

# HILARY A. HAYFORD

POSTDOCTORAL RESEARCH ASSOCIATE  
DEPARTMENT OF BIOLOGY & FRIDAY HARBOR LABS  
UNIVERSITY OF WASHINGTON  
BOX 351800, SEATTLE, WA 98195-1800  
hayford@uw.edu | hilaryhayford.com

## EDUCATION

**PhD**, Biology, University of Washington, Seattle, 2016  
Thesis: "Tidal migration patterns moderate thermal risk in the intertidal snail *Nucella ostrina*"  
**BSc**, Marine Biology, University of California, Santa Cruz, 2001  
**AA**, Spanish, & **AS**, Biology, Cabrillo College, Aptos, CA, 1998

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## RESEARCH – 18 YEARS, COLLABORATION ON > 40 PROJECTS -

### PROFESSIONAL POSITIONS

**POSTDOCTORAL RESEARCH ASSOCIATE**, University of Washington 2016 - present  
Ecophysiology, thermal biology, climate change, aquaculture, ocean acidification.

#### GRADUATE STUDENT RESEARCHER

University of Washington: Thermoregulation, tidal cycles, predation, performance 2009 - 2016  
Moss Landing Marine Labs/San Jose State: Molecular ecology & invertebrate zool. 2005 - 2009  
Hopkins Marine Station, PISCO: Biomechanics, ecophysiology & genetics Jul 2007  
Universidad Católica del Norte, Coquimbo, Chile: Kelp forest community ecology Oct 2006

**RESEARCH SPECIALIST**, University of California, Santa Cruz 1999 - 2009  
Partnership for Interdisciplinary Studies of Coastal Oceans (PISCO). Lab Manager 2001-2005.  
Experimental ecology, environmental monitoring; supervised > 50 people, >700 field days.

### PEER-REVIEWED PUBLICATIONS

4. **HA Hayford**, MJ O'Donnell, E Carrington. (2018) Radio tracking detects behavioral thermoregulation at a snail's pace. *Journal of Experimental Marine Biology and Ecology*, 499:17-25
3. WB Stickle, E Carrington, **H Hayford** (2017) Seasonal changes in the thermal regime and gastropod tolerance to temperature and desiccation stress in the rocky intertidal zone at the southern end of the inside passage. *Journal of Experimental Marine Biology and Ecology*, 488:83-91
2. SE Gilman, **H Hayford**, C Craig, E Carrington (2015) Body temperatures of an intertidal barnacle and two whelk predators in relation to shore height, solar aspect, and microhabitat. *Marine Ecology Progress Series*, 536:77-88
1. **HA Hayford**, SE Gilman, E Carrington (2015) Foraging behavior minimizes heat exposure in a complex thermal landscape. *Marine Ecology Progress Series*, 518:165-175

## HILARY A. HAYFORD

### MANUSCRIPTS – Available upon request

**HA Hayford**, E Carrington. Slow migratory behavior benefits performance in a predictably dynamic habitat.

**HA Hayford**, MN George, E Carrington. Experimental ocean acidification inhibits growth of an intertidal snail.

LA Newcomb, **HA Hayford**, EA Roberts, I Jefferds, CS Friedman, E Carrington. Attachment strength dynamics of cultured *Mytilus trossulus*: linkages to abiotic and biotic factors.

