Climate Change
and
Rhode Island’s Natural History Future

17th Rhode Island Natural History Survey
Science Conference

November 15, 2019
Quonset O Club, North Kingstown
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### Plenary Session

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<tr>
<td>7:30</td>
<td>30</td>
<td>Registration</td>
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<tr>
<td>8:15</td>
<td>5</td>
<td>David Gregg: Welcome and logistics, thanks, etc</td>
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<tr>
<td>8:20</td>
<td>20</td>
<td>August: Climate Change in Natural Areas</td>
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<td>8:40</td>
<td>5</td>
<td>August: Introduction for John Torgan</td>
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<tr>
<td>8:45</td>
<td>60</td>
<td>John Torgan: Keynote Address</td>
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<td>9:45</td>
<td>20</td>
<td>Herron: Climate Change in Lakes and Ponds</td>
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### Late Morning Session: Climate Change in Marine Systems

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<tr>
<td>10:20-10:40</td>
<td>20</td>
<td>McManus: Winter Flounder Spawning</td>
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<tr>
<td>10:40-11:00</td>
<td>20</td>
<td>Langan: Winter Flounder Declines</td>
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<tr>
<td>11:00-11:20</td>
<td>20</td>
<td>Collie: 60 Years Fish Trawling</td>
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<td>11:40-12:00</td>
<td>20</td>
<td>Kirk: Toxic Diatoms</td>
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<td>12:00-1:00</td>
<td>60</td>
<td>--LUNCH AND POSTERS--</td>
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### Concurrent Afternoon Session A1: Wetlands and Water

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<tr>
<td>1:00</td>
<td>20</td>
<td>Couret: Bladderwort and Culex</td>
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<td>1:20</td>
<td>20</td>
<td>Buchanan: Spotted Turtles</td>
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<td>1:40</td>
<td>20</td>
<td>Paul: Water Yield Scituate</td>
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<tr>
<td>2:00</td>
<td>20</td>
<td>Paton: Piping Plovers</td>
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### Concurrent Afternoon Session B1: Marine Systems

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<tr>
<td>1:00</td>
<td>20</td>
<td>Oakley: Bay Sedimentation</td>
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<td>1:20</td>
<td>20</td>
<td>Alex: Shad and Alewife</td>
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<td>1:40</td>
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<td>Schumann: Resilience Commerc’l Fishreze</td>
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<td>2:00</td>
<td>20</td>
<td>Long: Future of Local Seafood</td>
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### Concurrent Afternoon Session A2: Uplands

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<tr>
<td>2:40</td>
<td>20</td>
<td>Clarkson: RI Bird Atlas</td>
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<td>3:00</td>
<td>20</td>
<td>Cooper-Mullin: Bird Diet</td>
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<td>3:20</td>
<td>20</td>
<td>Karraker: Salamanders</td>
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<td>3:40</td>
<td>20</td>
<td>Russell: Forest Insect Diversity</td>
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<tr>
<td>4:00</td>
<td>5</td>
<td>Karraker: Closing Remarks</td>
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<tr>
<td>4:05</td>
<td>5</td>
<td>Oakley: Closing Remarks</td>
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<tr>
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<td>--POSTER SESSION AND SOCIAL--</td>
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### Concurrent Session B2: Salt Marsh

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<tr>
<td>2:40</td>
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<td>Chaffee: Partners and Projects</td>
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<td>3:00</td>
<td>20</td>
<td>Kutcher: Rapid Assessments</td>
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<td>3:20</td>
<td>20</td>
<td>Ferguson: Runnels</td>
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<td>3:40</td>
<td>20</td>
<td>Robinson: Salt Marsh Sparrows</td>
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<td>4:00</td>
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<td>Oakley: Closing Remarks</td>
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Thank You, Directors!

This conference would not have been possible without the hard work of the Survey Board of Directors (listed on the inside front cover) Extraordinary efforts were made by the ad hoc conference committee:

   Nancy Karraker, Peter August, Stephen Hale, and Bryan Oakley.

Conference Supporter

Henry & Theresa Godzala Research Fund
of the
Rhode Island Natural History Survey

The conference is supported in part by the Henry & Theresa Godzala Research Fund of the Rhode Island Natural History Survey. Created in 2019 by a dedicated, longtime Survey member, this fund will provide small research grants for Rhode Island-focused projects as well as support for future science conferences.

Henry Godzala was born in Buffalo, NY in 1925. He served in the US Army in Europe during 1943-45, after which he studied electronics at the University of Buffalo under the GI Bill. He and his wife Theresa moved to Florida in 1958 to take jobs with NASA at Cape Canaveral. Due to the classified nature of his work, his family knew few details of his duties, but it was known that he traveled extensively to NASA’s tracking stations around the world. Theresa’s career was as a secretary at NASA. They both retired during the late 1980’s, after taking part in a major portion of US space exploration history.

They both passed away during 2018. Having no children, they willed their joint estate to their great-nephews and great-nieces. To honor their supporting roles in science and their generosity, their beneficiaries have created a research fund at the Rhode Island Natural History Survey. The primary purposes of this fund are to provide small research grants and to provide sponsorship to Rhode Island Natural History Survey science conferences.
Please Thank These Conference Supporters

Natural Resources Conservation Service

The Watch Hill Conservancy

URI Environmental Data Center

The University of Rhode Island
Department of Natural Resources Science
KEYNOTE ADDRESS:

Meeting the Greatest Challenges to Nature in Rhode Island: A Path for Conservation in the Face of Climate Change

John Torgan, State Director, The Nature Conservancy in Rhode Island

ABSTRACTS:

(for oral presentations and posters, alphabetically by first author’s last name)

Climate Change Impacts in Coastal Rhode Island: Managing a Natural Area (Napatree Point) and Informing a Community (Watch Hill)

Peter August, Univ. of Rhode Island Natural Resources & The Watch Hill Conservancy; Bryan Oakley, Eastern CT State Univ.; Janice Sassi, Kevin Rogers, Laura Craver-Rogers, Melissa Cote, Grant Simmons, Deborah Lamm & Jocelyn Lahey, The Watch Hill Conservancy; Hope Leeson, Rhode Island Natural History Survey

The village of Watch Hill, RI and the Napatree Point Conservation Area are ground zero for climate change impacts, especially sea level rise and storm surge. The community feels these effects now; climate change is upon us! The impacts to the natural and built systems in this region are numerous and profound. As a Univ. of Rhode Island Coastal Institute Climate Change Demonstration Site and a designated Globally Important Bird Area (National Audubon Society), we actively manage the heavily-visited Napatree Point Conservation Area to be as resilient as possible to anticipated climate change impacts. Our baseline monitoring data help us know when change is occurring. We carefully manage sand movement to allow for the natural function of the barrier spit on Napatree. Our plant restoration efforts are aimed at providing food for pollinating birds and insects. Our bird surveys and long-term horseshoe crab surveys of Napatree help us understand changes in the composition and phenology of the biota. We recognize that natural areas like Napatree sit within a large, complex, human-dominated landscape. We will describe our diverse efforts to inform the Watch Hill community of anticipated climate change impacts and how the community might adapt to be more resilient to these anticipated changes.
Applying Dredge Sediments to Build Coastal Resiliency in Salt Marshes

Joseph Bishop, US Environmental Protection Agency; Joseph, Loffredo, US Environmental Protection Agency; Danielle, Perry, University of Rhode Island; Caitlin, Chaffee, RI Coastal Resources Management Council; Wenley, Ferguson, Save the Bay

