

Caroline S. Fortunato

Assistant Professor
Biology Department
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Education

- 2012 Ph.D. Marine-Estuarine-Environmental-Science, Area of Specialization: Biological Oceanography, University of Maryland
“Spatial and temporal variation of bacterioplankton communities across river to ocean environmental gradients”
- 2007 M.S. Biology, American University, *Summa Cum Laude*
- 2005 B.A. Environmental Studies, minor in Biology, American University, *Summa Cum Laude*

Professional Positions

- 2020-Present Assistant Professor, Biology Department, Widener University, Chester, PA
- 2017-2020 Assistant Professor, Biology Department; Wilkes University, Wilkes-Barre, PA
- 2015-2016 Adjunct Faculty, Biology Department; Bridgewater State University, Bridgewater, MA
- 2012-2017 Postdoctoral scientist; Josephine Bay Paul Center, Marine Biological Laboratory, Woods Hole, MA

Papers in Published in Refereed Journals

1. Moulana, A., R.E. Anderson, **C.S. Fortunato**, J.A. Huber. 2020. Selection Is a Significant Driver of Gene Gain and Loss in the Pangenome of the Bacterial Genus *Sulfurovum* in Geographically Distinct Deep-Sea Hydrothermal Vents. *mSystems*. doi: 10.1128/mSystems.00673-19
2. Stewart, L.C., C.K. Algar, **C.S. Fortunato**, B. Larson, J. Vallino, J.A. Huber, D.A. Butterfield, and J.F. Holden. 2019. Metabolic activity and local hydrology define methanogen community size and composition in deep-sea hydrothermal vents. *The ISME Journal*. doi: 10.1038/s41396-019-0382-3
3. **Fortunato, C.S.**, B. Larson, D.A. Butterfield, and J.A. Huber. 2018. Spatially distinct, temporally stable microbial populations mediate biogeochemical cycling at and below the seafloor in hydrothermal vent fluids. *Environmental Microbiology*. 20(2) 769-784. doi: 10.1111/1462-2920.14011
4. Crump, B.C., L. Fine, **C.S. Fortunato**, J.A. Needoba, S. Bolton, and F. Prahl. 2017. Quantity and quality of particulate organic matter controls bacterial production in the Columbia River estuary. *Limnology and Oceanography*. 62(6) 2713-2731.

5. Herfort, L., B.C. Crump, **C.S. Fortunato**, L.A. McCue, V. Campbell, H.M. Simon, A.M. Baptista, and P. Zuber. 2017. Factors affecting the bacterial community composition and activity of Columbia River Estuarine Turbidity Maxima. *Microbiology Open*. 6(6): 1-15. doi:10.1002/mbo3.522
6. Doherty, M., P.L. Yager, M. A. Moran, V.J. Coles, **C.S. Fortunato**, A.V. Krusche, P.M. Medeiros, J.P. Payet, J.E. Richey, B.M. Satinsky, H.O. Sawakuchi, N.D. Ward, B.C. Crump. 2017. Bacterial biogeography across the Amazon river-to-ocean continuum. *Frontiers in Microbiology*. 8: 1-17. doi:10.3389/fmicb.2017.00882
7. Smith, M.A., L. Herfort, **C.S. Fortunato**, B.C. Crump, and H.M. Simon. 2017. Microbial players and processes involved in phytoplankton bloom utilization in the water column of a fast-flowing, river-dominated estuary. *Microbiology Open*. 6(4): 1-13. doi: 10.1002/mbo3.467
8. **Fortunato, C.S.** and J.A. Huber. 2016. Coupled RNA-SIP and metatranscriptomics of active chemolithoautotrophic communities at a deep-sea hydrothermal vent. *The ISME Journal*, 10: 1925-1938.
9. **Fortunato, C.S.** and B.C. Crump. 2015. Microbial gene abundance and expression patterns across a river to ocean salinity gradient. *PLoS ONE* 10(11): e0140578. doi:10.1371/journal.pone.0140578.
10. Satinsky, B.M., **C.S. Fortunato**, M. Doherty, C.B. Smith, S. Sharma, N.D. Ward, A.V. Krusche, P.L. Yager, J.E. Richey, M.A. Moran, and B.C. Crump. 2015. Metagenomic and metatranscriptomic inventories of the lower Amazon River, May 2011. *Microbiome* 3: 1-8.
11. **Fortunato, C.S.**, A. Eiler, L. Herfort, J.A. Needoba, T.D. Peterson, and B.C. Crump. 2013. Determining indicator taxa across spatial and seasonal gradients in the Columbia River coastal margin. *The ISME Journal*, 7: 1899-1911.
12. **Fortunato, C.S.**, L. Herfort, P. Zuber, A.M. Baptista, and B.C. Crump. 2012. Spatial variability of bacterioplankton communities overwhelms seasonal patterns across a river to ocean gradient. *The ISME Journal*, 6: 554-563.
13. **Fortunato, C.S.**, and BC Crump. 2011. Bacterioplankton community variation across river to ocean environmental gradients. *Microbial Ecology*, 62(2): 374-382.
14. **Fortunato, C.S.**, D.B. Carlini, E. Ewers, and K.L. Bushaw-Newton. 2009. Nitrifier and denitrifier molecular operational taxonomic unit compositions from sites of a freshwater estuary of Chesapeake Bay. *Canadian Journal of Microbiology*, 55(3): 333-346.

