

# Molly E. Grear

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Ocean Sciences Division

National Science Foundation

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Ocean engineer and marine biologist passionate about emerging ocean technology and the human impact on the marine environment, with research expertise in marine mammals, fluid dynamics, marine biomechanics, numerical modeling, structural mechanics, ocean policy, and technology policy.

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## Education

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| 2018 | <b>Ph.D.</b> in Civil and Environmental Engineering<br><i>University of Washington</i><br>Dissertation: Characterization of Marine Mammal Soft Tissue Biomechanics to Evaluate Tidal Turbine Collision<br>Advisor: Dr. Michael Motley |
| 2016 | <b>M.S.</b> in Civil and Environmental Engineering<br><i>University of Washington</i>   |
| 2012 | <b>B.E.</b> in Engineering Sciences<br><i>Thayer School of Engineering, Dartmouth College</i><br>Capstone project: Optimization of a diffuser-augmented hydrokinetic turbine  |
| 2011 | <b>A.B.</b> in Engineering Sciences<br><i>Dartmouth College</i>   |

## Research and Work Positions

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| Feb 2019 – present | <i>Ocean Science and Technology Policy Fellow</i><br><b>National Science Foundation</b><br>Representing the National Science Foundation in interagency and international ocean policy. Coordinating of national ocean policy committees and programs, setting ocean science and technology priorities across the federal government. Trained in Merit Review Process |
| 2018 – 2019        | <i>Postdoctoral Research Assistant, Marine Sciences Laboratory</i><br><b>Pacific Northwest National Laboratory</b><br>Development of hydrodynamic models for offshore macroalgae cultivation, as well as better stakeholder communication and outreach around ocean energy projects.   |
| 2014 – 2018        | <i>Graduate Research Assistant, Department of Civil and Environmental Engineering</i><br><b>University of Washington</b><br>Laboratory material testing, data analysis, and numerical modeling to quantify the risk tidal turbines pose to marine mammals.   |
| 2014 – 2018        | <i>PhD Intern</i><br><b>Pacific Northwest National Laboratory</b><br>Modeling and data analysis around projects involving human impact on the marine environment.  |
| 2017               | <i>Marine Renewable Energy Outreach Coordinator</i><br><b>Washington Sea Grant and Northwest National Marine Renewable Energy Center</b><br>Designed and organized a speaker series at three locations across the Puget Sound; created curriculum around marine energy for use in local schools.   |
| 2012 – 2014        | <i>Post-Bachelor's Research Assistant</i><br><b>Pacific Northwest National Laboratory</b><br>Investigated potential environmental impacts of installing various ocean energy devices through predictive modeling, marine mammal science, and collaboration with stakeholders, developers and governmental agencies.  |

May–Nov 2011	<i>Environmental Engineer</i> <b>United State Forest Service</b> Monitored the remediation of the coastal Salt Chuck Mine site on Prince of Wales Island, Alaska.
Jan–March 2011	<i>Research Assistant</i> <b>University of Arkansas Agricultural Engineering Lab</b> Prepared and analyzed sweetgum samples for making cellulosic ethanol from Southern Arkansas undergrowth biomass.
Jan–Mar 2010	<i>Research in Marine Ecology</i> <b>Dartmouth College Study Abroad Program</b> Independent research at various Costa Rican and Little Cayman research stations in ecology, marine biology, and environmental science.

