

ALEXIS D. FISCHER

Associate Scientist II at *University Corporation for Atmospheric Research (UCAR)*
Visiting Scientist at *National Oceanographic and Atmospheric Administration (NOAA)*
NOAA's Northwest Fisheries Science Center
2725 Montlake Blvd. East
Seattle, WA 98112

Email: alexis.fischer@noaa.gov
Website: alexisfischer.com

SCIENTIFIC INTERESTS & EXPERTISE

Phytoplankton ecology; Modeling of phytoplankton physiology, blooms, and population dynamics; Impacts of environmental and climatological variability on phytoplankton dynamics; Imaging FlowCytobot (IFCB) and other autonomous observing platforms; Harmful algal bloom ecology and mitigation; Dinoflagellate resting cysts and life cycle dynamics; Automated image analysis and machine learning for image classification.

EDUCATION

Ph.D. Biological Oceanography, Massachusetts Institute of Technology–Woods Hole Oceanographic Institution Joint Program, Woods Hole, MA, 2017
Thesis: *Alexandrium catenella* cyst dynamics in a coastal embayment: temperature dependence of dormancy, germination, and bloom initiation
Advisor: Donald Anderson

B.A. Biological Sciences, Wellesley College, Wellesley, MA, 2010

PROFESSIONAL EXPERIENCE

05/2021– **Associate Scientist II** at UCAR and **Visiting Scientist** at NOAA, Seattle, WA.
Environmental drivers of phytoplankton blooms, IFCB, machine learning classifiers
Supervisor: Stephanie Moore

05/2021– **Guest Investigator**; Woods Hole Oceanographic Institution, Woods Hole, MA.
Host: Donald Anderson

2020–2021 **Postdoctoral Investigator**; Woods Hole Oceanographic Institution, Woods Hole, MA.
Interactions between climate and harmful algal bloom physiology, analytical/statistical models
Supervisor: Donald Anderson

2017–2020 **Postdoctoral Research Fellow**; University of California at Santa Cruz, Santa Cruz, CA.
Phytoplankton dynamics in the California Current System, IFCB, machine learning classifiers
Supervisor: Raphael Kudela

2011–2017 **Graduate Research Assistant**; Woods Hole Oceanographic Institution, Woods Hole, MA.
Ecophysiology of harmful algal bloom species, dinoflagellate life cycles, analytical modeling
Supervisor: Donald Anderson

2010–2011 **Research Technician**, University of Alberta, Edmonton, AB, Canada
Microbial ecology and evolution of *Vibrio cholerae*; bacterial-algal interactions
Supervisors: Yan Boucher & Rebecca Case

COMPETITIVE GRANT SUPPORT

Woods Hole Center for Oceans and Human Health. Co-Investigator. Harmful algal bloom dynamics: assessing physiological and behavioral plasticity in natural populations. National Science Foundation, National Institute of Environmental Health Sciences. Award: \$6.9 million (2018–2023).

Delta Science Postdoctoral Fellowship. Primary Investigator. Do Light, Nutrient, and Salinity Interactions Drive the “Bad Suisun” Phenomenon? A Physiological Assessment of Biological Hotspots in the San Francisco Bay-Delta. California Sea Grant, Delta Stewardship Council. Award: \$202,222 (2018–2020).
Link: <https://caseagrants.ucsd.edu/project/do-light-nutrient-and-salinity-interactions-drive-the-bad-suisun-phenomenon-a-physiological>

Ocean Ventures Fund Grant. Primary Investigator. A novel transcriptomics approach to characterize genetic regulation of the annual rhythmicity in *Alexandrium fundyense* cysts. Woods Hole Oceanographic Institution. Award: \$7,000 (2014).

