

# CARTER S. SMITH

Duke University Marine Lab  
Beaufort, NC 28516 USA  
cartersheldonsmith.com

Phone: (201) 650 8295; Email: [carter.smith@duke.edu](mailto:carter.smith@duke.edu)

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## EDUCATION

- 2019      **Ph.D.: Marine Sciences, University of North Carolina at Chapel Hill**  
Advisor: Dr. Charles 'Pete' Peterson  
Dissertation title: "The socioeconomic and ecological effects of shoreline hardening with implications for nature-based coastal protection"
- 2009      **BA: Theater, Wesleyan University**

## PROFESSIONAL APPOINTMENTS

- 2019-      **Postdoctoral Research Associate**, Duke University, Advisor: Dr. Brian Silliman
- 2014- 2019      **Royster Society Graduate Fellow**, UNC Chapel Hill, Advisor: Dr. Charles Peterson
- 2017- 2018      **NC Sentinel Site Cooperative & NC Sea Grant Fellow**, Advisor: Dr. Charles Peterson
- 2016      **NSF EAPSI Fellow**, Hokkaido University, Japan, Advisor: Dr. Masahiro Nakaoka
- 2015      **NC Sea Grant Coastal Policy Fellow**, Advisor: Dr. Charles Peterson

## PUBLICATIONS

### Refereed Articles

10. Namba, M., M. Hashimoto, M. Ito, K. Momota, C.S. Smith, T. Yorisue, and M. Nakaoka. Accepted. The effect of environmental gradient on biodiversity and similarity of invertebrate communities in eelgrass (*Zostera marina*) beds. *Ecological Research*.
9. Smith, C.S., and S.B. Scyphers. 2019. Past hurricane damage and flood zone outweigh shoreline hardening for predicting residential-scale impacts of Hurricane Matthew. *Environmental Science and Policy* 101, 46-53.  
DOI:10.1016/j.envsci.2019.07.009
8. Silliman, B.R., Q. He, C. Angelini, C. S. Smith, M. L. Kirwan, P. Daleo, J. Renzi, J. Butler, J. C. Nifong, and J. van de Koppel. 2019. Field experiments and meta-analysis reveal wetland vegetation as a crucial element in the coastal protection paradigm. *Current Biology* 29(11), 1800-1806.  
DOI:10.1016/j.cub.2019.05.017
7. Neylan, I. P., C.S. Smith, E.A. Swann, S. R. Fegley, and R.K. Gittman. 2019. Interspecific and intraspecific interactions between fiddler crabs *Uca pugnax* and *Uca Pugilator* influence species' burrowing behavior. *Journal of Experimental Marine Biology and Ecology* 517, 40-48.  
DOI:10.1016/j.jembe.2019.05.010
6. Smith, C.S., B. Puckett, R. K. Gittman, C.H. Peterson. 2018. Living shorelines enhanced the resilience of saltmarshes to Hurricane Matthew (2016). *Ecological Applications* 28(4), 871-877.  
DOI:10.1002/eap.1722

5. Smith, C.S., M. Ito, M. Namba, M. Nakaoka. 2018. Oyster aquaculture impacts *Zostera marina* epibiont community composition in Akkeshi-ko estuary, Japan. *PLoS ONE* 13(5): e0197753. DOI:10.1371/journal.pone.0197753
4. Zhang, Y. Stacy, W. Cioffi, R. Cope, P. Daleo, E. Heywood, C. Hoyt, C.S. Smith, and B. R. Silliman. 2018. A global synthesis reveals gaps in coastal habitat restoration research. *Sustainability* 10(4). DOI:10.3390/su10041040
3. Smith, C.S., R. K. Gittman, I. P. Neylan, S. B. Scyphers, J. Morton, F.J. Fodrie, J. H. Grabowski, C.H. Peterson. 2017. Hurricane damage along natural and hardened estuarine shorelines: using homeowner perspectives to promote nature-based coastal protection. *Marine Policy* 81, 350-358. DOI:10.1016/j.marpol.2017.04.013
2. Gittman, R.K., S.B. Scyphers, C.S. Smith, I.P. Neylan, J.H. Grabowski. 2016. The ecological consequences of shoreline hardening: a meta-analysis. *Bioscience* 66, 763-773. DOI:10.1093/biosci/biw091
1. Hobbs, N., E. Lazo-Wasem, M. Faasse, J.R. Cordell, J.W. Chapman, C.S. Smith, R. Prezant, R. Shell, and J.T. Carlton. 2015. Going global: the introduction of the Asian isopod *Ianiropsis serricaudis* Gurjanova to North America and Europe. *Aquatic Invasions* 10(2), 177-187. DOI:10.3391/ai.2015.10.2.06

