

ROXANNE MARINO

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Education

BS, University of Hartford, Chemistry (summa cum laude), 1980
Ph.D., Cornell University, Biogeochemistry, 2001

Professional experience

2003-present Senior Research Associate, Department of Ecology & Evolutionary Biology, Cornell University.
2018-present Faculty Fellow, Atkinson Center for a Sustainable Future.
2005-present Visiting Investigator (Whitman Center Scientist), The Ecosystems Center, Marine Biological Laboratory, Woods Hole.
2001- 2004 Staff Scientist I, The Ecosystems Center, Marine Biological Laboratory, Woods Hole.
1988-2001 Research Support Specialist III & Laboratory Manager, Section of Ecology & Systematics, Division of Biological Sciences, Cornell University.
1985-1988 Research Support Specialist II, Section of Ecology & Systematics, Division of Biological Sciences, Cornell University.
1981-1985 Research Assistant I, II & III, The Ecosystems Center, Marine Biological Laboratory, Woods Hole.
1980-1981 Participant on research cruise (R/V Endeavor), University of Rhode Island; Summer Intern, Chemistry Dept., Woods Hole Oceanographic Institution.

Research Interests

Biogeochemistry and aquatic ecosystem ecology; controls on biological nitrogen fixation; interactions of major nutrient cycles and trace elements in aquatic and terrestrial ecosystems; influence of land use and management, and climate change on nitrogen and phosphorus fluxes to rivers and estuaries; controls and consequences of eutrophication in estuaries; atmospheric deposition of gaseous nitrogen from near-source emissions; greenhouse gas emissions associated with roadside ditches; greenhouse gas footprints of technologies for heating and cooling, and societal policies for a more sustainable energy future; application of research results to science education, public outreach, and government policy at local to state levels to address ecological and environmental problems and sustain the biosphere.

Relevant Professional Activities

2020-present Coordinator, Honors Thesis Reviews, Environment & Sustainability Major
2020-present University Faculty Senator, EEB.
2017, -19,-21 Member, Whittaker and Book Awards committee, EEB.
2013-2019 Founding member of Board of Directors and treasurer, Solar Tompkins / HeatSmart Tompkins.
2022 Town of Ulysses Board member, Comprehensive Plan and Conservation and Sustainability Committees, liaison to Tompkins County Council of Governments, Cayuga Lake Watershed Inter-municipal Organization.

- 2017-2021 Chair of Town of Ulysses Conservation and Sustainability Advisory Committee; member of Town of Ulysses Zoning Update Committee (2017-2019); chair of Sustainability Committee and member, Ulysses Philomathic Library Board of Trustees; member of Cayuga Lake Inter-municipal Organization, Education and Outreach Committee.
- 2013 Co-author, Pritchard Award from the Coastal & Estuarine Research Federation for the best physical oceanography paper published in *Estuaries and Coasts*, 2011-2012.
- 2004 - 2013 Town Supervisor (2010-2013), and Town Councilperson (2004-2007, Ulysses, Tompkins County NY); member of Tompkins County Council of Governments (2010-2013); member of Elected Officials to Protect New York (2011-2013); member of Tompkins County Advisory Board on Water Resources (2004-2006); member of Ulysses Comprehensive Plan Committee (2007-2009).
- 2009 - 2013 Committee member, Leanna Heffner (Ph.D., University of Rhode Island)
- 2005 - 2012 Co-principal Investigator, Agricultural Ecosystems Program at Cornell; studying nutrient pollution in the Upper Susquehanna River basin, and its influence on Chesapeake Bay
- 2004 - 2006 Participant, North American Nitrogen Center Initiative (part of International Nitrogen Initiative, ICSU)
- 2003 Member, Shoals Marine Laboratory Director Search Committee
- 2002 Co-organizer, Workshop to Identify National Research Priorities for Nutrient Pollution in Coastal Waters, Woods Hole, MA
- ongoing EEB Safety Committee as needed; research advisor to Howarth lab graduate and undergraduate students

