

MARIA T. KAVANAUGH, Ph.D.
CURRICULUM VITAE

Woods Hole Oceanographic Institution
Marine Chemistry and Geochemistry
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CAREER SUMMARY

I am a seascape ecologist and biological oceanographer interested in patterns and mechanistic responses of marine communities and ecosystems to multiscale environmental forcing including climate change. I utilize a multi-pronged approach to research that includes lab and field based studies, statistical and bioinformatic analyses, satellite remote sensing and coupled climate ecosystem models.

EDUCATION

Postdoctoral Scholarship, Woods Hole Oceanographic Institution	Nov 2012-current
Ph.D. Biological Oceanography and Statistics (minor), Oregon State University	Oct. 2012
M.S. Marine Ecology, Statistics and Oceanography (minors), Oregon State University	2006
B.S. Zoology (cum laude), Oregon State University	2000

PROFESSIONAL PREPARATION

Woods Hole Oceanographic Institution	Woods Hole, MA
Postdoctoral Scholar	Dec. 2012-current

Supervisor: Scott C. Doney

- Published/prepared (4) peer reviewed articles on remotely sensed and numerical model based studies related to oceanic ecosystem responses to global and regional climate. Published additional manuscript on epistemological differences between aquatic science disciplines.
- Investigating global and regional climate effects on structure and multi-trophic level productivity of coastal ecosystems along the Western Antarctic Peninsula using field observations, remote sensing and higher resolution coupled climate-ecosystem models. Investigating influence of mesoscale features and sub-mesoscale dynamics on plankton succession, carbon export and air-sea exchange.
- Teaching marine biogeochemistry and climate change for summer program designed to increase participation of underrepresented groups in marine science. Developing curriculum for computational ecology and statistics for undergraduates. Advised undergraduate research projects.

College of Oceanic and Atmospheric Sciences, Oregon State University	Corvallis, OR
Graduate Research Fellow.	2006- 2012

Advisor: Dr. Ricardo Letelier

- Published/prepared (4) first author peer-reviewed articles on the development and validation of a quantitative framework for scaling dynamic processes and patterns in pelagic ecosystems with subsequent applications for plankton ecology, biogeochemistry and marine ecosystem and fisheries management. Co-authored (3) additional manuscripts on productivity in the North Pacific and scales of variability in coastal oceans.

- Developed and executed research proposals as sole principal investigator as well as in collaboration with advisor. Oversaw 3 different projects with funding from NSF, NASA, and AAAS related to understanding spatial and temporal variability of North Pacific ecosystems.
- Led cruise-based field research in subarctic (7 cruises; over 70 sea days), subtropical (1; 15 days), and coastal (9; approximately 20 days) waters where responsible for biogeochemical and taxonomic measurements.
- Supervised field based coastal research involving observing, capturing, sampling and field experiments of marine species in remote areas of the Olympic coast, WA (days in field > 70). Trained undergraduate and postgraduate scientists and coordinated with federal agency scientists. Advised undergraduate research projects; mentored master's research projects.

Department of Zoology, Oregon State University

Corvallis, OR

Graduate Research and Teaching Assistant,

2003- 2006

Advisors: Dr. Bruce Menge and Dr. Jane Lubchenco

- Investigated direct and indirect effects of changing coastal phytoplankton abundances on benthic communities. Published first author peer-reviewed article. Supervised and trained faculty research assistants on taxonomic identification, field protocols and statistical analyses. Trained postdoctoral scholars and graduate students on multivariate statistics.
- Led field studies, taught lab sections and developed lectures for General Biology and Marine Ecology (Marine Macroalgae and Invertebrates).

Partnership for Interdisciplinary Studies of Coastal Oceans, OSU

Corvallis, OR

Faculty Research Assistant

2000-2003

Supervisor: *Dr. Bruce Menge*

- Managed and conducted multiscale research survey of intertidal fish, invertebrates and macroalgae along the US West coast. Curated and analyzed multiple year record of 48 sites, 300+ species, and more than 20 environmental indices.
- Supervised and trained faculty research assistants, undergraduate and graduate interns (6-10 per season), and volunteers on taxonomic identification, field protocols (>60 days per year in field).