### **Manuscripts in Preparation**

1. Smith, C.S., M. Rudd, R. Gittman, and B. Silliman. Coming to terms with living shorelines: A systematic review of the literature.
2. Smith, C.S., J. C. Taylor, A.B. Paxton, S.E. Donaher, R. V. Van Hoeck, C. H. Peterson, and B. R. Silliman. Acoustic camera surveys along estuarine shorelines show limited variation in fish usage of the unvegetated habitat seaward of natural and artificial shorelines.
3. Abelson, A. et al. Challenges for restoration of coastal marine ecosystems in the Anthropocene.
4. Gittman, R. et al. Preference for hardened shorelines outweighs environmental values and impedes conservation and restoration of coastal habitats.

### **Technical Reports**

1. Smith, C.S. 2018. NC Sea Grant and NC Sentinel Site Cooperative Final Report. Evaluating stakeholder perceptions of coastal hazards in North Carolina using a social-ecological systems framework.
2. Smith, C.S. 2015. NC Sea Grant Final Report. Quantifying erosion protection and habitat enhancement provided by marsh sills: a “living shoreline” alternative to bulkheads and revetments.

### **HONORS AND AWARDS**

2018	<b>UNC Chapel Hill Graduate Education Advancement Board Impact Award</b>
2017	<b>NC MarCo Consortium Graduate Student Symposium 3<sup>rd</sup> Place Poster Presentation</b>
2016	<b>UNC Chapel Hill Graduate Student Mentoring Award</b>
2016	<b>Atlantic Estuarine Research Society Outstanding Graduate Oral Presentation</b>
2015	<b>Coastal Conservation Association of North Carolina Scholarship</b>

## **RESEARCH FELLOWSHIPS AND GRANTS**

**Grants (total to C. Smith) = \$205,536**

**Fellowships total = \$280,000**

### **Pending**

- 2020      **NSF, CNH2**, \$1,200,000: “Wellbeing through oyster aquaculture and restoration.” C.S. Smith (Co-author), G. Murray (Lead PI), B. Silliman (co-PI), and L. Campbell (co-PI).
- 2020      **NOAA, NERRS Science Collaborative**, \$600,000: “Evaluating the sustainment of coastal ecosystem services by living shorelines under accelerated sea level rise” C.S. Smith (Technical project lead), H. Stevens (Fiscal lead), R. Gittman (Collaborative project lead), and 8 other co-PIs.

### **Current**

- 2018-2020      **North Carolina Sea Grant**, \$120,000 (portion of grant received: \$18,617): “Quantifying the geomorphic, ecological, and socioeconomic impacts of shoreline management strategies: a multi-disciplinary approach.” C.S. Smith (Co-author), D.O. Eulie (Lead-PI), and R.K. Gittman (Co-PI)
- 2018-2019      **NSF, RAPID**, \$43,317: “Evaluation of the resilience of shoreline protection methods to Hurricane Florence.” C.S. Smith (Unfunded collaborator), D.O. Eulie (Lead-PI), R.K. Gittman (Co-PI), H. Hao (Co-PI)
- 2015-2019      **NC Coastal Recreational Fishing License Grant**, \$174,469: “Quantifying fish enhancement and erosion protection provided by marsh sills: a “living shoreline” alternative to bulkheads and revetments.” C.S. Smith (Primary author and project lead) and C.H. Peterson (PI)