AWARDS

Maureen Keller Prize for Best Student Presentation, 17th International Conference on Harmful Algae (2016)
Maureen Keller Prize for Best Student Presentation, 8th Symposium on Harmful Algae (2015)
Joshua A. Nickerson Conservation Fellowship, Friends of Cape Cod National Seashore (2014)
Maureen Keller Prize for Best Student Presentation, 7th Symposium on Harmful Algae (2013)
Wood Hole Oceanographic Institution Summer Student Fellowship (2010)
AMGEN Scholarship (2009)

PUBLICATIONS

Fischer, A.D., Brosnahan, M.L. 2022. Growing degree day-based cyst germination rates in the toxic dinoflagellate *Alexandrium catenella*. Applied & Environmental Microbiology Journal 88: e02518-21 <https://doi.org/10.1128/aem.02518-21>

Ruhl, H.A., J.A. Brown, A.R. Harper, E. Hazen, L. deWitt, P. Daniel, A. DeVogelaere, R.M. Kudela, J.P. Ryan, **A.D. Fischer**, F.E. Muller-Karger, and F.P. Chavez. 2021. Integrating biodiversity and environmental observations in support of national marine sanctuary and large marine ecosystem assessments. Oceanography 34. <https://doi.org/10.5670/oceanog.2021.221>

Anderson, D.M., Fachon, E., Pickart, R.S., Lin, P., **Fischer, A.D.**, Richlen, M.L., Uva, V., Brosnahan, M., McRaven, L., Bahr, F., Lefebvre, K., Grebmeier, J., Danielson, S., Lyu, Y., Fukai, Y., Moore, G.W.K. 2021. Evidence for massive and recurrent toxic blooms of *Alexandrium catenella* in the Alaskan Arctic. PNAS 118: e2107387118. <https://doi.org/10.1073/pnas.2107387118>

Kramer, S.J., Bisson, K.M., **Fischer, A.D.** 2020. Observations of phytoplankton community composition in the Santa Barbara Channel during the Thomas Fire. Journal of Geophysical Research: Oceans 125: e2020JC016851. <https://doi.org/10.1029/2020JC016851>

Fischer, A.D., McGaraghan, A., Hayashi, K., Kudela, R.M. 2020. Return of the “age of dinoflagellates” in Monterey Bay: Drivers of dinoflagellate dominance examined using automated imaging flow cytometry and long-term time series analysis. Limnology & Oceanography 65: 2125–2141. <https://doi.org/10.1002/lno.11443>.

Bisson, K.M., Baetge, N., Kramer, S.J., Catlett, D., Girling, G., McNair, H., Arrington, E., Hayes, D., Jacobs, C., James, A., Closset, I., **Fischer, A.D.**, Wagner, S., Reading, M., Comstock, J., Amiri, S., Harvey, E., C. Carlson, C., Gaube, P., Drushka, K., Valentine, D.L. 2020. California wildfire burns boundaries between science and art. Oceanography 33: 16–19. <https://doi.org/10.5670/oceanog.2020.110>.

Brosnahan, M.L. & **Fischer A.D.***, Lopez, C., Moore, S., Anderson, D.M. 2020. Cyst-forming dinoflagellates in a warming climate. Harmful Algae 91: 101728. <https://doi.org/10.1016/j.hal.2019.101728>. *co-first author

Fischer, A.D., Brosnahan, M.L., Anderson, D.M. 2018. Quantitative response of *Alexandrium catenella* cyst dormancy to cold exposure. Protist 169: 645–661. <https://doi.org/10.1016/j.protis.2018.06.001>.

Brosnahan, M.L., Ralston, D.K., **Fischer, A.D.**, Solow, A.R., Anderson, D.M. 2017. Bloom termination of the toxic dinoflagellate *Alexandrium catenella*: vertical migration behavior, sediment infiltration, and benthic cyst yield. Limnology & Oceanography 62: 2829–2849. <https://doi.org/10.1002/lno.10664>.

Fischer, A.D., Moberg, E.A., Alexander, H.A., Brownlee, E.F., Hunter-Cevera, K.R., Pitz, K.J., Rosengard, S.Z., Sosik, H.M. 2014. Sixty Years of Sverdrup: A Retrospective of Progress in the Study of Phytoplankton Blooms. Oceanography 27: 222–235. <https://doi.org/10.5670/oceanog.2014.26>.

INVITED SEMINARS

Fischer A.D. Bloom initiation of the harmful algae *Alexandrium catenella*: Resolving the temperature dependence of dormancy and germination. University of Massachusetts Dartmouth, New Bedford, MA (April 2021).