PUBLICATIONS (18).

1. Saunders, M., Brown, C., Foley, M.E., Febria, C., Albright, R., Mehling, M., **Kavanaugh, M.T.** and Burfeind, D. 2014. Human impacts on connectivity in marine and freshwater ecosystems assessed using network measures. Submitted *Marine and Freshwater Research*
2. **Kavanaugh, M.T.**, Abdala, F.N. Ducklow, H., Glover, D., Schofield, O., Stammerjohn, S., and Doney, S. C. Canyon effects on phytoplankton biomass and community structure along the Western Antarctic Peninsula. Accepted pending minor revision *Marine Ecology Progress Series*
3. **Kavanaugh, M.T.**, Letelier, R.M. and E. Sherr. Satellite derived seascapes describe unique microbial assemblages and environmental forcing in the NE Pacific. In revision *Marine Ecology Progress Series*.
4. Muller-Karger, F.E., **M.T. Kavanaugh**, E. Montes, W.M. Balch, M. Breitbart, F.P. Chavez, S.C. Doney, E.M. Johns, R.M. Letelier, M.W. Lomas, H.M. Sosik, and A.E. White, 2014: A framework for a marine biodiversity observing network within changing continental shelf seascapes. *Oceanography*, 27(2), 18–23, <http://dx.doi.org/10.5670/oceanog.2014.56>.

5. **Kavanaugh, M.T.**, Hales, B. Lockwood, D., Emerson, S., Quay, P.D., Letelier, R.M. Controls on primary and net community production across NE Pacific seascapes. *In press, Limnology and Oceanography*
6. **Kavanaugh, M.T.**, Hales, B., Saraceno, M., Spitz, Y.H., White, A.E., Letelier, R.M., 2014. Hierarchical and dynamic seascapes: a quantitative framework for scaling pelagic biogeochemistry and ecology. *Progress in Oceanography* 120: 291-304
7. **Kavanaugh, M.T.**, Holtgrieve, G.W., Baulch, H., Brum, J.R., Cuvelier, M.L., Filstrup, C.T., Nickols, K.J., Small, G.E., 2013. A salty divide within ASLO? *Limnology and Oceanography Bulletin* (22) 2: 34-37
8. Lockwood D, Quay, P.D., **Kavanaugh, M.T.**, Juranek, LW, Feely, R. 2012. Influence of net community production on air-sea CO₂ flux in the Northeast Pacific. *Global Biogeochemical Cycles* 26: GB4010. doi:10.1029/2012GB004380
9. **Kavanaugh, M. T.** 2012. Dynamic seascapes: a quantitative framework for scaling pelagic biogeochemistry and ecology. Ph.D. dissertation. <http://hdl.handle.net/1957/34739>
10. Hamme, R., and 15 others. 2010. Volcanic ash fuels anomalous plankton bloom in the subarctic NE Pacific. *Geophysical Research Letters* VOL. 37, L19604, doi:10.1029/2010GL044629
11. **Kavanaugh, M.T.**, Nielsen, K.J., Chan, F.T, Menge, B.A., Letelier, R.M., and Goodrich, L.M.. 2009. Experimental assessment of shading on an intertidal kelp: do phytoplankton inhibit open-coast macroalgae? *Limnology and Oceanography* (54) 276-288
12. Davis C.O., **Kavanaugh, M.T.**, Letelier, R.M. Bissett, P and Kohler,D. 2007. Spatial and spectral resolution considerations for imaging coastal waters. *Proceedings of SPIE* 6680
13. Schoch, G.C., Menge, B.A., Allison, G.W., **Kavanaugh, M.T.**, Thompson, S.A., and Wood, S.A. 2006. Fifteen degrees of separation: Examining patterns and processes on Pacific coast rocky intertidal benches. *Limnology and Oceanography* (52): 2564-2585
14. **Kavanaugh, M.T.**, 2006. Phytoplankton shading of benthic macrophytes: implications for intertidal community structure. MS Thesis. <http://hdl.handle.net/1957/1357>