Coastal marshes in the Northeast US are vulnerable to increased flooding due to accelerated sea level rise and an increase in the frequency and severity of storms. Some southern New England salt marshes are drowning in place, and observations of increased interior ponding, stunted and dying grasses, and rapid shoreline erosion have been reported. Increasing salt marsh surface elevation by applying clean dredge sediments is one approach to build coastal resiliency. US Environmental Protection Agency is partnering with the RI Coastal Resource Management Council, Save the Bay, and other partners to examine the effects of varying depths of clean dredge material (+ 5 cm, + 10 cm) on sediment biogeochemistry, porewater nutrients, seed germination, plant productivity, and greenhouse gas fluxes in a mesocosm experiment. This greenhouse experiment is coupled with field monitoring at a nearby coastal site, Quonochontaug Pond, RI that is currently undergoing marsh nourishment with placement of coastal lagoon dredge sediments on its surface. The dredge materials in the field restoration effort and greenhouse experiment are the same. Preliminary results of soil characteristics, seed germination success, pH, redox, salinity and dissolved oxygen of the experimental treatments and controls will be presented. The coupled greenhouse-field research and cooperation among state, NGO, and federal partners allow for innovative monitoring approaches, which address difficult management questions arising from restoration efforts. One such approach being developed concerns the unique problem of collecting surface porewater for measuring soil pH and salinity from the coarse sediment dredge material. Salinity may substantially affect seedling success and overall recolonization. This rapid method assesses soil pH and salinity using a 1:1 (soil:deionized water) dilution and is designed for efficiency of use for those involved in monitoring these elevation enhancement restoration sites.

The State of Spotted Turtles (Clemmys guttata) in Rhode Island: Occupancy along a Landscape Gradient and Characterization of Population Genetic Structure

Scott Buchanan, Rhode Island Dept. of Environmental Management Division of Fish and Wildlife; Bill Buffum, University of Rhode Island; Jason J. Kolbe, University of Rhode Island; Johanna E. Wegener, University of Rhode Island; and Nancy E. Karraker, University of Rhode Island

Spotted turtles (Clemmys guttata) are a species of increasing conservation concern throughout their range. Habitat loss, fragmentation, road mortality, subsidized predators, and illegal collection all contribute to increased pressure on populations. To better assess the distribution, abundance, and demography of spotted turtles in Rhode Island, three-years of systematic surveys were carried out along a landscape gradient in which 88 hydrologically isolated, non-riparian wetlands were trapped throughout the activity season. Occupancy was modeled using a suite of landscape and within-wetland
variables. Spotted turtle occupancy was low, occurring in 8% of wetlands, and they exhibited a strong association with forested, shallow, natural (i.e., not manmade or heavily modified) wetlands. Blood samples were opportunistically collected from wetlands containing spotted turtles in wetlands for population genetic analysis. We genotyped 148 individual spotted turtles from 11 populations, at 17 microsatellite loci. We found evidence of modest inbreeding, as well as tentative evidence of recent population declines. However, genetic diversity and differentiation among sites gave no indication of compromised populations. As our results do not suggest any major signals of genetic degradation in spotted turtles, the southern region of Rhode Island may serve as a regional conservation reserve network, where the maintenance of population viability and connectivity should be prioritized.

All Hands On Deck: The Importance of Partnerships in Addressing Impacts of Climate Change and Sea Level Rise on Rhode Island’s Salt Marshes

Caitlin Chaffee, RI Coastal Resources Management Council

Monitoring, assessment and restoration of salt marshes has long been a collaborative effort in Rhode Island, made ever more urgent by the threat of climate change and accelerated sea level rise. This presentation will give an overview of how state, federal and NGO partners have worked together to develop and implement a robust salt marsh monitoring, assessment and restoration program within Rhode Island. Outputs of the program, such as the Salt Marsh Restoration, Assessment and Monitoring Program (Salt Marsh RAMP) and the Rhode Island Coastal Wetland Restoration strategy will be discussed, along with example case studies of recent marsh restoration and enhancement projects led by the RI Coastal Resources Management Council and Save The Bay.

The Rhode Island Bird Atlas 2.0: An Essential Conservation Tool for Land Trusts

Charles Clarkson, Univ. of Rhode Island; Rhode Island Dept. of Environmental Management; Peter Paton, Univ. of Rhode Island; Jay Osenkowski, Rhode Island Dept. of Environmental Management

Breeding bird atlases have been conducted throughout the world to quantify the local distribution and abundance of birds. In Rhode Island, the first atlas was conducted from 1982-1987, and recorded 164 breeding species in the state, with 155 confirmed. From 2015-2019, Rhode Island Dept. of Environmental Management funded one of the most comprehensive breeding bird atlas projects conducted to date in North America. The second atlas had over 200 volunteers survey 165 25-km² blocks and detected 167 species. Final analyses of second atlas are ongoing, but it is clear that a number of species have increased dramatically since the first atlas (e.g., Common Raven, Red-bellied Woodpecker), whereas other species had declined significantly (e.g., Canada Warbler, American Kestrel) or are now extirpated (e.g., Northern Bobwhite). Most of these changes in populations are due habitat changes such as maturation of forests or loss of early successional habitat. For the second atlas, we also conducted over 3,800 6-min
point count surveys using trained ornithologists at sites randomly located across the state. These surveys were used to develop spatially-explicit density and probability models for most species breeding in Rhode Island. These detailed maps can serve as effective conservation and management tools by state and local entities interested in managing land for specific species or promoting biodiversity. When published, the bird atlas will serve as the most comprehensive collection of information on Rhode Island birds to date. This presentation will review the current bird atlas, discuss the important conservation tools stemming from its completion and make recommendations on how conservation groups can utilize the atlas for targeted land management.

The Univ. of Rhode Island-Graduate School of Oceanography Fish Trawl Survey: Documenting 60 Years of Ecosystem Change in Narragansett Bay

Jeremy Collie, University of Rhode Island; Joseph Langan, Univ. of Rhode Island Graduate School of Oceanography; Austin Humphries, Univ. of Rhode Island College of the Environment and Life Sciences

As a result of rapid warming due to climate change, the marine species assemblage of southern New England has shifted toward a warm-water community faster than any other along the US Atlantic coast. Already posing significant challenges to stakeholders and managers, these ecosystem changes must be monitored and understood in order to adapt and prepare for a warmer future. Conducted at two locations in Narragansett Bay, Rhode Island, the Univ. of Rhode Island-Graduate School of Oceanography weekly fish trawl survey (1959-Present) provides a unique opportunity for in-depth study of changes in the coastal ecosystem. During the past 60 years, survey data indicate that the Narragansett Bay food web has shifted both in its assemblage and organization. Following the decline of cold-water, resident fish species during the 1970s and early-1980s, lower trophic level taxa increased in abundance from an apparent predator release. During the 2000s, however, warm-water, migratory fish species began to dominate the community. Mirroring these shifts in abundance, the residence periods of migratory species in Narragansett Bay have in many cases changed by several months in response to shifting temperature fields across the continental shelf. Taken together, the observations of the Univ. of Rhode Island-Graduate School of Oceanography fish trawl survey suggest that Narragansett Bay now resembles the Carolinian marine province. The insights gained from this unique data set help to anticipate further change in Narragansett Bay and provide an example of the effects of climate change on marine ecosystems.
Dietary Antioxidants and Food Availability Alter Stopover Decisions in Passerines: A Field Experiment

Clara Cooper-Mullin, Univ. of Rhode Island; Scott R. McWilliams, Univ. of Rhode Island