### PRESENTED PAPERS (Presenting author = 12, Total = 19)

\*denotes undergraduate mentee

- 2018 **Hayford HA**, \*Kreis M, \*Le Baron N, Carrington E. Performance benefits of slow behavior in the thermally dynamic intertidal zone. Western Society of Naturalists (WSN), Tacoma, WA
- 2018 \*May CH, \*Fields JA, \*Toler-Scott C, **Hayford H**, Elahi R. Undergraduate research in historical ecology: A comparison of invertebrate body size over 45 years. WSN, Tacoma, WA
- 2018 Elahi R, Galloway AWE, **Hayford H**, King W. Synthesizing snail size shifts: evidence for body size decline over time despite considerable response heterogeneity. WSN, Tacoma, WA
- 2018 **Hayford HA**, George MN, Carrington E. Experimental ocean acidification inhibits snail growth. Society for Integrative & Comparative Biology (SICB) –San Francisco, CA
- 2017 **Hayford HA**, Carrington E. Small movements with big benefits: thermoregulation in an intertidal snail. Ecological Society of America, Portland, OR
- 2017 **Hayford HA**, Carrington E. Performance benefits of slow migratory behavior in a predictable dynamic habitat. SICB, New Orleans, LA
- 2017 Carrington E, George M, **Hayford H**, Newcomb L, Friedman C, Jefferds I. All washed up? Mussel survival in the face of ocean warming and acidification. SICB, New Orleans, LA
- 2015 **Hayford HA**. Slowly but surely: navigating thermal stress at a snail's pace. Biology Graduate Student Symposium (BGSS), Seattle, WA
- 2015 **Hayford HA**, Carrington E. The best of both worlds: Radio tracking and thermal mimics show thermoregulation in intertidal snails. SICB, West Palm Beach, FL
- 2014 **Hayford HA**, Carrington E. Catching waves: Radio tracked snails use tidal cycles to thermoregulate. WSN, Tacoma, WA
- 2014 **Hayford HA**. Behavior ameliorates thermal stress when tidal cycle shifts microclimate. Graduate Climate Conference, Eatonville, WA
- 2014 **Hayford HA**, Carrington E. Slowly but surely: Avoiding heat stress at a snail's pace. SICB, Austin, TX
- 2013 Carrington E, **Hayford H**, Gilman S, Kull K. Open air dining: Circatidal foraging patterns of the intertidal whelk *Nucella ostrina* in a complex thermal landscape. Congress of Malacology, Ponta Delgada, Portugal
- 2012 **Hayford HA**, O'Donnell MJ, Carrington E. Low speed, high tech: Radio tracking intertidal snails. WSN, Monterey, CA
- 2012 Gilman SE, **Hayford H**, Nishizaki M, Vaughn D, Carrington E. NSF-sponsored workshop 'Climate Change and Species Interactions: Ways Forward' - An (exhaustively) mechanistic study of temperature and species interactions. Cary Institute for Ecosystem Studies, NY
- 2012 Gilman SE, Helmuth B, Wetthey D, Carrington E, **Hayford H**. Moving beyond measurement: Connecting sensor data to organismal performance. U.S. Regional Association of the International Association for Landscape Ecology, Newport, RI

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- 2011 **Hayford HA**, Gilman SE, Carrington E. *Nucella ostrina* alters behavior when tidal cycle shifts microclimate. WSN, Vancouver, WA
- 2011 **Hayford HA**. Snail behavior changes when tidal cycling alters temperature. BGSS, Seattle, WA
- 2007 Geller JB, Mackie J, **Hayford HA**. Towards a molecular inventory of the plankton of Elkhorn Slough. Monterey Bay National Marine Sanctuary Currents Symposium, Monterey, CA

## INVITED RESEARCH SEMINARS

Oregon Institute of Marine Biology	University of Oregon	Aug 2018
Biology Department	Pacific Lutheran University (WA)	Nov 2017
Friday Harbor Labs	University of Washington	Jul 2017
Biology Department	Western Washington University	May 2016
Marine Ecology Research Group	University of California, Irvine	Aug 2015
Friday Harbor Labs	University of Washington	Nov 2014
Friday Harbor Labs	University of Washington	Nov 2012
Docent Program	Natural Bridges State Park (CA)	Jul 2008

## GRANTS & FELLOWSHIPS (\$78,000)

WA Sea Grant invited full proposal, junior scientist, PI: Carrington	(Not funded)	2017
Rafe Sagarin Fund for Innovative Ecology Honorable Mention (Co-PI)	\$250	2017
Patricia L. Dudley Fellowship, Friday Harbor Labs	\$1,500	2017
Charlotte Magnum Student Support, Soc. Int. Comp. Biol	Mtg housing	2014, 2015
Alan & Marian Kohn Fellowship, Friday Harbor Labs	\$2,500	2014
Achievement Rewards for College Scientists (ARCS), Seattle Chapter	\$17,500	2009-2012
Edmondson Fellowship, Dept. of Biology, U. Washington	\$1,500	2012
Richard & Megumi Strathmann Fellowship, Friday Harbor Labs	\$1,600	2012
Neuro & Behavior Fellowship, Friday Harbor Labs	\$400	2012
Ragen Family Fellowship, Friday Harbor Labs	\$2,000	2011
Richard & Megumi Strathmann Fellowship, Friday Harbor Labs	\$1,000	2011
Pacific Northwest Shell Club Research Scholarship	\$750	2011
Top Scholar, Dept. of Biology, U. Washington	\$11,400	2009
David & Lucille Packard Research & Travel Grant	\$1,000	2009
Kim Peppard Memorial Scholarship, Moss Landing Marine Labs	\$1,000	2009
San Jose State University Fellowships (Grad Equity, Burmahln)	\$1,425	2007 - 2009
Harvey Fellowship, Moss Landing Marine Labs	\$3,000	2008
Dr. Earl & Ethel Myers Oceanographic & Marine Biology Grant	\$1,000	2006
Regents Scholar, U. California, Santa Cruz	\$30,000	1998 - 2000
McHenry Scholar (4 university-wide), U. California, Santa Cruz	\$420	1999