### **Past**

- 2014-2019      **Royster Society Graduate Fellowship**, \$250,000
- 2018      **UNC Chapel Hill Graduate Student Transportation Grant**, \$1,400
- 2017-2018      **NC Sentinel Site Cooperative & NC Sea Grant Joint Research Fellowship**, \$10,000: “Evaluating stakeholder perceptions of sea level rise in coastal North Carolina using a social-ecological framework.” C.S. Smith (Graduate fellow)
- 2017      **P.E.O. Scholar Award**, \$15,000
- 2017      **Coastal and Estuarine Research Federation Travel Grant**, \$300
- 2016      **NSF, EAPSI**, \$10,000: “Can ecosystem friendly engineering enhance fisheries production in Japan.” C.S. Smith (PI)
- 2016      **Southern Association of Marine Laboratories Travel Grant (\$300)**
- 2016      **Restore America’s Estuaries Travel Grant (\$250)**
- 2016      **Atlantic Estuarine Research Society Anne C. Powell Student Travel Grant (\$200)**
- 2015      **NC Sea Grant Coastal Policy Research Fellowship**, \$5,000: “Quantifying fish enhancement and erosion protection provided by marsh sills: a “living shoreline” alternative to bulkheads and revetments.” C.S. Smith (Graduate fellow)

## **INVITED TALKS AND PANELS**

### **Academic Audience**

Invited	North Carolina State University, Morehead City, NC. TBD
Nov 2019	North Carolina Coastal Conference, Wilmington, NC. “Assessing damage from Hurricane Matthew and how it relates to homeowner concern for coastal hazards”
Mar 2018	East Carolina University, Research in Progress Seminar Series, Biology Department, Greenville, NC. “Using living shorelines to promote coastal sustainability and resilience”
July 2016	University of Hokkaido, Akkeshi Marine Station, Japan. “Can ecosystem friendly engineering enhance fisheries production?”

### **Practitioner and Policy Audience**

Oct 2019	Restore America’s Estuaries, Living Shorelines Technology Transfer Workshop, Beaufort, NC. Materials breakout session: oyster castles.
Aug 2019	Duke University, The Coming Storm: Using Science to Build Community Resilience, Durham, NC. “Living shorelines for coastal sustainability and resilience”
Nov 2018	Restore America’s Estuaries, Living Shorelines Community of Practice Webinar, “Using living shorelines to enhance coastal resilience”
Oct 2017	Congressional Briefing sponsored by the Estuaries Caucus, Washington, D.C. “Using living shorelines to design sustainable and resilient coastlines”
Dec 2016	Restore America’s Estuaries Summit, Living Shorelines Workshop, New Orleans, LA. “Addressing misperceptions about the effectiveness, durability, and cost of hardened versus living shorelines.”
Dec 2016	NC Department of Coastal Management Staff Living Shorelines Training, Beaufort, NC. “Shore protection structure performance over multiple storms: A socioeconomic analysis”

## **CONFERENCE ACTIVITY**

### **Symposia Organized**

2019	“Positive Interactions in Coastal Restoration,” Society for Ecological Restoration, 8 <sup>th</sup> World Congress on Ecological Restoration, Cape Town, South Africa
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## Papers Presented