Teaching Experience

Courses and Laboratories

2020 Assistant Professor, Wilkes University

Microbiology for Nursing Majors: Instructor of course and coordinator of laboratories.

This introductory course microbiology provided a general overview of microorganisms, including cell structure, genetics, and metabolic activities. As

this was a course for health science majors, Specific attention was given to microorganisms as agents of infectious disease. The laboratory component focused on learning aseptic techniques, microscopy and staining, as well as physiological tests of various bacterial species, with emphasis towards potential pathogenic bacteria.

General Microbiology: This course in General Microbiology provided a professional level introduction to microorganisms, who they are, what they are doing, and their impact on the environment and human health. The first part of the course focused on microbial cell structure, growth, and metabolism. The second part looked at molecular biology of microbes and the diversity of microbes in the surrounding environment. In the last part of the course centered on microbes related to infectious disease. During the laboratory, basic techniques were applied toward understanding microbial metabolism and function, the diversity of microbes present in our environment, and the role of microbes in human health and disease.

2019 Assistant Professor, Wilkes University

Microbial Ecology: Microbial ecology is the study of microorganisms and their interactions with the natural environment, from terrestrial to freshwater to marine systems. In this course we studied how microbial populations drive ecosystem processes and influence overall ecosystem function. Students learned microbial-mediated nutrient and carbon cycling, symbioses, microbial primary and secondary production, and microbial community structure and interactions. The laboratory portion of the course focused on isolation and characterization of microbes from various environments, including freshwater and soil.

Microbiology for Nursing Majors: Instructor of course and coordinator of laboratories. This introductory course microbiology provided a general overview of microorganisms, including cell structure, genetics, and metabolic activities. As this was a course for health science majors, Specific attention was given to microorganisms as agents of infectious disease. The laboratory component focused on learning aseptic techniques, microscopy and staining, as well as physiological tests of various bacterial species, with emphasis towards potential pathogenic bacteria.

2018 Assistant Professor, Wilkes University

Microbiology for Nursing Majors: Instructor of course and coordinator of laboratories. This introductory course microbiology provided a general overview of microorganisms, including cell structure, genetics, and metabolic activities. As this was a course for health science majors, Specific attention was given to microorganisms as agents of infectious disease. The laboratory component focused on learning aseptic techniques, microscopy and staining, as well as physiological tests of various bacterial species, with emphasis towards potential pathogenic bacteria.

General Microbiology: This course in General Microbiology provided a professional level introduction to microorganisms, who they are, what they are doing, and their impact on the environment and human health. The first part of the course focused on microbial cell structure, growth, and metabolism. The second part looked at molecular biology of microbes and the diversity of microbes in the surrounding environment. In the last part of the course centered on microbes related to infectious disease. During the laboratory, basic techniques were applied toward

understanding microbial metabolism and function, the diversity of microbes present in our environment, and the role of microbes in human health and disease.

