes in the Upper Ocean" advised by Dr Amala Mahadevan

Brown University, Bachelor of Science in Applied Math with honors, *magna cum laude* *May 2015*
Thesis: "Numerical modeling of the effect of transport processes on ocean biogeochemistry" with Professor Baylor Fox-Kemper and Professor Bjorn Sandstede

PUBLICATIONS AND PRESENTATIONS

Peer reviewed publications

10. **Freilich, M.**, Mignot, A., Flierl, G., and Ferrari, R. (in prep). *Grazing dynamics reconcile critical depth and dilution-recoupling hypotheses for North Atlantic bloom.*
9. **Freilich, M.**, Rebolledo, R., Corcoran, D., and Marquet, P. (in revision). *Reconstructing ecological networks with noisy data.* Proceedings of the Royal Society A.
8. Dever, M., **Freilich, M.**, Farrar, JT., Hodges, B., Lanagan, T., Baron, A., Mahadevan, A., (in revision). *EcoCTD for profiling oceanic physical-biological properties from an underway ship.* Journal of Atmospheric and Oceanic Technology.
7. Shroyer, E., Gordon, A., Spiro Jaeger, G., **Freilich, M.** Waterhouse, A., Farrar, J.T., Sarma, VVSS., Venkatesan, R., Weller, R., Moum, J., and Mahadevan, A. (2019) *Upper Layer Thermohaline Structure of the Bay of Bengal during the 2013 Northeast Monsoon.* Deep Sea Research II, 104630.
6. **Freilich, M.** and Mahadevan, A. (2019). *Decomposition of vertical velocity for nutrient transport in the upper ocean.* Journal of Physical Oceanography, 49 (6), 1561-1575.
5. **Freilich, M.**, Weiters, E., Broitman, B., Navarrete, S. (2018) *Species co-occurrence networks: can they reveal trophic and non-trophic interactions in ecological communities?.* Ecology, 99 (3), 690-699.
4. Mahadevan, A., Spiro-Jaeger, G., **Freilich, M**. Omand, M., Shroyer, E., Sengupta, D., Sharma, R. (2016) *Freshwater in the Bay of Bengal: Its fate and role in air-sea heat exchange.* Oceanography, 29 (2), 72-81.
3. Lucas, AJ., Nash, JD, Pinkel, R, MacKinnon, JA, Tandon, A., Mahadevan, A., Omand, M., **Freilich, M.**, Sengupta, D., Ravichandran, M., Le Boyer, A., and Moum, J. (2016) *Adrift upon a salinity-stratified sea: a view of upper ocean processes in the Bay of Bengal during the southwest monsoon.* Oceanography, 29 (2), 134-145.
2. Gordon, A., Shroyer, E., Mahadevan, A., Sengupta, D., and **Freilich, M.** (2016) *Bay of Bengal: Upper Ocean Circulation from the 2013 Northeast Monsoon.* Oceanography, 29 (2), 82-91
1. **Freilich, M.** and Connolly, S. (2015). *Phylogenetic Community Structure When Similarity-Based Competition and Environmental Filtering Determine Abundances.* Global Ecology and Biogeography, 24: 1390-1400.

Invited presentations

4. Panelist, "Oceans and Climate" (November 2019), MIT Science Policy Initiative
3. **Freilich, M.** (2018 October) *Vertical transport of biogeochemical tracers in the upper ocean.* Seminar at Brown University Department of Geosciences

2. **Freilich, M.**, Mahadevan, A. (2015 January). *Lagrangian modeling of Aquarius surface salinity in the Bay of Bengal.* Talk at Princeton University Department of Atmospheric and Oceanic Sciences.

1. **Freilich, M.**. (2014 Fall). *A Vision for a More Resilient Rhode Island.* Intensive Workshop on Greenhouse Gas Emissions Reductions in RI: From Goals to Implementation, Providence, RI.

Other presentations and meeting participation

19. **Freilich, M.**, Pacini, A., Suca, J., Lobert, L., (22 co-authors) Gawarkiewicz, G. (2020). *Hurricane Dorian Impacts on Northeast US Shelf Marine Hydrography and Ecosystem.* Poster session at Ocean Sciences Meeting.

18. **Freilich, M.** and Mahadevan, A. (2020). *The Vertical Structure of Vertical Velocity.* Talk presented at Ocean Sciences Meeting. San Diego, CA.

17. **Freilich, M.** and Mahadevan, A., (2020). *Is vertical nutrient supply influenced by phytoplankton physiology?.* Talk presented at Ocean Sciences Meeting. San Diego, CA.