- Fischer A.D. Return of the Age of Dinoflagellates in the Monterey Bay. Woods Hole Oceanographic Institution, Woods Hole, MA (October 2020).
- Fischer A.D. Return of the Age of Dinoflagellates in Monterey Bay (and the California Current Large Marine Ecosystem?). Monterey Bay Aquarium Research Institute, Moss Landing, CA (September 2019).
- Fischer A.D. Unusual dinoflagellate dominance in northern Monterey Bay detected with automated imaging flow cytometry. University of California Santa Barbara, Santa Barbara, CA (May 2019).
- Fischer A.D. Return of the “age of dinoflagellates”: unusual dinoflagellate dominance in northern Monterey Bay detected with automated imaging flow cytometry. Moss Landing Marine Laboratories, Moss Landing, CA (May 2019).
- Fischer A.D. Quantifying the chilling requirement for germinability of natural *Alexandrium fundyense* resting cysts. Woods Hole Oceanographic Institution, Woods Hole, MA (May 2016).

OTHER PRESENTATIONS AT PROFESSIONAL MEETINGS (FIRST AUTHOR)

(^T Denotes talk, otherwise poster)

- ^T Fischer, A.D., Brosnahan, M.L. Degree-day-based cyst germination rates and in situ germling production of *Alexandrium catenella*. International Conference on Harmful Algae, La Paz, Mexico (October 2021).
- ^T Fischer, A.D., Brosnahan, M.L., Kulis, D., Anderson, D.M. *Alexandrium* germling flux in the Nauset Estuary and Gulf of Maine. Gulf of Maine HAB Science Symposium (March 2021).
- ^T Fischer, A.D., Brosnahan, M.L., Anderson, D.M. New insights into the climate response of *Alexandrium catenella* through investigation of temperature-based dormancy control. Oceans and Human Health Meeting, Woods Hole, MA (October 2020).
- Fischer, A.D., Kudela, R.M. Shifts in phytoplankton productivity and community structure in the San Francisco Bay-Delta driven by Delta Outflow. Ocean Sciences Meeting, San Diego, CA (February 2020).
- Fischer A.D., Brosnahan, M.L., Ralston, D.K., Anderson, D.M. Progress toward understanding HAB climate response through intensive in situ observation of *Alexandrium catenella*. Ocean Sciences Meeting, San Diego, CA (February 2020).
- ^T Fischer, A.D., McGaraghan, A., Hayashi, K., Kudela, R.M. Return of the “age of dinoflagellates”: unusual dinoflagellate dominance in Monterey Bay examined with automated imaging flow cytometry. Symposium on Harmful Algae, Orange Beach, AL (November 2019).
- ^T Fischer, A.D., McGaraghan, A., Hayashi, K., Kudela, R.M. Unusual dinoflagellate dominance detected in northern Monterey Bay with automated imaging flow cytometry. Imaging FlowCytobot Workshop, Woods Hole, MA (November 2018).
- ^T Fischer, A.D., McGaraghan, A., Hayashi, K., Kudela, R.M. Detecting Harmful Algal Blooms using a Novel Underwater Microscope. CeNCOOS PI Science Impact Meeting, Moss Landing, CA, (November 2018).
- ^T Fischer, A.D., Kulis, D.M., Brosnahan, M.L., Anderson, D.M. Environmental entrainment of the endogenous annual rhythm of *Alexandrium catenella* cysts from the Gulf of Maine. International Conference on Harmful Algae, Nantes, France (October 2018).
- ^T Fischer, A.D., Kulis, D.M., Brosnahan, M.L., Anderson, D.M. Germination and in situ emergence of *Alexandrium catenella* in response to vernal warming. Symposium on Harmful Algae, Baltimore, MD, USA (November 2017).
- ^T Fischer, A.D., Brosnahan, M.L., Anderson, D.M. Quantifying the chilling requirement for germinability of natural *Alexandrium catenella* resting cysts. International Conference on Harmful Algae, Florianopolis, Brazil (October 2016).
- ^T Fischer, A.D., Brosnahan, M.L., Anderson, D.M. Winter chilling induces synchronous spring germination by *Alexandrium fundyense* cysts in the Nauset Marsh System. Ocean Sciences Meeting, New Orleans, LA (February 2016).
- Fischer, A.D., Anderson, D.M. The Dynamic Role of Temperature in Spring Bloom initiation: Winter Chilling induces Synchronous Germination by *Alexandrium fundyense* cysts. Symposium on Harmful Algae. Long Beach, CA (November 2015).