During migration, birds must decide many times when to travel and these decisions are likely contingent on their fuel stores and antioxidant capacity. We manipulated the condition of migrating birds on an offshore stopover site (Rhode Island: 41°13'N, 71°33'W) to test the hypothesis that birds with greater fuel stores and antioxidant capacity have shorter stopovers than lean birds with low antioxidant capacity. We used a 2 X 2 factorial experiment (high or low food availability, dietary anthocyanins or no anthocyanins) in four species of birds that differed in migration strategy: Myrtle Warblers (Setophaga coronata coronata, n = 32), Hermit Thrushes (Catharus guttatus, n = 32), Red-eyed Vireos (Vireo olivaceus, n = 16), and Blackpoll Warblers (Setophaga striata, n = 16). We then attached Avian NanoTags (Lotek Wireless) to assess stopover duration. Oxidative damage was high when birds arrived on stopover, and birds given anthocyanins were able to reduce oxidative damage during captivity more than birds not given anthocyanins. Birds fed ad libitum with anthocyanins were able to increase their antioxidant capacity more than those not given anthocyanins. Stopover was shorter for Hermit Thrushes, Red-eyed Vireos and Blackpoll Warblers fed ad libitum as compared to maintenance food (GLMM, F= 7.52, P = 0.01; F= 2.96, P= 0.09; F= 18.01, P= 0.004 respectively), but not for Myrtle Warblers (GLMM, F= 0.69, P= 0.41). These findings indicate that fat stores and oxidative status can influence the time passerines spend on stopover, and those condition-dependent movements are influenced by a bird’s migration ecology.

Effect of Common Bladderwort (Utricularia vulgaris) on Larval Survival and Adult Oviposition Site Choice of Mosquitoes in the Genus Culex

Jannelle Couret, University of Rhode Island; Jannelle Couret, Biological Sciences Univ. of Rhode Island; Saraswathy Veera, Univ. of Rhode Island; Aya Rothwell, Univ. of Rhode Island; Uchechukwu Njoku, Univ. of Rhode Island; Marco Notarangelo, Univ. of Rhode Island; Roger Lebrun, Plant Science and Entomology, Univ. of Rhode Island; and Howard Ginsberg, USGS

Plants in the genus Utricularia, commonly known as bladderworts, are freshwater, floating, carnivorous plants which ambush and consume small invertebrate prey. These plant predators may offer an ecological pest management tool for the control of mosquito larval populations. We sought to determine the predation efficiency of bladderwort plants in laboratory environments, the impact of bladderwort presence on adult female oviposition site choice, and whether plants can survive and grow in artificial containers. In a laboratory experiment we placed individual mosquito egg rafts into containers with bladderworts, comparing low to high densities of bladders (the structures responsible for predation) and found total predation of Culex restuans larvae at even the lowest bladder density. We found no preference or avoidance of oviposition sites with or without bladderworts in field experiments in early summer (June and July), but a marked difference in August, with a strong preference for oviposition sites with the plant predator
present. Plant samples from ponds in Rhode Island housed for one year thrived indoors when provided with larvae, but also survived in sunlight in the absence of prey. The ability to survive by photosynthesis in the absence of prey and consume larvae throughout the peak period of mosquito populations in Rhode Island suggests this plant may provide an additional tool for ecological pest management plans for mosquitoes.

Where Do Hatchling Diamondback Terrapins Overwinter?

Carolyn Decker, Univ. of Rhode Island; Scott Buchanan, Rhode Island Dept. of Environmental Management Division of Fish and Wildlife; Nancy E. Karraker, University of Rhode Island

The Diamondback terrapin (*Malaclemys t. terrapin*) is a state-endangered turtle in Rhode Island that lives almost exclusively in salt marshes. Although the habitat uses and behaviors of adult terrapins are relatively well known, very little research has been done on hatchling and juvenile terrapins. Recent research in Jamaica Bay, New York suggests that hatchling terrapins spend their first winter on land before moving to the marsh in the spring following emergence. Our research in Barrington, Rhode Island asks: where do diamondback terrapin hatchlings overwinter? This research is ongoing from 2019-2021. We attached nanotag radio transmitters and PIT (passive integrated transponder) tags to hatchlings as they emerged from nests in late summer/early autumn. We attached radio transmitters and PIT tags to 20 hatchlings. We attached only PIT tags to an additional 50 hatchlings. Tagged hatchlings were tracked using radio telemetry and a sweeping PIT tag reader. Locations of hatchlings were plotted with universal transverse mercator (UTM) coordinates on a daily basis for the first four days, then twice weekly over the study period. Habitat data regarding vegetative cover and substrate were also recorded where hatchlings were detected. As of submission of this abstract, five (5) tagged hatchlings moved to the salt marsh within the first week after emergence. Twenty-five (25) tagged hatchlings have been repeatedly detected on land, generally under dense vegetation within 50 meters of their original nest (emergence site). This research sheds light on a poorly understood phase of the terrapin life cycle by gathering spatial data on hatchling terrapin movements and habitat selection. By investigating the behaviors and movements of hatchling terrapins, this research may provide habitat management implications for coastal marshes and their adjacent uplands.

Salt Marsh Response to Shallow Drainage or Runnels

Wenley Ferguson, Save The Bay

Coastal wetlands in southern New England are not keeping pace with sea level rise as evidenced by a transition from a vegetated marsh platform to an increase in die off areas and interior ponding. Installation of shallow creeks or runnels is an adaptive management technique that is being used in marshes in New England including Rhode Island, the Massachusetts section of the Narragansett Bay watershed and New Hampshire. Runnels connect marsh dieback and shallow impounded water areas to existing tidal channels or
ditches. By facilitating drainage, formerly impounded water areas can revegetate with early colonizing species such as Salicornia and eventually Spartina alterniflora and high marsh species dependent upon the marsh elevation. These hydrologic alterations can increase exchange of tidal waters and drainage of groundwater. Runnels can be relatively simple to install with low ground pressure equipment or by hand. Due to their shallow dimensions, runnels need to be maintained to prevent clogging from vegetation or sediment. In this presentation, data will be presented including the effect on the vegetation community, groundwater table and porewater salinities. Additionally lessons learned will be shared from marshes where this adaptation technique has been implemented.

**Increasing Resiliency in Southern New England Oak Forests**

*Amanda Freitas, RI Wildlife Action Plan; Christopher Riely, Sweet Birch Consulting, LLC; Amanda Mahaffey, Forest Stewards Guild*

Southern New England’s oak-dominated forested landscape is iconic, yet most people don’t fully appreciate that all our forests provide. And while 70% of these forests are oak-dominated, silvicultural prescriptions that once worked now fail to secure healthy oak regeneration because of a combination of contemporary threats. Connecticut, Massachusetts, and Rhode Island’s Forest and Wildlife Action Plans identify shared forest threats, including native species loss, invasive pests and pathogens, fragmentation, deer browse, and lack of age diversity, with nearly all exacerbated by climate change. These plans also share priority actions, but resources to act are few. And most forestland is owned by small, private owners; yet landowner decisions don’t always align with landscape-scale biodiversity goals. As we focus on this important work in our own “silos,” connections and opportunities are missed.