Book chapter

15. **Kavanaugh, M.T.**, Boersma, K., Close, S., Ganio, L., Hooven., L. and B. Lachenbruch: Advancing Toward Professorship in Biology, Ecology and Earth System Sciences. In FORWARD to Professorship in STEM: Inclusive Strategies That Work. C. Mavriplis, P. Sabila and S. Heller (Eds). Elsevier Press. *In press*

In preparation

16. Vogt, M, N. Gruber, L. Bopp, M. Kidston, O. Aumont, J.Bruggeman, E. Buitenhuis, A. Cabre, S.t C. Doney, J. Dunne, S. Dutkiewicz, M. Gehlen, T. Hashioka, T. Hirata, **M. T. Kavanaugh**, J. Martinez-Rey, I. Marinov, W. McKiver, P. Landschuetzer, C. Laufkoetter, C. Le Quéré, C. O'Brien, S. Sailley, B. Stawiarski, A. Tagliabue, S.Vallina, M.Vichi, C.Völker, T.Wang, B. Ward, Y.Yamanaka. Global scale lower trophic level marine ecosystem modeling: Quo vadis? *Target Annual Reviews of Marine Science*
17. **Kavanaugh, M.T.**, I. D. Lima, S.C. Doney. Recent and future shifts in marine planktonic habitat diversity. *Target Nature. Manuscript available on request*
18. **Kavanaugh, M.T.**, Hales, B., Saraceno, M., Spitz, Y.H., White, A.E., Letelier, R.M and S.C. Doney. ALOHA from the Edge: seascapes provide spatiotemporal context for Eulerian time series. *Target Global Biogeochemical Cycles. Manuscript available on request*

TEACHING

¹ curriculum development ² classroom/lab/field management ³ assessment

Undergraduate

Marine Biogeochemistry and Global Change^{1,2,3} (Woods Hole PEP and UMES) 2013-current
Matlab Computational Ecology Workshop^{1,2} (WHOI) June 2014
General Biology, graduate teaching assistant^{1,2,3} (OSU) 2003-2005
Marine Ecology, graduate teaching assistant^{1,2,3} OSU 2004

Graduate

Biogeochemical Earth, teaching assistant and guest lecturer^{1,2,3} (OSU) 2012
Phytoplankton Ecophysiology, regular guest lecturer^{1,2} (OSU) 2009-2010
Coastal Ecology and Resource Management^{1,2}, Invited lecturer (OSU) 2004-2006

K-12 and teacher training

Microbial Oceanography from Space^{1,2,3}(OSU) 2008
Coastal Oceanography Science Connections^{1,2}(OSU) 2003-2006
Ecology: Discovering the World Around Us^{1,2} (OSU) 2005

MENTEES (Undergraduate) and current position

2004-2005. Lea Goodrich, Corvallis School District 509J, Corvallis, OR.
2008- 2010. Andrew Traylor, Bonneville Power Administration, Portland OR.
2008-2009. Pamela Tyhurst, National Park Service, TX and HI.
2008-2009. Erin Wells, Naval Civilian Service, Bremerton, WA.
2013. Felipe Nalin Abdala, Visiting student (WHOI), Federal University of Rio Grande, Brazil.
2014. Maria Ordovas Montanes, WHOI Summer Student Fellow, currently at Tufts University.
2014. Shanna Williamson, PEP student, currently a Research Assistant at WHOI.

GRANTS AND AWARDS

NOPP: National Marine Sanctuaries as Sentinel Sites for a Demonstration Marine Biodiversity Observation Network (Co-I; Lead PI: F.Muller-Karger; WHOI award: \$729,000) 2014-2019
NASA Carbon Cycle Science: Climate-driven Impacts on the Marine Ecology, Biogeochemistry, and Carbon Cycle of the West Antarctic Peninsula (Co-I; Lead PI: Scott C. Doney WHOI award: \$1,093,000) 2014-2017
NASA Science of Aqua and Terra:Multiscale Satellite Analysis of the Biophysical Dynamics Governing Ocean Phytoplankton Community Structure (Co-I; Lead PI: Scott C. Doney; WHOI award: \$865,000) 2014-2017
WHOI Postdoctoral Scholarship, Woods Hole, MA (~\$180,000) 2012-current
NSF Advance Program (workshop sub-award, co-PI). Advancing Toward Professorship in Biology, Ecology and Earth System Sciences (\$10,000) 2011
NASA Earth and Space System Graduate Fellowship (\$84,000) 2007-2011
Canon Foundation/AAAS National Park Scholarship (\$80,000) 2007-2011
Mamie Markham Graduate Research Award, (\$9900) 2004-2006

