

# Jessica C. Garwood

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Dept. of Marine and Coastal Sciences,  
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**Website**  
**Email**  
**Languages**

JessCG.github.io  
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English, French (fluent)  
Italian (conversational)

## Research Interests

My research interests focus on elucidating the fundamental dynamics that govern small-scale physical-biological interactions in the coastal ocean. By combining *in situ* measurements with numerical models and theory, I seek to interpret the ocean from a planktonic perspective. At the core of my research is a desire to develop and employ underwater robotic plankton swarms to capture these dynamics.

## Education

**2019** PhD Oceanography - Scripps Institution of Oceanography, UCSD

*Transport in internal waves with a background flow: Lessons learned from robotic larval mimics*

Advisors: Peter J. S. Franks & Andrew J. Lucas

**2014** MSc Oceanography - Dalhousie University

*Seasonal variation and biological effects on mudflat erodibility in the Minas Basin, Bay of Fundy*

Advisor: Paul S. Hill

**2011** BSc Marine Biology & Oceanography, First Class Honours - Dalhousie University

## Appointments

**2020 -** Postdoctoral Associate, Dept. of Marine and Coastal Sciences, Rutgers University

*Linking behavior and transport of larvae using waves and turbulence as cues*

Principal investigators: Heidi Fuchs, Greg Gerbi, Bob Chant

**2013-2019** Graduate Student Researcher, Scripps Institution of Oceanography, UCSD

**2017** Teaching Assistant, Scripps Institution of Oceanography, UCSD

**2011-2013** Graduate Student Researcher, Dept. of Oceanography, Dalhousie University

**2011-2012** Teaching Assistant, Dept. of Oceanography, Dalhousie University

**2009-2011** Undergraduate Student Researcher, Dept. of Oceanography, Dalhousie University

## Peer-Reviewed Publications

**Garwood, J.C.,** A.J. Lucas, P. Naughton, P.L.D. Roberts, J.S. Jaffe, L. deGelleke, and P.J.S. Franks. 2021. Larval cross-shore transport estimated from internal waves with a background flow: The effects of larval vertical position and depth regulation. *Limnol. Oceanogr.* 66(3):678-693. doi:10.1002/lno.11632

**Garwood, J.C.,** R.C. Musgrave, and A.J. Lucas. 2020. Life in Internal Waves. *Oceanography.* 33(3): 38-49. doi:10.5670/oceanog.2020.313

**Garwood, J.C.,** A.J. Lucas, P. Naughton, M.H. Alford, P.L.D. Roberts, J.S. Jaffe, L. deGelleke, and P.J.S. Franks. 2020. A novel cross-shore transport mechanism revealed by subsurface, robotic larval mimics: Internal wave deformation of the background velocity field. *Limnol. Oceanogr.* 65(7):1456-1470. doi:10.1002/lno.11400

Franks, P.J.S., **J.C. Garwood**, M. Ouimet, J. Cortes, R. Musgrave, and A.J. Lucas. 2020. Stokes drift of plankton in linear internal waves: Cross-shore transport of neutrally buoyant and depth-keeping organisms. *Limnol. Oceanogr.* 65(6):1286-1296. doi:10.1002/lno.11389

**Garwood, J.C.,** P.S. Hill, H.L. MacIntyre, and B.A. Law. 2015. Grain sizes retained by diatom biofilms during erosion on tidal flats linked to bed sediment texture. *Cont. Shelf Res.* 104:37-44. doi:10.1016/j.csr.2015.05.004

**Garwood, J.C.,** P.S. Hill, and B.A. Law. 2013. Biofilms and size sorting of fine sediment during erosion in intertidal sands. *Estuar. Coasts.* 36:1024-1036. doi:10.1007/s12237-013-9618-z

## In-Preparation Publications

**Garwood, J.C.,** H.L. Fuchs, G.P. Gerbi, E.J. Hunter, and R.J. Chant. Estuarine larval retention enhanced by tuning into turbulence and tuning out waves. *In preparation.*

Moulton, M., S.H. Suanda, **J.C. Garwood**, N. Kumar, M.R. Fewings, J.M. Pringle. 2023. Mechanisms for the transport of nutrients, plankton, and pollutants across the nearshore region. *Ann. Rev. Mar. Sci. In preparation.*