This project provides the forum needed to sharing tools and innovations to tackle landscape-level problems. The Forest Stewards Guild and partners across all three states, including the Rhode Island Department of Environmental Management and Rhode Island Woodland Partnership (RIWP), will craft a series of collaborative knowledge sharing events. These include an Oak Regeneration Learning Exchange addressing forest threats and how to effectively communicate them to the public in the context of increasing resilience; an Oak Forest Resilience Assessment Workshop to equip natural resource professionals with oak forest resilience assessment and management tools; and Oak Forest Landowner Stewardship Summits in each state to help landowners recognize signs of unhealthy oak forests, teach forest stewards to communicate with landowners about what is happening on their land and what they can do about it, and build excitement for increasing resiliency. RIWP will prepare a Regional Oak Forest Resilience Synthesis of lessons learned, and outreach materials, presentations, and a final report will extend the benefits of this work well beyond the project.
Assessing Changes in Coastal Ecosystem Engineers and Associated Communities in Narragansett Bay

Lindsay Green-Gavrielidis, Salve Regina University; Gabrielle Pantoni, University of Rhode Island; Niels-Viggo Hobbs, Connecticut College; David Taylor, Roger Williams University; Giancarlo Cicchetti, U.S. Environmental Protection Agency; Carol Thornber, University of Rhode Island

Habitat-forming seaweeds, such as rockweeds and kelps, are ecosystem engineers that form dynamic habitats in cool-water regions and support complex food webs. Rockweeds, such as Fucus spp. and Ascophyllum nodosum, are dominant, temperate seaweeds in the intertidal and shallow subtidal of rocky shorelines, while kelps form complex habitats in the subtidal. Changes in the distribution or abundance of habitat-forming seaweeds can have dramatic consequences for the associated food webs and ecosystem health. Recent anecdotal reports suggest that habitat-forming seaweeds have declined in Narragansett Bay. Accordingly, we hypothesized that the abundance and species composition of rockweed and kelp and their associated invertebrate and fish, have shifted over time in Narragansett Bay. Our research project assessed the current health of economically and ecologically important habitats in Narragansett Bay by revisiting 24 sites that were historically surveyed (1970s and 1980s) and determining how these communities have changed. Video surveys were conducted via SCUBA diving in both the fall and summer using a metal ski mounted with GoPro cameras, underwater lasers, and lights along a 30m transect in order to document seaweeds, invertebrates, and fishes at all sites. Current percent cover of rockweed and kelp at all 24 sites was determined by analysis of the seaweed videos. Our initial results indicate that there has been a significant decline in the percent cover of kelp in Narragansett Bay. Rockweed percent cover has also changed significantly over the past 4 decades and we documented a decline in rockweed in the northern part of the bay, but an increase in percent cover at southern sites. Future research and analyses will determine the consequences of these changes for the wider ecosystem.

Art and Environmental Stewardship

Melissa Guillet, 15 Minute Field Trips

How can art be used to inspire environmental stewardship? A look at education, exploration, and advocacy.

Benthic Invertebrates Are Shifting Northward Along the US Atlantic Coast in Response to Warming Waters

Stephen Hale, U.S. Environmental Protection Agency (retired)

Numerous marine and terrestrial species have shifted their ranges poleward in response to warming from global climate change. However, few studies have examined range shifts of subtidal benthic communities in estuarine and nearshore waters. This study examined 20 years (1990–2010) of occurrence and abundance data of soft-bottom, benthic invertebrates along the Atlantic coast of the USA. Data from two biogeographic
provinces (Carolinian and Virginian), which spanned 15° of latitude from mid-Florida to Cape Cod, were extracted from a national coastal assessment program. Mean water temperatures increased significantly during the study period, bottom water by 1.6 °C and surface water by 1.7 °C. Of 25 species with significant changes in centers of abundance (out of the 30 most prevalent), 18 (60%) shifted northward and 7 (23%) shifted southward. Species that shifted north moved an average distance of 181 km, in contrast with 65 km for species that shifted south. The southern limits of 22 species showed significant northward shifts; because there was little change in northern limits, this resulted in an average 25% range contraction. Community composition changed during the study period, most notably in southern latitudes. Five Carolinian species surmounted their northerly biogeographic boundary. Consequences of these range shifts include changes in benthic community structure and function, which have strong implications for ecosystem functioning and services including changes in fisheries dependent upon benthic prey.

Development and Validation of a Roadkill Hotspot Model for Herpetofauna in Rhode Island

Noah Hallisey, University of Rhode Island; Scott Buchanan, Rhode Island Dept. of Environmental Management Division of Fish and Wildlife; Nancy E. Karraker, University of Rhode Island

Roadways act as barriers to movement and sources of direct mortality for amphibians and reptiles, many of which migrate between uplands and wetlands to breed. Roadways that intersect these migration corridors can have substantial negative consequences for populations. Presence of suitable habitat, proximity of wetlands to roadways, and traffic volume all play roles in road mortality. To reduce mortality, roadways with high road mortality must first be identified. Once identified, reduction methods including fencing and road tunnels can be implemented at these locations. Using Geographic Information Systems (GIS) and pre-existing geospatial datasets, a geospatial model was created for Rhode Island to predict roadways with high levels of amphibian and reptile road mortality. To validate the accuracy of the model, roadways that were predicted to have high levels of road mortality were surveyed. After the first year of validation, 272 dead amphibian and reptiles were identified on the roadways during surveys. Once validated, this model will be used to guide efforts in reducing road mortality in hotspot locations.

Movement and Passage of Alewife and American Shad in the Pawcatuck River

Alex Haro, U.S. Geological Survey, Conte Laboratory

In 2018 and 2019, telemetry of Alewife (Alosa pseudoharengus) and American Shad (A. sapidissima) was conducted at seven mainstem sites on the Pawcatuck River where dams or other barriers were removed, modified, or remain in place with fishways. Alewife ascended throughout entire monitored reach, with some fish entering tributaries. The technical fishways at had modest (~60%) to high (~80%) internal passage efficiency for
Alewife, which ascended fishways with relatively short transit times (< 30 min). Transit times of Alewife between sites was relatively short (1-2 days); transit times were longer for American Shad (2-8 days from Potter Hill to Bradford). Passage efficiency of Alewife through breached dams, nature-like fishways, and a streamgauging weir was relatively high (~60-90%), and none of the sites appeared to be complete barriers to passage of Alewife. Transit times of Alewife and American Shad within sites was relatively short, usually <1 hour. Most American Shad appeared to not ascend much above the second barrier within the mainstem but congregated in deeper lower mainstem reaches. It is likely that American Shad volitionally remained in lower reaches, perhaps because of the presence of suitable spawning habitat there.

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**Climate Change Impacts to RI Lakes and Ponds**

*Elizabeth Herron, Univ. of Rhode Island Watershed Watch; Linda Green, Univ. of Rhode Island Watershed Watch*

Univ. of Rhode Island Watershed Watch (Univ. of Rhode IslandWW) volunteers have produced over three decades of comprehensive data for lakes and ponds in Rhode Island, creating a valuable dataset allowing trends to become apparent. While land use and other changes have occurred throughout those decades, climate change seems to be a larger driver for increases in productivity in many lakes and ponds. This presentation will review some of those impacts, highlighting the value of long-term data sets and the engagement of volunteers in generating credible water quality data. Further it will share information on available data resources for additional research opportunities.

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**Assessment of *Hypena opulenta* (Lepidoptera: Erebidae) as a Biocontrol Agent of Invasive Swallow-worts (*Vincetoxicum* spp.)**

*Lexi Johnson, Univ. of Rhode Island Biocontrol Lab; Karina Camacho, Rebecca Donegan, Alana Russell, Lisa Tewksbury (all Univ. of Rhode Island Biocontrol lab)*

Two species of invasive swallow-worts (*Vincetoxicum nigrum* and *V. rossicum*) were introduced from Europe into the United States at the end of the 19th century as an ornamental. In recent decades swallow-worts have begun to threaten our native flora and fauna. It is especially problematic in pastures and Christmas tree farms. Both species contain toxins which make them unpalatable to livestock. Monarch butterflies have been reported to lay their eggs on *Vincetoxicum* spp., since they are closely related to milkweed, the monarch’s host plant. This is detrimental to monarch populations because monarch caterpillars cannot complete development on swallow-worts. *Hypena opulenta* is a moth species native to Ukraine, that was approved in the US for field release as a biocontrol agent for management of swallow-worts in 2017. The first releases of *H.*
opulenta in the US were made by the Univ. of Rhode Island Biocontrol Lab and all sites will be monitored to evaluate the establishment, reproduction, and impact of *H. opulenta* as a swallow-wort biocontrol agent.

