Elizabeth (Effie) Coombs Fine

Scripps Institution of Oceanography
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Education

Ph.D. in Oceanography, Scripps Institution of Oceanography — 2019
M.S. in Physics, University of Colorado, Boulder — 2014
B.S. in Physics, Minor in Philosophy, Stanford University — 2011

Professional Appointments

Postdoctoral Scholar — 2023-present
Scripps Institution of Oceanography
Advisor: Amy Waterhouse

Postdoctoral Investigator — 2022-2023
Woods Hole Oceanographic Institution
Advisor: John Toole

Lecturer — Fall 2022
Scripps Institution of Oceanography

Postdoctoral Investigator/Scholar — 2021-2022
Split Appointment
Woods Hole Oceanographic Institution
Advisor: John Toole
Scripps Institution of Oceanography
Advisor: Julie McClean

Postdoctoral Scholar — 2019-2021
Woods Hole Oceanographic Institution
Advisor: Sylvia Cole

Graduate Student Researcher — 2015-2019
Scripps Institution of Oceanography
Advisors: Jennifer MacKinnon and Matthew Alford

Summer Research Assistant — 2012, 2013, 2014
Scripps Institution of Oceanography
Advisors: Robert Pinkel and Andrew Lucas

Graduate Research Assistant 2013-2014
National Center for Atmospheric Research
Advisor: Frank Bryan

Graduate Research Assistant 2013
University of Colorado, Boulder
Advisor: Murray Holland

AWARDS AND FELLOWSHIPS

Weston Howland Jr. Postdoctoral Scholar Appointment, 18 months 2019
NSF Graduate Research Fellowship, 3 years 2014

PUBLICATIONS

Beer, E., I. Eisenman, T. J. W. Wagner, and **E. C. Fine** (2023). A possible hysteresis in the Arctic Ocean due to release of subsurface heat during sea ice retreat. *J. Phys. Oceanogr.*, **53**, 1323–1335, https://doi.org/10.1175/JPO-D-22-0131.1.

Boury, S., R. Supekar, **E.C. Fine**, R. Musgrave, J.B. Mickett, G. Voet, P. Odier, T. Peacock, J.A. MacKinnon, M.H. Alford (2022). Observations of double diffusive staircase edges in the Arctic Ocean. *J. Geophys. Res. Oceans*, 127, e2022JC018906. https://doi.org/10.1029/2022JC018906

Waterhouse, A. F., T. Hennon, E. Kunze, J. A. MacKinnon, M. H. Alford, R. Pinkel, H. Simmons, C. B. Whalen, **E. C. Fine**, J. Klymak, and J. M. Hummon (2022). Global observations of rotary-with-depth shear spectra. *J. Phys. Oceanogr.* https://doi.org/10.1175/JPO-D-22-0015.1

Fine, E. C. and S. T. Cole (2022). Decadal observations of internal wave energy and shear in the western Arctic. *J. Geophys. Res. Oceans,* 127(5) e2021JC018056. https://doi.org/10.1029/2021JC018056

Rippeth, T. P. and **E. C. Fine** (2022). Turbulent mixing in a changing Arctic Ocean. *Oceanography* 35. https://doi.org/10.5670/oceanog.2022.103

Fine, E. C., J. A. MacKinnon, M. H. Alford, L. Middleton, J. Taylor, S. Cole, J. B. Mickett, N. Couto, A. le Boyer, T. Peacock (2022). Microstructure observations of Pacific Summer Water in the western Arctic. *J. Phys. Oceanogr.* 52, 189-203. https://doi.org/10.1175/JPO-D-21-0074.1

Middleton, L., **E. C. Fine**, J. A. MacKinnon, M. H. Alford, J. R. Taylor (2021). Estimating dissipation rates associated with double diffusion. *Geophys. Res. Lett.,* 48(15) e2021GL092779. https://doi.org/10.1029/2021GL092779

MacKinnon, J. A., H. L. Simmons, J. Hargrove, J. Thomson, T. Peacock, M. H. Alford, B. I. Barton, S. Boury, S. D. Brenner, N. Couto, S. L. Danielson, **E. C. Fine,** H. C. Graber, J. Guthrie, J. E. Hopkins, S. R. Jayne, T. Klenz, C. M. Lee, Y.-D. Lenn, A. J. Lucas, B. Lund, C. Mahaffey, L. Norman, L. Rainville, M. M. Smith, S. Torres-Valdés, K. R. Wood (2021). A warm jet in a cold ocean. *Nature Comms.,* 12, 2418. https://doi.org/10.1038/s41467-021-22505-5

