

Heidi K. Hirsh

Postdoctoral Associate

Cooperative Institute for Marine and Atmospheric Studies (CIMAS)
University of Miami | NOAA | AOML
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I am passionate about solution-driven science to enhance resilience in coral reefs, other coastal ecosystems, and stakeholder communities facing the compounding stressors of climate change.

EDUCATION

- Ph.D., Earth System Science**, School of Earth, Energy, and Environmental Science **2021**
Stanford University, Stanford, CA
Advisors: Prof. Rob Dunbar & Prof. Karen Casciotti
Dissertation: *Spatiotemporal variability in kelp forest and seagrass ecosystems: Can local biogeochemical modification combat acidification stress?*
- M.S., Earth System Science**, School of Earth, Energy, and Environmental Science **2019**
Stanford University, Stanford, CA
- B.A., Marine Science**, University of San Diego **2012**
Minor, Environmental Studies
Advisors: Prof. Michel Boudrias & Prof. James Bolender
Honors Senior Thesis: *Analysis of three proteins as biomarkers of environmental stresses in a transplantation experiment of the common white clam (Chione californiensis), Bahía Magdalena, Baja California Sur, Mexico*

PROFESSIONAL EXPERIENCE

- RSMAS-CIMAS Department, University of Miami **January 2021-Present**
Postdoctoral Associate
Synthesis of National Coral Reef Monitoring Program (NCRMP) ocean acidification data and description of reef-scale biogeochemical processes driving carbonate chemistry variability. Development of a statistical model to link offshore data to nearshore carbonate chemistry. This model relies on the NCRMP records of offshore and reef carbonate chemistry, as well as local hydrodynamic model outputs and records of benthic cover, to describe the change in chemistry driven by the nearshore coral reef environment.
- Nekton Mission/Project Baseline, Baseline Explorer, Bermuda **July-August 2016**
Seawater Chemist, Science Team
Submersible water sampling for dissolved inorganic carbon (DIC), total alkalinity (TA), and nutrients; CTD programming and data collection; coral reef BEAMS (Benthic Ecosystem and Acidification Measurement System) deployments.
- Virgin Islands Environmental Resource Station, St. John, USVI **May 2013-August 2014**
Research Assistant
Coordinated monthly sediment trap deployment, retrieval, and processing; Nephelometer (Neph 1000 Series) and Marotte current meter programming, deployment, retrieval, and data processing; coordinating and supervising of local field assistants and graduate students; outreach presentations to community stakeholders and field station visitors; regular remote communication with PI and research team in San Diego, CA.

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University of San Diego

June 2011-September 2012

Lab Assistant/Lachat Instrument Technician

Responsible for running and maintaining the Lachat (QuickChem® 8000) Nutrient Auto-analyzer; developed comprehensive instrument protocol; hosted training sessions for USD faculty as well as graduate and undergraduate student; established communication with the Lachat Instruments Technical Support Chemists for collaborative troubleshooting.

AWARDS AND RECOGNITION

Stanford Earth Special Service Award for Diversity, Equity, and Inclusion	2021
Recognizing outstanding individual long-term contribution to DEI at Stanford University	
MARINE Inter-institution Synergistic Grant (Hirsh, McPherson, Eddy)	2020
“Creating a collaborative Unmanned Aerial System (UAS) network by bringing together regulators, scientists, and wildlife monitors through a series of region-wide workshops”	
ARCS (Achievement Rewards for College Scientists) Fellow	2019-2020
MARINE Inter-institution Synergistic Grant (Hirsh, Lummis, White)	2019
“Evaluating Drone Survey Methods to Inform Coastal Resource Management”	
National Science Foundation Graduate Research Fellow	2015-2018
McGee Grant, Stanford School of Earth, Energy, and Environmental Science	2017
Certification for Outstanding Achievement in Mentoring	2016, 2018, 2019
Stanford School of Earth, Energy, and Environmental Science	
McGee Grant, Stanford School of Earth, Energy, and Environmental Science	2015
Phi Beta Kappa Honors Society	2012
Kappa Gamma Pi National Catholic College Graduate Honor Society	2012