Adult *H. opulenta* were released into large field cages in June and July at seven sites in Rhode Island, Massachusetts, and Connecticut. All releases resulted in egg-laying, larval development, and in half of the sites extensive defoliation of swallow-wort plants. Approximately a month after adults were released, cages were removed to allow larvae to disperse away from the defoliated plants onto new plant material. In some cases, larval feeding and defoliation was found as far as 4m from the release cage. Monitoring will continue to assess whether establishment of *H. opulenta* was successful, demonstrated by emergence of new adults from the overwintered pupae.

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**Using a Common Rhode Island Salamander to Develop Methods for Studying an Endangered Salamander in New Mexico**

*Nancy Karraker, University of Rhode Island; Anne Devan-Song, University of Rhode Island; Ryan Healey, University of Rhode Island; Emma Wilkinson, University of Rhode Island; Sadie DeCurtis, University of Rhode Island; Jessica Lord, University of Rhode Island; Liam Corcoran, University of Rhode Island*

Populations of the Jemez Mountains salamander (*Plethodon neomexicanus*), endemic to a single mountain range in New Mexico, have declined over the past 50 years because of logging, grazing, and high-severity wildfire. Listed as Endangered by the U.S. Fish and Wildlife Service in 2013, it has become challenging to find individuals during surveys. Efforts to document numbers of *P. neomexicanus* in the past have used time-constrained surveys that require searching beneath rocks and logs, and also dismantling larger decaying logs. There has been increasing concern that surveys disturb these important microhabitats and may be further impacting populations. A new method was needed to monitor populations of *P. neomexicanus*, and a common species was needed on which to test the new method. We developed artificial cover objects, called ‘artificial logs’, which consisted of hollow wooden boxes with holes on the underside large enough for salamanders to move through and filled with moist wood chips to mimic the interior of a decaying natural log. Boxes could be opened to check inside for salamanders. We tested their effectiveness against traditional coverboards on the Eastern red-backed salamander (*Plethodon cinereus*), a highly abundant species in Rhode Island that is closely related to and ecologically similar to *P. neomexicanus*. Over four seasons at the Alton Jones Research Forest, we compared the effectiveness of 75 artificial logs and 75 traditional coverboards of similar surface area for sampling salamanders. Salamanders were individually marked to determine densities using each cover type. Density of *P. cinereus* under and within artificial logs were more than two times higher than density under traditional coverboards, indicating their effectiveness as a monitoring tool for *P. cinereus*. Artificial logs are now being tested in New Mexico as a potential method for monitoring populations of the endangered *P. neomexicanus*. 
A Tangled Web: Impacts of Climate Change on North Atlantic Right Whales

Robert D. Kenney, Graduate School of Oceanography, University of Rhode Island; North Atlantic Right Whale Consortium

The North Atlantic right whale, *Eubalaena glacialis*, is the world’s most endangered whale species. After three decades of slow but relatively steady growth, the population has been in decline since about 2010. The immediate cause of the decline is a sharp decrease in birth rate, from a peak of 39 calves in 2009 to a low of zero in 2018, very likely linked to a decline in whale feeding success. These clear reversals in positive trends coincide with substantial ecosystem alterations linked to climate change and ocean warming. The western North Atlantic, including the Gulf of Maine, is one of the fastest-warming regions of the global ocean. The effects of warming on right whales are much more complex than one might predict\(^1\), e.g., thermal stress on the whales, collapse of their food supplies, or expanding distribution and abundance of predators (large sharks). There are complex and interacting effects of ocean temperature, regional ocean circulation patterns, whale movements, underlying abundance of their main prey (copepod zooplankton), copepod over-winter survival, copepod life history, whale habitat-selection patterns, whale movements, the risk of entanglement in commercial fishing gear, and sub-lethal effects of entanglement. While there is little that we can do in the short term to improve right whale calving, we can work to minimize entanglement risk. Under the best-case scenario, if only 100% whale-safe fishing gear had been in use since 1990, the population would still be growing, slowly, despite low calving rates.

\(^1\) And also more complex than any one person or group could work out; the number of individuals who have contributed to this research over the years likely exceeds the number of whales in the population.

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Drivers of Domoic Acid Production in *Pseudo-nitzschia*: Are the Toxic Diatoms in Narragansett Bay Here to Stay?

Riley Kirk, The University of Rhode Island, Department of Biomedical and Pharmaceutical Sciences; Riley Kirk, URI Department of Biomedical and Pharmaceutical Sciences; Alexa Sterling, URI Department of Cell and Molecular Biology; Patrick Wilson, URI Department of Cell and Molecular Biology; Meagan King, URI Department of Biological Sciences

Some marine diatoms in the genus *Pseudo-nitzschia* produce the neurotoxin domoic acid (DA). When toxic strains of *Pseudo-nitzschia* (PN) are present in water bodies they can enter secondary trophic levels via ingestion from filter feeding organisms such as shellfish. Upon consumption of shellfish impregnated with high levels of DA, humans can experience Amnesic Shellfish Poisoning (ASP), resulting in neurological damage, seizures, and occasionally death. With ocean temperatures rising, more extreme weather events occurring, and ocean currents changing, the phytoplankton community distribution is expected to change. Although *Pseudo-nitzschia* species have been present in Narragansett Bay (NB) for over 50 years, the first RI shellfish closure due to high levels of domoic acid wasn’t until October 2016. This event, and the continued detection of DA in the bay suggests that either species composition has shifted towards inhabiting more
toxigenic strains of PN or environmental conditions have changed in favor of making resident PN more toxic. This event sparked interest in identifying environmental drivers that lead to increased DA production as well as identifying PN species composition in the bay. Through weekly sampling of NB, and analysis of factors such as: dissolved nutrients, chlorophyll, temperature, salinity and genotyping, in conjunction with MRM-MS/MS monitoring of DA from seawater samples our group has detected patterns in toxic blooms over time and we have begun to infer environmental drivers of toxin production.

A Comprehensive Rapid Assessment Method to Support Salt Marsh Management in Rhode Island

Tom Kutcher, RI Natural History Survey;

This presentation will focus on the development and implementation of a salt marsh rapid assessment method (MarshRAM) for Rhode Island. The method was developed by the Rhode Island (RI) Natural History Survey in partnership with the RI Department of Environmental Management and the RI Coastal Resources Management Council, with Wetland Program Development Grant funding from Environmental Protection Agency and input from federal, state, NGO, and academic technical partners. MarshRAM draws upon prior work and is designed to efficiently document attributes, ecosystem functions and services, landscape setting, disturbances, platform integrity, and migration potential of salt marshes across the state. The method is intended to generate a reference condition gradient and categories of marsh condition, against which individual marshes can be evaluated for supporting management decisions, such as prioritization for salt marsh conservation or restoration. Findings of a recent application of MarshRAM indicate that it can reflect marsh vulnerability to sea-level rise and other anthropogenic stressors. Development, metrics, implementation, results, and implications will be presented.

