

ANDREW R. BABBIN

MIT Building 54–1420
T +1 617 253 2181 || babbin@mit.edu
<http://bablab.mit.edu>

APPOINTMENTS

Massachusetts Institute of Technology, Cambridge, MA — Jan 2017 – present

Doherty Chair in Ocean Utilization (July 2018 – June 2020)

Assistant Professor (Jan 2017 – present)

Department of Earth, Atmospheric & Planetary Sciences

Massachusetts Institute of Technology, Cambridge, MA — Nov 2014 – Dec 2016

NSF Postdoctoral Research Fellow (Nov 2014 – Oct 2016)

Visiting Research Scientist (Nov 2016 – Dec 2016)

Department of Civil and Environmental Engineering

- *Project*: Marine microbial response to organic matter and chemical gradients characteristic of oxygen minimum zones
- *Mentors*: Roman Stocker & Otto X. Cordero

EDUCATION

Columbia University, New York, NY— Bachelor of Science, *Summa Cum Laude*, 2008

Earth and Environmental Engineering with a minor in Applied Mathematics

- Concentration in Water Resources and Climate Risks

Princeton University, Princeton, NJ — Master of Arts, 2010

Geosciences Department

- Concentrations in Chemical Oceanography and Environmental Microbiology

Princeton University, Princeton, NJ — Doctor of Philosophy, 2014

Geosciences Department

- *Dissertation*: **Biogeochemical controls on fixed nitrogen loss processes in the marine environment**
- *Advisor*: Bess B. Ward
- *Committee*: François M.M. Morel; Jorge L. Sarmiento; Daniel M. Sigman

HONORS & AWARDS

Simons Foundation Early Career Investigator in Marine Microbial Ecology and Evolution
2019–2022

First Year Advising Rookie of the Year 2019

MIT Sea Grant Doherty Assistant Professor in Ocean Utilization 2018–2020

MIT Ally of Nature Award 2018

NSF Postdoctoral Fellow in Biology, Intersections of Biology and Math 2014–2016

National Defense Science and Engineering Graduate Fellowship 2008–2011

RESEARCH GRANTS

Earl A. Killian III (1978) and Waidy Lee Fund

Bruce Heflinger Class of 1969 Award

MIT Environmental Solutions Initiative Seed Grant

MIT James H. Ferry, Jr. Award for Innovation in Research

MIT ESI Curriculum Development Grant, Biogeochemistry of natural environments

PUBLICATIONS

(MIT °undergraduate; *graduate student; †postdoc or research scientist advised on project)

†Smriga, S., †D. Ciccarese, and **A.R. Babbin**. Denitrifying bacteria respond to and shape microscale gradients within particulate matrices. Submitted.

*Zhang, I.H., †S. Mullen, †D. Ciccarese, *D. Dumit, *D.E. Martocello, M. Toyofuku, N. Nomura, †S. Smriga, and **A.R. Babbin**. Ratio of organic carbon to fixed nitrogen regulates metabolic specialization and denitrification dynamics in *Pseudomonas aeruginosa*. Submitted.

Wang, P., J. Scott, S. Solomon, J. Marshall, **A.R. Babbin**, M. Lickley, D.W.J. Thompson, T. DeVries, Q. Liang, and R.G. Prinn. On the effects of the ocean on atmospheric CFC-11 lifetimes and emissions. Submitted.

Hardisty, D., T.J. Horner, N. Evans, R. Moriyasu, **A.R. Babbin**, S.D. Wankel, J.W. Moffett, and S.G. Nielsen. Limited in situ iodate reduction within the Eastern Tropical North Pacific oxygen deficient zone. *Earth and Planetary Science Letters* (2020).

Babbin, A.R., *T. Tamasi, *D. Dumit, L. Weber, M.V.I. Rodríguez, *S.L. Schwartz, M. Armenteros, S.D. Wankel, and A. Apprill. Discovery and quantification of anaerobic nitrogen metabolisms among oxygenated tropical Cuban stony corals. In press at *ISME Journal* (2020).

Babbin, A.R., °E.L. Boles, J. Mühle, R.F. Weiss. On the natural spatio-temporal heterogeneity of South Pacific nitrous oxide. *Nature Communications*, **11**: 3672 (2020).