PUBLICATIONS

- Ward, M., Kindinger, T. L., **Hirsh, H. K.**, Hill, T., Jellison, B. M., Lummis, S., Rivest, E., Waldbusser, G. G., Gaylord, B. and Kroeker, K. J. (2022) Reviews and syntheses: Spatial and temporal patterns in seagrass metabolic fluxes. *Biogeosciences*, 19, 689–699.
<https://doi.org/10.5194/bg-19-689-2022>.
- Traiger, S. B., Cohn, B., Panos, D., Daly, M., **Hirsh, H.K.**, Martone, M., Gutierrez, I., Mucciarone, D.A., Takeshita, Y., Monismith, S.G., Dunbar, R. B., & Nickols, K. J. (2022) Limited biogeochemical modification of surface waters by kelp forest canopies: Influence of kelp metabolism and site-specific hydrodynamics. *Limnology & Oceanography*, 67:2.
<https://doi.org/10.1002/lno.11999>.
- Cavanaugh K.C., Bell T., Costa M., Eddy N.E., Gendall L., Gleason M.G., Hession-Lewis M., Martone R., McPherson M., Pontier O., Reshitnyk L., Beas-Luna R., Carr M., Caselle J.E., Cavanaugh K.C., Flores Miller R., Hamilton S., Heady W.N., **Hirsh H.K.**, Hohman R., Lee L.C., Lorda J., Ray J., Reed D.C., Saccomanno V.R. and Schroeder S.B. (2021) A Review of the Opportunities and Challenges for Using Remote Sensing for Management of Surface-Canopy Forming Kelps. *Frontiers in Marine Science*. 8:753531.
<https://doi.org/10.3389/fmars.2021.753531>.
- Hirsh, H. K.**, Nickols, K. J., Takeshita, Y., Traiger, S. B., Monismith, S. G., Mucciarone, D. A., & Dunbar, R. B. (2020) Drivers of biogeochemical variability in a central California kelp forest: Implications for local amelioration of ocean acidification. *Journal of Geophysical Research: Oceans*, 125:11. <https://doi.org/10.1029/2020JC016320>.

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- Monismith, S. G., **Hirsh, H.**, Batista, N., Egan, G., & Dunbar, R. B. (2019) Flow and drag in a seagrass bed. *Journal of Geophysical Research: Oceans*, 124:3. <https://doi.org/10.1029/2018JC014862>.
- Hirsh, H. K.**, Takeshita, Y., Mereb, G., Egan, G., Mucciarone, D.A., Monismith, S. G., & Dunbar, R. B. Diurnal and sub-diurnal impacts of tropical seagrass community metabolism on the seawater carbonate system, Ngermid Bay, Republic of Palau. In preparation.
- Ward, M., Hill, T., Reyna, K., Boyer, K., Rivest, E., Knight, E., **Hirsh, H. K.**, Tyburczy, J., Carter, H., Shukla, P., Kroeker, K., Nickols, K. J., Giddings, S., Phillips, J., Sawyer, T. & Lummis, S. Integrating California Eelgrass Science, Policy, and Management in a High CO₂ World. In review.
- Hirsh, H. K.**, McPherson, M., & Bell, T. W. Comparing giant kelp canopy extent over time in aerial UAV surveys and Landsat satellite imagery. In preparation.
- Campbell, S. E., Gray, S. C., Whinney, J., Ramos-Scharrón, C., **Hirsh, H. K.**, & Campbell, S. Watershed Runoff and Sediment Resuspension: Factors affecting suspended sediment and sedimentation in bays with coral reefs, St. John, USVI. *Estuarine Coastal and Shelf Science*. In preparation.

