Baseline Conditions & Success Rates of NNBF – Virtual Forum II
December 14th, 2023

Hosted by New York Sea Grant & The Science & Resilience Institute at Jamaica Bay

With funding through the US Coastal Research Program, our team is convening this forum to bring together practitioners and stakeholders (researchers and policymakers) from New York State, with experts on natural and nature-based features (NNBF) to facilitate the exchange of experience, insights and innovative solutions that address identified knowledge gaps pertaining to the implementation and management of nature-based solutions in New York State.

To put us one step closer to addressing these gaps, we have invited experts in the field to present case studies from their own work, on how they've managed to tackle these problems.

Speakers:

Dr. Joel Fodrie, Dr. Mariko Polk, Dr. Bret Webb, & Dr. Chester Zarnoch

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Dr. Joel Fodrie

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Dr. Joel Fodrie is a Professor at the Institute of Marine Sciences (UNC-CH), where he studies the population and community ecology of coastal fishes, shellfish, seagrasses, and saltmarshes. Dr. Fodrie has worked along all three major U.S. coastlines, examining: 1) linkages between coastal habitat quality and fishery production; 2) landscape ecology; 3) novel approaches for habitat restoration; 4) marine population connectivity; and 5) effects of harvest pressure and climate variability on long-term population trends of fishery species (using multi-decade data sets). In 2021, USCRP funded Dr. Fodrie's project: Investigating oyster-reef morphodynamics to optimize nature-based infrastructure.

Dr. Fodrie's talk will focus on addressing two data gaps pertaining to living shorelines (LS). Firstly, how do existing LS designs leverage shellfish life history and ecology to promote oyster reef fitness? And secondly, how do said designs impact landward-seaward movement of larger mobile fishes? Looking at his current USCRP-funded project investigating oyster-reef morphodynamics to optimize NNBF, Dr. Fodrie will detail his work with oyster reefs along the Mid- and South Atlantic Coast. The goal of this research is to leverage the natural history of oyster reef formation and growth to optimize the design of intertidal oyster-reef restoration projects aimed at providing shoreline protection and maximizing the provision of ecosystem services and resilience to climate change ensuring a self-sustaining reef in perpetuity. Additionally, Dr. Fodrie will touch on some ongoing related research in North Carolina pertaining to whether living shorelines effectively maintain marine faunal connectivity and diversity in intertidal landscapes.

Relevant Links

- **Dr. Joel Fodrie's Lab Website**
- **Dr. Fodrie's UNC Profile**
- **Dr. Fodrie's Google Scholar**
- **2021 USCRP Funded Research**

- Gittman RK, CH Peterson, CA Currin, FJ Fodrie, MF Piehler, and JF Bruno (2016) Living shorelines can enhance the nursery role of threatened coastal habitats. Ecological Applications 26: 249-263

- Keller DA, RK Gittman, MC Brodeur, MD Kenworthy, JT Ridge, LA Yeager, AB Rodriguez, and FJ Fodrie (2019) Salt marsh shoreline geomorphology influences the development of restored oyster reefs and use by associated fauna. Restoration Ecology 27: 1429-1441

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Dr. Mariko Polk

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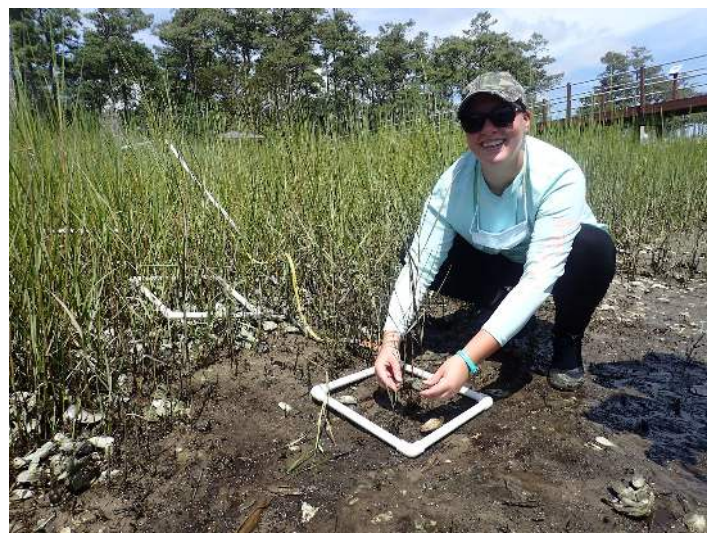
Dr. Mariko Polk serves as the Coastal Processes Specialist for NC Sea Grant and is positioned at UNCW Center for Marine Science. In her position, she serves as a resource for coastal processes and hazards including hurricanes, sea level rise, and climate change. She has expertise in shoreline erosion management, natural and nature-based management, estuary and barrier island ecology, wetland flooding, and sea level rise in NC. Dr. Polk works with managers, organizations, and individual community groups to help generate solutions and best practices to develop communities and habitats that are adaptive, resistant, and resilient. In 2019, USCRP funded Dr. Polk's project: Multidisciplinary quantification of biogeomorphological impacts of living shorelines.