Professional Societies

Association for the Sciences of Limnology and Oceanography; Coastal and Estuarine Research Federation; American Geophysical Union

Reviewer

National Science Foundation; Maryland SeaGrant; *Biogeochemistry*; *Estuaries and Coasts*; *Estuarine and Coastal Shelf Science*; *Limnology and Oceanography*; *Marine Ecology Progress Series*; *Ecosystems*

Publications:

- 2022 Haviland, K.A, R.W. Howarth, R. Marino, and M. Hayn. Variation in sediment and seagrass characteristics reflect multiple stressors along a eutrophication gradient in a New England lagoon. *Limnology & Oceanography*, 67: 660-672.
- 2022 Marino, R. and R.W. Howarth. Nitrogen Fixation. In L. Rudstam (ed.), *Encyclopedia of Inland Waters*, Second Edition. Elsevier. *in press*.
- 2022 Schneider, R., N. Baker, E. Chase, S. Dunn, R. Marino, D. Orr, W. Puer, and S. Reynolds. Replumbing watersheds: a how-to guide for improving roadside ditch management to buffer the impacts of climate change. In: W.L. Filho (ed.), *Climate Change Strategies: Handling the challenges of adapting to a changing climate*, ICCIR, Springer Nature, *in review*.
- 2021 Howarth, R.W., F. Chan, D.P. Swaney, R. Marino, and M. Hayn. Role of External inputs of nutrients to aquatic ecosystems in determining prevalence of nitrogen vs. phosphorus limitation of net primary productivity. *Biogeochemistry*. doi: 10.1007/s10533-021-00765-z.
- 2021 Wong, M.,Y., S.D. Rathod, R. Marino, L. Li, R.W. Howarth, A. Alastuey, M.G. Alaimo, F. Barraza, M.C. Carneiro, S. Chellam, Y. Chen, D.D. Cohen, D. Connely, G. Dongarra, D. Gomez, J. Hand, R.M. Harrison, P.K. Hopke, C. Hueglin, Y. Kuang, F. Lambert, J. Liang, R. Losno, W. Maenhaut, C. Milano, M.I.C. Monteiro, Y. Morera-Gómez, X. Querol, S.