- Principles in Modern Biology (laboratory):** Laboratory instructor for introductory course in biology for majors. Prepared and delivered introductory lectures, gave demonstrations of laboratory techniques, worked closely with students to complete laboratory assignments. Laboratories focused on enzymes, membranes, genetics, cellular repair, photosynthesis, and molecular techniques
- 2017 Assistant Professor, Wilkes University
- Medical Microbiology:** Co-instructor for course and coordinator of laboratory for Biology majors. Course was split into two parts, the first being focused on general microbiology concepts, including bacterial cell structures, gene regulation, viruses, and bacterial diversity and phylogeny. The second part of the course focused on medical application of these concepts. Laboratories focused on aseptic techniques, microscopy, Gram staining, using differential and selective media, water filtration for enteric bacteria, DNA extraction, and PCR.
- Principles in Modern Biology (laboratory):** Laboratory instructor for introductory course in biology for majors. Prepared and delivered introductory lectures, gave demonstrations of laboratory techniques, worked closely with students to complete laboratory assignments. Laboratories focused on enzymes, membranes, genetics, cellular repair, photosynthesis, and molecular techniques
- 2016 Adjunct Faculty, Bridgewater State University
- Microbiology (laboratory):** Prepared and delivered introductory lectures, gave demonstrations of laboratory techniques, taught laboratories, and evaluated lab assignments including oral presentations and lab notebooks. Laboratories focused on aseptic techniques, microscopy, Gram staining, using differential and selective media, water filtration for enteric bacteria, DNA extraction, and PCR. Worked closely with students to identify assigned unknown bacteria using various physiological tests.
- 2015 Adjunct Faculty, Bridgewater State University
- Introduction to Biology for Non-Majors:** Sole instructor for one section of course (34 students). Developed syllabus, prepared and delivered all lectures, administered course Blackboard site, and prepared and graded all tests and assignments. Developed and executed multiple classroom activities to engage students and encourage active learning.
- Microbiology (laboratory):** Prepared and delivered introductory lectures, gave demonstrations of laboratory techniques, taught laboratories, and graded lab assignments. Laboratories focused on developing aseptic techniques, Gram-staining, microscopy, using differential and selective media, identifying enteric bacteria in food/soil, DNA extraction, and PCR.
- 2012 Teaching Assistant, University of Maryland Center for Environmental Science
- Aquatic Microbial Ecology:** Prepared and gave class lectures on microbial carbon cycling and molecular methods for assessing microbial diversity. Prepared course material, administered course Blackboard site, graded class assignments, and ran study sessions.
- 2007 Teaching Assistant, Department of Biology, American University
- Microbiology:** Prepared all cultures and media for labs, graded lab reports and assisted professor in teaching laboratories. Laboratories focused on Gram staining, using differential and selective media, microscopy, and DNA extractions.

- 2006 Teaching Assistant, Department of Biology, American University
Cellular Biology: Prepared all laboratory materials, taught laboratories, and graded lab reports for writing-intensive honors section. Laboratories focused on restriction enzyme activity, identifying target proteins, and microscopy.
General Biology II: Taught laboratories and graded lab assignments. Laboratories focused on plant biology, evolution and ecology exercises, and vertebrate anatomy.
- 2005 Teaching Assistant, Department of Biology, American University
Cellular Biology: Prepared all laboratory materials including standards and solutions, taught laboratories, and graded lab reports. Laboratories focused on restriction enzyme activity, identifying target proteins, and microscopy.
- 2005 Teaching Assistant, Department of Chemistry, American University
General Chemistry II: Prepared all chemical solutions, taught laboratories, and graded lab reports. Laboratories focused on acid-base titration, oxidation/reduction, and general chemistry skills.

Student Mentoring

Miquela Langan, *Undergraduate at Wilkes University, Spring 2020*

- Independent research mentor, performed DNA extraction and PCR of HAB associated water samples,

Grace Evan, *Undergraduate at Wilkes University, Summer 2019*

- Independent research mentor, performed field sampling, DNA extraction and PCR of soil samples, and analysis of 16S rRNA gene sequence data

Carter Whittemore, *Undergraduate at Wilkes University, Fall 2018-Fall 2019*

- Independent research/senior project mentor, performed DNA extraction of water and soil samples, PCR, and analysis of 16S rRNA gene sequence data

Emily Kamieniecki, *Undergraduate at Wilkes University, Spring 2018-Summer 2019*

- Independent research mentor, performed PCR of soil samples, summer field sampling

Emily Taylor, *Undergraduate at Wilkes University, Spring 2018-Fall 2018*

- Senior project mentor, performed DNA extractions, PCR, and summer field sampling

Paula Pelayo, *Research Experience for Undergraduate Program. Marine Biological Laboratory, Woods Hole, MA, Summer 2016*

- Worked together to develop a RT-qPCR assay for RNA stable isotope probing experiments.

Petra Byl, *University of Chicago Metcalf Internship Program. Marine Biological Laboratory, Woods Hole, MA, Summers 2015 and 2016*

- Co-mentor, helped supervise DNA and RNA extractions, provided support for bioinformatic analyses of metagenomes and metatranscriptomes.