*Wolf, M.J., M. Goodell, E. Dong, °L.A. Dove, C. Zhang, L.J. Franco, C. Shen, °E.G. Rutkowski, °D.N. Narducci, °S. Mullen, **A.R. Babbin**, and D.J. Cziczo. A link between the ice nucleation activity of sea spray aerosol and the biogeochemistry of seawater. *Atmospheric Chemistry and Physics* (2020).

Babbin, A.R., C. Buchwald, F.M.M. Morel, S.D. Wankel, and B.B. Ward. Nitrite oxidation exceeds reduction and fixed nitrogen loss in anoxic Pacific waters. *Marine Chemistry*, **224**: 103814 (2020).

Evans, N., °E.L. Boles, °J.V. Kwiecinski, °S. Mullen, *M.J. Wolf, R. Moriyasu, S. Nam, **A.R. Babbin**, and J.W. Moffett. The Role of Water Masses in Shaping the Distribution of Redox Active Compounds in the Eastern Tropical North Pacific Oxygen Deficient Zone and Influencing Low Oxygen Concentrations in the Eastern Pacific Ocean. *Limnology and Oceanography* (2020).

†Ranjan, S., Z.R. Todd, P.B. Rimmer, D.D. Sasselov, and **A.R. Babbin**. Nitrogen oxide concentrations in natural waters on early Earth. *Geochemistry, Geophysics, Geosystems*, **20**: 2021–2039 (2019).

Babbin, A.R., B.D. Peters, C.W. Mordy, B. Widner, K.L. Casciotti, and B.B. Ward. Novel metabolisms support the anaerobic nitrite budget in the Eastern Tropical South Pacific. *Global Biogeochemical Cycles*, **31**: 258–71 (2017).

Peters, B.D, **A.R. Babbin**, B.B. Ward, K. Lettman, C.W. Mordy, O. Ulloa, and K.L. Casciotti. Vertical modeling of the nitrogen cycle in the eastern tropical south Pacific ODZ using high resolution concentration and isotope measurements. *Global Biogeochemical Cycles*, **30**: 1661–1681 (2016).

Babbin, A.R., A. Jayakumar, and B.B. Ward. Organic matter loading modifies the microbial community responsible for nitrogen loss in estuarine sediments. *Microbial Ecology*, **71**: 555 (2016).

Babbin, A.R., D. Bianchi, A. Jayakumar, and B.B. Ward. Rapid nitrous oxide cycling in the suboxic ocean. *Science*, **348**: 1127–1129 (2015).

Ji, Q., **A.R. Babbin**, A. Jayakumar, S. Oleynik, and B.B. Ward. Nitrous oxide production by nitrification and denitrification in the Eastern Tropical South Pacific oxygen minimum zone. *Geophysical Research Letters*, **42**: 10755–10764 (2015).

Ji, Q., **A.R. Babbin**, X. Peng, J.L. Bowen, and B.B. Ward. Nitrogen sources of nitrous oxide in salt marsh sediments. *Journal of Marine Research*, **73**: 71–92 (2015).

Babbin, A.R., R.G. Keil, A.H. Devol, and B.B. Ward. Organic matter stoichiometry, flux, and oxygen control nitrogen loss in the ocean. *Science*, **344**: 406–408 (2014).

Bianchi, D., **A.R. Babbin**, and E.D. Galbraith. Enhancement of anammox by the excretion of diel vertical migrators. *Proceedings of the National Academy of Sciences*, **111**: 15653–15658 (2014).

Bowen, J.L., **A.R. Babbin**, P.J. Kearns, and B.B. Ward. Connecting the dots: Linking nitrogen cycle gene expression to nitrogen fluxes in marine sediment mesocosms. *Frontiers in Microbiology*, **5**: 429 (2014).

Babbin, A.R. and B.B. Ward. Controls on nitrogen loss in Chesapeake Bay sediments. *Environmental Science & Technology*, **47**: 4189–4196 (2013).

[Selected as Editors' Choice, "Lost N Found" in *Science*, **340**: 408]

Newell, S.E., **A.R. Babbin**, A. Jayakumar, and B.B. Ward. Ammonia oxidation rates and nitrification in the Arabian Sea. *Global Biogeochemical Cycles*, **25** (2011).