PROFESSIONAL PRESENTATIONS

- Hirsh, H.K.**, Oliver, T., Barkley, H., Wren, J.L.K., Monismith, S.G., and I.C. Enochs. *Predicting coral reef carbonate chemistry through statistical modeling: constraining nearshore residence time at Pacific Island scales*. Ocean Sciences Meeting (Feb. 24–Mar. 4, 2022). Oral.
- Hirsh, H.**, *Understanding Local Drivers of Coral Reef Biogeochemistry: From a single Palauan seagrass-coral community to the span of the NOAA National Coral Reef Monitoring Program*. Combined OCE MPO ATM Seminar Series. Rosenstiel School of Marine and Atmospheric Science, Miami, FL (December 9, 2021). Oral.
- Hirsh, H.K.**, Oliver, T., Barkley, H., Wren, J.L.K., Monismith, S.G., and I.C. Enochs. *Constraining nearshore residence time at Pacific Island scales: Linking offshore and reef carbonate chemistry through statistical modeling of synthesized NCRMP ocean acidification datasets*. Pattullo Conference, Warrenton, VA (October 24-27, 2021). Poster.
- Hirsh, H.**, *Ocean acidification and the carbonate system: Describing local biogeochemical variability on coral reefs*. Ocean Odyssey Lecture Series, C-300. Sea Education Association (September 28, 2021). Oral.
- Hirsh, H.**, *Linking nearshore carbonate chemistry and community metabolism: from a single Palauan seagrass-coral community to the span of the National Coral Reef Monitoring Program*. NOAA Coral Reef Conservation Program Coral Collaboration Series (August 12, 2021). Oral.
- Hirsh, H.K.**, Takeshita, Y., Monismith, S., Mereb, G., Egan, G., Mucciarone, D.A., and R.B. Dunbar. *Diurnal and Sub-diurnal Impacts of Tropical Seagrass-Coral Metabolism on the Seawater Carbonate System*. 14th International Coral Reef Symposium (July 19-23, 2021). Poster.
- Hirsh, H.**, *Linking nearshore carbonate chemistry and community metabolism: from a single Palauan seagrass-coral community to the span of the National Coral Reef Monitoring Program*. NOAA Ocean Acidification Working Group Meeting (July 15, 2021). Oral.
- Hirsh, H.**, *Low Altitude Mapping of Emergent Kelp Canopy in Southern Monterey Bay*. DroneCamp, California State University Monterey Bay (June 25, 2020). Oral.

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- Hirsh, H.** *Drone Surveys of Giant Kelp Canopy in Southern Monterey Bay*. Stanford Grad Alumni Day, Stanford, CA (March 7, 2020). Oral.
- Hirsh, H.**, Nichols, K., Takeshita, Y., Traiger, S., Mucciarone, D.A., Monismith, S.G., and R.B. Dunbar. *Drivers of biogeochemical variability in a California kelp forest and implications for local amelioration against Ocean Acidification*. Ocean Sciences Meeting (OSM), San Diego, CA (Feb. 16-21, 2020). Oral.
- Traiger, S., **Hirsh, H.**, Cohn, B., Panos, D., Takeshita, Y., Mucciarone, D., Dunbar, R.B., and K.J. Nickols. *Biological contributions to biogeochemical variability of kelp forest habitats*. Ocean Sciences Meeting (OSM), San Diego, CA (Feb. 16-21, 2020). Poster.
- Hirsh, H.** *A year of kelp canopy extent in Monterey Bay*. GISDay@Stanford, Stanford, CA (November 11, 2019). Oral.
- Lummis, S., **Hirsh H.**, and T. White. *UAV Surveys of Coastal Marine Ecosystems: regulations, methods, and image analysis*. MARINE (Monterey Area Research Institutions' Network for Education) Oceans Colloquium, Moss Landing, CA (May 11, 2019). Oral.
- Hirsh, H.** *Where's the kelp? Implications for coastal sea surface chemistry in Monterey Bay, CA*. GISDay@Stanford, Stanford, CA (November 14, 2018). Oral.
- Nickols, K.J., Bell, T.W., Kowek, D.A., Mucciarone, D.A., Litvin, S.Y., Leary, P.R., **Hirsh, H.**, Takeshita, Y., Traiger, S., and R.B. Dunbar. *A tale of transition: physical and chemical conditions of kelp forests and urchin barrens within a marine protected area*. Western Society of Naturalists (WSN), Tacoma, WA (November 8-11, 2018). Oral.
- Traiger, S.B., **Hirsh, H.K.**, Takeshita, Yui, Mucciarone, D.A., Dunbar, R. and Nickols, K. *Kelp versus phytoplankton: how does primary production affect carbon chemistry in the nearshore environment of Monterey Bay?* Western Society of Naturalists (WSN), Tacoma, WA (November 8-11, 2018). Oral.
- Hirsh, H.**, Takeshita, Y., Egan, G., Mereb, G., Mucciarone, D.A., Monismith, S.G., and R.B. Dunbar. *Diurnal and sub-diurnal impacts of tropical seagrass community metabolism on the seawater carbonate system*. World Seagrass Conference and International Seagrass Biology Workshop (WSN, ISBW), University Town, National University of Singapore (June 11-17, 2018). Oral.
- Hirsh, H.**, Francis, H., Batista, N., Mereb G., Takeshita, Y., Egan, G., Monismith, S.G., and R.B. Dunbar. *Diurnal and sub-diurnal impacts of tropical seagrass community metabolism on the seawater carbonate system*. Ocean Sciences Meeting (OSM), Portland, OR (February 11-16, 2018). Poster.
- Batista, N., Francis, H. **Hirsh, H.**, Mereb, G., and S.G. Monismith. *Flow and drag over a seagrass bed in Nikko Bay, Republic of Palau*. Ocean Sciences Meeting (OSM), Portland, OR (February 11-16, 2018). Poster.
- Hirsh, H.**, W.I. Torres, M.M. Shea, D.A. Mucciarone, and R.B. Dunbar. *Coupled Biogeochemical and Hydrodynamic Measurements over a Palauan Seagrass Bed: Can Seagrasses Mitigate Local Acidification Stress?* International Coral Reef Symposium (ICRS), Honolulu, HI (June 19-24, 2016). Poster.
- Hirsh, H.**, W. Torres, M. Shea, D. Mucciarone, and R. Dunbar. *Coupled Biogeochemical and Hydrodynamic Measurements over a Palauan Seagrass Bed: Can Seagrasses Mitigate Acidification Stress?* Ocean Sciences Meeting (OSM), New Orleans, LA (February 2016). Poster.
- Hirsh, H.**, W. Torres, M. Shea, D. Mucciarone, and R. Dunbar. *Coupled Biogeochemical and Hydrodynamic Measurements over a Palauan Seagrass Bed: Can Seagrasses Mitigate*

