

Benjamin Davidson

PhD Student

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Education

September 2020 –
Current | **University of Wisconsin - Madison, Madison, WI**
PhD Student: Civil and Environmental Engineering
Minor: Mechanical Engineering
DELTA Teaching Certificate - Completed August 2024
Cumulative GPA: 3.987 of 4.0

September 2016 –
May 2020 | **Luther College, Decorah, IA**
BA: Physics – Summa Cum Laude
Minors: Mathematics and Environmental Studies
Cumulative GPA: 3.920 of 4.0

Research Experience

August 2020 –
Current | **Project:** Graduate Research Assistant
Location: University of Wisconsin - Madison, Madison, WI
Advisor: Nimish Pujara, PhD

- Investigating the physical beaching process of buoyant marine debris in coastal environments through field work, wave flume and wave basin experiments, and computational modeling.
- Retrieved and isolated microplastics from beach sediments on Western Lake Superior to investigate the trends in microplastic beach deposition.
- Developed simple beaching model (1D) for buoyant marine debris with wave flume experimental validation.
- Developed expanded beaching model (2D) for buoyant marine debris with wave basin experimental validation (in progress).
- Exploring a novel regime for buoyant debris dispersion in the swash zone and the implications for particle transport and fate.

January 2024 | **Project:** Transatlantic Research Partnership - Casimir Study
Location: IRPHE, Marseille, France
Advisors: Gautier Verhille, PhD. and Nimish Pujara, PhD

- Set up preliminary experiments to study the Casimir effect on buoyant marine debris in surface wave turbulence.

May 2019 - May 2020 | **Project:** Incorporated Research Institutions for Seismology REU
Location: Brown University, Providence, RI
Advisor: Colleen Dalton, PhD

- Developed structural model of the crust and upper mantle beneath Alaska using Rayleigh wave attenuation.

September 2018 –
May 2019 | **Project:** Undergraduate Student Research Assistant
Location: Luther College, Decorah, IA
Advisor: Erin Flater, PhD

- Researched in nanotribology lab investigating nano-scale wear through atomic force microscopy experiments.

Leadership and Teaching Experience

Spring 2024	Delta Internship Location: University of Wisconsin - Madison, Madison, WI <ul style="list-style-type: none">Developed an enrichment activity for local high school students to explore the mathematical modeling of beach plastics through simple coding exercises.
August 2023 - Current	Grainger Engineering Design Innovation Lab Fabrication Fellowship Location: University of Wisconsin - Madison, Madison, WI <ul style="list-style-type: none">Managed 3D printing operations at the UW - Madison Engineering Design Innovation Lab (makerspace).Supervised team of undergraduate student staff to maintain and assist users with equipment.Mentored first year teams through the process from design to fabrication of a product to benefit a real-world client.
Fall 2021 & Fall 2022	Introductory Fluid Mechanics Teaching Assistant Location: University of Wisconsin - Madison, Madison, WI <ul style="list-style-type: none">Led discussion sections and facilitated hands-on laboratory exploration of fluid mechanics principles for undergraduate introductory fluid mechanics course.
Fall 2017	Physics Lab Assistant Location: Luther College, Decorah, IA <ul style="list-style-type: none">Assisted students through hands on laboratory discovery and understanding of material for General Physics I.
Fall 2018 - Spring 2020	Physics Tutor Location: Luther College, Decorah, IA <ul style="list-style-type: none">Drop in and individual tutoring for students in physics classes at Luther College.

Outreach and Service

August 2023	Young Coastal Scientist and Engineers Conference - Americas (YCSEC-A) Student Organizer Location: University of Wisconsin - Madison, Madison, WI <ul style="list-style-type: none">Assisted in the organization and facilitation of the YCSEC-A conference hosted in Madison, WI.
Spring 2022 - 2023	Engineering Expo Location: University of Wisconsin - Madison, Madison, WI <ul style="list-style-type: none">Assisted in presenting engineering topics of waves and beaching to high school students.
February 2023	Wisconsin Sea Grant Ask a Scientist Location: Rhinelander High School - Rhinelander, WI (virtual) <ul style="list-style-type: none">Presented a virtual lesson to high school students about microplastics in the Great Lakes.
Summer 2022 & 2023	UW - Madison Grandparents University Location: University of Wisconsin - Madison, Madison, WI <ul style="list-style-type: none">Led outreach event for elementary and middle school aged youth and their grandparents to explore water waves in the UW-Madison wave flume. We also explored the issue of microplastics and connection to the Great Lakes.
April 2022	UW - Madison Day at the Capitol Location: Wisconsin State Capitol <ul style="list-style-type: none">Presented work regarding microplastic pollution and issues to legislators and staff at the Wisconsin state capitol.

Publications

- 2023 | **Davidson, B.**, Brenner, J. & Pujara, N. Beaching model for buoyant marine debris in bore-driven swash. *Flow* (2023).
- 2022 | **Davidson, B.**, Batista, K., Samrah, S., Rios Mendoza, L. M. & Pujara, N. Microplastic contamination of sediments across and within three beaches in western Lake Superior. *Journal of Great Lakes Research* **48**, 1563–1572 (Dec. 2022).

