2021 Northeast Natural History Conference Oral Abstracts

Listed in alphabetical order by first-listed presenter (presenter names are in bold). Code at the bottom left of each abstract indicates when in the conference schedule the presentation will be given: Day-Session-Room-Presentation # (thus, for example, Sun-2-E-4 indicates the presentation will be the 4th presentation in Zoom E in the 2nd concurrent oral session time slot on Sunday). The name of the session in which the presentation is included is given at the bottom right of each abstract.

Giants from Antarctica: The Fossil Record of Penguins, Pelagornithids, and Other Birds

Carolina Acosta Hospitaleche (División Paleontología Vertebrados, Museo de La Plata, Paseo del Bosque S/N, 1900, Buenos Aires, Argentina)

Abstract - The fossil record of birds from Antarctica is concentrated in the James Ross Basin, located north-east of the Antarctic Peninsula. The oldest records correspond to the Maastrichtian neornithine birds *Vegavis iaai* (Anseriformes) and the controversial *Polarornis gregorii*, plus the recently described *Antarcticavis capelambensis*, a derived ornithuromorph that might correspond to an Ornithurae although its accurate assignment is not possible due to the poor preservation of the holotype. The Paleogene record is richer and represented mostly by penguins (Sphenisciformes), pseudo-toothed birds (Pelagornithidae), falcons (Falconiformes), and albatrosses (Procellariiformes), besides controversial records of "Ratites", Threskiornithidae, Charadriiformes, Gruiformes, and Phoenicopteriformes. Seymour (Marambio) Island constitutes the most fossiliferous area in Antarctica for fossil vertebrates, the record is heterogeneous for the different groups of birds; the most extensive collections correspond to penguins, whereas groups like the pelagornithids and procellariiforms, with more fragile skeletons, are less represented. Consequently, our knowledge about penguins is more exhaustive and complete. The record includes the Paleocene *Crossvallia unienwillia*, one of the oldest penguin around the world, and more than a dozen Eocene species represented by thousands of remains. Among them, several skeletons belonging to giant species assigned to *Paleeudyptes klekowskii*, *P. gunnari*, *Anthropornis grandis*, and *A. nordenskjöldi*, a dwarf penguin named *Aprosdokitos mikrotero*, and other skulls with extremely elongated and slender bills. Some of these Antarctic species have been recently recognized in the South American record, particularly in southern localities of Chile and Argentina, suggesting a broader distribution area during the Eocene. Other giants recorded in Antarctica belong to Pelagornithidae or pseudo-toothed birds, a group of seabirds characterized by the presence of denticles made of bony expansions of the maxilar and dentary bones that are accompanied by a hooked premaxilar. Antarctic pelagornithids reached more than 6 m of wingspan and were probably excellent gliders. On the contrary, the primitive albatross *Notoleptos giglii* was a small bird in comparison with the living representatives of the group. It shares the Antarctic coasts and the aerial space with the giant pseudo-toothed birds during the Eocene times. Paleogene appears to have been an optimal time for the development of seabirds in these high latitutes.

Fri-1-B-1   Oral Session: Paleozoology: Feathers, Fins, and Fur

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Dwarf and Normal Pitch Pine Populations Respond Differently to Fire: Results From a Long-Term Monitoring Survey

Matthew E. Aiello-Lammens (Pace University, Pleasantville, NY) and Jessica Gurevitch (Stony Brook University, Stony Brook, NY)

Abstract - Variation in demographic structure and properties such as establishment, growth, and survival contribute to differences in population density, size structure, growth rate, and resilience to disturbance. In this study, our goal was to understand how intra-specific variation in life-history characteristics of the tree *Pinus rigida* (Pitch Pine) in the Long Island Pine Barrens (LIPB) contributes to differences in population structure at a landscape level. The LIPB is located in central and eastern Suffolk County, NY, and is an ecosystem dominated, or co-dominated, by *P. rigida*. It includes both normal-stature *P. rigida* forest stands, where the mature tree canopy varies from 8 m to 15 m tall, and the globally rare Dwarf Pine Plains, where the mature tree canopy varies from <1 m to 3 m tall and individuals have a twisted, sometimes multi-stemmed growth form. The precise cause, or causes, of the dwarf growth form remains unknown, though both abiotic conditions, such as soil characteristics, and intrinsic biotic factors, such as genetic differences between normal- and dwarf-stature plants, have been implicated. We intiated a long-term demographic monitoring survey in the LIPB region, including normal, dwarf, and intermediate *P. rigida* stands, following a series of major stand-replacing fires in 1995. We monitored more than 6000 individuals over the course of 13 years, allowing us to estimate population-level survival, growth, fecundity, and prevalence of serotiny values for normal, dwarf, and intermediate stature populations. We found prevalence of serotiny to be significantly higher for dwarf populations (χ^2 = 105.63, df = 2, P << 0.01), resulting in a substantially larger aboveground seedbank in these populations. We parameterized population-specific, stage-based matrix models with the demographic parameter estimates, and found that differences in the aboveground seedbank, which only becomes available post-fire, dramatically influences population responses to a fire. Dwarf populations have much higher seedling mortality in the years immediately following a stand-replacing fire, but because of the larger number of seeds, maintain larger, denser populations of *P. rigida*. This work opens up further avenues of investigation into the interactions between biotic and abiotic factors that may influence the prevalence of dwarf-stature *P. rigida*, including such factors as intra-specific density dependence effects, and ultimately may help inform management of the rare Dwarf Pine Plains ecosystem.