## Grants & Fellowships

**2014-2016** Alexander Graham Bell Canada Graduate Scholarship - PhD  
**2013-2014** Regents Fellowship  
**2011-2012** Alexander Graham Bell Canada Graduate Scholarship - MSc  
**2007-2011** Chancellor's Scholarship  
**2007-2011** Provincial Millennium Excellence Award  
**2011** NSERC Undergraduate Summer Research Grant  
**2010** NSERC Undergraduate Summer Research Grant  
**2009** NSERC Undergraduate Summer Research Grant  
**2007-2008** Residence Scholarship  
**2004-2006** Full scholarship - United World College of the Adriatic

## Honors

**2015** Fager Award - *recognizes excellence in quantitative training of peers*  
**2014** Canada Governor General's Academic Medal - Gold  
**2007-2011** Dean's list  
**2011** Hugh P. Bell Scholarship  
**2011** J. G. Ogden Memorial Prize  
**2011** Vemco Scholarship  
**2010** David Durward Memorial Prize  
**2009** Shao Hua and Wen Hsiang Yoh Prize in Biology  
**2004** Canada Governor General's Academic Medal - Bronze

## Presentations

### Invited

- 2021** Gordon Research Conference speaker invitation. Session: Novel approaches to observing in coastal systems. Postponed to 2023. *Coastal Ocean Dynamics Gordon Research Conference*.
- 2021** Estuarine and nearshore larval retention enhanced by sinking in turbulence and depth-keeping in internal waves. March 2021. *Department of Marine Sciences, University of Connecticut*.
- 2020** Cross-shore transport in internal waves: Lessons learned from robotic larval mimics. Nov. 2020. *Department of Oceanography, Dalhousie University*.
- 2020** Cross-shore transport in internal waves: Lessons learned from robotic larval mimics. Oct. 2020. *Applied Ocean Physics and Engineering, Woods Hole Oceanographic Institution*.
- 2020** Transport in coastal internal waves: Lessons learned from robotic larval mimics. Jan. 2020. *Department of Marine and Coastal Sciences, Rutgers University*.

### Oral presentations

- 2020** **Garwood, J.C.**, A.J. Lucas, P. Naughton, M.H. Alford, P.L.D. Roberts, J.S. Jaffe, L. deGelleke, and P.J.S. Franks. Three-way interaction between larval swimming behavior, internal waves, and the mean flow enhances cross-shore transport. Feb. 2020. *Ocean Sciences Meeting, San Diego, CA, USA*.
- 2018** **Garwood, J.C.**, P.J.S. Franks, P. Naughton, P.L.D. Roberts, A.J. Lucas, J.S. Jaffe. A ratchet to shore: How background flow and nonlinear internal waves can interact to enhance transport of quasi-Lagrangian plankton mimics. Sept. 2018. *Eastern Pacific Ocean Conference, Mount Hood, OR, USA*.
- 2018** **Garwood, J.C.**, P.J.S. Franks, P. Naughton, P.L.D. Roberts, A.J. Lucas, J.S. Jaffe. A ratchet to shore: transport of quasi-Lagrangian plankton mimics by nonlinear internal waves. Feb. 2018. *Ocean Sciences Meeting, Portland, OR, USA*.
- 2017** **Garwood, J.C.**, P.J.S. Franks, P. Naughton, P.L.D. Roberts, A.J. Lucas, J.S. Jaffe. A ratchet to shore: transport of quasi-Lagrangian plankton mimics by nonlinear internal waves. Sept. 2017. *Scripps Student Symposium, San Diego, CA, USA*.
- 2016** Law, B.A., T.G. Milligan, P.S. Hill, **J.C. Garwood**, V. Zions. Temporal and spatial changes in grain size on a macro-tidal channel-flat complex: Results from Kingsport, Nova Scotia, Bay of Fundy. Feb. 2016. *Ocean Sciences Meeting, New Orleans, LA, USA*.
- 2013** Law, B.A., P.S. Hill, T.G. Milligan, P.L. Wiberg, **J.C. Garwood**, V. Zions. Temporal and spatial change in grain size and erodibility on a macro-tidal channel-flat complex in Kingsport, N.S., Canada, versus a mesa-tidal channel-flat complex in Willapa Bay, Washington, USA. Nov. 2013. *Conference of the Coastal & Estuarine Research Federation, San Diego, CA, USA*.
- 2012** **Garwood, J.C.**, S.S. Kienast, and P.S. Hill. Evidence of dust deposition in a core from the Eastern Equatorial Pacific on glacial-interglacial timescales. Dec. 2012. *AGU Fall Meeting, San Francisco, CA, USA*.