SELECTED PRESENTATIONS

Babbin, A.R., 2019. Spatio-temporal heterogeneity in marine nitrous oxide emissions of the South Pacific. *UCLA Atmospheric & Oceanic Sciences Seminar*, Los Angeles, California. **(invited)**

Babbin, A.R., 2019. Direct measurements of microbial nitrogen transformations in suboxic waters. *Gordon Research Conference in Chemical Oceanography*, Holderness, New Hampshire. **(invited)**

Babbin, A.R., 2019. Nitrite oxidation exceeds reduction and fixed nitrogen loss in anoxic Pacific waters. *Xiamen Symposium on Marine Environmental Sciences*, Xiamen, China. **(invited)**

Babbin, A.R. and E.L. Boles, 2018. Inter-annual variability of nitrous oxide over the ETSP. *OCB Workshop on Oceanic Methane and Nitrous Oxide*, Lake Arrowhead, CA.

Babbin, A.R., 2017. Nitrogen cycling in coral reefs. *Symposium for the Joint Cuba/USA Study of the Gardens of the Queen*, Havana, Cuba. **(invited)**

Babbin, A.R., 2017. Can we finally balance the marine nitrogen budget? *Program in Atmospheres, Oceans, and Climate Colloquium*, MIT. **(invited)**

Babbin, A.R., 2017. The denitrification conundrum. *Gordon Research Conference in Chemical Oceanography*, New London, New Hampshire.

Babbin, A.R., C. Buchwald, and S.D. Wankel, 2016. Anaerobic nitrogen cycling: Tales from the Eastern Tropical Pacific. *Ocean Sciences Meeting*, New Orleans, Louisiana.

Babbin, A.R., B.B. Ward, and R. Stocker, 2015. Incomplete denitrification causes rapid nitrous oxide cycling in the oceanic oxygen minimum zones. *American Geophysical Union Fall Meeting*, San Francisco, California. **(invited)**

Babbin, A.R., 2015. Anaerobic cycling of marine nitrogen. *Biogeochemistry and Pollutant Dynamics Seminar*, ETH Zürich. **(invited)**

Babbin, A.R., 2015. Anaerobic cycling of marine nitrogen. *EAPS Sack Lunch Seminar*, Massachusetts Institute of Technology. **(invited)**

Babbin, A.R., B.B. Ward, R.G. Keil, and A.H. Devol, 2014. Biogeochemical controls on nitrogen loss processes in the marine environment. *Dissertations in Chemical Oceanography*, Lihue, Hawaii. **(invited)**

Babbin, A.R., B.B. Ward, R.G. Keil, A.H. Devol, and D. Bianchi, 2014. Fixed nitrogen loss: Controversy and resolution. *Earth Systems Special Seminar, Stanford University. (invited)*

Babbin, A.R., B.B. Ward, R.G. Keil, A.H. Devol, and D. Bianchi, 2014. Resolving the controversy over anammox and denitrification. *Environmental Geology & Geochemistry Seminar, Princeton University. (invited)*

Babbin, A.R. and B.B. Ward, 2013. Heterotrophy-coupled anaerobic ammonium oxidation in the Eastern Tropical North Pacific oxygen minimum zone. *International Conference on Nitrification, Tokyo, Japan.*

Babbin, A.R., A. Jayakumar, and B.B. Ward, 2013. Rapid cycling of N₂O in the Eastern Tropical North Pacific oxygen deficient zone. *SOLAS Summer School, Xiamen, China. (invited)*

MIT ADVISING

Graduate students

Tyler Tamasi (2017–2019), MIT/WHOI Chemical Oceanography Joint M.S. Program
Master of Science 2019

Diana Dumit (2017–present), MIT Geology, Geochemistry & Geobiology Ph.D. Program

Irene Zhang (2018–present), MIT Microbiology Ph.D. Program

Research scientists

Dr. Steven Smriga (2018–present), Research scientist [interests: microbial interactions]

Susan Mullen (2018–2019), Research associate, now Ph.D. student at UC Berkeley

Postdoctoral researchers

Dr. Benedict Borer (2020–present), Researcher in biophysics and microfluidics

Dr. Davide Ciccarese (2020–present), Researcher in microbial interactions and ecology

Dr. Elizabeth Shoenfelt (2019–2020), Crosby Fellow in paleoclimatology and biogeochemistry