Sun-2-D-4   Oral Session: Pitch Pines and Pine Barrens: Natural History and Human

Incidental Observations of Snakes and Game Birds in a Managed Pine Barren in Massachusetts

Michael E. Akresh (Department of Environmental Studies, Antioch University New England, Keene, NH), Evan D. Meeker (Antioch University New England, Keene, NH), and David I. King (US Forest Service, Northern Research Station, Amherst, MA)

Abstract - *Pinus rigida–Quercus ilicifolia* (Pitch Pine–Scrub Oak; PPSO) barrens are a globally threatened ecosystem that support a number of rare and endangered species. In the absence of natural disturbance, the vitality of this habitat relies on active management, including tree thinning, mechanical mowing, and prescribed burning. However, the effects of this management on many species, especially snakes and game birds, is poorly understood. We examined incidental encounter data of a variety of avian and snake species collected during field work on a managed pine barren in Montague, MA, between the years of 2008 to 2018. In total, we recorded 71 incidental observations, including 43 *Coluber constrictor constrictor* (Northern Black Racer), 8 *Lampropeltis triangulum triangulum* (Eastern Milk Snake), 4 *Thamnophis sirtalis* (Common Garter Snake), 6 *Scolopax minor* (American Woodcock), 2 nests of American Woodcock, 7 nests of *Meleagris gallopavo* (Wild Turkey), and 1 nest of *Anas platyrhynchos* (Mallard Duck). Most of these observations were in open-canopy, managed habitats (Scrub Oak, thinned Pitch Pine, and power-line corridors). We did not conduct extensive surveys in closed-canopy Pitch Pine forests, and we were thus unable to determine the extent of their use. Nonetheless, we at least know that these species are using and nesting in the managed habitats to some extent. We also report other relevant characteristics of our observations in relation to pine barrens management, such as the number of years post-treatment, and the distances to the nearest fire breaks and roads, and forest edges. Our initial findings suggest that management in PPSO barrens is supporting snake and game bird populations, and we recommend further study on these species to better understand the details of their response to management and general usage of pine barrens.

Sun-1-D-1   Oral Session: Biodiversity in Pine Barrens and Heathlands II

Foraging and In-colony Behavior of Breeding Leach's Storm-Petrels in the Gulf of Maine

Sam Albright (University of Southern Maine, Portland, ME), Linda Welch (USFWS Maine Coastal Islands National Wildlife Refuge, Milbridge, ME), Anya O'Meara (University of Southern Maine, Portland, ME), and Karen Wilson (University of Southern Maine, Portland, ME)

Abstract - *Hydrobates leuchorhus* (Leach's Storm-petrel) is a nocturnal, burrow nesting seabird that breeds in the northern Atlantic and the Pacific. The bulk of Leach's Storm-petrel population breeds in eastern Canada, where some colonies have declined by as much as 40% in recent decades. Work is ongoing in the Gulf of Maine to understand breeding populations. We investigated foraging and in-colony activity on Petit Manan and Metinic Islands in the Gulf of Maine. We deployed PathTrack GPS tracking tags and set up passive acoustic SongMeters and game cameras within colonies We obtained 6 foraging tracks from petrels nesting in 2019. Most birds spent the majority of their time foraging just inshore of Georges Bank. Trips were a mean of 6 days, and individuals traveled 200–850 km from their colonies. In 2020, we used 5 passive acoustic recording devices and 12 game cameras to monitor vocal and physical behavior of petrels on Metinic Island. We observed a number of behaviors in the colony including chicks strengthening wings, and interactions between multiple adults. These observations increase our understanding of colony attendance and movement patterns of Leach's Storm-petrels in the Gulf of Maine.

Fri-2-E-1   Oral Session: Avian Breeding Season Ecology Along the Coast

Horseshoe Crab Interactions within a Newly Restored Fringing Marsh of Stratford Point, Connecticut

Alex Amankwah-Asare (Sacred Heart University, Fairfield, CT), Jo-Marie Kasinak (Sacred Heart University, Fairfield, CT), and Jennifer H. Mattei (Sacred Heart University, Fairfield, CT)

Abstract - Long Island Sound is an urban estuary that has eroding beaches, loss of nearly all of its natural oyster reefs, and a substantial area of both low and high saltmarsh grasses due to the effects of climate change and human alteration of the shoreline including the installation of sea walls. An example of loss can be seen along the western shore of the Housatonic River at Stratford Point, CT. Sea-level rise and erosion from storms has led to the breakup of fringing marsh and shoreline erosion. Over the last 10 years, average annual spawning counts (spawning index [SI]) of *Limulus polyphemus* (Atlantic Horseshoe Crab) have declined from an already low of 0.035 females/m^2 to 0.01 in 2017 across Long Island Sound. Nature-based restoration efforts, where a combination of gray and green structures was used to allow habitat recovery along the Stratford Point shoreline began in 2014. *Spartina alterniflora* (Saltmarsh Cordgrass) has steadily increased in height and density in ~1 ha (~2.5 acres) within the restoration area. The SI for Horseshoe Crabs in Stratford prior to restoration was 0.02 females/m^2. The SI varies greatly over each spawning season dependent on wind, storm conditions, and water temperature; however, on average over the past 4 years, it has increased slightly (SI = 0.03) after restoration activity was completed. The Stratford Point Living Shoreline will be monitored annually for changes in biodiversity and use by once dominant species like the Horseshoe Crab and *Crassostrea virginica* (Eastern Oyster).