## Peer-Reviewed Papers

2018 paper	T. Wang, Z. Yang, W.-C. Wu, and <b>M. Grear</b> . Sensitivity study of wind forcing on the accuracy of wave-resource modeling. <i>Journal of Marine Science and Engineering</i> , accepted
2018 paper	A. Copping and <b>M. Grear</b> . Applying a simple model for estimating likelihood of collision of marine mammals with tidal turbines. <i>International Marine Energy Journal</i> , 1(1):27–32, 2018
2017 paper	<b>M. Grear</b> , M. Motley, S. Crofts, A. Witt, A. Summers, and P. Ditsche. Mechanical properties of harbor seal skin and blubber - a test of anisotropy. <i>Zoology</i> , 126:137–144, 2018
2017 paper	A. Copping, <b>M. Grear</b> , R. Jepsen, C. Chartrand, and A. Gorton. Understanding the potential risk to marine mammals from collision with tidal turbines. <i>International Journal of Marine Energy</i> , 19:110 – 123, 2017
2016 paper	Z. Yang, S. Taraphdar, T. Wang, R. Leung, and <b>M. Grear</b> . Uncertainty and feasibility of dynamical downscaling for modeling tropical cyclones for storm surge simulation. <i>Natural Hazards</i> , 84(2):1161–1184, 2016
2016 paper	A. Copping, S. Breithaupt, J. Whiting, <b>M. Grear</b> , J. Tagestad, and G. Shelton. Likelihood of a marine vessel accident from wind energy development in the atlantic. <i>Wind Energy</i> , 19(9):1557–1566, 2016

## Conference Papers

2017 paper & talk	<b>M. Grear</b> and M. Motley. Tidal turbine collision assessment using the bulk and shear modulus of marine mammals’ soft tissue. In <i>European Wave and Tidal Energy Conference</i> , Cork, Ireland, 2017
2017 paper	A. Copping and <b>M. Grear</b> . Applying a simple model for estimating likelihood of collision of marine mammals with tidal turbines. In <i>European Wave and Tidal Energy Conference</i> , Cork, Ireland, 2017
2015 paper & talk	<b>M. Grear</b> and M. Motley. Numerical Modeling of the Impact Response of Tidal Devices and Marine Mammals. In <i>European Wave and Tidal Energy Conference</i> , Nantes, France, 2015
2015 paper & talk	<b>M. Grear</b> , A Copping, R. Jepson, A. Gorton, and C. Chartrand. Understanding the Risk to Marine Mammals from Collision with a Tidal Turbine. In <i>Marine Energy Technology Symposium</i> , Washington, DC, 2015

## Technical Reports

2018 report	A. Copping and <b>M. Grear</b> . Humpback whale encounter with offshore wind mooring lines and inter-array cables. <i>Report by Pacific Northwest National Laboratory</i> , 2018
2014 report	T. Carlson, <b>M. Grear</b> , A. Copping, M. Halvorsen, R. Jepsen, and K. Metzinger. Assessment of strike of adult killer whales by an OpenHydro tidal turbine blade. <i>Report by Pacific Northwest National Laboratory</i> , 2014
2013 report	T. Carlson, <b>M. Grear</b> , M. Halvorsen, and A. Copping. Monitoring and Mitigation Alternatives for Protection of North Atlantic Right Whales during Offshore Wind Farm Installation. <i>Report by Pacific Northwest National Laboratory</i> , 2013

- 2013 report A. Copping, S. Breithaupt, J. Tagestad, J. Whiting, **M. Grear**, and G. Shelton. Risk Assessment for Marine Vessel Traffic and Wind Energy Development in the Atlantic. *Report by Pacific Northwest National Laboratory*, 2013
- 2013 report A. Copping, L. Hanna, J. Whiting, S. Geerlofs, **M. Grear**, K. Blake, A. Coffey, M. Massaua, J. Brown-Saracino, and H. Battey. Environmental effects of marine energy development around the world for the OES Annex IV. *Pacific Northwest National Laboratory for the Ocean Energy Systems Initiative*, page pp 97, 2013

## Work in Progress

- M. Grear**, M. Motley, P. Ditsche, and A. Summers. Comparative material properties of marine mammals skin and blubber. *Journal of Experimental Biology*, submitted
- M. Grear** and M. Motley. Development of a material constitutive model for toothed whales. in prep