Oral Presentations at Professional Meetings (first author only)

1. **Fortunato, C.S.** and J.A. Huber. 2015. Comparing chemolithoautotrophic subseafloor communities across geochemical gradients using 'Omics and RNA-SIP. Gordon Research Seminar - Applied and Environmental Microbiology, South Hadley, MA

2. **Fortunato, C.S.** and J.A. Huber 2014. Using RNA-SIP and metatranscriptomics to determine the active autotrophic subseafloor microbial communities at Axial Seamount. International Society for Microbial Ecology (ISME) 15th International Symposium, Seoul, South Korea
3. **Fortunato, C.S.** and B.C. Crump. 2012. Patterns of bacterioplankton distribution and gene expression across a river to ocean gradient. International Society for Microbial Ecology (ISME) 14th International Symposium, Copenhagen, Denmark
4. **Fortunato, C.S.** and B.C. Crump. 2012. Spatial and temporal variability of bacterioplankton communities across a river to ocean gradient assessed with tag pyrosequencing. American Society of Limnology and Oceanography (ASLO) Aquatic Sciences Meeting, San Juan, PR
5. **Fortunato, C.S.** and B.C. Crump. 2009. Spatial and temporal variability of microbial communities in the Columbia River, its estuary, and the adjacent coastal ocean assessed with tag pyrosequencing. Coastal and Estuarine Research Federation (CERF) Biennial Conference, Portland, OR
6. **Fortunato, C.S.** and K. L. Bushaw-Newton. 2007. Assessing the Biogeochemical Processes of a Freshwater Tidal Estuary through Microbial Community and Nutrient Composition. Coastal and Estuarine Research Federation (CERF) Biennial Conference, Providence, RI

Poster Presentations at Professional Meetings (first/last author only)

(* Denotes Fortunato lab undergraduate student)

1. E. Kamieniecki*, C. Whittlemore*, E. Taylor*, and **C. S. Fortunato**. 2019. Understanding the biogeographical patterns of microbial communities within the grassland soils of Northeastern Pennsylvania. American Society of Microbiology (ASM) Annual Meeting, San Francisco, CA
2. **Fortunato, C.S.**, E. Reddington, D. A. Butterfield, B. Larson, N. Lawrence-Slavas, J. F. Holden, L. C. Stewart, B. D. Topcuoglu, C. K. Algar, L. Zeigler, and J. A. Huber. 2019. Comparison of active autotrophic microbial communities at a deep-sea hydrothermal vent via shipboard and seafloor RNA Stable Isotope Probing. American Society of Microbiology (ASM) Annual Meeting, San Francisco, CA
3. **Fortunato, C.S.**, D.A. Butterfield, B. Larson, C.K. Algar, J.J. Vallino, and J.A. Huber. 2016. Microbial metabolic potential and gene expression patterns across geochemical gradients in the deep ocean. International Society for Microbial Ecology (ISME) 16th International Symposium, Montreal, Canada
4. **Fortunato, C.S.** and J.A. Huber. 2015. Comparing chemolithoautotrophic subseafloor communities across geochemical gradients using meta-omics and RNA-SIP. American Geophysical Union (AGU) Fall Meeting, San Francisco, CA
5. **Fortunato, C.S.** and J.A. Huber. 2015. Comparing chemolithoautotrophic subseafloor communities across geochemical gradients using 'Omics and RNA-SIP. Gordon Research Conference - Applied and Environmental Microbiology, South Hadley, MA

6. **Fortunato, C.S.** and B.C. Crump. 2014. Comparison of gene abundance and expression patterns across the river to ocean gradients of the Columbia River coastal margin. Gordon Research Conference - Marine Microbiology, Wrentham, MA
7. **Fortunato, C.S.** and B.C. Crump. 2010. Spatial and temporal variability of bacterioplankton communities across a river to ocean gradient assessed with tag pyrosequencing. International Society for Microbial Ecology (ISME) 13th International Symposium, Seattle, WA
8. **Fortunato, C.S.** and K. L. Bushaw-Newton. 2007. Assessing the Biogeochemical Processes of a Freshwater Tidal Estuary through Microbial Community and Nutrient Composition. American Society for Microbiology (ASM) 107th General Meeting, Toronto, Canada
9. **Fortunato, C.S.**, O.T. McDonough, and R.M. Chambers. 2005. The Effectiveness of Dry and Wet Stormwater Detention Basins as Sediment and Nutrient Processors. Ecological Society of America (ESA) 90th Annual Meeting, Montreal, Canada
10. **Fortunato, C.S.**, O.T. McDonough, and R.M. Chambers. 2005. The Effectiveness of Dry and Wet Stormwater Detention Basins as Sediment and Nutrient Processors. EWRI Watershed Management Conference, Williamsburg, VA