Sun-1-A-3   Oral Session: Horseshoe Crab Ecology I

Less Shelter in Shelterwoods: Management Strategies Change Epiphytic Microarthropod Assemblages

Tahnee Ames (Department of Environmental Biology, SUNY ESF, Syracuse, NY), Gregory G. McGee (Department of Environmental Biology, SUNY ESF, Syracuse, NY), and David A. Bullis (Department of Environmental Biology, SUNY ESF, Syracuse, NY)

Abstract - Epiphytic lichens and bryophytes are often indicators of old-growth forests, and provide important ecological services such as shelter and nutrition to a host of animals. A more species-rich and abundant community of lichens and bryophytes allows for a more diverse community of associated microarthropods, consequently increasing high-level trophic diversity. The response of these epiphytic communities to disturbance and management strategies, however, is not well known. In this study, we compare forest management impacts on richness, abundance, and diversity of microarthropods and compare the microarthropod communities between 2 contiguous northern hardwood stands in the Adirondack Mountains, NY. The shelterwood logging method creates gaps in canopy cover, resulting in increased light penetration compared to a fully stocked forest, leading to higher temperatures and water loss. In July 2020, we extracted eight 25-cm^2 samples of 4 epiphytic bryophyte and 3 epiphytic lichen species from *Acer saccharum* (Sugar Maple) trees in both the shelterwood and in the interior of reserve strips of an adjacent stand that received a strip clear-cut which served as a proxy for a full forest. We resolved the extracted microarthropods to the family level. Our results indicate that bryophytes are susceptible to desiccation under low canopy cover in the shelterwood, but are better buffered from harsh understory conditions within the residual patches in the strip cuts. Abundance, richness, and diversity of microarthropods associated with bryophytes were negatively affected by the decrease in canopy cover in the shelterwood. Beta-diversity was likewise affected by these changes in abiotic condition, with healthy bryophytes hosting a wider and more highly structured community of microarthropods compared to the desiccated bryophyte mats in the shelterwood. This study elucidates impacts of different harvesting strategies on nuanced biodiversity patterns in often overlooked but very biodiverse microhabitats.

Fri-1-F-1   Oral Session: Forest Ecology

Habitat, Life History, and Phenology of a Non-Native Ant-Mimicking Spider, *Myrmarachne formicaria*

Jennifer L. Apple (SUNY Geneseo, Geneseo, NY)

Abstract - The ant-mimicking spider *Myrmarachne formicaria* (Araneae: Salticidae) is a recent arrival to North America from Eurasia, but little is known about its natural history in its native or invaded range. Most published accounts of this species in North America are from domestic settings inside or near buildings. Long-term study of populations of mound-nesting ants in Geneseo, NY, revealed an increasing incidence of *M. formicaria* as they are often seen near ant nests, with silken shelters built on the vinyl flags marking colonies. To determine if these spiders are associated with ant density or specific habitats, I employed grids of pin flags as a sampling method at 18 sites. I visited grids weekly over summer 2019 and summer 2020 to check for the presence, stage, and sex of *M. formicaria* on the flags. Ants were sampled at each site in 2019 using pitfall traps and baits. Though commonly encountered near *Formica* ant nests in the main study area, *M. formicaria* can be found in areas devoid of such nests. They were rare in older forest with a sparse understory, but frequently found in younger forest, forest edges, and fields. In natural settings *M. formicaria* builds its silken shelters in leaf folds. Egg masses were noted in early June, while spiderlings appeared in early July. Observations of field and captive spiders indicate that females remain in shelters with eggs and spiderlings for an extended time. Females or juveniles were much more common in surveyed sites than mature males, which were not apparent until August, or at least were less likely to shelter on flags used for surveys before late summer. Continued work includes assessing the nature of *M. formicaria's* interactions with ants and other spiders as well as characterizing genetic variation across its introduced range. These findings expand our knowledge of the natural history of this recently introduced species, which is critical to predicting its impact on the native arthropod community

Sun-2-F-1   Oral Session: Life Histories of Northeastern Arthropods

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Landscape Ecology of Forest Mammals along a Gradient of Urbanization: A Hierarchical Scale Approach

Daniel R. Ardia (Franklin & Marshall College, Lancaster, PA)

Abstract - Urbanization changes the composition and function of ecosystems, particularly through habitat fragmentation, where large habitats become disjointed into smaller, disconnected patches. Here I provide results of an ongoing study of distribution and abundance of forest mammals in Lancaster and York counties, PA, along a gradient of urbanization. I have rotated trail cameras among forest patches since 2015. I use a hierarchical scale approach to test for relative influence of factors related to (1) the position of forest areas in the landscape (the matrix), (2) characteristics of the forest patch itself, and (3) the internal composition of the patch and the use of the patch for human recreation. I placed trail cameras using a stratified design to rotate across patches to maximize seasonal coverage, patch size and matrix, recreational pressure, and distance from an urban area. Since 2015, I have made >400 camera placements for periods varying from 4 to12 weeks. As recreational pressure can have detrimental effects on wildlife through habitat alteration and through disturbance, I also tested explicitly for the effects of recreation on the temporal and spatial habitat use of wildlife. In general, most species were found in most patches, though more forest-sensitive species were less likely to be found in smaller patches or those surrounded by development. Recreation appeared to be the strongest predictor with increased recreational pressure leading to temporal and spatial changes. A further aspect of the study as a frame to understand socioeconomic disparities in green space and the role of informal green spaces will also be discussed.

