

DANIEL E. SANDBORN

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EDUCATION

University of Minnesota

Intended 2024

Ph.D. Candidate, Limnology and Oceanography

Advisor contact:

Elizabeth C. Minor, emminor@d.umn.edu, +1 (218) 726-8056, 2205 E. 5th St. Duluth MN 55812.

California Polytechnic State University San Luis Obispo

2020

B.S. Chemistry *summa cum laude* with Honors

RESEARCH EXPERIENCE

University of Minnesota — Large Lakes Observatory

Duluth, MN

Ph.D. Dissertation Research with Prof. Elizabeth Minor

August 2020 - Present

- Designed, built, and tested novel open-source alkalinity measurement instrumentation to advance the accessibility of high-quality environmental chemical analysis.
- Described CO₂ dynamics and fluxes in the Laurentian Great Lakes using continuous and discrete observations and machine learning models.
- Advanced the use of CaCO₃ saturation state as a novel predictor of invasive mussel habitat in freshwater ecosystems.
- Created and contributed to software for marine chemical equilibrium and particle tracking research.

California Polytechnic State University

San Luis Obispo, CA

Research Assistant to Prof. Emily Bockmon

January 2018 - June 2020

- Pioneered seawater carbonate chemistry timeseries on the California Central Coast.
- Built spectrophotometric pH instrument capable of high-accuracy measurement of seawater chemistry.
- Coordinated and volunteered with community marine science outreach.

Research Assistant to Prof. Corinne Lehr

September 2017 - June 2020

- Investigated solubility behavior of cyanuric acid.
- Operated HPLC instrumentation for quantitative analysis.

Pacific Northwest National Laboratory

Richland, WA

Summer Undergraduate Laboratory Internship with Dr. Aditi Sengupta *June 2019 - September 2019*

- Developed methods for respiration rate analysis of soil and sediment samples.
- Participated in soil, water, and gas sampling study of salinity encroachment upon terrestrial ecosystems.
- Assisted with WHONDRS global biogeochemistry sampling campaign.

TEACHING EXPERIENCE

University of Minnesota Duluth

Duluth, MN

Graduate Teaching Assistant

August 2020 - December 2023

- CHEM 2212: Environmental Chemistry — *3 semesters*

Redeveloped laboratory experiment manual to promote student engagement and application of environmental chemistry concepts to real-world contexts. Designed and delivered lectures on analytical methods. Planned and led field science activities.

- CHEM 1153: General Chemistry I — *2 semesters*

Led discussion groups with undergraduate students.

- CHEM 1154: General Chemistry I Laboratory — *3 semesters*

Led laboratory activities with undergraduate students.

California Polytechnic State University

Undergraduate Learning Assistant

San Luis Obispo, CA

August 2019 - January 2020

- CHEM 124: General Chemistry I — *1 quarter*

Assisted faculty in studio chemistry classrooms.

FIELD EXPERIENCE

Scientific Cruises

- CTD Watchstander, GO-SHIP A13.5, *RV Marcus G. Langseth*, February 2-March 24 2024
- **Chief Scientist**, *RV Kingfisher*, August 11 2022
- Scientist, GLOS Mooring Deployment, *RV Blue Heron*, June 7-9 2022
- **Chief Scientist**, *RV Kingfisher*, June 1 2022
- Scientist, Seagrant sampling campaign, *RV Blue Heron*, August 3-4 2022

Field Research

- EXCHANGE sampling campaign, Summer 2022
- WHONDRS Soil/water sampling, July 2019

PUBLICATIONS

Refereed Publications

1. **Sandborn, D.E.**; Minor, E.C.; Hill, C. (2023). "Total alkalinity measurement using an open-source platform". *Limnol. Oceanogr. Methods*, 21: 334-344. doi: 10.1002/lom3.10549

Submitted, In-preparation and In-review

1. **Sandborn, D.E.**; Minor, E.C. "Underway $p\text{CO}_2$ surveys unravel CO_2 invasion of Lake Superior from seasonal variability". (2024) *J. Geophys. Res. Biogeosci.* *In review*.
2. **Sandborn, D.E.**; Minor, E.C. "A neural network predictive model for Lake Superior surface $p\text{CO}_2$ ". *In preparation*.

Software

1. Humphreys, M. P., Schiller, A. J., **Sandborn, D. E.**, Gregor, L., Pierrot, D., van Heuven, S. M. A. C., Lewis, E. R., and Wallace, D. W. R. (2022). PyCO2SYS: marine carbonate system calculations in Python. Zenodo. doi:10.5281/zenodo.3744275.
2. **Sandborn, D.E.** RPi-Alkalinity: Publication Release. Zenodo. doi:10.5281/zenodo.7864447

GRANTS AND FELLOWSHIPS

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| Student Conference Award | 2023 |
| <i>Northeastern Association of Marine and Great Lakes Laboratories</i> | <i>\$400</i> |
| · Presentation at the 2023 Ocean Carbon Biogeochemistry Summer Workshop | |
| Graduate Research Fellowship | 2022-2023 |
| <i>Cooperative Institute for Great Lakes Research</i> | <i>\$25,000</i> |
| · “Aragonite Saturation State as a Driver of Invasive Dreissenid Habitat” | |
| Early Career Travel Award | 2022 |
| <i>Association for the Sciences of Limnology and Oceanography</i> | <i>\$400</i> |
| · <i>Presentation at the 2022 Joint Aquatic Sciences Meeting</i> | |
| COAST Undergraduate Research Award | 2019 |
| <i>Central Coast Center for Marine Sciences</i> | <i>\$500</i> |
| · “Purifying <i>meta</i> -Cresol Purple Indicator Dye for Accurate Measurements of Ocean pH” | |