WORKSHOPS

I have been invited to workshops related to ocean time series (Sea change: charting the course for ecological and biogeochemical time series research, OCB 2010), interdisciplinary research (Ecological Dissertations in the Aquatic Sciences. 2010), bio-optics (IOCCG, 2014, declined), and global change marine biology (Gordon Research Conference, 2014).

SELECTED PRESENTATIONS

I have given over 50 talks or posters at regional, national and international scientific meetings. In addition, I have given public talks to stakeholders and informal educators related to natural resource management and changes to ecosystems with climate change.

* abstract published

Kavanaugh, M.T. 2014. Characterizing dynamic ocean habitats. NOAA Webinar.

Kavanaugh, M.T. 2014. Ocean carbon cycles and climate change. National Network of Ocean and Climate Change Interpretation Workshop. Woods Hole, MA.

Kavanaugh, M.T.*, et al. 2014. Role of canyons on phytoplankton dynamics along the West Antarctic Peninsula. Ocean Sciences 2014. Honolulu HI

Doney S.C.*, et al., 2014. Numerical modeling and remote sensing studies of regional marine biogeophysical variability around the Hawaii Ocean Time-Series (HOT) station ALOHA. Woods Hole, MA.

Kavanaugh, M.T. et al. 2014. Climate-induced shifts of plankton functional diversity revealed through seascape-based model intercomparison (poster). Gordon Research Conference. Waterville Valley, NH.

Kavanaugh, M.T. 2013. Dynamic Seascapes: Scaling from the Sample to the System. December, 2013. Hatfield Marine Science Center, Newport OR.

Kavanaugh, M.T.*, Abdala F. Ducklow, H. Glover, D. Schofield, O. Stammerjohn, S. Doney, S. 2013. Spatiotemporal variability of phytoplankton along the Western Antarctic Peninsula: role of submarine canyons (poster). July, 2013. Ocean Carbon and Biogeochemistry Summer Meeting. Woods Hole Oceanographic Institution. Woods Hole, MA.

Kavanaugh, M.T. 2013. ATPinBEESS at Oregon State University (talk). Forward to Professorship workshop meeting. April, 2013. Washington DC.

Kavanaugh, M.T., Lima, I. Sailley, S., Doney, S. 2013. Pelagic ecosystem dynamics revealed through satellite and modeled seascapes (poster). Marine Ecosystem Modeling Intercomparison Project meeting. March, 2013. Paris, France.

Kavanaugh, M.T. 2013. Dynamic Seascapes: An objective and hierarchical framework for scaling pelagic ecosystem variability (talk). WHOI Marine Chemistry and Geochemistry Departmental Seminar. Woods Hole Oceanographic Institution, Woods Hole, MA.

Kavanaugh, M.T.*, Hales, B., Letelier, R.M. Spitz, Y., Saraceno, M. White, A.E., Church, M., Doney, S. Dynamic Seascapes: A dynamic and objective framework to understand pelagic ecosystem spatiotemporal variability (talk). February 2013, ASLO Aquatic Sciences, New Orleans, LA.

Boersma, K*., Close, S., **Kavanaugh, M.T.** Ganio, L., Hooven, L and B. Lachenbruch. 2012. Advancing toward professorship in biology, ecology, and earth systems sciences: Perceptions of confidence in early career scientists (poster). Ecological Society of America. Portland, OR.

Kavanaugh, MT. 2011. Seascape studies of microbial structure and function. Line P Symposium. Sidney, BC.

Kavanaugh*, Letelier, Lockwood, Emerson, Quay. 2010. Ecophysiological constraints on the biological pump across the Pacific subarctic transition zone. ASLO/AGU Ocean Sciences, Portland, OR.

Lockwood*, Quay, Emerson, **Kavanaugh**, Letelier. 2010. Carbon export rates and air-sea CO₂ flux across the North Pacific Transition Zone. ASLO/AGU Ocean Sciences, Portland, OR.