Sun-1-C-4   Oral Session: Urban Ecology and Environmental Justice II

Male Availability but not Breeding Synchrony Affects Extra-Pair Paternity in a Grassland Specialist: The Grass Wren (*Cistothorus platensis*)

Ramiro Santiago Arrieta (Biología de Aves – Instituto Argentino de Investigaciones de Zonas Áridas, CONICET, Mendoza, Argentina), Leonardo Campagna (Cornell Lab of Ornithology, Ithaca, NY, USA), Bettina Mahler (Departamento de Ecología, Genética y Evolución, IEGEBA – CONICET, Facultad de Ciencias Exactas y Naturales, Universidad de Buenos Aires, Buenos Aires, Argentina), and Paulo E. Llambías (Biología de Aves – Instituto Argentino de Investigaciones de Zonas Áridas, CONICET, Mendoza, Argentina)

Abstract - Demographic factors are thought to affect the frequency of extra-pair paternity (EPP) in birds, as the distribution and availability of potential mates in both space and time should determine the rate of encounters between females and males. We examined the influence of breeding density, synchrony, and adult sex ratio (ASR) on the genetic mating system of a south temperate population of *Cistothorus platensis* (Grass Wren). The Grass Wren is a small, territorial, socially monogamous passerine, broadly distributed across South America. Over 3 breeding seasons, we intensively studied the breeding system of Grass Wrens and genotyped 73 broods (319 nestlings) to estimate the EPP rate and the presence of extra-pair offspring (EPO) in the nest. Our analyses focused on a local demographic scale that considers the spatial interactions of wrens. We calculated the mean distance that individuals moved to obtain extra-pair fertilizations (130.4 ± 0.1 m). We then defined a radius of 130 m around each nest containing a genotyped brood and calculated within this area the local breeding density, synchrony, and ASR. We found that the EPP rate increases with the number of males (higher local ASR). However, the local ASR did not affect the presence of EPO in the nest. Neither the local breeding density nor the local breeding synchrony influenced the EPP rate or the presence of EPO in the nest. Our results suggest that extra-pair behavior in Grass Wrens was driven by male availability, whereas the simultaneous fertility of females did not affect extra-pair fertilizations. Breeding synchrony may increase EPP rates if the simultaneous display of males allows females to more accurately compare potential mates. However, year-round territoriality of Grass Wrens may allow females to assess social and extra-pair mates throughout the year. Setting a local demographic approach that effectively reflects the social interactions among individuals is essential to evaluate the impact of demographic factors on extra-pair behavior.

Sat-3-E-3   Oral Session: Behavior and Ecology of Neotropical Birds

Habitat Selection by Eastern Whip-poor-will on Migration and Winter Locations

Marja Bakermans (Department of Biology and Biotechnology, Worcester Polytechnic Institute, Worcester, MA), Andrew Vitz (Massachusetts Division of Fisheries & Wildlife, Westborough, MA), and Joshua Driscoll (Department of Biology and Biotechnology, Worcester Polytechnic Institute, Worcester, MA)

Abstract - Full life-cycle conservation is critical for *Antrostomus vociferous* (Eastern Whip-poor-will), an aerial insectivore in steep decline (4.4% annual decline in New England since 1966). Since 2018, we focused efforts on Whip-poor-will movements and habitat selection during migration and on the wintering grounds. We fitted Whip-poor-wills breeding in Massachusetts with Pinpoint GPS loggers (Lotek) programmed to collect location data during the migratory and over-wintering periods and retrieved and downloaded data from 30 units. We quantified land-cover data using the North American Land Change Monitoring System and aerial imagery. Preliminary results indicate that for migration and wintering locations, birds selected areas with significantly more forest cover (and less agricultural cover) compared to random locations, and this pattern held at multiple spatial scales. These data suggest that habitat loss and fragmentation on the wintering grounds and migration routes could be contributing to population declines.

Sun-1-E-1   Oral Session: Full-cycle Nightjar Monitoring in Eastern North America

Does Living in the City Make Northern Cardinals Change Color?

Daniel T. Baldassarre (SUNY Oswego, Oswego, NY) and Kristie M. Drzewiecki (SUNY Oswego, Oswego, NY)

Abstract - Urbanization is rapidly increasing, and it is critical that we understand how wildlife responds to such anthropogenic change. *Cardinalis cardinalis* (Northern Cardinal) is a widespread songbird that readily breeds in urban areas. One way urbanization may affect Northern Cardinals is by altering their plumage color, which is used as a sexual signal. Such a color change can happen if urban birds have a different diet than rural birds, since dietary carotenoids contribute to color variation. To test this idea, we captured Northern Cardinals at a rural and urban site in upstate New York and compared the color of multiple plumage patches using reflectance spectrometry and image analysis. Our preliminary results indicate little to no difference in plumage color, although data collection is ongoing. If Northern Cardinal plumage color is unaffected by urbanization, this may be a partial explanation for why this species is so adept at colonizing and breeding in urban areas.