- 2012 Garwood, J.C.,** S.S. Kienast, and P.S. Hill. Evidence of dust deposition in a core from the Eastern Equatorial Pacific on glacial-interglacial timescales. March 2012. *Conference of Dalhousie Oceanography Graduate Students, Halifax, NS, Canada.*
- 2012 Garwood, J.C.,** P.S. Hill, and B.A. Law. Biofilms and size sorting of intertidal sediment during erosion. Feb. 2012. *Ocean Sciences Meeting, Salt Lake City, UT, USA.*
- 2011 Garwood, J.C.,** and P.S. Hill. Effects of biofilms on sediment sortability. March 2011. *Conference of Dalhousie Oceanography Graduate Students, Halifax, NS, Canada.*

### Poster presentations

- 2016 Garwood, J.C.,** R.C. Musgrave, R.C., P.J.S. Franks. Modeling plankton aggregation and transport by nonlinear internal waves propagating onshore. Feb. 2016. *Ocean Sciences Meeting, New Orleans, LA, USA.*
- 2016 Jaffe, J.S.,** B. Laxton, **J.C. Garwood,** P.J.S. Franks, P.L. Roberts. A micro-fluidic treadmill for observing suspended plankton in the lab. Feb. 2016. *Ocean Sciences Meeting, New Orleans, LA, USA.*
- 2014 Garwood, J.C.,** K. Devitt, R. Cox, and P.S. Hill. Comparison of biofilm effects on sediment erosion at two intertidal sites with distinct surface sediment grain size. Feb. 2014. *Ocean Sciences Meeting, Honolulu, HI, USA.*
- 2013 Garwood, J.C.,** and P.S. Hill. Seasonal and biofilm effects on sediment erosion and sorting in an intertidal mudflat in the Bay of Fundy, Canada. Nov. 2013. *Conference of the Coastal & Estuarine Research Federation, San Diego, CA, USA.*
- 2013 Garwood, J.C.,** P.S. Hill, and B.A. Law. Mudflat biofilms coarsen suspended sediment in the Minas Basin. May 2013. *Nova Scotia Tidal Energy Research Symposium and Forum, Acadia University, Wolfville, NS, Canada.*
- 2011 Garwood, J.C.,** and P.S. Hill. Effects of biofilms on sediment sortability. Feb. 2011. *Cameron Conference, Halifax, NS, Canada.*

## Student mentorship

- 2020 Samikshya Poudel**  
*RIOS undergraduate summer intern, Rutgers*  
 Samikshya investigated the likelihood of larvae spawned near Cape Hatteras to be transported North and back to the shelfbreak via the Gulf Stream. Analyses were conducted using virtual larval tracks generated with ROMSPath and ROMS output. My role was to supervise the project.
- 2018 Shailja Gangrade**  
*Scripps Undergraduate Research Fellow*  
 Shailja compiled CTD data to map ocean depths with optimal light and oxygen levels based on larval visual system requirements. My role was to provide programming mentorship, and co-advise with Lillian McCormick, under the supervision of Lisa Levin and Peter Franks.

**2012 - 2013 Rachel Cox**

*Dalhousie Undergraduate Honours Research Project*

Rachel investigated the effects of benthic fauna on sediment resuspension on an intertidal flat in the Bay of Fundy. I helped frame her research project, and provided input on the experimental design and data interpretation. Advisor: Paul S. Hill.

**2011 - 2012 Karen Devitt**

*Dalhousie Undergraduate Honours Research Project*

Karen investigated sediment retention by benthic biofilms grown in the lab. I helped frame her research project, and provided input on the experimental design. Advisor: Paul S. Hill.