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Acidification Stress? Western Society of Naturalists (WSN) Meeting, Sacramento, CA (November 2015). Poster.

Sarah C. Gray, W. Sears, S. Campbell, C. E. Ramos-Scharrón, **H. Hirsh**, and T. Barnes. *Monitoring Approaches to Assess the Impact of Watershed Development and Restoration on Land-based Sedimentation in the US Virgin Islands: Lessons Learned*. American Geophysical Association (AGU) Fall Meeting, San Francisco, CA (December 15-19, 2014). Poster.

Hirsh, H. and Bolender, J. *Short-term analysis of three biomarkers in a transplantation experiment of the common white clam (*Chione californiensis*), Bahía Magdalena, BCS, Mexico*. California Estuarine Research Society (CAERS) Conference, California State University Long Beach, CA (September 2012). Oral.

WORKSHOPS AND PROFESSIONAL DEVELOPMENT

NOAA Women in the Science Leadership Workshop	May 10-11, 2021
NCCOS-AOML Joint Virtual Symposium	February 23-25, 2021
Joint conference highlighting opportunities for future collaboration between the National Centers for Coastal Ocean Science and NOAA's Atlantic Oceanographic and Meteorological Laboratory	
Annual Kelp Mappers Meeting	April 1-2, 2020; May 5-6, 2021
Hosted by The Hakai Institute and The Nature Conservancy, this collaborative workshop brings together kelp mappers, managers, and researchers across the Pacific Coast to discuss the status of kelp habitat from Baja California to British Columbia and present the latest mapping technology.	
DroneDeploy Conference	October 13, 2020
Kelp Mappers Meeting: Drone Deep Dive	May 15, 2020
Writing your first scientific article (10-week course)	Jan. 7-Mar. 11, 2020
Tips for Successful Manuscript Submission Workshop	Feb. 18, 2020
Dissertation Boot Camp	Nov. 4-15, 2019; Jan. 27-Feb. 7, 2020
Central California Regional UAV Workshop	Dec. 12, 2019
Strategic Communication Workshop, Association for Women in Science (AWIS)	Nov. 12, 2019
Women in Data Science @ Stanford Earth	Nov. 1, 2019
Seagrass Mapping & Neural Networks Workshop	Sept. 24-25, 2019
NASA Ames Laboratory for Advanced Sensing, Mountain View, CA	
Women in STEM Symposium	Feb. 2019
LaTeX for manuscripts and dissertations	Jan. 2019
Mentee, AWIS (Association for Women in Science) Mentoring Program	2018-2020
Women in STEM Career Circle, inaugural cohort	Fall 2018
Durafet Sensor Analysis Best Practices Workshop, Long Marine Lab, UC Santa Cruz	Nov. 2018
Mapping and Analysis of Drone Imagery Workshop	June 16-17, 2018
International Seagrass Biology Workshop 13, National University of Singapore	
Seagrass Restoration and Engineering: Engineering a Better Future for Seagrass	July 15, 2018
International Seagrass Biology Workshop 13, National University of Singapore	
Human Dimension of Seagrass Use and Management	July 15, 2018
Human dimensions related to seagrass: adding gender for better management and conservation	
International Seagrass Biology Workshop 13, National University of Singapore	
Stanford University PhD Pathways Career Education Conference	2017, 2018
Science Teaching through Art (STAR), Infographic workshop series	2018
Rising Environmental Leaders Program (RELP) Fellow	2018