Fri-3-E-1   Oral Session: Avian Ecology in Urban Areas

The Effects of Nest Conditions and Weather on Body Condition and Juvenile Recruitment

Adele Balmer (Virginia Commonwealth University, Richmond, VA), Derek Johnson (Virginia Commonwealth University, Richmond, VA), and Lesley Bulluck (Virginia Commonwealth University, Richmond, VA)

Abstract - Juvenile recruitment, the assimilation of offspring into a breeding population, is a key process that significantly influences population growth; however, it is difficult to measure for mobile organisms and therefore often poorly understood. The rapid declines seen in many migrant songbirds have led to a need to identify limiting factors in populations, including juvenile mortality. The goal of this study was to understand how different weather conditions and nest factors affect nestling body condition (mass adjusted for age) and juvenile recruitment. Specifically, we investigated how hatch date, brood size, mother's age, precipitation, and temperature affected nestling body condition and juvenile recruitment in female *Protonotaria citrea* (Prothonotary Warbler) between 2010 and 2020. We also looked at the how the multivariate El Niño Southern Oscillation (ENSO) Index during their overwintering period affected juvenile recruitment. Prothonotary Warblers are Neotropical migratory songbirds known to have high site fidelity, making them an ideal species for studying population dynamics. We found that the juvenile female Prothonotary Warblers at our field site (n = 3431) located along the James River, in Henrico County, VA, had an average annual recruitment rate of 6.48% ± 2.86 (min–max = 0.00–8.78) between 2009 and 2020. Using the 'climwin' R package, we found that a 9-day precipitation window starting 12 days before a nestling's hatch date, and a 7-day temperature window beginning 6 days before hatching positively correlated with body condition. Using a piecewise structural equation model, we calculated relative contribution of each predictor variable to its response variable in our study. We found that hatch date was the strongest predictor for both nestling condition and juvenile recruitment; however, brood size, temperature, precipitation, and the ENSO Index prior to the year they hatched also influenced nestling body condition. Interestingly, body condition was positively correlated with recruitment for birds hatched later in the season but was not associated with recruitment for birds hatched earlier in the season. The results of this study can be used to help advance the ecological understanding of the limited factors of declining migratory songbirds.

Fri-2-A-1   Oral Session: Climate Effects on Birds

Addressing Biases in Community Science Data to Document Phenology Patterns at Broad Spatial and Phylogenetic Scales

Michael W. Belitz (Florida Museum of Natural History, Gainesville, FL), Elise A. Larse (Georgetown University, Washington, DC), Leslie Ries (Georgetown University, Washington, DC), and Rob Guralnick (Florida Museum of Natural History, Gainesville, FL)

Abstract - Shifts in the timing of seasonal events (i.e., phenology) are one of the most immediate and apparent responses to global climate change, but data limitations have made examining phenology patterns across greater taxonomic, spatial, and temporal scales challenging. One growing opportunity is leveraging rapidly increasing data resources from community science platforms. However, these data can be biased spatially and taxonomically, potentially leading to erroneous biological conclusions if appropriate data curation and modeling strategies are not used. Here, we will present recent and ongoing research exploring the novel methods of estimating phenology metrics using incidental community science observations. We will describe the mathematical framework used to develop a new presence-only phenology estimator, available in an R package titled 'phenesse'. We will then examine the accuracy of this and other phenology estimators across a suite of simulated and empirical examples. We will also present a case study that showcases a framework that can be used to answer fundamental questions of insect phenology across broad spatial and phylogenetic scales using community science records from iNaturalist. Collectively, incidental community science data provides a sizable resource for phenological research, and continued work to integrate the strengths and weaknesses inherent to these data promises to provide critical insight into pressing ecological issues.

Sat-2-C-1   Oral Session: How to Make Meaning of Citizen Science and Biodiversity

Physiology of Cooperative Antipredator Behavior in Trinidadian Guppies

Bronwyn H. Bleakley (Stonehill College, Easton, MA), Apsara Gurung (Stonehill College, Easton, MA), Ana Alcantara (Stonehill College, Easton, MA), Katie Helliwell (Stonehill College, Easton, MA), Quentin Odom-Lewis (Stonehill College, Easton, MA), Jason Brandt (Stonehill College, Easton, MA), Caitlyn Weston (Stonehill College, Easton, MA), Samantha Ormesher (Stonehill College, Easton, MA), and Alyssa Patti (Stonehill College, Easton, MA)

Abstract - *Poecilia reticulata* (Trinidadian Guppy) engage in a suite of cooperative antipredator behaviors that is highly sensitive to the behavior of their social partners. Visual, mechanosensory, and chemical cues may all provide information that allows partners to coordinate their antipredator behavior. We investigated whether wild fish from populations that differ in their historical exposure to predators differ in visual acuity and/or the number of neuromasts that comprise the lateral line organ and whether they provide different chemical environments for their social partners by excreting different amounts of estradiol during short-term interactions. Fish were obtained from both high and low predation populations on the Aripo and Turure rivers in the Northern mountain range in Trinidad.

Sat-2-A-3   Oral Session: Fish Biology II: Anatomy, Physiology, Behavior

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Naturalized Scotch Broom (*Cytisus scoparius*) on Nantucket Island, Massachusetts: A Proposal for Invasive Listing

Sarah T. Bois (Linda Loring Nature Foundation, Nantucket, MA)