Fine, E. C., J. A. MacKinnon, M. H. Alford, J. B. Mickett (2021). Microstructure mixing observations and finescale parameterizations in the Beaufort Sea. *J. Phys. Oceanogr.* 51*,* 19-35 https://doi.org/10.1175/JPO-D-19-0233.1

Boury, S., R. S. Pickart, P. Odier, P. Lin, M. Li, **E. C. Fine**, H. L. Simmons, J. A. MacKinnon, T. Peacock (2020). Whither the Chukchi Slope Current? *J. Phys. Oceanogr.* 50*,* 1717-1732. https://doi.org/10.1175/JPO-D-19-0273.1

Fine, E. C., J. A. MacKinnon, M. H. Alford, J. B. Mickett (2018). Microstructure observations of turbulent heat fluxes in a warm-core Canada Basin eddy. *J. Phys. Oceanogr.* 48*,* 2397-2418. https://doi.org/10.1175/JPO-D-18-0028.1

MacKinnon, J. A., J. D. Nash, M. H. Alford, A. J. Lucas, J. B. Mickett, E. Shroyer, A. F. Waterhouse, A. Tandon, D. Sengupta, A. Mahadevan, M. Ravichandran, R. Pinkel, D. Rudnick, C. B. Whalen, M. S. Alberty, J. Sreelehka, **E. C. Fine**, D. Chaudhuri, G. L. Wagner (2016). A tale of two spicy seas. *Oceanography* 29, 50–61. http://www.jstor.org/stable/24862669.

Fine, E. C., F. O. Bryan, W. G. Large, D. A. Bailey (2015). An initial estimate of the global distribution of diurnal variation in sea surface salinity. *J. Geophys. Res. Oceans* 120, 3211-3228. https://doi.org/10.1002/2014JC010483

Xu, Minghui, D. A. Tieri, **E. C. Fine**, J. K. Thompson, and M. J. Holland (2014). Synchronization of two ensembles of atoms. *Phys. Rev. Lett.*, 113, 154101-154106. https://doi.org/10.1103/PhysRevLett.113.154101

Fine, E. C., J. L. McClean, D. P. Ivanova, A. P. Craig, A. J. Wallcraft, E. P. Chassignet, E. C. Hunke. Arctic ice-ocean interactions in an 8-to-2 kilometer resolution global model. *Ocean Modeling, accepted.*

R. Yee, R. Musgrave, **E. Fine**, J. Nash, L. St. Laurent, R. Pickart. Turbulent diffusivity profiles inferred from temperature microstructure at the southern edge of the Canada Basin. *J, Geophys. Res. Oceans, in review*.

PRESENTATIONS

E. C. Fine, J. Toole, R. Musgrave, and R. Krishfield, “Near-inertial wave energy at four different Global Ocean Observatories Initiative sites.” WHOI Postdoc Symposium, November 2022 (virtual).

E. C. Fine, J. L. McClean, A. Craig, E. Chassignet, A. Wallcraft, M. E. Maltrud, D. Ivanova, J. Richie, E. Hunke, "Arctic Ocean circulation and water mass properties in an ultra-high resolution global model." Observing, Modeling, and Understanding the Circulation of the Arctic Ocean and Sub-Arctic Seas Workshop, Seattle, WA, June 2022.

E. C. Fine, R. Musgrave, J. Toole, R. Krishfield, "Generation, propagation and dissipation of near inertial waves at the Global Ocean Observatory Sites, Part I." Gordon Research Conference, June 2022, poster.

E. C. Fine, "Turbulent mixing, double diffusion, and lateral stirring of a warm Arctic intrusion." NOAA Coastal Ocean Modeling Science Seminar, March 2022, invited (virtual).

E. C. Fine and S. T. Cole, "Decadal observations of internal wave energy, shear, and mixing in the western Arctic Ocean." Ocean Sciences Meeting, March 2022 (virtual).

E. C. Fine and S. T. Cole, "The influence of sea ice on internal wave mixing in the Beaufort Sea." Physical Oceanography Seminar, University of British Columbia, November 2021, invited (virtual).

E. C. Fine, R. Musgrave, and J. Toole, "Characterizing internal waves at four deep-ocean sites." WHOI Postdoc Symposium, November 2021 (virtual).

E. C. Fine and S. T. Cole, "Decadal observations of internal wave energy, shear, and mixing in the western Arctic Ocean." Ocean Circulation and Climate Dynamics Colloquium, GEOMAR June 2021, invited (virtual).