The Role of Climate Change in the Decline of Narragansett Bay Winter Flounder

Joseph Langan, Univ. of Rhode Island Graduate School of Oceanography; Joseph Langan, Univ. of Rhode Island Graduate School of Oceanography; Jeremy Collie, Univ. of Rhode Island Graduate School of Oceanography

Winter flounder (*Pseudopleuronectes americanus*) has historically supported large commercial and recreational fisheries as a dominant finfish in the Narragansett Bay, Rhode Island ecosystem. However, its abundance has declined to an all-time low during the past three decades. As a cold-water, estuarine-dependent species, winter flounder has been shown to experience poor recruitment due to increased predation related to warming winters. Through this mechanism, climate change, in addition to past harvest pressure, is thought to be responsible for this population decline. While there are other stressors that could impact winter flounder survivability at different points in its life cycle, there has yet to be a comprehensive assessment of such factors or how they may interact with exploitation and environmental change. This work collated multiple long-term data sets from Rhode Island waters to determine the life-cycle stages at which winter flounder experience increased mortality and identify stressors, including harvest, climate change, predation, and
pollution, that best explain this decreased survival through key factor analysis and structural equation modeling. The model results suggest that year-class size is not determined prior to recruitment to the fishery and both the direct and indirect impacts of climate change, including thermal stress and predation by warm-water fish, are responsible for increased mortality. In building an understanding of life stage-specific mortality and its drivers, these findings can be used to evaluate adaptive fishery management methods to enhance survival of winter flounder throughout its range and ultimately determine the feasibility of recovering one of Narragansett Bay’s most important species.

**Changing Environments and Changing Fisheries – The Future of Local Seafood in the Ocean State**

*Michael Long, Commercial Fisheries Research Foundation; Christopher Glass, Commercial Fisheries Research Foundation; Fred Mattera, Commercial Fisheries Center of Rhode Island; Scott Bode, Pier Fish Company*

With changing environmental conditions in the waters off the coast of Rhode Island, our local marine species are forced to adapt. The same is true of our fishing fleets and seafood consumers; with the abundance and distribution of our local species changing, commercial fishing vessels are diversifying their fishing practices by targeting and landing new species. Along with these changes to fisheries landings, seafood consumers must also adapt and diversify their purchasing habits to support and expand emerging markets for local sustainable seafood. From Jonah crab to scup, squid to black sea bass, and everything in between, there are ample opportunities to enjoy local Rhode Island seafood which comes with fresh quality and great taste. Through discussion of the changing fisheries in southern New England and using scup as an example species, we will discuss expanding local seafood markets in our region, advantages to buying local seafood, and resources available to further pursue local sustainable seafood to match the changing marine ecosystem and fisheries out Rhode Island’s back door.

**Inferring Climate’s Influence on Winter Flounder Spawning Dynamics from Larval Abundance in Narragansett Bay**

*M. Conor McManus, Rhode Island Dept. of Environmental Management Division of Marine Fisheries; Joseph A. Langan, Univ. of Rhode Island-Graduate School of Oceanography; Alison Frey, NOAA-NMFS-NEFSC; Richard J. Bell, The Nature Conservancy; Jeremy S. Collie, Univ. of Rhode Island-Graduate School of Oceanography*

Winter flounder (*Pseudopleuronectes americanus*) has historically supported significant commercial and recreational fisheries in southern New England. However, the Southern New England/Mid-Atlantic Bight winter flounder stock has declined substantially since mid-1980s, including local abundances within Narragansett Bay. While fishing pressure has accounted for part of this decline, changes in climate have been attributed to the lack of recovery of the stock. Specifically, warmer winters have been hypothesized to impact the egg and larval stages in estuaries such as Narragansett Bay though increased
predation. To assess how climate has influenced the dynamics of early-life stage winter flounder, we conducted ichthyoplankton sampling throughout Narragansett Bay during the winter flounder spawning season in 2016 and 2017. Larval abundances from these years were compared to similar work from 2001-2008 to discern how patterns have changed during the past two decades of warming and whether such changes vary across spawning locations within the Bay. Further, larval abundances observed throughout the Bay are compared to young-of-year abundances from seine surveys to ascertain if similar spatial variability corresponds across life stages. Results indicate significant Bay-wide declines in winter flounder larval abundance from the 2000s to the 2010s, similar to those observed in older life stages. Annual larval abundances were correlated to the corresponding winter sea temperature for the Bay and were not spatially uniform; the upper Bay had greater larval abundances than the lower Bay across years. This work provides additional evidence of environmental influence on the winter flounder stock and serves as an example for climate’s influence on Narragansett Bay ecology.

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**Sediment Deposition in the Point Judith Harbor of Refuge since ~1900**

*Bryan Oakley, Eastern Connecticut State University; Cody J. Murphy, Eastern Connecticut State University; Kym K. Lee, Eastern Connecticut State University; Robert J. Hollis, Rhode Island Geological Survey*

The Point Judith Harbor of Refuge, an offshore breakwater harbor constructed between 1891 and 1914 is designed to provide a refuge for shipping traffic, search and rescue operations, a commercial harbor and recreational beaches. Globally, the use of armoring to protect coastal properties from storms, erosion and sea level rise has increased markedly since 1900 and the percentage of hardening could double by 2100. Installation of shoreline protection structures alter the characteristics of the shoreline, sediment transport pathways and can have negative impacts on the fronting beach and adjacent shorelines both physically and ecologically. Sediment deposition behind offshore structures (breakwaters) is expected as the incoming wave energy is reduced. The volume of sediment deposited behind these structures provides an estimate of the rate and direction of sediment transport, important first steps to understanding a coastal systems sediment budget. Sediment budgets remain one of the most useful concepts in coastal research and science-based management of a coastline. The Rhode Island south shore (RISS) has been described as ‘sediment starved’, with an estimated berm volume of $1 \times 10^6$ m$^3$ and less than $4 \times 10^6$ m$^3$ of sediment on the upper shoreface over the entire 30 km shoreline. No sediment budget exists for the RISS and the rates of the various sediment transport pathways remain poorly constrained. Seismic reflection profiling, evaluation of historic bathymetric mapping and sediment coring has provided an estimate on the sediment volume interpreted to be deposited since the offshore breakwaters were constructed >100 years ago. While work is on-going, the estimated volume deposited is $\sim 3.1 \times 10^6$ m$^3$. Assuming sediment began depositing within a few years of initial construction (1891), the annualized rate of deposition is $2.5 \times 10^4$ m $3\text{yr}^{-1}$ over the past 125 years and represents a significant and previously unquantified sediment sink for this system.
Coastal Aquifer Response to Storm Events

Jeeban Panthi, University of Rhode Island; Thomas Boving, Univ. of Rhode Island; Soni M. Pradhanang, Univ. of Rhode Island, Mamoon Ismail, Univ. of Rhode Island

Coastal aquifers are vulnerable to seawater intrusion for many reasons, including over-extraction of groundwater to supply the growing population moving into coastal areas or increasing climatic extremes, such as strong storms. For instance, all drinking water system in RI’s South Coast area pump groundwater from either public or private wells. When more fresh water is pumped than is replenished by natural processes, salt water might intrude into coastal aquifers. The natural interaction of fresh groundwater and saline ocean water is also affected by storms and heavy rains that can push saltwater landwards or can change aquifer hydraulics, respectively. The focus of the study is to analyze the interaction of storm surge and heavy precipitation with coastal aquifer during winter storm and hurricane events. In particular, the project aims at analyzing the temporal variations of groundwater level and precipitation, possibly amplified by sea-level change and anthropogenic factors. Results show that storm events have an effect on groundwater. However, the degree of interaction between storms and groundwater is highly variable.