Abstract - *Cytisus scoparius* (Scotch Broom) has been introduced to many parts of the world as an ornamental for its evergreen foliage and beautiful yellow flowers. In some parts of North America, primarily on the western coast, it has become one of the worst invaders in terms of ecological and economic impact. It is considered by some researchers and land managers as invasive in parts of coastal New England. However, Scotch Broom has not been listed as invasive or potentially invasive in any New England state. Having been introduced to New England in the early 1800s, Scotch Broom's low freeze tolerance has historically limited spread and potential range expansion. However, warmer winter temperatures seen with global climate change have made parts of New England, such as the maritime coast, potentially more tolerant for species like Scotch Broom. We investigate the extent of Scotch Broom presence on Nantucket Island, a first step in understanding its invasiveness on the island. Nantucket's unique assemblage of rare species habitats make it particularly vulnerable to nonnative species invasion. We seek to demonstrate that not only has Scotch Broom established naturalized populations in minimally managed habitats on the island, but that it is reproducing and expanding on the landscape. This project provides supporting documentation for listing Scotch Broom as an invasive species with the Massachusetts Invasive Plant Advisory Group. To date, we have documented close to 400 individual Scotch Broom plants across the island found in a variety of habitats. We have documented evidence of reproduction in the form of seedlings and dehiscent seed pods. Location data has been used to investigate patterns of habitat use and amount of minimally managed habitats impacted. Listing Scotch Broom as invasive within Massachusetts will prevent further sale and transport of the plant and will bolster efforts to reduce populations in coastal communities.

Fri-1-D-2   Oral Session: Invasive Species in the Northeast: Regulatory Approaches and

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How Does Human Activity Affect Wildlife Use of Existing Highway Crossing Structures?

Valerie Bolduc (Concordia University, Montreal, QC, Canada), Kendra Warnock-Juteau (Concordia University, Montreal, QC, Canada), and Jochen Jaeger (Concordia University, Montreal, QC, Canada)

Abstract - Previous research has found a link between wildlife use of non-purpose-built crossing structures and human activity, but the results are ambiguous. The goal of our research is to expand on these findings and better understand the influence of human-caused disturbances on the local fauna's use of these existing passageways. To gather data, we employed infra-red motion capture cameras to document the use of the crossing structures by both humans and other mammals. These images were collected in the various large and medium-sized underpasses under Autoroute 10 in Quebec, Canada. More detailed understanding of the relationship between human activity levels for different types of human use (pedestrians, ATVs, vehicles, trains, etc.) and use by wildlife could lead to improvements and a greater use of these structures by wildlife currently impacted by habitat fragmentation and road mortality. For example, there may be thresholds in the use by humans above which wildlife does not use them any more. Knowing how human activity impacts wildlife using crossings is particularly beneficial and cost-effective for the co-use of infrastructure not initially intended for animal use.

Fri-3-D-3   Oral Session: Trail Camera Wildlife Monitoring in Human-dominated

Stable Isotopes Reveal Contrasting Trophodynamics across American Horseshoe Crab Age Groups

Justin J. Bopp (SUNY Stony Brook, Stony Brook, NY), Jill Olin (Michigan Technological University, Houghton, MI), Matthew Sclafani (Cornell Cooperative Extension of Suffolk County, Riverhead, NY), and Robert Cerrato (SUNY Stony Brook, NY)

Abstract - Quantifying the trophodynamics of marine species can be challenging, particularly across age, but is critical to understand their functional roles in local ecosystems and identify important habitats that are necessary for their persistence. Despite being a well-studied marine invertebrate, the trophic niche characteristics, and resource use patterns of *Limulus polyphemus* (American Horseshoe Crab) have not been rigorously quantified between populations, among ontogenetic stages and across seasons. Here, we used stable isotopes of carbon, nitrogen, and sulfur to quantify trophic niche metrics (i.e., θ and ellipse eccentricity), trophic niche overlap, and trophic position between Horseshoe Crab age groups (juveniles, sub-adults, and adults), locations (Long Island Sound [LIS] and Moriches Bay, NY [MB]) and seasons (spring and fall). The proportional contributions of basal organic matter resource pools assimilated in Horseshoe Crab tissues were quantified and compared between age groups to determine if resource use differed across older ontogenetic stages. Sub-adults (instars 16–18) had higher niche overlap (median = 87.7%; 95% CI = 74.0–97.0) with adults compared to juvenile (instars 14–15) overlap with adults (median = 49.3%; 95% CI = 19.0–80.0) in MB. In contrast, adults exhibited lower niche overlap estimates with both sub-adult (29.9%; 95% CI = 19.0–44.0) and juvenile age groups (23.1%; 95% CI = 10.0–48.0), presumably from differences in resource-use patterns between these groups. In MB, adult crabs predominantly relied on phytoplankton-based pathways (51%; 95% CI = 10.1–75.1), whereas immature crabs primarily relied on sedimentary organic matter (39%; 95% CI = 4.6–69.0) and phytoplankton (31.7; 95% CI = 2.6–68.7) to meet energetic requirements and did not predominantly rely on a single resource pool. Despite these differences, trophic position estimates differed by <0.10 between juvenile/sub-adult and adult crabs, suggesting these age groups have similar functional roles. No seasonal differences in resource use were present in Horseshoe Crabs, suggesting foraging patterns remain static over time. Adult crabs in LIS exhibited 4-fold higher θ values and the lowest eccentricity values relative to mature and immature crabs in MB, indicating LIS crabs exhibited greater foraging specialization. Although our results corroborate previous evidence that Horseshoe Crabs are dietary generalists, we provide novel insight into the intricacies of their trophic patterns and ecological roles across disparate ontogenetic stages and populations.