E. C. Fine and S. T. Cole, "Decadal observations of internal wave energy, shear, and mixing in the western Arctic Ocean." Canadian Meteorological and Oceanographic Society Congress, June 2021 (virtual).

E. C. Fine, J. A. MacKinnon, M. H. Alford, J. B. Mickett, T. Peacock, N. Couto, A. le Boyer, "Warm eddies, mixing, and turbulent heat fluxes in the western Arctic." Physical Oceanography Seminar, UAF January 2021, invited (virtual).

E. C. Fine and S. T. Cole, "Decadal changes in internal waves in the western Arctic Ocean". WHOI Postdoc Symposium, October 2020 (virtual).

E. C. Fine, J. A. MacKinnon, M. H. Alford, J. B. Mickett, T. Peacock, N. Couto, A. le Boyer, "Microstructure observations of mixing and turbulent heat fluxes in the western Arctic." Physical Oceanography Seminar, WHOI August 2020 (virtual).

E. C. Fine, M. H. Alford, J. A. MacKinnon, J. B. Mickett, "Near-inertial waves and microstructure mixing observations in the Beaufort Sea." Ocean Sciences Meeting, San Diego February 2020, poster.

E. C. Fine, M. H. Alford, J. A. MacKinnon, J. B. Mickett, "Near-inertial waves and mixing observations in the Beaufort Sea." Arctic Dynamics Workshop, MIT November 2019.

E. C. Fine, J. A. MacKinnon, M. H. Alford, J. B. Mickett, "Microstructure observations of upwards turbulent heat fluxes in a warm-core Canada Basin eddy." Polar Marine Science Gordon Research Conference, Tuscany March 2019, poster.

E. C. Fine, J. A. MacKinnon, M. H. Alford, J. B. Mickett, "Microstructure observations of heat fluxes in the western Arctic Ocean." Physical Oceanography Seminar, WHOI August 2018.

E. C. Fine, J. A. MacKinnon, M. H. Alford, J. B. Mickett, "Microstructure observations of upwards turbulent heat fluxes in a warm-core Canada Basin eddy." Ocean Mixing Gordon Research Conference, New Hampshire June 2018, poster.

E. C. Fine, J. A. MacKinnon, M. H. Alford, J. B. Mickett, "Microstructure observations of upwards turbulent heat fluxes in a warm-core Canada Basin eddy." Ocean Sciences Meeting, Portland February 2018, poster.

E. C. Fine, J. A. MacKinnon, M. H. Alford, J. B. Mickett, "Microstructure observations of turbulent heat fluxes in a Beaufort Gyre eddy." Ocean Mixing Meeting, Bangor University July 2017.

E. C. Fine, J. A. MacKinnon, M. H. Alford, J. B. Mickett, "Microstructure observations of upward turbulent heat fluxes in the Beaufort Gyre." Liege Colloquium, May 2016, poster.

E. C. Fine, J. A. MacKinnon, M. H. Alford, J. B. Mickett, M. M. Hamann, O. B. Marques, G. Voet, G. L. Wagner, M. Alberty, A. Peterson,"Microstructure observations of upward turbulent heat fluxes in the Beaufort Gyre." Ocean Sciences Meeting, New Orleans February 2016, poster.

E. C. Fine, J. A. MacKinnon, M. H. Alford, J. B. Mickett, M. M. Hamann, O. B. Marques, G. Voet, G. L. Wagner, M. Alberty, A. Peterson, "Microstructure observations of upward turbulent heat fluxes in the Beaufort Gyre." Forum for Arctic Modeling and Observational Synthesis Meeting, Falmouth November 2015, poster.

E. C. Fine, F. O. Bryan, W. G. Large, D. Bailey, "Diurnal Sea Surface Salinity Variation Detection in Aquarius Data." Ocean Sciences Meeting, Honolulu February 2014, poster.