PRESENTATIONS

Invited Presentations

1. **Daniel, D.E.**; Minor, E.C.; Austin, J. “Drivers of Dreissenid Habitat: Moving Beyond Calcium and Temperature”. Invasive Mussel Collaborative meeting. December 2024. *Virtual*.
2. **Daniel, D.E.**; Minor, E.C. “The Breath of Lake Superior and Observation of “The Other CO₂ Problem”. Twin Ports Freshwater Folk meeting. December 2024. *Virtual*.
3. Minor, E.C.; **Sandborn, D.E.**; Brinkley, G. 2022. “Are increasing atmospheric CO₂ concentrations causing lake acidification in Lake Superior?”. MN AWWA Annual Conference. September 2022. Duluth, MN. [*Minor, invited oral presentation*]

Abstracts

1. **Sandborn, D.E.**; Austin, J. “Patterns of Lake Superior AIS dispersal illustrated by particle tracking.”. Meeting of the Association for the Sciences of Limnology and Oceanography. June 2024. Madison, WI.
2. **Sandborn, D.E.**; Austin, J. “Patterns of Lake Superior AIS dispersal illustrated by particle tracking.”. Meeting of the International Association for Great Lakes Research. May 2024. Windsor, ON.
3. Kittaka, P. K.; **Sandborn, D.E.**; Minor, E.C. “Diel, Seasonal and Storm-related Changes in Carbonate System Variables in Lake Superior Tributaries”. Meeting of the American Geophysical Union. December 2022. Chicago, IL.

Presentations

1. **Sandborn, D.E.**; Minor, E.C. “The Other CO₂ Problem in the Saltless Seas: High-Resolution Observations in Lake Superior”. June 2023. Poster presentation. Ocean Carbon Biogeochemistry Summer Workshop. Woods Hole, MA, USA.
2. **Sandborn, D.E.**; Minor, E.C.; Errera, R.M. “CaCO₃ Saturation State: The Case for a Comprehensive Dreissenid Chemical Predictor”. October 2022. Poster presentation. Cooperative Institute for Great Lakes Research All Partners Meeting. *Virtual*.
3. **Sandborn, D.E.**; Minor, E.C. “CO₂ Acidification in Lake Superior: Developing a Chemical Forecast”. May 2022. Poster presentation. Joint Aquatic Sciences Meeting, Grand Rapids, MI, USA.

4. **Sandborn, D.E.**; Minor, E.C. "Quantifying Spatiotemporal Heterogeneity in Inorganic Carbon Chemistry of Lakes Superior and Michigan". June 2021. Oral presentation. Association for the Sciences of Limnology and Oceanography Meeting. *Virtual*.
5. **Sandborn, D.E.**; Sengupta, A. "Developing methods for sediment carbon flux measurement via incubation". August 2019. Poster presentation. Pacific Northwest National Laboratories Undergraduate Symposium. Richland, WA, USA.
6. Bockmon, E.; **Sandborn, D.E.**; Schmidt, G.; Norgaard, A. "Improving instrumentation for characterizing the carbon dioxide system in seawater". August 2018. Poster presentation. Cal Poly Frost Symposium. San Luis Obispo, CA, USA.
7. Bockmon, E.; **Sandborn, D.E.**; Schmidt, G.; Norgaard, A. "Seawater carbonate chemistry at the Cal Poly Pier, Avila Beach". August 2018. Poster presentation, Cal Poly Frost Symposium. San Luis Obispo, CA, USA.
8. **Sandborn, D.E.**; Lehr, C.R.; "Solubility behavior of Cyanuric Acid". May 2018. Southern California Undergraduate Research Conference. Pomona, CA, USA.

HONORS

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| Outstanding Graduate Teaching Assistant Award | <i>2022</i> |
| Swenson College of Science and Engineering | |
| Learning Assistant of the Year | <i>2020</i> |
| Cal Poly Department of Chemistry and Biochemistry | |
| Award for Excellence in Analytical Chemistry | <i>2018</i> |
| Cal Poly Department of Chemistry and Biochemistry | |

PROFESSIONAL SERVICE AND AFFILIATIONS

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| Professional Affiliations | American Chemical Society Member 2016-Present Assn. for the Sciences of Limn. and Oceano. Member 2020-Present International Assn. for Great Lakes Research Member 2022-Present |
| Profesional Service | Student Fees Coordinator for Large Lakes Observatory 2022-Present Water Resources Students in Action Coordinator 2021-2022 |
| Outreach | <i>RV Blue Heron</i> Science on Deck Volunteer 2023 LLO Open House Volunteer 2023 UMN Day of Data Presenter 2022 UMD Chemistry Mole Day Volunteer 2022 CCMS Pier Open House Volunteer 2019 |