Sun-2-A-2   Oral Session: Horseshoe Crab Ecology II

Mapping in Extreme Shallow Waters and Providing Useful Data to Scientists, Managers, and the Public

Mark Borrelli (UMass, Boston, MA, and Center for Coastal Studies, Provincetown, MA)

Abstract - Mapping in shallow coastal waters can be hazardous, time-consuming, and prohibitively expensive. Technological advances related to the collection of vessel-based acoustic data (bathymetry and sidescan) have improved greatly over the last 10–15 years. Among the most advanced systems are phase-measuring sidescan sonars. These instruments collect co-located bathymetry and sidescan sonar imagery simultaneously. Two- and three-dimensional spatial acoustic data from have been used to quantitatively document seagrass, kelp, algae, shellfish, sediment transport (erosion and deposition), as well as anthropogenic impacts from competing uses that include derelict fishing gear and other marine debris, impacts from mooring blocks, and other recreational uses. With spatial acoustic and additional data from bottom-grab samples, benthic invertebrates, sediment coring, and sub-bottom profiling, we can provide a better understanding of the nearshore coastal ecosystem with regards to past evolution, current state, and potential future change.

Sat-2-B-1   Oral Session: Coastal Marine Habitats of the Northwest Atlantic

Patterns of Carapace Condition and Epibiont Distribution on Horseshoe Crabs from Two Northeastern Bays

Mark L. Botton (Fordham University, New York, NY), Christina P. Colon (Kingsborough Community College, City University of New York, Brooklyn, NY), Shiva Jean-Baptiste (Kingsborough Community College, City University of New York, Brooklyn, NY), Fu Hsiang Chih (Hunter College, City University of New York, New York, NY), and Robert E. Loveland (Rutgers University, New Brunswick, NJ)

Abstract - We obtained data on adult *Limulus polyphemus* (American Horseshoe Crab) carapace condition and epibiont coverage related to the host's sex, carapace width, and carapace condition from long-term data sets from Delaware Bay, NJ (1997–2003, *n* = 3088), and Jamaica Bay, NY (2012–2019, *n* =2–255). Carapace condition (a proxy for "age") was assessed as 1 (bright and smooth with clear lateral eyes, indicative of a new molt), 2 (duller appearance with intermediate levels of carapace wear), or 3 (darkened, extensively pitted and worn). Epibiont species presence or absence was recorded, along with the total area of the dorsal carapace covered by all epibionts, on a scale of 0 (none) to 10 (100% coverage). The 5 most commonly occurring epibionts on Horseshoe Crabs from both Delaware Bay and Jamaica Bay were bryozoans, the barnacle *Semibalanus balanoides*, the tube-building polychaete *Sabellaria vulgaris*, *Crepidula fornicata* (Common Slipper Shell), and *Mytilus edulis* (Blue Mussel). Barnacles were the most common epibiont observed on Jamaica Bay Horseshoe Crabs, and bryozoans were most commonly observed on Delaware Bay Horseshoe Crabs. Male and female Horseshoe Crabs showed similar frequencies of occurrence of the major epibionts. In general, condition 2 ("middle aged") Horseshoe Crabs were most likely to have a highest epibiont prevalence. The Jamaica Bay population is more heavily skewed towards middle-aged and older adults, with a much smaller percentage of young adults than Delaware Bay, suggesting that recruitment into the Jamaica Bay population has been poor.

Sun-2-A-4   Oral Session: Horseshoe Crab Ecology II

Riparian Buffers and Their Effect on Mammal Richness and Total Abundance as Measured Using Camera Traps in a Vermont Cooperative Farmland Area

Julia L. Bowen (SMC, Colchester, VT) and Declan J. McCabe (Department of Biology, Saint Michaels College, One Winooski Park, Colchester, VT)

Abstract - The creation and restoration of sustainably managed natural spaces is an important tool in managing biological diversity. Pollution, erosion, and threatened wildlife populations are all issues that can in part be addressed by these efforts. By creating more and wider riparian buffers between farmed land and rivers, agricultural landscapes can positively impact conservation. The Intervale in Burlington, VT, includes 146 ha (360 ac) of farmland, trails, and open space in the lower Winooski River valley. The area houses a conservation nursery, and the Intervale management team aim to repair the riparian buffer between the Winooski River and their campus. We hypothesized that the riparian buffer zones would be home to more mammal species and have greater total abundance than control sites. We deployed 18 camera traps; 8 at control sites, and 11 at forested sites along the Winooski River from July through October 2021. Over the 4-month period, we recorded 13 mammal species. Riparian areas had significantly higher abundance and slightly higher diversity than control sites. These results have important implications for management of riparian buffers as corridor habitats for mammals in human-dominated landscapes.

Sat-3-D-1   Oral Session: Use of Trail Cameras in Mammal Conservation

Diversity of Birds Overwintering in Multiple Stand Stages within a Private Working Forest

Rebecca D. Bracken (Mississippi State University, Mississippi State, MS), Daniel U. Greene (Weyerhaeuser Company, Strategy and Technology, Environmental Research South, Columbus, MS), Darren A. Miller (National Council for Air and Stream Improvement, Inc., Mississippi State, MS), and Scott A. Rush (Mississippi State University, Mississippi State, MS)