- Smith, C.S.** Assessing fish use of hardened, natural, and nature-based estuarine shorelines using acoustic imagery. Coastal Estuarine Research Federation Conference, Mobile, AL, November 2019. *Oral presentation.*
- Smith, C.S.** B. R. Silliman. Can intraspecific cooperation enhance restoration success and help meet multiple human goals? Society for Ecological Restoration, 8<sup>th</sup> World Congress on Ecological Restoration, Cape Town, South Africa, September 2019. *Oral presentation.*
- Smith, C.S.,** B. Puckett, R.K. Gittman, C. H. Peterson. Living shorelines were more resilient than hardened shorelines during Hurricane Matthew (2016). Restore America's Estuaries meeting, Long Beach, CA, December 2018. *Oral presentation.*
- Smith, C.S.,** M. Ito, M. Namba, M. Nakaoka. Oyster aquaculture impacts *Zostera marina* epibiont community composition. Benthic Ecology Meeting, Corpus Cristi, TX, March 2018. *Oral presentation.*
- Smith, C.S.,** C.H. Peterson. Using a social-ecological framework to investigate connections between shoreline hardening and perceptions of hurricane risk. Coastal Estuarine Research Federation Conference, Providence, RI, November 2017. *Oral presentation.*
- Smith, C.S.,** M. Ito, M. Namba, M. Nakaoka. Long-line oyster aquaculture impacts *Zostera marina* epibiont community composition in Akkeshi-ko estuary, Japan. UNC Institute of Marine Sciences Thursday Think-tank Seminar Series, Morehead City, NC, September 2017. *Oral presentation.*
- Smith, C.S.,** B. Puckett, R.K. Gittman, C. H. Peterson. Evaluating the performance of hardened versus living shorelines during Hurricane Matthew (2016). Benthic Ecology Meeting, Myrtle Beach, SC, April 2017. *Oral presentation.*
- Smith, C.S.,** R. K. Gittman, I. P. Neylan, S. B. Scyphers, J. Morton, F.J. Fodrie, J. H. Grabowski, C.H. Peterson. Addressing homeowner misperceptions about the effectiveness, durability, and cost of hardened shorelines: An analysis of hurricane damage in North Carolina. MarCo Marine Consortium Graduate Student Symposium, Beaufort, NC, March 2017. *Poster presentation.*  
\*\* 3<sup>rd</sup> Place poster presentation
- Smith, C.S.,** R. K. Gittman, I. P. Neylan, S. B. Scyphers, J. Morton, F.J. Fodrie, J. H. Grabowski, C.H. Peterson. Addressing homeowner misperceptions about the effectiveness, durability, and cost of hardened shorelines: An analysis of hurricane damage in North Carolina. Restore America's Estuaries Summit, New Orleans, LA, December 2016. *Poster presentation.*
- Smith, C.S.** Ecosystem friendly engineering can enhance fisheries production in Japan. East Asia Pacific Summer Institutes Symposium, Tokyo, Japan, June 2016. *Poster presentation.*
- Smith, C.S.,** R.K. Gittman, I. Neylan, C.H. Peterson. Hurricane damage along natural and engineered shorelines in NC. Benthic Ecology Conference, Portland, March 2016. *Oral presentation.*
- Smith, C.S.,** R.K. Gittman, I. Neylan, C.H. Peterson. Hurricane damage along natural and engineered shorelines in NC. Atlantic Estuarine Research Society Spring Meeting, Virginia Beach, March 2016. *Oral presentation.*  
\*\* Outstanding graduate presentation
- Smith, C.S.** Hurricane resiliency: a moral dilemma. Institute of Marine Sciences Graduate Student Symposium, Morehead City, September 2015. *Oral presentation.*
- Smith, C.S.,** R. Prezant, R. Shell. First report of *Ianiropsis serricaudis* on the East Coast of North America. Benthic Ecology Conference, Jacksonville, March 2014. *Poster presentation.*

## **TEACHING EXPERIENCE**

### **Courses Taught**

- Fall 2019 Co-instructor, “Marine Community Ecology,” Hybrid undergraduate class at the Duke University Marine Laboratory, Lead Instructor: Brian Silliman, Duke University
- Spring 2018 Co-instructor, “Tropical Field Ecology”, Graduate and undergraduate field course in Belize, Lead Instructor: Brian Silliman, Duke University

### **Guest Lectures**

- 2019 “Coastal protection in a world of rising sea levels”, Undergraduate course, Instructor: Niels Lindquist, UNC Chapel Hill’s Institute of Marine Sciences
- 2019 “The socio-ecological dimensions of coastal protection”, Undergraduate summer course, Instructor: Rachel Gittman, Duke University Marine Lab
- 2018 “Coastal protection in a world of rising sea levels”, Undergraduate course, Instructor: Niels Lindquist, UNC Chapel Hill’s Institute of Marine Sciences
- 2018 “Mangrove communities”, Graduate and undergraduate course, Instructor: Brian Silliman, Duke University Marine Lab
- 2016 “Can ecosystem friendly engineering ensure a brighter future for NC fisheries?” Undergraduate course, Instructor: John Bane, UNC Chapel Hill