Local and Regional Movements of Atlantic Coast Piping Plovers

Peter Paton, University of Rhode Island; Pamela Loring, USFWS; John Veale, USFWS

Until recently, biologists were not permitted to band Piping Plovers (Charadrius melodus) in southern New England, although biologists have been tagging other populations for years. Thus little was known about the local and regional movement patterns breeding in Rhode Island and Massachusetts. From 2015-2019, biologists at Univ. of Rhode Island and the USFWS were permitted to use leg flags to uniquely mark 88 adult plovers breeding in Rhode Island and 59 in Massachusetts. Based on observations of flagged birds, we documented that adult plovers are highly site faithful to their previous nest site, with adult females dispersing 117 m, whereas males only disperse on average 68 m between years. After the breeding season, most adults appeared to fly directly to a stopover site in Cape Hatteras, NC, although some individuals were detected stopping briefly at beaches on Long Island south to New Jersey. After staging in NC for about 40-50 days, plovers dispersed to wintering areas, with most birds wintering in the Bahamas or Turks & Caicos, or along the southern Atlantic Coast in Georgia and Florida. Therefore, Piping Plovers breeding in southern New England are extremely vulnerable to hurricanes, such as Dorian, during the non-breeding season.

Assessment of Safe Yield of Scituate Reservoir Under the Future Climate Scenarios

Supria Paul, PhD. student, Univ. of Rhode Island; Thomas B. Boving, Professor, Geosciences; Soni M. Pradhanang, Associate Professor, Geoscience

Safe yield is the maximum quantity of water which can be supplied from a drinking water reservoir during a specified time period during a critical dry year. This definition of safe yield refers to the maintainable yield of drinking water which must be available
continuously during projected future drought conditions. In New England future climate projection point to increasing and more intense precipitation events, which lead to flood and shifting flow pattern. Therefore, safe yield pattern for reservoirs are also changing. In this study, I employed the OASIS model for evaluating the impact of the hydro-climatic extreme events on the water balance of a Scituate reservoir watershed and therefore its safe yield. I postulate that the reservoir’s safe yield management strategies can be adjusted for future climate condition. In my model setup, precipitation, land cover, and soil maps from Soil Survey Geographic Database (SSURGO) have been used. Reservoir storage from Providence water Supply Board was utilized for model calibration and validation with OASIS-simulated storage. I then used RCP 4.5 and RCP 8.5 climate data for projecting safe yield under different climate change scenarios. My results indicate that that detailed reservoir modeling can be used to manage reservoir levels in anticipation of extreme events.

Sediment Enhancement and Hydrological Restoration Impacts on Salt Marsh Vegetation and Soils in Coastal New England

Danielle Perry, University of Rhode Island; Carol Thornber, University of Rhode Island

Salt marsh restoration has become increasingly important in New England due to the impacts of sea level rise. Sea level rise within New England is accelerating at a rate faster than the global average. Therefore, these areas are particularly susceptible to salt marsh loss. Sediment enhancement and hydrological restoration (via dredged runnels) are two types of restoration techniques that have been implemented along the Narrow River in Rhode Island to combat the effects of sea level rise. In this study, we investigated the impacts of these restoration treatments on belowground biomass, soil % organic matter, and vegetation composition. Runnel areas showed an increase in plant density over time as well as higher Spartina patens (high marsh plant) coverage than the Spartina alterniflora (low marsh plant) dominated control areas. The higher Spartina patens coverage in the runnel treatment suggests that additional drainage provided by the runnels is leading to the persistence of high marsh plants. The sediment enhancement treatment resulted in low belowground biomass, soil % organic matter, and plant recolonization. This suggests that the added sediment material inhibited vegetation growth, and therefore belowground biomass and soil % organic matter. We have learned that larger grain size sediment (higher % sand) is important for successful sediment enhancement projects. Our results suggest that dredged runnels can be a potential method to enhance salt marsh resiliency and mitigate sea level rise impacts. For future sediment enhancements projects, we have learned that large sediment grain size is essential for project success.

A Five-Year Study of the Demographics and Breeding Ecology of the Saltmarsh Sparrow in Upper Narragansett Bay

Deirdre E. Robinson, Saltmarsh Sparrow Research Initiative (SALSri.org); Steven E. Reinert, Saltmarsh Sparrow Research Initiative

The Atlantic Coast joint Venture (ACJV)—a regional partnership of 16 state wildlife agencies with a mission of conserving coastal bird populations—has identified the
Saltmarsh Sparrow (SALS) as one of two of the coastal species most vulnerable to sea-level rise. They report in their Salt Marsh Bird Conservation Plan a 9% annual decline in SALS numbers along the Atlantic Coast during recent decades, with an even higher rate of 12.2% specified for the New England states. In concert with ACJV conservation efforts, and with state and local agencies in Rhode Island, Rhode Island Natural History Survey (unpublished report) recognizes the critical vulnerability of salt marshes to sea-level rise, and has invested substantial resources in developing methods for quantitatively assessing salt-marsh communities for their resilience to the more frequent inundations that will result from sea-level rise, and habitat value to wildlife. In 2017 we initiated a five-year project to intensively document aspects of the breeding ecology and demographics of a population of SALS occupying a salt marsh in Warren, RI. During our third year, in 2019, we marked 14 adult females and 20 adult males, and documented the return, since 2017, of 15 marked females, 33 marked males, and 3 SALS banded as nestlings. Thus, in 2019 our 14-ha study-area provided breeding-season habitat for a minimum of 84 adult SALS (63% males). Further, we have documented the fate, microhabitat, and elevation of 85 nests found during the three breeding seasons. SSRI has formed relationships with ACJV, and RINHS, and associated wetlands scientists, and will collaborate with their efforts by providing comprehensive baseline data on SALS habitat-use and demographics to enable validation of their respective efforts to assess habitat quality, gauge SALS population trends, and to, potentially, gauge the effectiveness of habitat management efforts designed to aid salt-marsh-dependent species.

Bees of Coastal Napatree Point and Inland Sites in Southern Rhode Island

Aya Rothwell, University of Rhode Island; Howard Ginsberg, U.S. Geological Survey

We surveyed bees at coastal Napatree Point and two inland sites in southern Rhode Island. We took comparative bee bowl samples at all sites, and we also sampled by netting at Napatree Point. We collected 53 species at Napatree Point (35 species in bee bowls), compared to 66 species in bee bowls at inland sites. Nine species were not previously recorded in RI. The bee fauna at Napatree differed from the inland sites, with twig nesting bees prominent at Napatree and soil nesting bees common at inland sites. Most bees in our samples were generalists, but we found five foraging specialist species active when their hosts plants were in bloom. Some interesting species include sand-associated and cavity nesting species at Napatree Point and soil nesting species at the inland sites.

Using Non-target Insect Collections as a Tool to Improve Understanding of Rhode Island’s Species Diversity and Forest Ecology

Alana Russell, University of Rhode Island Biological Control Lab; Lisa Tewksbury, Univ. of Rhode Island Biological Control Lab; Heather Faubert, Univ. of Rhode Island Plant Clinic; Paul Ricard, Rhode Island Dept. of Environmental Management, Div. of Ag.