Dr. Einat Segev (2017), now Senior Research Scientist at Weizmann Institute, Israel

Undergraduate students

Jarek Kwiecinski (2017–present), Class of 2021; Civil & Environmental Engineering

Laura Schmidt-Hong (2020–present), Class of 2023; Bioengineering

Lin Hou (2020–present), Class of 2023; Earth, Atmospheric & Planetary Sciences

Timothy Kostolansky (2020–present), Class of 2023; Physics

Jose Gomez (2020–present), Class of 2023; Chemical Engineering

Alexander Miller (2020–present), Class of 2021; Physics

Rachel Shen (2020–present), Class of 2023; Biology

Elisabeth Boles (2017–2018), Class of 2018; Earth, Atmospheric & Planetary Sciences
now Ph.D. student at Stanford University

Janice Shiu (2017), Class of 2020; Earth, Atmospheric & Planetary Sciences

MIT TEACHING

12.373/777 | Field Oceanography (Spring 2018, 2020)

12.742 | Marine Chemistry (Fall 2020)

12.S597 | Great Papers in EAPS (Fall 2018, 2019)

12.S992 | Nitrogen in the Marine Environment (Spring 2019)

12.007 | Geobiology: History of Life on Earth (Spring 2019, guest; Spring 2020)

12.A01 | Climate and Life (Fall 2019)

[no number] | Field Methods in Microbial Oceanography, in Bermuda (Winter 2020)

MIT SERVICE

Departmental Committees

EAPS Grad student admissions committee (2019–present)

EAPS Diversity Council / DEI Committee (2017–present)

PAOC Graduate Admissions (2017–present); Chair (2019–present)

MIT/WHOI Joint Committee in Biology (2017–present)

First Year Advisor (2018–present)

Crosby Fellow Committee (2020–present)

EAPS 2023 Taskforce (2019–2020)

EAPS Communications (2017–2019)

Thesis Committees

Martin Wolf (2017–2020); PhD defense chair, student in Atmospheric Chemistry

B. B. Cael (2018); PhD defense chair, student in Physical Oceanography

Jennifer Karolewski (2017–present); 5th year student in Chemical Oceanography

Lydia Babcock-Adams (2018–present); 5th year student in Chemical Oceanography

Cynthia Becker (2018–2020); 3rd year student in Biological Oceanography

Emily Zakem (2017); PhD defense chair, student in Atmospheres, Oceans, and Climate

SERVICE TO THE COMMUNITY

Panelist, National Science Foundation, Division of Ocean Sciences: 2019

Session Chair, Microbial interactions within OMZs, Aquatic Sciences Meeting: 2019

Session Chair, Nitrogen at the interface, Ocean Sciences Meeting: 2016

Evaluation Panelist, National Defense Science & Engineering Graduate Fellowship: 2015

Session Chair, The many faces of the marine nitrogen cycle, Ocean Sciences Meeting: 2014

RESEARCH CRUISES

Bermuda, St. George's, Bermuda. Jul 2008 (3 days) [Class field trip]

Eastern Tropical North Pacific, Manzanillo, Mexico to San Diego, CA. Mar–Apr 2012 (26 days)

Subtropical Atlantic, St. George's, Bermuda. Aug 2012 (4 days)

Eastern Tropical South Pacific, Valparaíso, Chile. Jun–Jul 2013 (33 days)

Subpolar North Atlantic, Narragansett, RI to Reykjavik, Iceland. Apr–May 2014 (24 days)

Subtropical Pacific (UNOLS Chief Scientist Training cruise), San Diego, CA. Feb 2016 (8 days)

Pacific P18 Transect, San Diego, CA to Punta Arenas, Chile. Nov 2016–Feb 2017 (75 days)

East Pacific Rise, Manzanillo, Mexico to Puntarenas, Costa Rica. Apr–May 2017 (21 days)

Gardens of the Queen, Jucaro, Cuba to Ft. Lauderdale, FL. Nov 2017 (14 days)

Florida Straits, Key West, FL. Mar 2018 (4 days) [**Class field trip; Chief Scientist**]

Eastern Tropical North Pacific, San Diego, CA. Jun–Jul 2018 (23 days) [**Chief Scientist**]