## SPECIALIZED SKILLS

Field biology: natural history of marine algae, invertebrates, & plankton, deployment of equipment, experience at >100 field sites across 3 countries, snorkeling, WA State Boaters License

General lab & shop: animal husbandry, plumbing, microscopy, respirometry, fluorometry, spectrophotometry, soldering, wiring, flume, wind tunnel, construction with power tools

Molecular lab: cell culture, transformation & cloning, DNA & protein extraction, PCR, restriction digestion, electrophoresis, SDS-PAGE, Western blotting

Statistical software: R, SPSS, Systat, Matlab

Languages: English (fluent), Spanish (proficient)

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## TEACHING & MENTORING - 27 COURSES, >1200 STUDENTS -

† denotes courses with labs

\* denotes courses with field trips

### INSTRUCTOR OF RECORD – 5 COURSES

Marine Ecological Processes x 2	U. Washington, Seattle	2017, 2018
Historical Ecology Research Apprenticeship†*	UW Friday Harbor Labs	2018
Foundations in Ecology x 2†*	U. Washington, Seattle	2017, 2018

### TEACHING ASSISTANT – 22 COURSES

Introductory Cell & Molecular Biology†	U. Washington, Seattle	2016
Mycology†*	U. Washington, Seattle	2015
Invertebrate Zoology†*	U. Washington, Seattle	2015
Marine Ecology*	U. Washington, Seattle	2015
Cell & Molecular Lab Techniques x 3†	U. Washington, Seattle	2013 - 2015
Limnology & Limnology Lab x 4†*	U. Washington, Seattle	2011 - 2014
Invert. Zoology & Research Apprenticeship x 2†*	UW Friday Harbor Labs	2013 - 2014
Marine Algae & Research Apprenticeship x 3†*	UW Friday Harbor Labs	2010 - 2012
Foundations in Physiology	U. Washington, Seattle	2012
Foundations in Ecology†*	U. Washington, Seattle	2011
Introductory Ecology & Evolution†*	U. Washington, Seattle	2010
Invertebrate Zoology†*	San Jose State University	2008
Teacher Enhancement Program: Lab & Field†*	San Jose State University	2007
Teacher Enhancement Program: Biotechnology†*	San Jose State University	2006

### GUEST LECTURER – CLASSES & INSTITUTES

ASKXXI: Arts + Science Knowledge	USA & Chile collaboration	2018
Salish Sea Sciences Summer Program	Salish Sea Sciences	2017, 2018
Spring Street Summer Institute	Spring Street International School	2013, 2014
Cell & Molecular Lab Techniques	U. Washington, Seattle	2014
Invertebrate Zoology	Seattle University	2013
Marine Botany	U. Washington, Seattle	2012
Marine Ecological Processes	U. Washington, Seattle	2012
Marine Ecology	U. California, Santa Cruz	2008

### MENTOR – INDEPENDENT RESEARCH (16 undergraduates, University of Washington)

Sean Dougherty, Jamie Andersen Fields, Elena Kahn, Chloe May, Henry Steinhebel, Jessica Stutz, Kia Sutter, Cormac Toler-Scott, Lauren Wiest (2018) “Historical marine ecology of San Juan Island: using historical studies to assess long-term change”

Nadia Ahmed (2016) “Seasonal variation in mussel shell thickness”

Maia Kreis (2014) “Measuring thermal performance of *Nucella ostrina*”; (2012) “Vertical migration patterns of two marine snails: *Nucella lamellosa* & *Nucella ostrina*”

Kat Barton (2013) “Effect of heat stress & starvation on snail behavior and recovery rate”

Erik Nash & Dan O’Connor (2013) “Effect of heat stress & starvation on the respiration rate of *Nucella ostrina*”

Kathleen Conery (2012) “Migration & feeding in intertidal whelks, *Nucella ostrina* & *N. lamellosa*”

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Lauren Colpo (2010-2011) senior capstone “Metabolic response of *Nucella ostrina* & *Nucella lamellosa* to increased temperatures in aerial environments”

**+Research supervisor for > 80 undergraduate students & technicians**

## TEACHING & MENTORING RECOGNITION

Postdoc Mentoring Award Nominee (university-wide), U. Washington		2018
Ingrith Deyrup Distinguished Teaching Award, Biology Dept., U. Washington	\$750	2015