Emerald ash borer (EAB) is an invasive insect from China that was introduced into the US in 2002. It was first found in Michigan but spread throughout the eastern US in
subsequent years. EAB is a destructive pest of all ash species (Fraxinus spp.) in North America. After EAB was detected in Connecticut and Massachusetts in 2012, Rhode Island Dept. of Environmental Management Division of Forestry and Univ. of Rhode Island began a program of biosurveillance using Cerceris fumipennis, a solitary wasp that provisions its nests with jewel beetles (Busprestidae). This program was successful and in 2018 EAB was detected for the first time in Rhode Island. Through this process we have collected six field seasons of data on jewel beetle populations in Rhode Island. By identifying all specimens to species level, we have improved understanding of the diversity of jewel beetles in the state, as well as discovered trends in populations that have important implications for the ecology of Rhode Island’s forests. Specifically, we noted a significant increase in two-lined chestnut borer (TLCB, Agrilus bilineatus) populations since 2017. TLCB is a native species that attacks stressed trees, including oaks. Populations of TLCB likely increased due to stress caused to oak trees following gypsy moth (Lymantria dispar) outbreaks in 2016 and 2017, which left much of Rhode Island’s oak population dead or dying. These results demonstrate the value of identifying non-target insects (bycatch) collected while monitoring for an invasive species and can help improve understanding of the ecology in Rhode Island’s forests.

A Stakeholder-led Process to Design Climate Resilience Strategies for Wild-Harvest Commercial Fisheries

Sarah Schumann, RI fishing industry

The state of Rhode Island is home to several fishing ports of varying sizes and a spectrum of vessels targeting numerous species at different scales. The Resilient Fisheries RI project brought together a diverse cross section of fishery participants to identify crosscutting themes related to climate adaptation and resilience. Through 48 one-on-one interviews, 10 evening seminars, one daylong scenarios planning workshop, and a broad industry-based review and feedback process, the project explored current and potential sources of climate vulnerability, and distilled several rules of thumb for building resilience and adaptive capacity in wild-harvest fisheries. Salient themes included alignment of decision-making jurisdictions to changing resource distributions, alignment of access to fishery resources with present-day resource distributions, alignment of the timing of seasonal management actions to coincide with seasonal resource distributions, diversity and flexibility in permitting, ecosystem-based fisheries management, addressing non-climate sources of environmental degradation, improving the knowledge base for fisheries management, increasing the pace and flexibility of fisheries management, innovative marketing as a route to market consistency and diversity, resilient social systems, and participatory governance.
Cultivated Dawn Redwood Records Climate Change in Rhode Island

Nyeka Scott, Laboratory for Terrestrial Environments, Department of Science & Technology, College of Arts and Sciences, Bryant University; Qin Leng, Hong Yang

The Dawn Redwood (Metasequoia glyptostroboides, Cupressaceae) is an endemic conifer species in China. As a living fossil experiencing evolutionary stasis, Metasequoia however was a dominant plant species in the Northern Hemisphere during much of the Cenozoic (65 million years ago to the present). Living trees of this species were first introduced to the United States more than 70 years ago from limited genetic stock in south central China. Cultivated Metasequoia trees in Rhode Island, including five planted on Bryant University campus in 2006, have limited genetic diversity, thus with their morphological, anatomical, and physiological variations attributed to environmental pressures, especially climate changes in this state, providing a unique and informative dataset to track local climate changes.

Carbon and hydrogen isotope analyses of lipids from Metasequoia leaf tissues correlate with precipitation variations as well as other ecological changes such as changes in light irradiation. Stomata Frequency (SF, such as Stomata Density, SD or Stomata Index, SI) studies have revealed correlations with change of historical atmospheric CO2 concentrations. The comparison with its extensive fossil record, especially with chemical and isotopic signatures obtained from exceptionally preserved fossil Metasequoia tissues, provided a baseline data for modeling future climate changes.

Since these Metasequoia trees were planted in New England in the late 1940s, the global CO2 has increased more than 100ppm, and the rate of change has accelerated in the past few decades. As an “Ocean State” Rhode Island is especially vulnerable for sea level changes induced by increasing global temperature. Data from cultivated Metasequoia trees in Rhode Island can offer (1) an archive of tissue specimens to be used for testing various climate change proxies, (2) leaf cuticle data for changing historical CO2 variations, (3) stable isotope records for establishing geological baseline for long term climate change, and (4) morphological and anatomical changes related to rapid climate changes.

Mineral Species of Rhode Island

Josh Wood (josh_wood@uri.edu), Deep Carbon Observatory, Univ. of Rhode Island Graduate School of Oceanography

Carbon is critical to life on Earth. Yet despite carbon’s importance, much is still unknown about the element. How much carbon is there throughout Earth? How does it move from the surface to the core and back again? What forms does it take? Where did it come from? One of the most accessible manifestations of solid carbon in Earth comes in the form of minerals in Earth’s shallow crust. This is a survey of the carbon-bearing minerals found at localities throughout Rhode Island.
VISIT THE TABLE DISPLAYS OF THE FOLLOWING ORGANIZATIONS:

Commercial Fisheries Research Foundation
Eating With The Ecosystem
Northeast Natural History & Supply
RI Coastal Resources Management Council
RI DEM - Division of Agriculture
The Nature Conservancy - RI
URI Biological Control Lab
USDA - NRCS, RI State Office

RHODE ISLAND NATURAL HISTORY SURVEY:

STAFF
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Kyle Hess, Wildlife Biologist Assistant
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Hope D. Leeson, Botanist
Kimberly Justham, Database Manager
Barbara Shaughnessy, Propagation Assistant

CONFERENCE VOLUNTEERS
Robin Baranowski
Sarah Carlson
Nancy Fullerton
Marcia Peña
Carl Sawyer
ORGANIZATIONAL MEMBERS OF THE NATURAL HISTORY SURVEY:

Applied Bio-Systems, Inc.
Block Island Bird Banding Station
Cumberland Land Trust
Denelle Realtors
Ecosystem Solutions, Inc.
Friends of National Wildlife Refuges of RI
Kinney Azalea Gardens
Land Conservancy of North Kingstown
Narragansett Bay National Estuarine Research Reserve
Ocean View Foundation, Inc.
Providence College, Dept. of Biology
RI School of Design, Nature Lab
RI Sea Grant College Program
RI Zoological Society
Richmond Conservation Commission
RIDEM Division of Agriculture
Roger Williams Park, Museum of Natural History
Roger Williams University, Center for Economic & Environmental Development
Rose Island Lighthouse Foundation
South Kingstown Land Trust
The Conservation Agency
The Nature Conservancy of RI
Tupelo Garden Works
URI Biological Control Lab
URI Coastal Institute
URI College of the Environment & Life Sciences (CELS)
URI Watershed Watch
Watch Hill Conservancy
Westerly Land Trust
NOTES:
Rhode Island’s natural history future is up to us.

Thank you for everything you do.

Photo: Noel Rowe
RHODE ISLAND NATURAL HISTORY SURVEY

CASE
There are fewer resources than ever for environmental conservation and natural resource management. But the natural world isn't getting any smaller or less complicated. To be effective at our research, conservation, or educational goals, we need to treat information about the ecosystem like an ecosystem: knowledge needs to be shared and knowledgeable people connected.

MISSION
The Rhode Island Natural History Survey connects people knowledgeable about Rhode Island's animals, plants, and natural systems with each other and with those who can use that knowledge for research, education, and conservation.

VISION
Rhode Island Natural History Survey is an independent non-profit that manages data documenting Rhode Island's species and natural communities, publishes books and articles, and hosts public events including the annual Rhode Island BioBlitz.

HOW CAN YOU HELP?
You’ve made a big difference by supporting the conference. If you’re already a member, thank you. If you're not, memberships are the main way we fund public programs such as lectures, conferences, and the BioBlitz. Please join many of your colleagues here today in supporting these kinds of occasions by joining the Survey. We also appeal for donations at the end of every year to help balance the budget and fund the next year's work plan. If you received an appeal letter in the mail please consider a gift. If you haven’t, you can join in on the appeal on our website. Thank you!

www.rinhs.org

Cover photo: Black Sea Bass (Centropristis striata) by John Lee, thedentedbucket.com