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Teaching in the Field: Basic skills for working with students in the field (course) **Spring 2017**
 Seagrass Working Group, Bodega Marine Laboratory **May 31-June 2 & Oct. 27-28, 2016**
 Meeting of leading experts in ocean acidification, seagrass ecology, and coastal hydrodynamics & oceanography to resolve key processes and unknowns dictating whether seagrass meadows provide a viable tool for offsetting local consequences of emerging, global scale changes in seawater chemistry.

TEACHING, LEADERSHIP, AND MENTORSHIP

DIMES (Diversifying and Integrating Marine Education at Stations) Network **January 2021-Present**
 We are developing a network of engaged scientists and learners at marine stations along the west coast of North America. Our goal is to test the effectiveness of experiential field opportunities by exporting field experiences to the classroom, increasing the accessibility and impact of field stations.

Dissertation Boot Camp, Monitor/Instructor **March-November 2020**
 Host, Central California Regional UAV Workshop, Moss Landing, CA **December 12, 2019**
 Hosted a workshop (56 attendees, 30 institutions) to bring together regional partners to: 1) develop focused working groups to (a) address UAV regulations and wildlife impacts and to (b) design/fund a region-wide platform to combine regional resources and 2) to implement a streamlined UAS program for the Monterey Bay region to highlight the priorities of scientists, policy makers and monitors.

Mentor, Women in STEM Mentoring Program (5 mentees) **2018-2021**
 Teaching Assistant, Marine Chemistry and Biological Oceanography **Spring 2018**
 Stanford EARTH Recruitment Ambassador, Office of Multicultural Affairs **2018, 2020**
 Stanford Science PenPal **2017-2018**
 Mentor, Stanford VPUE Summer Undergraduate Research Program **2017-2018**
 Mentor, Stanford Earth Summer Undergraduate Research (SESUR) Program **2017-2018**
 Mentor, Women in STEM Mentoring Pilot Program **2017-2018**
 New Graduate Student Mentor, Earth System Sciences **2016-2018**
 Mentor, Stanford Woods Institute MUIR Program **2015-2016, 2016-2017**
 Mentoring Undergraduates in Interdisciplinary Research (MUIR)
 Elected Student Representative, Graduate Student Advisory Committee **2016-2017**
 Speaker/Educator, Marine Science Institute, Redwood City, CA **2017**
 Teaching Assistant, Bing Overseas Studies Program, Palau **Summer 2017**
 Coral Reefs of Palau: Marine Environment, Ecology and Management
 Graduate Student Representative, ESS New Faculty Search Committee **Spring 2016**
 Represented students' opinions of candidates for a dual hire between the Center for Ocean Solutions and Stanford Earth System Science Department
 Teaching Assistant, Stanford at Sea **Spring 2015**
 Five weeks of marine science (oceanography, marine physiology, maritime studies, conservation, nautical science) at Hopkins Marine Station and five weeks at sea aboard the *SSV Robert C. Seamans* sailing from Tahiti to Hawai'i.

Volunteer, Northern California Regional National Ocean Science Bowl **2015**
 Research Mentor, Bellarmine Preparatory School Marine Chemistry Program **2009-2015**
 VIERS Science Camp Environmental Education Coordinator **Summer 2014**
 Virgin Islands Environmental Resource Station, St. John, U.S. Virgin Islands
 Coral Reef Educator, Guest Faculty, Sea Education Association **Fall 2013**
 Counselor, Speaker, and Activity Leader, U.S.V.I. National Park Eco-Camps **Summer 2013**
 Volunteer Crew, Sea Education Association **Fall 2012, Spring 2013**
 Supervisor, R/V Robert Gordon Sproul Undergraduate Research Cruise **September 2012**

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Preceptorial Assistant, Natural Disasters Lecture/Lab, USD
Teaching Assistant, Organic Chemistry Laboratory, USD