Kavanaugh and Letelier. 2009. Spatio-temporal variability of primary production in the NE Pacific: Brief summary of OSP observations. Line P Symposium. Sidney, BC.

- Kavanaugh***, Letelier, Saraceno, Spitz. 2008. Satellite-derived biophysical provinces: tools for objective investigations of marine ecosystems. ASLO/AGU Ocean Sciences, Orlando, FLA
- Palacios*, Peterson, **Kavanaugh**, Kudela. 2008. Optical detection of a dinoflagellate bloom in Monterey Bay, CA. ASLO/AGU Ocean Sciences, Orlando, FLA
- Kavanaugh***, Letelier, Spitz. 2008. Determining objective biophysical provinces from multiple satellite sensor observations. NASA Ecosystems and Carbon Cycles, College Park, MD.
- Kavanaugh**.2008. Effect of changing phytoplankton production on Oregon kelp communities. Northwest Algal Symposium, Charleston, OR.
- Kavanaugh**, Letelier, Strutton, Davis. 2006. Scales of Variability in Coastal Oceans: Lessons from EO-1 Hyperion. NOAA/NESDIS/StAR/CoRP Symposium. Fort Collins, CO.
- Kavanaugh**, Nielsen, and Menge, 2004. Phytoplankton Shading of Benthic Macrophytes: implications for community structure. Western Society of Naturalists, Rohnert Park, CA.

PROGRAMS AND INSTRUMENTATION

I am a proficient in Matlab, ENVI, SAS, ArcGIS, S-plus, PC-Ord, Access, Wet-view, Sat-view. I have experience (field and lab) with a wide variety of bio-optical and biogeochemical analyses using: hyperspectral spectroradiometric buoys and profilers, attenuation absorption meters, FRRF and PAM fluorometers, spectrophotometer, flow cytometer, high-performance liquid chromatography, CHN analyzer.

SERVICE

Science Fellow/Advisor, National Network for Ocean and Climate Change Interpretation. 2014	
Reviewer: <i>Limnology and Oceanography</i> , <i>LO Methods</i> , <i>Deep Sea Research</i> , <i>Marine Biology</i> , <i>Biogeosciences</i>	2005- current
Professional Development Workshop Committee (ADVANCE)	2011-2012
Oregon Women in Higher Education: Chair, Concurrent Session Chair	2007-2009
Faculty Award selection committee, Oregon State University (OSU)	2008-2009
Graduate School Strategic Review Committee (OSU)	2008-2009
Promotion and Tenure Committee, OSU CEOAS	2008
<u>Science Advisor</u>	
Oregon Department of Transportation (land slide mitigation)	2005-2006
Oregon State Parks (macroalgal harvesting permit process)	2005-2006

REFERENCES

Dr. Scott Doney, Marine Chemistry and Geochemistry, MS 25. Woods Hole Oceanographic Institution, Woods Hole, MA 02541, sdoney@whoi.edu

Dr. Ricardo Letelier, College of Oceanic and Atmospheric Sciences, Oregon State University. Corvallis, OR 97331. 541-737-3890 . letelier@coas.oregonstate.edu

Dr. Burke Hales, College of Oceanic and Atmospheric Sciences, Oregon State University. Corvallis, OR 97331. 541-737-8121. bhales@coas.oregonstate.edu

Dr. Bruce Menge, Department of Zoology, Oregon State University. Corvallis, OR 97331. 541-737-5358 mengeb@oregonstate.edu

Dr. Yvette Spitz, College of Oceanic and Atmospheric Sciences, Oregon State University. Corvallis, OR 97331. 541-737-3227. yspitz@coas.oregonstate.edu

Dr. David Glover, Marine Chemistry and Geochemistry, MS 25. Woods Hole Oceanographic Institution, Woods Hole, MA 02541, dglover@whoi.edu

Dr. Curtiss Davis, College of Oceanic and Atmospheric Sciences, Oregon State University. Corvallis, OR 97331. 541-737-5707 cdavis@coas.oregonstate.edu

Dr. Steven Emerson, School of Oceanography, University of Washington, Seattle, WA 206-543-0428. emerson@u.washington.edu