Fischer, A.D., Anderson, D.M. How to overwinter on land and in the sea: terrestrial plant seeds and marine dinoflagellate cysts both rely on winter chilling. International Society for Seed Science, Seed Longevity Workshop. Wernigerode, Germany (June 2015).

^T Fischer, A.D., Anderson, D.M. Winter chilling entrains the endogenous annual rhythm in *Alexandrium fundyense* cysts from a shallow estuarine system. International Conference on Harmful Algae. Wellington, New Zealand (October 2014).

^T Fischer A.D. Winter chilling entrains the annual germination rhythm in *Alexandrium fundyense* cysts from a shallow estuarine system. Ocean Outlook Meeting. Bergen, Norway (February 2014).

Fischer, A.D., Anderson, D.M. Seasonal excystment rhythms of *Alexandrium fundyense* in a shallow estuarine system: Control by endogenous and/or exogenous factors. Symposium on Harmful Algae. Sarasota, FL (November 2013).

FIELDWORK

Budd Inlet, WA (2021–present): led phytoplankton data collection by an Imaging FlowCytobot (deployments, troubleshooting, repairs, data QA/QC). Designed and maintained underwater moored deployment and live data-transfer system.

California Current System (R/V *Shimada*; summer 2021): configured the sampling interface and remote communications, and remotely led a shipboard deployment of an Imaging FlowCytobot (networking, troubleshooting, repairs, data QA/QC).

Santa Cruz Municipal Wharf & San Francisco Exploratorium Museum (2017–2020): led phytoplankton data collection by Imaging FlowCytobots at both sites (deployments, troubleshooting, repairs, data QA/QC). Designed and maintained seawater flow-through and live data-transfer system.

San Francisco Bay, CA (R/V *Peterson*; 11/13/2020–11/14/2020 & 12/19/2019–12/20/2019): conducted measurements of water quality (chlorophyll, nutrients dissolved oxygen, light penetration, salinity, temperature, suspended particulate matter, phytoplankton) along a 145 kilometer transect spanning the length of the estuarine system.

San Francisco Bay, CA (R/V *Peterson*; 04/30/2018): led and conducted a benthic survey with a sediment grab sampler to quantify resting stages (cysts) of harmful algal bloom species in the sediments in order to evaluate the potential for harmful algal blooms in the estuary.

Santa Barbara Channel (R/V *Sally Ride*; 12/17/2017–12/22/2017): conducted measurements of seawater chemistry, fire ash, plankton community structure, CTD hydrocasts, and optical profiles in response to the Thomas Fire.

Western Greenland (R/V *Maria S. Merian*; 07/25/2017–08/19/2017): harmful algae whole cell sampling, phytoplankton and zooplankton toxin analysis, CTD hydrocasts, sediment coring (grab sampler, vibrocorer, and multicorer) sampling spatial distribution of cysts, optical profiling.

Nauset Marsh Estuary, MA (13' Boston Whaler and waders; 2012–2017): sediment coring with a gravity corer, sediment flux traps, phytoplankton and grazer sampling, nutrient measurements, CTD hydrocasts, sediment trap recovery and deployments, mooring recovery and deployments, hydrographic measurements, and HOBO data logger deployments and retrievals.

Gulf of Maine (R/V *Connecticut*, 11/11/2013–11/14/2013): conducted a benthic survey with a sediment multicorer sampler to quantify resting stages (cysts) of a harmful algal species (*Alexandrium catenella*) in the sediments to support the NOAA harmful algal bloom forecasting model.

North Pacific Subtropical Gyre (R/V *Kilo Moana*; 06/10/2012–06/20/2012): measurements of thermohaline structure, water column chemistry, optical properties, primary production, plankton community structure, and particle export for Hawaii Ocean Timeseries (HOT).

Gulf of Maine (R/V *Connecticut*; 07/08/2011–07/20/2011): retrieval of a specialized ocean robotic sampling platform (Environmental Sample Processor; ESP) and conducted measurements of water quality and phytoplankton abundance.