2011-2012
Spring 2011

FIELD RESEARCH EXPERIENCE

Monterey Bay, CA	Aug. 2018-Feb. 2020
Monthly drone surveys of Hopkins Marine Station kelp forest canopy.	
Central California Coast pH and Oxygen (C3PO) Cruise	May 11-17, 2019
<i>Western Flyer</i> , Monterey Bay Aquarium Research Institute (MBARI)	
Volunteer scientist responsible for collecting water samples and running total alkalinity titrations.	
Monterey Bay kelp forest biogeochemistry	June-October 2018
Spatial and temporal variability in kelp forest biogeochemistry (transects of surface chemistry beyond the kelp forest, mooring deployments inside and outside of the kelp canopy, three high-resolution (36-48 hour) pumping experiments to take a closer look at vertical variability inside the kelp)	
Ngeseksau Reef, Republic of Palau	June-August 2017
Field teaching at the Palau International Coral Reef Center (PICRC) and dissertation data collection in Nikko Bay. Measured current velocity, pH and dissolved oxygen to calculate oxygen flux over a 600-meter seagrass meadow in order to assess the diurnal and sub-diurnal impacts of tropical seagrass on the seawater carbonate system.	
Tomales Bay, CA	May 2017
Volunteer field work for UC Santa Cruz & The Nature Conservancy; recorded benthic seagrass shoot counts and conducted drone surveys of coastal seagrass and oyster habitat.	
Palmyra Atoll	October 2016
Coral reef thermistor retrieval; acoustic tagging and census of manta rays.	
Project Baseline/Nekton Mission Cruise, Bermuda	August 2016
Mesophotic biogeochemistry, BEAMS experiments, and media outreach.	
Ngeseksau Reef, Republic of Palau	June-August 2015
Site selection and preliminary field work including 24-hour monitoring of seagrass biogeochemistry.	
Monterey Bay, CA	August 2014
Collection of kelp forest discrete seawater chemistry samples (DIC, alkalinity, & nutrients).	
Virgin Islands Environmental Resource Station, St. John, U.S. Virgin Islands	May 2013-August 2014
Annual study of watershed runoff/sedimentation stress on reefs in Coral Bay and Lameshur Bay.	
Ocean Exploration Cruise, Caribbean	2013
Crew, <i>SSV Corwith Cramer</i> , Sea Education Association	
Plastics@SEA North Pacific Gyre Expedition	2012
Crew, <i>SSV Robert C. Seamans</i> , Sea Education Association (San Diego to Hawai'i)	
Sustainability in Polynesia Island Cultures and Ecosystems Cruise	2011
Student, <i>SSV Robert C. Seamans</i> , Sea Education Association (Tahiti to Hawai'i)	
Holy Innocents Children's Hospital, Mbarara, Uganda	January 2012
Community water quality analysis and local outreach	
Southern California Bight Undergraduate Research Cruises	September 2010, 2011
R/V Robert Gordon Sproul, Scripps Institution of Oceanography (plankton counts, sediment cores)	
SFS Center for Coastal Studies, Puerto San Carlos, BCS, Mexico	Summer 2010, 2011
Undergraduate research quantifying the biochemical response of clams exposed to transplantation and anthropogenic contamination in Bahia Magdalena, Baja California Sur.	
Spirit Lake, Mount Saint Helens National Volcanic Monument, WA	July 2009, 2010
SCUBA collection of lake vegetation and lake sediment/ash samples for grain size analysis.	

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Quartermaster Harbor, Puget Sound, WA

2007-2008

Designed and implemented an independent research project to capture and quantify the domoic-acid producing diatom, *Pseudo-nitzschia* spp. over an 8-week period.

SKILLS & CERTIFICATIONS

Proficiency in Microsoft Office (Word, Excel, PowerPoint)

Proficiency in Matlab and R

Experience running particle tracing in OceanParcels (via Python)

Experience in ArcGIS

Experience in Adobe Illustrator

Photogrammetry experience in DroneDeploy, Pix4D, and Agisoft Metashape

FAA Part 107 Remote Pilot Certification

2018

AAUS-certified SCUBA diver (250+ dives)

2015

California Boater Card

2018

Washington State Boater Education Card

2013

PADI Enriched Air Diver

2014

PADI Rescue Diver

2013

PADI Advanced Open Water Diver

2007

PADI Open Water Diver

2005

MEMBERSHIPS

DIMES (Diversifying and Integrating Marine Education at Stations) Network

SONAR (Stanford Ocean Networking And Research)

Stanford MARINE (Monterey Area Research Institutions' Network for Education)

American Academy of Underwater Sciences (AAUS)

World Seagrass Association

International Society of Reef Studies

The Nature Conservancy

Western Society of Naturalists

American Geophysical Union

American Academy of Underwater Sciences

Diver's Alert Network