- Rodríguez, P. Smichowski, D. Varrica, Y. Xiao, Y. Xu, and N.M. Mahowald. Anthropogenic Perturbations to the Atmospheric Molybdenum Cycle. *Global Biogeochemical Cycles* 35, e2020GB006787; doi:10.1029/2020GB006787.
- 2020 Wong, M., C. Neill, R. Marino, D. Silvério, and R.W. Howarth. Molybdenum, phosphorus, and pH do not constrain nitrogen fixation in a tropical forest in the southeastern Amazon. *Ecology*. doi:10.1002/ecy.3211.
- 2020 Wong, M., N.M. Mahowald, R. Marino, E.R. Williams, and R.W. Howarth. Atmospheric deposition of molybdenum: A global model and implications for tropical forests. *Biogeochemistry* 149. doi:10.1007/s10533-020-00671-w.
- 2019 Wong, M., C. Neill, R. Marino, D. Silvério, P.M. Brando, and R.W. Howarth. Biological nitrogen fixation does not replace nitrogen losses after forest fires in the southeastern Amazon. *Ecosystems*. doi:10.1007/s10021-019-00453-y.
- 2019 Plier, W.T., R.L. Schneider, N. Baker, R. Marino, and M.T. Walter. Modified denitrifying bioreactor for nitrate reduction in roadside ditches. *In revision*
- 2016 Marino, R., R.W. Howarth. Why is planktonic nitrogen fixation so rare in coastal marine ecosystems? Insights from a cross-systems approach. Pages 127-139 in: P.M. Glibert and T.M. Kana (eds.), *Aquatic Microbial Ecology and Biogeochemistry: A Dual Perspective*. Springer- Dordrecht. doi:10.1007/978-3-319-30259-1_11.
- 2015 Reynolds, L.K., R. Marino, M.F. Muth, N. McLenaghan, M. Hayn, A.C. Tyler, K.J. McGlathery, and R.W. Howarth. Evidence of grazer control on nitrogen fixation by eelgrass epiphytes in a temperate coastal bay. *Marine Ecology Progress Series* 526: 11-19; doi: 10.3354/meps11234.
- 2014 Butler, T., R. Marino, D. Schwede, R.W. Howarth, K. Sparks, and J. Sparks. Atmospheric ammonia measurements at low concentration sites in the northeastern USA: implications for nitrogen deposition and comparison with CMAQ estimates. *Biogeochemistry*. doi: 10.1007/s10533-014-0036-5.
- Howarth, R.W., M. Hayn, R. Marino, K. Foreman, P. Berg, A. E. Giblin, K. J. McGlathery, and J. D. Walker. Metabolism of a nitrogen-enriched coastal marine lagoon during the summertime. *Biogeochemistry*. doi:10.1007/s10533-013-9901-x.
- 2013 Berg, P., M.H. Long, M. Huettel, J.E. Rheuban, K.J. McGlathery, R.W. Howarth, K.H. Foreman, A.E. Giblin, and R. Marino. Eddy correlation measurements of oxygen fluxes in permeable sediments exposed to varying current flow and light. *Limnology & Oceanography* 58:1329-1343.
- Bettez, N.D., R. Marino, R.W. Howarth, and E.A. Davidson. Roads as nitrogen deposition hot spots. *Biogeochemistry*: 114:149-163.
- Hayn, M., R.W. Howarth, R. Marino, N. Ganju, P. Berg, K.H. Foreman, A.E. Giblin, and K.J. McGlathery. Exchange of nitrogen and phosphorus between a shallow seagrass-dominated lagoon and coastal waters. *Estuaries & Coasts*. doi:10.1007/s12237-013-9699-8.
- 2012 Ganju, N.K., M. Hayn, S. Chen, R.W. Howarth, P.J. Dickhudt, A.L. Aretxabaleta, and R. Marino. Tidal and groundwater fluxes to a shallow, microtidal estuary: Constraining inputs through field observations and hydrodynamic modeling. *Estuaries and Coasts* 35:1285-1298.
- Howarth, R.W., D. Swaney, G. Billen, J. Garnier, B. Hong, C. Humborg, P. Johnes, C. Morth, and R. Marino. Nitrogen fluxes from large watershed to coastal ecosystems controlled by net anthropogenic nitrogen inputs and climate. *Frontiers in Ecology & Environment* 10:37-43.
- 2011 Howarth, R.W., F. Chan, D. Conley, J. Garnier, S.C. Doney, R. Marino, and G. Billen. Coupled biogeochemical cycles: Eutrophication and hypoxia in coastal marine ecosystems. *Frontiers in Ecology & Environment* 9(1):18-26.