16. **Freilich, M.** (2019 July) *Vertical transport of biogeochemical tracers in the upper ocean.* Seminar in Woods Hole Oceanographic Institution Department of Physical Oceanography

15. **Freilich, M.**, Mignot, A., Flierl, G., and Ferrari, R. (2018 June). *Rethinking the critical depth: Non-linear mortality required to model wintertime phytoplankton growth.* Poster session presented at Ocean Carbon and Biogeochemistry meeting. Woods Hole, MA.

14. **Freilich, M.** and Mahadevan, A. *Deciphering Pathways for Vertical Nutrient Supply.* Poster presented at Gorden Research Conference. Portland, OR.

13. Mahadevan, A., **Freilich, M.**, Ruiz, S., Farrar, J.T., Pascual, A., Poirier C., Worden, A. *Effects of vertical motion on phytoplankton at a front.* Poster session presented at Ocean Sciences Meeting. Portland, OR.

12. **Freilich, M.**, Curry, R., Flierl, G., Mahadevan, A. (2018 February) *Deciphering Pathways for Vertical Nutrient Supply.* Talk presented at Ocean Sciences Meeting. Portland, OR.

11. **Freilich, M.**, Rebolledo, R., Marquet, P. (2018 January) *Reconstructing species interaction networks from time series data: The effect of stochastic noise.* Talk presented at MIT Ecology Meeting. Cambridge, MA.

10. Session chair, Graduate Climate Conference [Sessions: Numerical Modeling of the Climate System and Outreach].

9. Session organizer, Ocean Carbon and Biogeochemistry meeting. [Session: Student lightning talks].

8. **Freilich, M.** and Mahadevan, A. (2017 June). *What components of vertical velocity contribute to nutrient transport?.* Poster session presented at Ocean Carbon and Biogeochemistry meeting. Woods Hole, MA.

7. **Freilich, M.** and Mahadevan, A. (2016 May). *Lagrangian exploration of submesoscale vertical transport.* Poster session presented at Liege Colloquium on Submesoscale Dyanamics. Liege, Belgium.

6. Mahadevan, A., Omand, M., **Freilich, M.**, Shroyer, E., Sarma, V., Lucas, A., and Weller, R. (2016 February). *Distribution of Nitrate, Oxygen and Chlorophyll in the Bay of Bengal: Physical Constraints and Mechanisms for Vertical Transport.* Talk presented at Ocean Sciences Meeting. New Orleans, LA.

5. **Freilich, M.**, Fox-Kemper, B., Sandstede, B. (2015 May). *Mathematical Modeling of Oceanic Phytoplankton Blooms in Chaotic Flows.* Poster session presented at The Tony and Pat Houghton Conference on Non-Equilibrium Statistical Mechanics, Providence, RI.

4. Participant, Life in a Turbulent Environment: How the dynamic ocean shapes the distribution, diversity and growth of microorganisms, Harvard Radcliffe Institute

3. **Freilich, M.**, Mahadevan, A. (2014 December). *Lagrangian modeling of Aquarius surface salinity in the Bay of Bengal.* Poster session presented at American Geophysical Union, San Francisco, CA.

2. **Freilich, M.**, Aluthge, D., Bryant, R., Knox, B., McAdams, J., Plummer, A., Schlottman, N., Stanley, Z., Suglia, E., and Watson-Daniels, J. (2014 December). *Undergraduate-driven interventions to increase representation in science classrooms.* Poster session presented at American Geophysical Union, San Francisco, CA.

1. **Freilich, M.**, Connolly, S. (2014 February). *Measuring the effects on environmental conditions on biodiversity.* Poster session presented at American Meteorological Society, Atlanta, GA.

Other publications

5. Paul Lerner, Hilary I. Palevsky, Julius Busecke, **Mara Freilich**, Emma Cavan, Yassir Eddebbar, Andrea Fassbender, Jonathan Lauderdale, Jessica Luo, Precious Mongwe, Britt Stephens, Shawnee Traylor. *CMIP6 Biogeochemistry* doi: https://doi.org/10.5281/zenodo.3559209 [Project coordinator]

4. Dever, Mathieu, **Freilich, Mara**, Hodges, Benjamin A., Farrar, J. Thomas, Lanagan, Thomas, Mahadevan, Amala, "UCTD and EcoCTD Observations from the CALYPSO Pilot Experiment (2018): Cruise and Data Report", 2019-01, DOI:10.1575/1912/23637, https://hdl.handle.net/1912/23637

3. **Freilich, M.** (2018 September). *Forecasting Where Ocean Life Thrives.* Oceanus.

2. **Freilich, M.** (2013 Spring). *Moving Cells, Moving People.* The Triple Helix.

1. Haitians and Guantanamo: Who is a refugee? What is a refuge? Guantanamo Public Memory Project. National Traveling Exhibit. 2012.