### **Other Teaching Experience**

- Seasonal **Leadership Educator and Mountain Guide**, National Outdoor Leadership School (NOLS), WY: Led extended backcountry expeditions and taught leadership and first aid curriculum while operating in remote environments.
- 2010- 2013
- 2012 **PADI Divemaster/Crew**, Blue Corner Dive, Nusa Lembongan, Indonesia
- 2009- 2011 **Marine Science Teacher**, Catalina Island Marine Institute, CA: Taught a weeklong marine biology curriculum to 4<sup>th</sup> through 12<sup>th</sup> graders, incorporating formal classroom education as well as hands-on outdoor education.
- 2008- 2009 **SAT Preparatory Teacher**, Let’s Get Ready, CT: Taught a weekly math SAT preparatory course to underprivileged high school students.

## **BROADER IMPACTS AND PUBLIC OUTREACH**

- 2019 Oyster Restoration and Protection Plan for North Carolina: A Blueprint for Action 2020-2025 Workgroup member  
Beaufort Middle School Science Fair Mentor  
Fieldtrip coordinator and speaker, RAE Living Shorelines Technology Transfer Workshop, Beaufort, NC (~50 scientists, practitioners, and coastal managers)  
Invited Speaker, The Coming Storm, Duke University (~50 media)
- 2018 High School Science Fair Mentor  
Guest Speaker, North Carolina PEO Convention, Raleigh, NC (~400 people)  
Guest Speaker, PEO society meeting, New Bern, NC (~40 people)  
Guest Speaker, Beaufort Methodist Church Men’s Club, Beaufort, NC (~40 people)

- 2017 Undergraduate Honors Thesis Mentor  
Invited Speaker and Panelist, Congressional Briefing on Living Shorelines, Washington, D.C. (~100 people)  
Guest Speaker, The Beaufort Ole Towne Rotary, Beaufort, NC (~30 people)  
Scientific Research and Education Network (SciREN) Workshop
- 2016 Undergraduate Honors Thesis Mentor  
Invited Speaker, NC DCM Staff Living Shorelines Workshop (~100 people)  
Invited Speaker, Restore America's Estuaries Living Shoreline Workshop (~150 people)  
Field Studies Undergraduate Mentor  
NSF Increasing Diversity and Enhancing Academia (IDEA) Undergraduate Mentor  
UNC Summer Undergraduate Research Fellowship (SURF) Mentor  
SciREN Workshop  
Blue Heron Bowl volunteer
- 2015 Field Studies Undergraduate Mentor  
NSF IDEA Program Undergraduate Mentor  
"At Water's Edge" Teachers Workshop Leader (~35 teachers)  
Communicating Science Conference (ComSciCon)  
Guest Speaker, The Junior Curators Club, Raleigh Science Museum, Raleigh, NC (~30 people)  
NSF Research Educator Exchange Forum Workshop  
Blue Heron Bowl volunteer  
UNC Graduate and Professional Student Federation Senator
- 2014 SciREN Workshop

### **Journals Reviewed For**

*Ecological Engineering*  
*Estuaries and Coasts*  
*Journal of Environmental Management*  
*Journal of Experimental Marine Biology and Ecology*  
*Journal of Marine Science and Engineering*  
*Marine Policy*  
*Sustainability*

### **Proposals Reviewed**

Georgia Sea Grant  
Graduate Women in Science  
Hudson River Foundation  
Mississippi-Alabama Sea Grant

### **Undergraduates and Technicians Mentored (with current positions, if known)**

Anna Brodmerkel (Current Marine Science Instructor, Catalina Island Marine Institute)  
Michele Bradley (Masters in Environmental Management, NCSU)  
Sara Edwards (Science writing intern at the Geophysical Union)  
Abigail Henderson (UC Berkeley Public Health MPH candidate)  
David Kochan (Current PhD student with Alastair Harborne, Florida International University)  
Katie Mcquillan