COMMUNITY ENGAGEMENT

- Judge for MIT Research for a Water Secure Future Film Festival.** Abdul Latif Jameel Water and Food Systems Lab at MIT (March 2021).
- “All Quiet Under the Algal Bloom”** Interviewed and quoted in Hakai Magazine, by Lina Tran. <https://www.hakaimagazine.com/news/all-quiet-under-the-algal-bloom/> (January 2021).
- “Why Do Waves Glow During Red Tide, Exactly?”** Interviewed and quoted in SURFER Magazine, by Katie Rodriguez. <https://www.surfer.com/features/why-do-waves-glow-during-red-tide-exactly/> (April 2020).
- “A resurgence of dinoflagellates, which can cause harmful algal blooms, may be in the cards for some bays along the U.S. West Coast”.** Interviewed and quoted in San Francisco Estuary Magazine, by Kathleen M. Wong. <https://www.sfestuary.org/resurgence-of-dinoflagellates/> (April 2020).
- Advisor for the Exploratorium: The Museum of Science, Art, and Human Perception,** San Francisco, CA. Helped advise the creation of a museum exhibit on ocean robotics and machine learning classifiers to explore coastal phytoplankton dynamics (2018–2020).
- “Facial Recognition for Harmful Algae”.** General audience talk at Seymour Marine Discovery Center, Santa Cruz, CA (August 2019).
- “A marriage of robotics and artificial intelligence promises to automate the detection of harmful algal blooms, which can trigger shellfish harvesting bans and fill wildlife rescue centers with sickened animals”.** Interviewed and quoted in San Francisco Estuary Magazine, by Kathleen M. Wong. <https://www.sfestuary.org/estuary-news-pearls-flow-cytobot/> (February 2019)
- “Using New Technologies to Research Harmful Algal Blooms and Protect Public Health”.** General audience talk to high school students through the Stanford Pre-Collegiate Summer Institutes in Environmental Science, CA (July 2019).
- “Under Santa Cruz Wharf, a robot watches for algal blooms”.** Interviewed and quoted in The Santa Cruz Sentinel, by Erika K. Carlson. Article on a specialized ocean robotic sampling platform that I deployed to monitor and study harmful algal blooms and protect public health <https://www.santacruzsentinel.com/2018/11/30/under-santa-cruz-wharf-a-robot-watches-for-algal-blooms/> (November 2018).
- “Detecting Deadly Algae”.** Interviewed and quoted in UC Santa Cruz Science Notes, by Anna Katrina Hunter. Article on harmful algal blooms in the California Current System and new tools to monitor and study them to ensure seafood safety <https://ucscsciencenotes.com/feature/detecting-deadly-algae/> (September 2018).
- “Facial Recognition for San Francisco Bay Plankton”.** General audience talk at Exploratorium Museum, San Francisco, CA (August 2018).
- “Uncovering the Mysteries of Harmful Algal Blooms”.** General audience talk to high school students through the Stanford Pre-Collegiate Summer Institutes in Environmental Science, CA (July 2018).
- “Ready, Set, Bloom!”** Feature story in Outside Science (inside parks), by Weston Docker. YouTube video on my graduate work to understand harmful algal blooms in Cape Cod National Seashore, MA. <https://www.youtube.com/watch?v=ejKE9ruw3j4> (March 2016).
- “Making the Invisible Visible: The Secret, Bizarre, and Amazing World of Plankton”.** Designed and led a booth of hands-on activities for a general audience, Cambridge Science Festival, Cambridge, MA (April 2013).
- “Making the Invisible Visible: The Secret, Bizarre, and Amazing World of Plankton”.** Designed and led a booth of hands-on activities for a general audience, World Oceans Day, New England Aquarium, Boston, MA, (June 2013).

TEACHING & MENTORSHIP

Mentored a group of five LGBTQIA+ early career scientists through MPOWIR (Mentoring Physical Oceanographic Women to Increase Retention; <https://mpowir.org/>) (2023–present)

Mentored a NOAA postdoctoral scholar from France on a Fulbright Fellowship: Emilie Houliez. I taught her how to operate and repair an ocean robot (Imaging FlowCytobot) and have helped guide her with research direction, experimental design, manuscript and presentation preparation, analytical methods, statistical analysis, data interpretation, and career and personal development (2022–present).