## Conference Presentations, Public Talks, and Workshops

- 2018 talk **M. Grear** and A. Copping. Humpback whale and offshore wind interaction animation. In *Offshore Renewable Energy Conference*, Portland, OR, 2018
- 2018 talk **M. Grear**, A. Copping, and G. Shelton. Visual simulation of whales and offshore renewable energy mooring lines and electrical cables. In *Marine Energy Technology Symposium*, Washington, DC, 2018
- 2018 talk M. Fore, R. McLachlan, E. Bonnin, A. Weber, and **M. Grear**. Graduate students closing the gap in science communication training. In *AAAS Annual Meeting*, Austin, TX, 2018
- 2018 talk **M. Grear** and M. Motley. Testing marine mammal soft tissue to understand injury risk from tidal turbine collision. In *Ocean Sciences Meeting*, Portland, OR, 2018
- 2018 talk **M. Grear**, M. Motley, and A. Summers. Nonlinear mechanics of marine mammal skin. In *Society for Integrative and Comparative Biology Annual Meeting*, San Francisco, CA, 2018
- 2017 public talk **M. Grear**. Overview of environmental impacts of marine renewable energy. Northwest Maritime Center. Port Townsend, WA, 2017
- 2017 public talk **M. Grear**. State of the science: Environmental impacts of marine renewable energy. Olympic Natural Resource Center. Forks, WA, 2017
- 2017 public talk **M. Grear**. Understanding the impact of tidal turbines on marine mammals. Seattle Town Hall. Seattle, WA, 2017. Video available at <https://www.youtube.com/watch?v=uCVDhcyTAes>
- 2017 talk **M. Grear**, M. Motley, and P. Ditsche. Development of a material constitutive model for killer whale and harbor porpoise. In *Society for Integrative and Comparative Biology Annual Meeting*, New Orleans, LA, 2017
- 2016 poster **M. Grear** and M. Motley. Modeling marine mammal tissue to understand tidal turbine collision. In *Northwest National Marine Renewable Energy Center Annual Meeting*, Portland, OR, 2016
- 2016 talk **M. Grear** and M. Motley. Experimental and numerical development of material constitutive properties for marine mammals. In *Engineering Mechanics Institute*, Nashville, TN, 2016
- 2016 talk **M. Grear**, S. Crofts, A. Copping, M. Motley, A. Summers, and P. Ditsche. Finite element material model of harbor seals' (*Phoca vitulina*) skin and blubber. In *Society for Integrative and Comparative Biology Annual Meeting*, Portland, OR, 2016
- 2015 talk Z. Yang, S. Taraphda, T. Wang, R. Leung, and **M. Grear**. Uncertainty and feasibility of a dynamical downscaling climate model for coastal storm surge modeling. In *Coastal and Estuarine Research Federation*, Portland, OR, 2015
- 2015 invited speaker **M. Grear** and A. Copping. Workshop examining marine energy's impacts on marine mammals. In *International Network on Offshore Renewable Energy Symposium*, Friday Harbor, WA, 2015

- 2015 poster | **M. Grear** and M. Motley. Marine Mammal and Tidal Turbine Collision. In *International Network on Offshore Renewable Energy Symposium*, Friday Harbor, WA, 2015
- 2014 poster | A. Copping, **M. Grear**, and T. Carlson. Acoustic Impacts of Offshore Wind Development on North Atlantic Right Whales. In *American Wind Energy Association*, Atlantic City, NJ, 2014

## Teaching and Mentoring Experience

- Fall 2018 | **Adjunct Professor** *Civil and Environmental Engineering, Seattle University*: Instructor for fluid mechanics courses.
- Summer 2018 | **Research Mentor** *Civil and Environmental Engineering, University of Washington*: Mentored undergraduate student in a project about structural analysis of sculpin preopercle bones.
- Spring 2017 | **Finite Element Methods in Structural Mechanics** *Civil and Environmental Engineering, University of Washington*: Teaching assistant for graduate level finite element analysis.
- Fall 2016, Winter 2017 | **Introduction to Fluid Mechanics** *Civil and Environmental Engineering, University of Washington*: Taught workshops, classes, and labs for junior engineering students.
- Fall 2015 | **Research Mentor** *Friday Harbor Laboratories, University of Washington*: Mentored undergraduate biology students through designing projects about marine mammals' biomechanical tissue properties
- Summer 2012 | **Tutor** *Studypoint Tutoring*: Instructed high school seniors on SAT preparation, as well as science and math topics, primarily calculus.
- 2011 – 2012 | **Introduction to Scientific Computing** *Thayer School of Engineering, Dartmouth College*: Instructed small group sessions, designed homework projects, ran office hours, graded assignments and exams for introductory programming class for all engineering majors.
- Summer 2010 | **Science Educator** *Montshire Museum of Science*: Designed and taught curriculum for science summer camps for 4th-8th graders, including 'Kinetic Art', 'Environmental Science', and 'Inventors Camp'.
- Summer 2010 | **Introduction to Engineering** *Thayer School of Engineering, Dartmouth College*: Instructed engineering students through a complete design project, from fabrication to economic feasibility.