Invited Presentations

1. **Fortunato, C.S.** Microbial metabolic potential and gene expression patterns across geochemical gradients at Axial Seamount, pre and post 2015 eruption. American Geophysical Union (AGU) Fall Meeting, San Francisco, CA 15 December 2016
2. **Fortunato, C.S.** Tracking spatial and temporal changes in microbial metabolic potential and gene expression across geochemical gradients at deep sea hydrothermal vents. Biology Department Seminar. University of Massachusetts, Amherst, MA. 6 October 2016
3. **Fortunato, C.S.** Microbial metabolic potential and gene expression patterns across geochemical gradients in the deep ocean. Friday Informal Seminar Hour (FISH). Bridgewater State University, Bridgewater, MA. 1 April 2016
4. **Fortunato, C.S.** Understanding the diversity of microbes across gradient-driven environments, from estuaries to the deep sea. Friday Informal Seminar Hour (FISH). Bridgewater State University, Bridgewater, MA. 27 February 2015

Workshops and Courses Attended

1. Gordon and Betty Moore Foundation Marine Microbiology Initiative Research Associate and Postdoc Summit (MMI-RAPS). Dorado, PR. 2014.
2. Strategies and Techniques for Analyzing Microbial Population Structures (STAMPS), The Marine Biological Laboratory, Woods Hole, MA. 2011.
3. Introduction to community analysis using MOTHUR, three day workshop given by Patrick Schloss at Pennsylvania State University 2009.

4. Microbial Oceanography: Genomes to Biomes, summer course through the Center for Microbial Oceanography: Research, and Education (C-MORE). University of Hawaii at Manoa, Honolulu, HI. 2008.

Scientific Cruises

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| 2013-2014 | Participant in three research cruises to Axial Seamount, an undersea volcano off the coast of Oregon, USA. (Postdoctoral research) |
| 2008 | Participant in a research cruise to station ALOHA as part of C-MORE course in microbial oceanography |
| 2007-2011 | Participant in seven research cruises across the Columbia River coastal margin (Ph.D. research) |

Service and Outreach

To University of Maryland

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| 2009-2011 | Graduate Student Organization treasurer |
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To the Profession

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| 2013-present | Reviewer for the following journals and funding agencies: <ul style="list-style-type: none"> • National Science Foundation - Geobiology • <i>The ISME Journal, Environmental Microbiology, Microbial Ecology, FEMS Microbial Ecology, Limnology and Oceanography, Frontiers in Microbiology, Plos One, Harmful Algae, Progress in Oceanography</i> |
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To the Community

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| 2018 | Constructed and ran microbiology lessons for 6 th grade girls as part of the Women Empowered by Science (WEBS) program at Wilkes University |
| 2018 | Participated in community service day for Wilkes University freshman orientation |
| 2013 | Participant in two research cruises with web-based outreach at sea |
| 2007-2012 | Horn Point Laboratory tour and touch tank guide for elementary and middle school students in Dorchester County, MD |

Grants Awarded, Academic Honors, and Fellowships

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| 2019 | NSF Major Research Instrumentation (NSF-MRI)”; \$362,246 <ul style="list-style-type: none"> • One of five co-PIs on grant “Acquisition of High Performance Computing Facilities for Research, Instruction, and Outreach” |
| 2019 | Wilkes University Faculty Development Grant; \$2000 <ul style="list-style-type: none"> • Provided support for travel to American Society of Microbiology meeting in San Francisco, CA in June 2019. |
| 2018 | Wilkes University Research and Scholarship grant; \$30,000 <ul style="list-style-type: none"> • Provides three years of support for the project: “Microbial Biogeography of Grassland Soils” |
| 2018 | Wilkes University Student Mentoring Grant; \$7421 <ul style="list-style-type: none"> • Provided support for two undergraduate students to perform summer research, also provided small stipend for faculty member. |
| 2014 | Center for Dark Energy Biosphere Investigations (C-DEBI) travel award; \$2000 |

- Provided support to travel to ISME15 International Symposium, Seoul, South Korea
- 2007-2009 Horn Point Laboratory graduate research fellowship
- Provided two years of graduate assistant salary
- 2006 Hemlinge research grant, American University; \$1000
- Provided salary and support for materials for Master's thesis work
- 2006 Sigma Xi Society research grant; \$650
- Provided support for Master's thesis work