Mentored University of California, Santa Cruz graduate students Meredith McPherson, Niky Taylor, and Charles Martin. I helped guide several of my supervisor's graduate students on research direction, presentation preparation, analytical methods, statistical analysis, data interpretation, and career and personal development, especially while he was on sabbatical (2018–2020).

Lectures on phytoplankton pigments and phytoplankton photosynthesis. Two guest lectures for the graduate course, “Biological Oceanography”. University of California, Santa Cruz, CA (April 2018).

Lectures on coastal processes and life in the ocean. Two guest lectures for the undergraduate course, “The Oceans”. University of California, Santa Cruz, CA (February 2018).

Lecture on harmful algal blooms. Guest lecturer for the undergraduate course, “Marine Biology.” Wellesley College, Wellesley, MA (October 2016).

MIT Teaching & Learning Lab Teaching Certificate Program. Massachusetts Institute of Technology, Cambridge, MA. 02/05/2015–05/14/2015.

Lecture on phytoplankton bloom phenology. Guest lecturer for the undergraduate course, “Marine Biology.” Wellesley College, Wellesley, MA (October 2014).

Mentored Woods Hole Oceanographic Institution guest students Natalie Kukshel, Jessica Roth, Nathaniel Haycock, Finn Correia, Jennifer Haskell, and Madeline McKenna. I guided a number of undergraduate students in research direction, experimental design, presentation preparation, analytical methods, data interpretation, and career and personal development (2013–2016).

Invited speaker on graduate student panel at Wellesley College, Wellesley, MA (2012, 2015).

LEADERSHIP

Group leader for the **Unlearning Racism in Geosciences (URGE)** program at the Woods Hole Oceanographic Institution. Led my laboratory team to develop anti-racist policies and resources, and facilitated discussion of existing literature, expert opinions, and personal experiences (2021).

North Pacific Marine Science Organization (PICES) Working Group on “Towards best practices using imaging systems for monitoring plankton” (2020–2021).

Peer Reviewer for *Journal of Phycology*, *Limnology and Oceanography*, *Harmful Algae*, *European Journal of Phycology*

Early Career Ocean Professionals Working Group for the United Nations Decade of Ocean Science for Sustainable Development (Intergovernmental Oceanographic Commission of UNESCO). Contributed to the development of the Decade Implementation Plan for sustainable development (2019–2020).

Co-President (2015–2016) & **Treasurer** (2014–2015) of the **Massachusetts Institute of Technology Water Club**, Cambridge, MA. Led a graduate student team in the organization of conferences, lectures, research showcases, outreach events, and entrepreneurship competitions to bring together passionate individuals to explore ways by which research, innovation, and policy to help solve pressing challenges in the water sector. Fundraised and managed a \$70,000 (2015–2016) and \$20,000 (2014–2015) budget.

Challenger Expeditions Seminar Series Chair at the Woods Hole Oceanographic Institution, Woods Hole, MA. Developed and coordinated a monthly seminar series for students and postdoctoral investigators to get feedback on unfinished work and build community (2013–2015).

PROFESSIONAL COURSES

Imaging FlowCytobot User Workshop. Woods Hole Oceanographic Institution, Woods Hole, MA. 11/14/2018–11/15/2018.

Imaging FlowCytobot Training Course. McLane Research Laboratories, Inc., Falmouth, MA. 06/19/2017–06/21/2017.

Microbial Oceanography: Genomes to Biomes Summer Course. The Center for Microbial Oceanography: Research and Education (C-MORE), University of Hawai‘i at Mānoa, Honolulu, HI. 05/28/2012–07/10/2012.

PROFESSIONAL AFFILIATIONS

Member, Society for Women in Marine Science, 2017–present

Member, Association for the Sciences of Limnology and Oceanography (ASLO), 2017–present
Member, International Society for the Study of Harmful Algae (ISHA), 2011–present
Member, The Oceanography Society (TOS), 2014–present
Member, Massachusetts Institute of Technology Club of Northern California, 2017–present
Member, Wellesley College Club of Silicon Valley, 2017–present