## Service

- July 2017 | **Puget Sound Renewable Energy Leadership Institute** *Bonneville Environmental Foundation*. Taught 11 K-12 teachers about marine energy, relating marine energy curriculum to the Next Generation Science Standards
- April 2017 – present | **Engage Board of Directors** Engage is a science speaker series and seminar program promoting science communication. [www.engage-science.com](http://www.engage-science.com)
- March 2017 – present | **San Juan Island Marine Mammal Stranding Network Volunteer** *The Whale Museum*.
- Sept 2016 – Sept 2017 | **Campus Sustainability Fund Committee Member** *University of Washington*, member of the committee allocating \$400,000 per year to projects fostering sustainability on campus.
- June 2016 – June 2018 | **Graduate and Professional Student Senate** *University of Washington*, senator representing Civil and Environmental Engineering
- 2014 – 2018 | **Engineering Discovery Days** *University of Washington* Engineering demonstrations to schools grades 4-12 for hands on learning about research and classes on campus

## Fellowships and Awards

- 2018 | **John A. Knauss Marine Policy Fellowship**
- 2018 | **Charles H. Norris Award** award for the structural engineering graduate student having the best record for a given academic year.

- 2018 | **Forbes 30 Under 30 in Energy**
- 2017 | **Three Minute Thesis** first place in the University of Washington’s competition to describe research to a public audience in less than three minutes.
- 2017 | **Friday Harbor Laboratories Fellowship** funding to conduct research at the University of Washington’s marine laboratory at Friday Harbor.
- 2017 | **Civil and Environmental Engineering Film Festival** award for the best cinematography in the 2017 short film festival. Video available at [https://www.youtube.com/watch?v=ij\\_PyfWynkM](https://www.youtube.com/watch?v=ij_PyfWynkM)
- 2017 | **Graduate & Professional Student Senate Travel Grant** travel award from the University of Washington to attend the Society of Integrative and Comparative Biology conference
- 2016 | **Graduate School Fund for Excellence and Innovation Award**, travel award from the University of Washington to attend Engineering Mechanics Institute conference
- 2016, 2017, 2018 | **Society of Integrative and Comparative Biology Student Support**, provided by the Society of Integrative and Comparative biology to attend the 2016 and 2017 annual meeting.
- 2015 | **EWTEC Travel Stipend**, provided by Ocean Energy System’s Annex IV as one of the top papers in the environmental track at the European Wave and Tidal Energy Conference.
- 2014 | **National Science Foundation Graduate Research Fellowship**
- 2012 | **The John C. Woodhouse Environmental Engineering Prize**, *Thayer School of Engineering at Dartmouth* Awarded annually to a student in recognition of outstanding work in the field of environmental study or research at Thayer School.
- 2012 | **Citation for Excellence in Teaching**, Thayer School of Engineering at Dartmouth. Received a citation for both Winter and Spring terms of teaching ‘Introduction to Scientific Computing’.

## Skills and Certifications

- Certifications | AAUS Scientific Diver in Training, PADI SCUBA Open Water, Engineer-in-Training (EIT)
- Computing | Python, Matlab, R, ABAQUS, Blender, Fortran, SQL, C, C++, AutoCAD, Solidworks, Photoshop, Video Editing, ANSYS Fluent