FIELDWORK AND OTHER RESEARCH EXPERIENCE

Research cruises

- Physical Oceanography Ship Time Cruise (Northeast US Shelfbreak), Co-PI — November 15-22, 2019
- Joint Program Cruise (Northeast US Shelfbreak), Co-Chief Scientist — September 20-22, 2019
- Calypso (Western Mediterranean Sea), Biogeochemical sampling lead — March 21 - April 12, 2019
- Calypso (Western Mediterranean Sea), Biogeochemical sampling lead — June, 2018
- Investigating Vertical Exchanges (Mediterranean Sea), Biogeochemical sampling lead — July 17-24, 2017

Climate Changed Research Group — September 2018-present
Co-investigator

Pontificia Universidad Católica de Chile — 2016
Fulbright Scholar at Pontificia Universidad Católica de Chile and Universidad de Concepcion

Woods Hole Oceanographic Institution — Summer 2014
Summer Student Fellow — *PI: Amala Mahadevan*

Center for Environmental Studies, Brown University — 2014
Research Assistant — *PI: J. Timmons Roberts*

ARC Centre for Excellence in Coral Reef Studies — Summer 2013
Royce Fellow — *PI: Sean Connolly*

Marine Biological Laboratory — 2012
Intern funded by Brown-MBL LINK Award — *PI: Linda Amaral-Zettler*

HONORS, AWARDS, AND GRANTS

Grants

Access to the Sea, 1 day of ship time on R/V Neil Armstrong — 2019
Grassle Fellowship Fund, $7,500 — 2018
Montrym Fund, $4,800 — 2018

MISTI-Chile – UC Graduate Student Seed Fund, $20,000 2017-2018
INSPIRE, grant to start a citizen science program related to urban trees 2013

Fellowships

Martin Fellowship for Sustainability 2018-2020
Fulbright Fellowship 2016
National Defense Science and Engineering Graduate Fellowship 2015-2018
Summer Student Fellowship, Woods Hole Oceanographic Institution 2014
Royce Fellowship, Brown University research fellowship 2013

MIT awards

School of Science SPOT award 2019
School of Science Quality of Life grant 2019

Brown University awards

Jerome L Stein Memorial Award, Division of Applied Math, Brown University 2015
Phi Beta Kappa 2014

External awards and scholarships

NCAR Undergraduate Leadership Workshop 2014
Columbia Economics Review Climate Policy Competition, Winner 2012
American Meteorological Society Scholarship 2011
National Merit Scholar 2011

TEACHING EXPERIENCE

Teaching Assistant

- Geophysical Fluid Dynamics (Dr Amala Mahadevan, MIT/WHOI), overall rating 6.7/7 Fall 2018
- Land Use and Capitalism (Professor Jo Guldi, Brown University) Fall 2014
- Principles of Ecology (Professor Jon Witman, Brown University) Spring 2013, 2014
- Intermediate Calculus (Professor Bianca Viray, Brown University) Fall 2013

Curriculum Assistant Fall 2019
Write climate science-related problem sets for first year math courses *MIT*

Coordinator and lecturer Summer 2016-2019
Coordinate a 5 week course for incoming graduate students *WHOI Summer Math Review*

Kaufman Teaching Certificate Program Fall 2017
Completed semester-long teaching course *MIT*

University Course Guest Lectures

- Social Movements in Boston 2019
- Biophysical Interactions, MIT/WHOI 2019

Public Lecture Series on Climate Science and Policy January 2016
Organizer and lecturer *MIT Joint Program on the Science and Policy of Global Change*

English for Action 2012-2015
ESOL and math volunteer coordinator and facilitator *Providence, RI*

- Curriculum design for participatory math and English classes for adult immigrants

SKILLS AND OTHER ACTIVITIES

Laboratory techniques Influx flow cytometry, DNA extraction, PCR & qPCR, DNA sequencing, culturing algae, microscopy, spectrophotometry
Programming experience Mathematica, Java, R, Matlab, Python, Fortran
Languages advanced Spanish, basic Chinese
SCUBA Certified

LEADERSHIP EXPERIENCE AND UNIVERSITY SERVICE

Reviewer for AGU books, FEMS Microbiology Reviews, The ISME Journal, Science Advances

Society for Women in Marine Science, treasurer — 2019 - present

Outreach in schools, 12 presentations in English and Spanish to over 300 students — 2015 - present

Joint Program Applicant Support, coordinator — 2019

PAOC Colloquium Committee, chair — 2017-2018

EAPS Graduate Student Advisory Council, peer mentorship coordinator — 2017-2019

recognized with MIT School of Science award for mentorship program

Women in Course XII, core board member — 2017

Graduate Climate Conference, executive committee — 2017, 2019

Brown emPOWER, executive director — 2014

New Scientist Program and Women in Science and Engineering, mentor — 2012-2015