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## SERVICE & COMMUNITY

### REVIEWER FOR

*American Naturalist*

*Comparative Biochemistry & Physiology*

*Ecography*

*Ecological Monographs*

*Invertebrate Biology*

*Journal of Coastal Research*

*Journal of Experimental Biology*

*Journal of Experimental Marine Biol. & Ecology*

*Marine Ecology*

*Marine Ecology Progress Series*

### PROFESSIONAL SERVICE

Student paper judge	Western Society Naturalists	2018
Broadening Participation mentor	Society Integr & Comp Biol	2018
Student paper judge	Society Integr & Comp Biol	2017, 2018
Friday Harbor Labs Advisory Board	University of Washington	2013 - 2014
Undergraduate Curriculum Committee, Biology Dept.	University of Washington	2013 - 2014
Graduate Coordinating Committee, Biology Dept.	University of Washington	2012 - 2013
Graduate Program Committee, Biology Dept.	University of Washington	2010 - 2012
Biology Graduate Student Symposium Coordinator	University of Washington	2011
Judge, HHMI Undergraduate Research Symposium	University of Washington	2010
Dean's Student Advisory Board, College of Science	San Jose State University	2007 - 2009

### FEATURES & POPULAR ARTICLES

“Hanging by a Thread - Mussels in a Changing Ocean” Animated video by Abby Lunstrum, Meg Chadsey, & Laura Newcomb, w/ WA Sea Grant; February 2018, <https://tinyurl.com/y977soft>

“Avoiding high temperatures at a snail’s pace.” Feature article in Friday Harbor Labs Tide Bites newsletter & San Juan Islander; May 2016, <http://tinyurl.com/j4vg8mp>

“The best of both worlds: A clever intertidal snail feeds on land and cools off in the sea.” Feature article in Pacific Northwest Shell Club newsletter; Oct 2014, <http://tinyurl.com/nwt7smh>

“A snail can tell us a lot about global warming.” Radio feature by Martha Baskin of Crosscut Radio; Apr 2012, <http://tinyurl.com/pqtlgmj>

### COMMUNITY OUTREACH > 1,300 hours

Volunteer docent, Seattle Aquarium, Seattle, WA	2016 - present
Public speaker, Friday Harbor Labs Open House, Friday Harbor, WA	2018
E-visiting scientist, Skype a Scientist, Denver Public Library, CO	2018
Fundraiser volunteer, Puget Soundkeeper Alliance, Seattle, WA	2017, 2018

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Visiting scientist, What is a Scientist? SICB School Outreach, New Orleans, LA	2017
Visiting scientist, Girls in Science, Burke Museum, Seattle, WA	2016
Science Positive blog contributor, Biology Dept., U. Washington, Seattle, WA	2015
Public speaker, Seattle Nerd Night, Seattle, WA	2015
Visiting lecturer, Advancement Board, Friday Harbor Labs, WA	2014
Volunteer naturalist, Lime Kiln Point State Park, Friday Harbor, WA	2013 – 2014
Visiting scientist, Friday Harbor Elementary School, Friday Harbor, WA	2010 – 2014
Volunteer writing mentor, Dream Project, U. of Washington, Seattle, WA	2010
Volunteer mentor, Student Oceanography Club, Monterey Bay Aquarium, CA	2007 – 2009
Science fair judge, secondary schools, Santa Cruz County, CA	2006 – 2009
Fundraiser volunteer, Moss Landing Marine Labs, Moss Landing, CA	2005 – 2009
Fundraiser volunteer, Long Marine Lab, Santa Cruz, CA	2003, 2008, 2009
Career panelist, junior & senior high schools, Santa Cruz County, CA	2007, 2008
Volunteer mentor, Young Women in Science, Monterey Bay Aquarium, CA	2007
Volunteer, Shark Festival & Sanctuary Celebration, Santa Cruz, CA	2002
Co-leader, Ocean Explorers summer camp, Long Marine Lab, Santa Cruz, CA	1999 – 2000
Volunteer docent, school programs, Long Marine Lab, Santa Cruz, CA	1996 – 2000

## PROFESSIONAL AFFILIATIONS

Ecological Society of America (ESA)  
Society for Integrative and Comparative Biology (SICB)  
Washington Ocean Acidification Center (WOAC)  
Western Society of Naturalists (WSN)

## COMMUNITY AFFILIATIONS

American Civil Liberties Union (ACLU)  
National Association for the Advancement of People of Color (NAACP)