Honors & Awards

- 2024 | **Becker Travel Award (YCSECA)**
- Research presentation scholarship of \$100 to travel to the YCSECA Conference in Quebec City, Quebec Canada in June 2024.
- 2024 | **Student Research Grants Competition**
- Research presentation scholarship of \$1,500 to travel to the AGU Ocean Sciences Meeting in February 2024.
- 2023 | **Student Research Grants Competition**
- Research funding scholarship of \$1,500 to conduct debris beaching experiments in the Queen's University wave basin (Kingston, ON).
- 2023 | **Becker Travel Award (IAGLR)**
- Travel award to attend and present at the International Association of Great Lakes Research annual meeting.
- 2023 | **IAGLR Student Travel Award**
- Student travel award for International Association of Great Lakes Research annual meeting.
- 2022 | **Becker Travel Award (APS)**
- Travel award to attend and present at the American Physical Society - Division of Fluid Dynamics annual meeting.
- 2021 | **Anna Grant Birge Scholarship**
- Research funding scholarship of \$1,500 for microplastic analysis and laboratory microplastic beaching experiments.
- 2021 | **YCSECA - Student Presentation Award**
- Outstanding oral presentation award at the Young Coastal Scientists and Engineers Conference - Americas 2021.
- 2020 | **Phi Beta Kappa**
- Inducted into Phi Beta Kappa, academic honor society.
- 2019 | **Herman E. Ellingson Prize in Physics**
- 2018 | **Sigma Pi Sigma**
- Inducted into Sigma Pi Sigma, physics honor society.
- 2018 | **Pi Mu Epsilon**
- Inducted into Pi Mu Epsilon, mathematics honor society.

Professional Memberships

- American Geophysical Union - Student Member
- American Physical Society - Student Member

Undergraduate Mentoring

Summer 2024	Ethan Steichen - Marine Debris Beaching at Queen's University
Fall 2022 - Summer 2023	Jamie Brenner - Beaching Models and Experiments at Queen's University
Fall 2021 - Summer 2022	Sabeel Samrah - Microplastics on Beaches: particle counting and identification
Spring/Summer 2021	Kallyn Batista - Microplastics on Beaches: sample collection and plastic isolation

Presentations

2024	Davidson, B. <i>Modeling buoyant debris transportation and deposition in the swash zone with experimental validation.</i> Invited Lecture. WHOI COFDL Seminar, Woods Hole Oceanographic Institution - Woods Hole, MA, 2024. Davidson, B. <i>Plastics on Beaches.</i> Invited Lecture. Weston Lecture Series, University of Wisconsin - Madison, 2024. Davidson, B., Brenner, J., Mulligan, R., Chardon-Maldonado, P., Puleo, J. & Pujara, N. <i>Debris transport and deposition in the swash zone from oblique surface waves.</i> Oral Presentation. American Geophysical Union - Ocean Sciences Meeting, 2024. Davidson, B., Brenner, J., Mulligan, R., Chardon-Maldonado, P., Puleo, J. & Pujara, N. <i>The impact of marine debris geometry on alongshore swash zone particle transport.</i> Oral Presentation. Young Coastal Scientists and Engineering Conference - Americas, 2024.
2023	Davidson, B., Batista, K., Samrah, S., Rio Mendoza, L. & Pujara, N. <i>Microplastic contamination of beach sediments: unpacking trends across three sites in Western Lake Superior.</i> Oral Presentation. International Association of Great Lakes Research Annual Conference, 2023. Davidson, B., Brenner, J. & Pujara, N. <i>Simple beaching model for buoyant marine debris with experimental validation.</i> Oral Presentation. Young Coastal Scientist and Engineering Conference - Americas, 2023.
2022	Davidson, B., Batista, K., Samrah, S. & Pujara, N. <i>Microplastics in Lake Superior Beach Sediments.</i> Oral Presentation. Wisconsin Section of the American Water Resources Association Annual Meeting, 2022. Davidson, B., Batista, K., Samrah, S., Tran, J., Kubenik, T., Rios Mendoza, L., Denison, A., Rylander, Z., Wellnitz, T., Haines, D. & Pujara, N. <i>Lake Superior Microplastic Pollution.</i> Poster Presentation. 2022. Davidson, B. & Pujara, N. <i>Modeling the Physical Beaching Process of Microplastic Particles.</i> Oral Presentation. American Physical Society - Division of Fluid Dynamics Annual Meeting, 2022.
2021	Davidson, B., Batista, K. & Pujara, N. <i>Lake Superior Microplastic Density in Beach Sediments.</i> Oral Presentation. Young Coastal Scientist and Engineering Conference - Americas, 2021. Davidson, B. & Pujara, N. <i>Physical Beaching Process of Microplastic Particles.</i> Poster Presentation. American Geophysical Union Annual Meeting, 2021.

Skills

Research and Analysis	Design and Fabrication	Communication Skills
Experimental Research	3D Printing (FDM, SLA, SLS)	Written and Oral Communication
Experimental Setup	3D Modeling (Onshape)	Science Communication and Outreach
Data Analysis	Engineering Design	Teaching and Mentoring
Image Processing	Micro-controllers	
MATLAB	T-slot Framing Systems (8020)	
Data Acquisition Systems		
Particle Image Velocimetry		