Dr. Polk's talk will focus on benefits of living shorelines (LS), and the multifunctionality of these NNBFs in fringing salt marsh ecosystems. Research shows that LS can and are often promoted as mechanisms that improve resilience, but research is limited to what extent, and many questions exist related to the variability of findings because of site and project characteristics and spatial and temporal variability between studies. Her two-year study seeks to quantify the multifunctionality of LS in fringing salt marshes. LS have the capacity to provide multiple functioning of salt marsh ecosystems although these functions can present different degrees of capacity based on individual site factors. LS provide significant capacity to encourage sediment accumulation, dampen wave energy, serve as potential nekton refugia and oyster brood stock, and facilitate marsh platform habitat. However, like studies in other regions, Dr. Polk's study also found that carbon storage capacity lags behind in comparison to nearby reference sites. Critically, this study begins to explore if results from other regions are seen in North Carolina and if sill LS in fringing salt marshes are able to keep pace with sea level rise via horizontal and vertical marsh development.



Relevant Links

- **Dr. Mariko Polk's LinkedIn**
- **Dr. Polk's Google Scholar**
- **NC Sea Grant Team Page**
- **USCRP 2019 Funded Research**

- Ecosystem Function and Biogeomorphology of Living Shorelines
- Building Coastal Resilience Through Shoreline Management
- Polk MA, RK Gittman, CS Smith, DO Eulie (2022) Coastal resilience surges as living shorelines reduce lateral erosion of salt marshes. Integrated Environmental Assessment and Management, 18(1):82-98
- Correll-Brown R, EH Wellman, DO Eulie, Scyphers SB, Smith CS, Polk MA, Gittman RK (2022) Shifting Baselines May Undermine Shoreline Management Efforts in the United States. Frontiers in Climate, 4, 719109
- Polk M A, DO Eulie (2018) Effectiveness of living shorelines as an erosion control method in North Carolina. Estuaries and Coasts, 41(8):2212-2222

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Dr. Bret M Webb

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Dr. Bret M Webb is a Professor of Civil Engineering at the University of South Alabama. Dr. Webb specializes in coastal engineering, specifically civil engineering that accounts for the unique wave, tide, and sand transport processes in the planning, design, and operation of civil engineering infrastructure within the coastal environment. As a coastal engineer, his research interests include NBS protection, resilience, vulnerability, and general coastal processes like waves, tides, storm surge, and sediment transport. In 2019 USCRP funded Dr. Webb's project: Barrier Island Hydrodynamics and Morphodynamics During an Extreme Event. And again in 2023, for his project: Augmenting Hurricane Sentinel Towers with Chemical and Biological Sensors.

Dr. Webb's talk will focus on a five-year living shoreline (LS) monitoring program. Dr. Webb and his team are continuously monitoring 10 coastal ecosystem restoration projects in Alabama to answer two specific questions: 1) how are these projects performing? and 2) what should be monitored and how should it be measured? In collaboration with the Dauphin Island Sea Lab, they are monitoring a wide range of biological, ecological, geological, and physical parameters (e.g., fish assemblages, benthic infauna, encrusting bivalves, marsh characteristics, sediment characteristics, elevation profiles, shoreline position, water levels, waves, currents, erosion/deposition, water quality, etc.) The ages of these projects range from 2-3 years old to 13-14 years old. Additionally, Dr. Webb may touch on another project: A case study looking at the design/use of an NNBF to enhance the resilience of a coastal road in the town of Brookhaven, NY (Long Island).

Relevant Links

- **Dr. Bret Webb's USA Profile**
- **Dr. Webb's Google Scholar**
- **USCRP 2019 Funded Research**
- **USCRP 2023 Funded Research**

- Comprehensive Living Shoreline Monitoring; Ronnie Baker (DISL PI), Bret Webb (USA PI); 03/16/21-07/31/26; RESTORE Alabama Department of Conservation and Natural Resources
- Webb BM, B Dix, SL Douglass, S Asam, C Cherry, B Buhring (2019) Nature-Based Solutions for Coastal Highway Resilience: An Implementation Guide. 229. Washington, D.C.: U.S. Department of Transportation Federal Highway Administration