GRANTS

NSF EAGER (co-PI) March 1, 2023
PI: Amy Waterhouse (SIO)
Amount: $159,271
Title: *Microstructure observations of vertical mixing and heat fluxes from χpods deployed on Arctic Observing Network cruises*

NASA EVS4 (co-author) *pending*
PI: Jamin Greenbaum (SIO) submitted April 2023
Amount: $30M
Title: *Circum-Antarctic subglacial hydrology, ocean forcing, and ecosystems experiment*

NSF Office of Polar Programs (co-PI) *in preparation*
PI: Jamin Greenbaum (SIO) targeted submission June 2023
Title: *Investigating drivers of enhanced ocean forcing at Denman and Thwaites Glaciers, Antarctica.*

NSF Office of Polar Programs (co-PI) *in preparation*
PI: Lauren Juranek (Oregon State University) targeted submission July 2023
Title: S*ubsurface productivity in the highly stratified Pacific Arctic gateway (LIMINAL: Lagrangian Investigation of the Microbial Intersection of Nutrients And Light)*

NSF Office of Polar Programs (co-PI) *in preparation*
PI: Till Wagner (University of Wisconsin - Madison) targeted submission August 2023
Title: *Dynamics of a wind-ice-ocean feedback in the Arctic Ocean*

RESEARCH CRUISES

USCGC Healy. Chukchi and Beaufort Seas, Beaufort Shelf. Microstructure measurements from CTD rosette, CTD. 25 days.	2018
R/V Sikuliaq. Chukchi and Beaufort Seas. CTD, FastCTD, MMP, Epsilometer, bow chain, Wirewalker, swift buoys. 30 days.	2018
R/V Sally Ride. La Jolla Canyon. CTD. 3 days.	2017
R/V Sproul. La Jolla Canyon. CTD, SWIMS. 5 days	2016
R/V Revelle. Palau. CTD, LADCP, SWIMs, MMP, bowchain, mooring deployments and recoveries. 23 days.	2016
R/V Sproul. La Jolla Canyon. CTD, bottom lander recovery. 2 days.	2016
R/V Sproul. La Jolla Canyon. CTD to-yos. **Co-Chief Scientist**. 2 days.	2016
R/V Sproul. La Jolla/Del Mar. CTD, mooring recovery, bottom lander deployment. 4 days.	2016
R/V Sikuliaq. Chukchi and Beaufort Seas. CTD, SWIMS, MMP, LADCP, mooring deployment and recovery. 34 days.	2015
R/V Revelle. Bay of Bengal. CTD, uCTD, LADCP. 10 days.	2014

SERVICE

External

Review Panelist, National Aeronautics and Space Administration, Physical Oceanography
Reviewer, National Science Foundation, Arctic System Science
Reviewer, National Science Foundation, Arctic Observing Network
Reviewer, National Science Foundation, Arctic Natural Sciences
Reviewer, *Journal of Physical Oceanography*, *Journal of Climate*, *Journal of Geophysics Research*, *Geophysical Research Letters*, *Journal of Atmospheric and Oceanic Technology,* and *Progress in Oceanography*

Ocean Sciences Meeting Session Co-Chair 2022

Internal

Scripps Anti-Bullying Anti-Harrassment Taskforce 2022-present
- Co-Chair and Postdoc Representative

Committee for Diversity, Equity & Inclusion at WHOI 2020-2022
- Postdoctoral Representative, Academic Recruitment

Mentor for MIT-WHOI Joint Program Students 2020-present
WHOI PO Department Seminar Organizer 2020-2021
WHOI Unlearning Racism in the Geosciences Participant 2020-2021
Steering Committee, Broader Impacts Group at WHOI 2020-2021
Panelist, Summer Interns at SIO 2019
Scripps Graduate Student Council Representative 2018-2019
- Physical Oceanography Student Representative
- Graduate Student Council/Diversity Advisory Committee Liaison

Peer Mentor at Scripps Institution of Oceanography 2016-2017

Outreach

Scripps Day Polar Ocean Outreach Booth 2019
Sally Ride Public Tour Wirewalker Demonstration 2016

Membership

The Oceanography Society Since 2016

TEACHING EXPERIENCE

Co-Instructor, SIO 30: The Oceans 2022
Co-taught an undergraduate course of 125 students
Responsible for physical oceanography and marine biology portions of course
University of California, San Diego - Scripps Institution of Oceanography

Instructor, SIO 90: Perspectives on Ocean Sciences 2019
Taught an undergraduate course of 61 students
Invited speakers to give 9 science seminars
University of California, San Diego - Scripps Institution of Oceanography

Teaching Assistant, Introductory Mechanics Course 2012
Led 4 weekly tutorial sections of 20 students
University of Colorado, Boulder - Physics Department

Tutor 2011-2012
Individual tutoring for AP Physics and AP History
Revolution Prep

Math Instructor 2011-2012
Tutored 3-4 student groups for grades 2-6
Mathnasium Learning Center

Teaching Assistant, Introductory Electricity and Magnetism Course 2011
Led 2 weekly tutorial sections of 20 students
Stanford University