- McLenaghan, N.A., A.C. Tyler, U.H. Mahl, R.W. Howarth, and R. Marino. Benthic macroinvertebrate functional diversity regulates nutrient and algal dynamics in a shallow estuary. *Marine Ecology Progress Series* 426:171-184.
- 2010 Davidson, E.A., K.E. Savage, N.D. Bettez, R. Marino, and R.W. Howarth. Nitrogen in runoff from residential roads in a coastal area. *Water Air Soil Pollution* 210:3-13. DOI 10.1007/s11270-009-0218-2.
- 2009 Marino, R. and R.W. Howarth. Nitrogen fixation. Pages 65-72 in G.E. Likens (ed.), *Encyclopedia of Inland Waters*. Elsevier.
- 2008 Swaney, D.P., D. Scavia, R.W. Howarth, and R. Marino. Estuarine classification and response to nitrogen loading: Insights from simple ecological models. *Estuarine Coastal and Shelf Science* 77:253-263.
- 2006 Chan, F., R. Marino, R.W. Howarth, and M.L. Pace. Ecological constraints on planktonic nitrogen fixation in saline estuaries. II. Grazing controls on cyanobacterial population dynamics. *Marine Ecology Progress Series* 309:41-53.
- Howarth, R.W. and R. Marino. Nitrogen as the limiting nutrient for eutrophication in coastal marine ecosystems: Evolving views over three decades. *Limnology and Oceanography* 51:364-376.
- Howarth, R.W., D.P. Swaney, E.W. Boyer, R. Marino, N. Jaworski, and C. Goodale. The influence of climate on average nitrogen export from large watersheds in the Northeastern United States. *Biogeochemistry* 79:163-186.
- Howarth, R.W., R. Marino, D.P. Swaney, and E.W. Boyer. Wastewater and watershed influences on primary productivity and oxygen dynamics in the lower Hudson River estuary. Pages 121-139 in J.S. Levinton and J.R. Waldman (eds.), *The Hudson River Estuary*. Cambridge University Press.
- Marino, R., F. Chan, R.W. Howarth, M.L. Pace, and G.E. Likens. Ecological constraints on planktonic nitrogen fixation in saline estuaries: I. Nutrient and trophic controls. *Marine Ecology Progress Series* 309:25-39.
- 2004 Chan, F., M.L. Pace, R.W. Howarth, and R. Marino. Bloom formation in heterocystic nitrogen-fixing cyanobacteria: The dependence on colony size and zooplankton grazing. *Limnology and Oceanography* 49:2171-2178.
- 2003 Howarth, R.W., R. Marino, and D. Scavia. Priority topics for nutrient pollution in coastal waters: An integrated national research program for the United States. National Ocean Service, NOAA 1-24.
- Marino, R., R.W. Howarth, F. Chan, J.J. Cole, and G.E. Likens. Sulfate inhibition of molybdenum-dependent nitrogen fixation by planktonic cyanobacteria under seawater conditions: A non-reversible effect. *Hydrobiologia* 500:277-293.
- 2002 Barron, S., C.F. Weber, R. Marino, E.A. Davidson, G. Tomasky, and R.W. Howarth. Effects of varying salinity on phytoplankton growth in a low-salinity coastal pond under two nutrient conditions. *Biological Bulletin* 203:260-261.
- Marino, R., F. Chan, R.W. Howarth, M. Pace, and G.E. Likens. Ecological and biogeochemical interactions constrain planktonic nitrogen fixation in estuaries. *Ecosystems* 5:719-725.
- Vitousek, P.M., K. Cassman, C. Cleveland, T. Crews, C.B. Field, N.B. Grimm, R.W. Howarth, R. Marino, L. Martinelli, E.B. Rastetter, and J.I. Sprent. Towards an ecological understanding of biological nitrogen fixation. *Biogeochemistry* 57&58:1-45.