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Dr. Chester B Zarnoch

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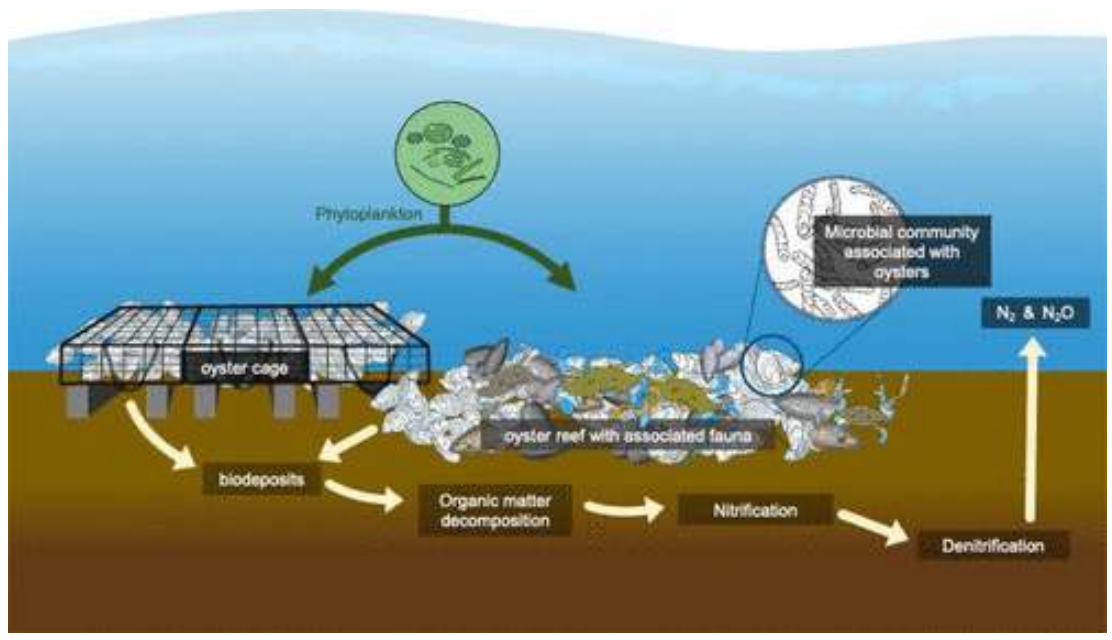
Dr. Chester B Zarnoch is a Professor in the Department of Natural Sciences at CUNY Baruch College. Dr. Zarnoch's research focuses on bivalve aquaculture and restoration. He studies the physiological ecology of bivalves to address issues hindering the success of bivalve restoration efforts and bottlenecks in the aquaculture industry. Examples of his work includes examining the over-winter mortality of juvenile hard clams and collaborating with the Brooklyn College's Aquatic Research and Environmental Assessment Center (AREAC) to examine the early growth of horseshoe crabs and urban aquaculture. And his current assessment of reefs in the Jamaica Bay Wildlife Refuge.

Dr. Zarnoch's talk will focus on bivalve mediated nitrogen (N) removal. Specifically, the role of long-term oyster-mediated denitrification in nutrient management. Oyster suspension feeding and ammonium release via waste and deposition of organic matter to the sediments can stimulate nitrification−denitrification near oyster reefs and aquaculture sites. Oysters also harbor a diverse microbial community in their tissue and shell promoting denitrification and thus enhanced N removal. Additionally, surface areas on oyster reefs provide a habitat for other filter-feeding macrofaunal communities that can further enhance denitrification. Denitrification is a complex biogeochemical process that can be difficult to convey to stakeholders. These complexities have limited consideration and inclusion of oyster-mediated denitrification within nutrient management. Although oyster-mediated denitrification will not be a standalone solution to excess N loading, it may provide an additional management tool that can leverage oyster aquaculture and habitat restoration as a N mitigation strategy. Additionally, Dr. Zarnoch may touch on the roll of ribbed-mussels in living shorelines/salt marshes. Here, he will provide an overview of the biogeochemical processes involved in oyster-mediated denitrification and summarize how it could be incorporated into nutrient management efforts by various stakeholders.



Relevant Links

- **Dr. Chester Zarnoch's Lab Website**
- **Dr. Zarnoch's CUNY Profile**
- **Dr. Zarnoch's Google Scholar**

- Ayvazian S, K Mulvany, C Zarnoch, M Palta, J Reichert-Nguyen, S McNally, M Pilaro, A Jones, C Terry, RW Fulweiler.(2021) Beyond Bioextraction: The Role of Oyster-Mediated Denitrification in Nutrient Management. Environ Sci Technol, 55(21):14457-14465

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