Isabelle Neylan (Current PhD student with Jay Stachowicz, University of California Davis)  
Francesca Peay (Current Research Technician with Joel Fodrie, UNC Chapel Hill)  
Anderson Tran  
Steven Tulevech

### **Undergraduate Honors Thesis Committees**

2017-2018      Anna Brodmerkel, UNC Chapel Hill

### **Professional Certifications and Memberships**

AAAS student member, Coastal Estuarine Research Federation Member, AAUS Scientific Diver, Divers Alert Network, PADI Dive Master, Society for Ecological Restoration Member

### **Media Coverage**

“State studies how to build resiliency after devastating storms” *WFAE (Charlotte’s NPR Source)* by David Boraks, August 2019. <https://www.wfae.org/post/state-studies-how-build-resiliency-after-devastating-storms#stream/0>

“Study: A bulkhead doesn’t mean property along North Carolina’s estuaries is safe” *The News & Observer* by Adam Wagner, August 2019. <https://www.newsobserver.com/news/weather-news/article233951777.html>

“Jakarta’s giant seawall is useless if the city keeps sinking” *Wired* by Matt Simon, July 2019. <https://www.wired.com/story/jakarta-giant-sea-wall/>

“Why coastal Carolina may never recover from its intensifying hurricanes” *PBS Newshour* by Nsikan Akpan, December 2018. <https://www.pbs.org/newshour/science/why-coastal-carolina-may-never-recover-from-its-intensifying-hurricanes>

“Protecting homes and ecosystems with living shorelines” *UNC Chapel Hill* by Aaron Moger, July 2017. <https://www.unc.edu/discover/living-shorelines/>

“As seas rise, American’s use nature to fight worsening erosion” *Climate Central* by John Upton, July 2017. <http://www.climatecentral.org/news/americans-use-nature-to-fight-erosion-sea-level-rise-21884>

Women in Science Wednesdays, *UNC Endeavors*, August 2017. <http://endeavors.unc.edu/carter-smith/>

“Measuring the Health of a Marsh” *UNC Endeavors*, August 2017. <http://endeavors.unc.edu/measuring-the-health-of-a-marsh/>

Coastal Daybreak Radio Interview, June 2017. <https://youtu.be/TbpRG7YaPl8>

“Living shorelines more cost effective way to control coastal erosion” *WNCT News* by Pierce Legeion, May 2017. <http://wnct.com/2017/05/29/new-research-living-shorelines-more-cost-effective-way-to-control-coastal-erosion/>

“Living shorelines withstand Matthew’s force” *Coastal Review Online*, December 2017. <http://www.coastalreview.org/2016/12/living-shorelines-withstand-matthews-force/>

“Living shorelines, a more natural approach to preventing coastal erosion” *WNCT News* by Pierce Legeion, May 2016. <http://wnct.com/2016/05/17/living-shorelines-a-more-natural-approach-to-preventing-coastal-erosion/>



“PKS Soundfront Environmental Study” *The Shoreline* by Barbara Milhaven, January 2016.

“UNC doctoral students study living shorelines” *WCTI-12 News* by Chris Hoffman, July 2015.  
<http://www.wcti12.com/news/unc-doctoral-students-studies-living-shorelines/34186894>

### **Public Interest Publications**

“What can homeowners tell us about how to protect shorelines” *Coastwatch Currents Blog*, July 2019.  
<https://ncseagrant.ncsu.edu/currents/2019/07/what-can-homeowners-tell-us-about-how-to-protect-our-shorelines/>

“Prioritizing ecology and economy” *The Daily Tar Heel (Tar Heels talk climate)*, November 2017.  
<http://www.dailytarheel.com/article/2017/11/summit-entry-eight-1115>

“Junior curators and whale falls” *Coastwatch Currents Blog*, April 2015.  
<http://ncseagrant.ncsu.edu/blog/2015/04/15/junior-curators-and-whale-falls/>.

“A different path to a doctoral program” *Montclair State University College of Science and Mathematics Newsletter*, Spring 2014 (12). <https://www.montclair.edu/csam/wp-content/uploads/sites/202/2019/01/csam-newsletter-spring-2014.pdf>