- Weber, C.F., S. Barron, R. Marino, R.W. Howarth, G. Tomasky, and E.A. Davidson. Nutrient limitation of phytoplankton growth in Vineyard Sound and Oyster Pond, Falmouth, Massachusetts. *Biological Bulletin* 203:261-263.
- 2001 Marino, R. An experimental study of the role of phosphorus, molybdenum, and grazing as interacting controls on planktonic nitrogen fixation in estuaries. Ph.D. thesis, Cornell University, Ithaca, NY, 199 pp.
- McGlathery, K.J., P. Berg, and R. Marino. Using porewater profiles to assess nutrient availability in seagrass-vegetated carbonate sediments. *Biogeochemistry* 56:239-263.
- 2000 Howarth, R.W., D.P. Swaney, T.J. Butler, and R. Marino. Climatic control on eutrophication of the Hudson River Estuary. *Ecosystems* 3:210-215.
- 1999 Howarth, R.W., F. Chan, and R. Marino. Do top-down and bottom-up controls interact to exclude nitrogen-fixing cyanobacteria from the plankton of estuaries: Explorations with a simulation model. *Biogeochemistry* 46:203-231.
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- 1998 Howarth, R.W. and R. Marino. A mechanistic approach to understanding why so many estuaries and brackish waters are nitrogen limited. Pages 117-136 in: *Effects of Nitrogen in the Aquatic Environment*, KVA Report 1998: 1, Kungl. Vetenskapsakademien (Royal Swedish Academy of Sciences), Stockholm.
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- 1995 Howarth, R.W., D. Swaney, R. Marino, T.J. Butler, and C.R. Chu. Turbulence does not prevent nitrogen fixation by plankton in estuaries and coastal seas (reply to the comment of Paerl et al.). *Limnology and Oceanography* 40:639-643.
- Howarth, R.W., H. Jensen, R. Marino, and H. Postma. Transport to and processing of phosphorus in near-shore and oceanic waters. Pages 323-345 in: H. Tiessen (ed.), *Phosphorus in the Global Environment*, SCOPE #54. Wiley & Sons, Chichester.
- 1994 McGlathery, K.J., R. Marino, and R.W. Howarth. Variable rates of phosphate uptake by shallow marine sediments: Mechanisms and ecological significance. *Biogeochemistry* 25:127-146.
- 1993 Marino, R. and R.W. Howarth. Atmospheric oxygen exchange in the Hudson River: Dome measurements and comparison with other natural waters. *Estuaries* 16:433-445.
- Cole, J.J., J.M. Lane, R. Marino, and R.W. Howarth. Molybdenum assimilation by cyanobacteria and phytoplankton in freshwater and salt waters. *Limnology and Oceanography* 38:25-35.
- 1992 McGlathery, K.J., R.W. Howarth, and R. Marino. Nutrient limitation of the macroalga, *Penicillus capitatus*, associated with subtropical seagrass meadows in Bermuda. *Estuaries* 15:18-25.
- Howarth, R.W., R. Marino, R. Garritt, and D. Sherman. Ecosystem respiration in a large, tidally influenced river: The Hudson River. *Biogeochemistry* 16:83-102.
- 1991 Howarth, R.W. and R. Marino. *Oil in the Oceans*. Greenpeace, London.
- Howarth, R.W. and R. Marino. Oil and water-- a bad mix. Pages 40-53 in: *Science Year*. World Book Encyclopedia, Chicago.

- 1990 Marino, R., R.W. Howarth, J. Shames, and E.E. Prepas. Molybdenum and sulfate as controls on the abundance of nitrogen-fixing cyanobacteria in saline lakes in Alberta. *Limnology and Oceanography* 35:245-259.
- Howarth, R.W. and R. Marino. Nitrogen-fixing cyanobacteria in the plankton of lakes and estuaries: A reply to the comment by Smith. *Limnology and Oceanography* 35:1859-1863.
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- Howarth, R.W., R. Marino, J.M. Lane, and J.J. Cole. Nitrogen fixation in freshwater, estuarine, and marine ecosystems. 1. Rates and importance. *Limnology and Oceanography* 33:669-687.
- 1986 Cole, J.J., R.W. Howarth, S.S. Nolan, and R. Marino. Sulfate inhibition of molybdate assimilation by planktonic algae and bacteria: Some implications for the aquatic nitrogen cycle. *Biogeochemistry* 2:179-196.
- 1984 Howarth, R.W. and R. Marino. Sulfate reduction in salt marshes, with some comparisons to sulfate reduction in microbial mats. Pages 245-263 in: Y. Cohen, R. W. Castenholz, and H. O. Halvorson (eds.), *Microbial Mats: Stromatolites*. Alan R. Liss Publishers.