## Teaching

**Co-instructor**

**2015** SIO 278: Introduction to R for Oceanographers - SIO

**Guest lecturer**

**2021** 11:628:410: Biophysical interactions: from barnacles to jellyfish - Rutgers University

**2020** 11:628:410: Biophysical interactions: from barnacles to jellyfish - Rutgers University

**2018** SIO 90: Perspectives on Ocean Sciences - SIO

**2017** SIO 285: Physical-Biological Interactions - SIO

**Teaching assistant**

**2017** SIO 134: Introduction to Biological Oceanography - SIO  
*Instructor: Mike Landry*

**2012** OCEA 3004: The Last Billion Years - Dalhousie University  
*Instructor: Paul S. Hill*

**2011** OCEA 2002: The Blue Planet - Dalhousie University  
*Instructor: Paul S. Hill*

## Field work

**Deployment of robotic swarm & moorings, small boat operations**

**2016** Principal investigator, PhD research - 2 weeks, Mission Beach, CA, USA

**Research cruises**

**2018** Introduction to at-sea sampling for summer interns, R/V Robert Gordon Sproul - 1 day, San Diego, CA, USA

**2017** Night shift leader, SCoNE student cruise, Inner-Shelf Dynamics Experiment, R/V Robert Gordon Sproul - 10 days, Point Sal, CA, USA

**2016** Chief scientist, class project, R/V Robert Gordon Sproul - 3 cruises totaling 5 days, San Diego, CA, USA

**2013** Class cruises, R/V Robert Gordon Sproul - 2 cruises totaling 2 days, San Diego, CA, USA

**2013** Research assistant, S0-228, R/V Sonne - 25 days, Jayapura, Indonesia to Townsville, Australia

### **Sediment collection on intertidal flats**

- 2011-2012** Principal investigator, MSc research - twice monthly for 8 months, Bay of Fundy, NS, Canada
- 2010** Principal investigator, BSc research - twice monthly in summer, Cole Harbour, NS, Canada
- 2010** Research assistant - 3 weeks, Willapa Bay, WA, USA

### **Service**

- 2020** Moderator & organizer, Panel on Diversity in STEM and screening of *Picture a Scientist* - Rutgers University
- 2017-2019** Diversity Advisory Committee - SIO
- 2018** Session co-chair - Eastern Pacific Ocean Conference, Sept. 2018, Mount Hood, OR, USA  
*Session: Interdisciplinary studies examining transport and mixing from the shelf to the shoreline.*
- 2017** Discussion leader, Munk Centennial Symposium on Internal waves, turbulence, and the overturning circulation of the ocean, May 2017, San Diego, CA, USA
- 2017** Organizer, Scripps Student Symposium - SIO
- 2014-2015** Organizer, Ecology Seminars - SIO
- 2011-2012** Organizer, Oceanography Seminars - Dalhousie University
- 2011-2012** Student recruitment volunteer, Oceanography - Dalhousie University
- 2011-2012** Treasurer, Dalhousie Oceanography Student Association
- 2012** Organizer, Conference of Dalhousie Oceanography Graduate Students

### **Outreach**

- 2020** Scientific adviser, United World Challenge  
*Designed coding activities introducing ocean concepts, and participated in a podcast (Episode 9) available on Spotify, Apple Podcasts, and others.*
- 2016 - 2018** Outreach, Ocean Discovery Institute  
*Developed two year-long research projects for low income, middle school students*

### **Manuscript reviews**

- 2020** *Coral Reefs* (1)
- 2020** *Frontiers in Marine Science* (1)
- 2020** *Journal of Marine Research* (1)
- 2020** *Marine Ecology Progress Series* (1)
- 2019-2020** *Estuarine, Coastal and Shelf Science* (2)

### **Broader community experience**

- 2014-2019** Climbing gym instructor, Outback Climbing Center, UCSD
- 2016-2018** Volunteer shift leader, Banff Centre Mountain Film and Book Festival, Banff, Canada
- 2014-2015** Volunteer, Banff Centre Mountain Film and Book Festival, Banff, Canada
- 2006-2007** Volunteer recreation program coordinator, Fort Good Hope, Northwest Territories, Canada