Abstract - Approximately 90% of Mississippi's 8 million ha of forestland are privately owned. Through certification standards for sustainable forest management and other forest management goals, working forests exist in a mosaic of forest patches of varying stand ages and stages (e.g., thinned, unthinned, open or closed canopies). At the landscape scale, biodiversity is supported through this shifting mosaic. For birds, research on habitat use within working forests has primarily focused on breeding-season surveys, while over-wintering bird communities remain understudied. Therefore, our objectives were to evaluate how: (1) varying forest-stage classes influence winter bird communities, and (2) birds respond to food resources and forest structure during winter. To date, we have banded winter birds during 7 sessions from November to February 2019–2021. We placed mist nets in young (unthinned), mid-age (unthinned), and mature (thinned) *Pinus taeda* (Loblolly Pine) stands (5, 11, and 25 years since planting, respectively). We banded each captured bird and collected a blood sample to evaluate dietary origins of nutrients assimilated. We banded 83 individuals of 15 species, with *Regulus calendula* (Ruby-crowned Kinglet; RCKI) comprising 43% of all captures. Capture among bird species were highest in the young stand (43% percent of captures) and decreased through mid-age (34%) and mature (23%) stands. We recaptured 18% of banded individuals, with 47% of recaptures occurring in the mid-age stand. Two recaptured *Catharus guttatus* (Hermit Thrush; HETH) were inter-annual recaptures and were recaptured in the second winter in a stand different from their original capture location. One RCKI was recaptured in the same location in the second winter as it was in the first. Species commonly classified as mature or interior forest birds, including RCKI and HETH, were captured most often in the young and mid-age stands during our study, and overall species diversity increased across all stands during the second winter. Our high capture success in mid-aged, unthinned stands, a stage often associated with poorest habitat quality during the breeding season, illustrates the importance in maintaining stands of varying ages, as habitat use in wintering- and breeding-bird communities differs based on food availability and different environmental conditions.

Sun-1-F-1   Oral Session: Avian Habitat Use and Ecology II: Forests Here and There

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Diversity and Abundance of Ants in Rocky and Sandy-soil Barrens of Inland Massachusetts

Kyle Bradford (Antioch University New England, Keene, NH), Michael Akresh (Antioch University New England, Keene, NH), and Chris Buelow (Massachusetts Natural Heritage and Endangered Species Program, Westborough, MA)

Abstract - Barrens in the northeastern United States have high ant diversity and are important habitat for rare and threatened ant species. In 2020 we sampled ant diversity and nest abundance using standardized hand sampling in eighty-two 0.56-ha plots from 18 barren sites mostly in inland Massachusetts (one site in New Hampshire). During our timed surveys, we collected 3–5 individual workers per nest, and also collected any ants found foraging outside of nests. Additionally, we collected data on vegetation, down woody debris, stumps, and leaf litter. In total, we found 975 ant nests, with an average of 12 nests per plot (min–max = 1–21). We have so far identified 44 species in these sites, but we are still in the process of identifying all of the specimens collected. We found a number of county records, including but not limited to *Formica querquetulana* (Oak-grove Ant) in Hampshire County, *Aphaenogaster treatae* (Treat's Aphaenogaster) in Hampden County, and *Dolichoderus plagiatus* (Mottled Dolichoderus) in Berkshire County. We also documented *Proceratium pergandei* (Pergande's Proceratium) in Hampden County, which to our knowledge has only been collected 1 other time in Massachusetts. We will share our preliminary results of how ant abundance is affected by forest management and environmental variables, such as time since first treatment, leaf-litter depth, understory vegetation structure, soil type, and canopy cover. Lastly, we will discuss how our preliminary findings connect to the broader picture of how managers can promote and protect barren ant assemblages.

Sat-1-D-1   Oral Session: Biodiversity in Pine Barrens and Heathlands II

Odonata Species Diversity, Distributions, and Status in a Rare Sand Prairie-savanna Wetscape

Jason Bried (Illinois Natural History Survey, Champaign, IL)

Abstract - Inland sand areas scattered across the North American eastern deciduous forest and western tallgrass prairie ecotone are known for supporting pyrogenic early successional vegetation and specially adapted terrestrial faunas. Many of these globally and regionally rare systems contain functionally connected wetland networks ("wetscapes") potentially important for aquatic insects. Sampling adults, larvae, and exuviae in a remnant sand prairie-savanna wetscape in Illinois, I assessed odonate species diversity (alpha, gamma, beta), distributions (spatial, temporal, abundance), and rarity status. In 1 field season (12 sites, 12 visits), I found more than a third of Illinois odonate species and close to half of the state's lentic breeding odonates, including new state record *Erythemis vesiculosa* (Great Pondhawk). Richness averaged 25.8 species per site, reducing to 12.4 species with removal of nonbreeding occurrences. Three sites including a shrub swamp, beaver pond, and forested vernal depressions complex made significant contributions to beta diversity, dependent on general versus breeding occurrences. Majorities of Anisoptera species (70%) and Zygoptera species (53%) bred at 3 or fewer sites. Eight species flew during all or most of the study period (late May to early October), whereas 14 species were detected on a single survey. Status classification based on the observed distributions resulted in 24 common or very common species, 20 uncommon or rare species, and 10 vagrants across the wetscape. I propose odonate conservation listings, priority habitats, and management actions for the study area and for inland sand area wetscapes of the region.

Sat-1-D-3   Oral Session: Biodiversity in Pine Barrens and Heathlands II

The Effects of Ericoid Mycorrhizal Fungi on Flowering and Pollinator Visitation in Highbush Blueberry

Alison K. Brody (University of Vermont, Burlington, VT), Erin O'Neill (University of Vermont, Burlington, VT), Joanna Santoro (University of Vermont, Burlington, VT), and Gretchen Saveson (University of Vermont, Burlington, VT)

Abstract - Most flowering plants simultaneously interact with organisms above and bellow ground. Although the evolution of floral traits is often strongly driven by pollinators, mycorrhizal fungi may affect flowering and floral rewards, thus altering the patterns of pollinator visitation and selection. We investigated the effects of inoculation with ericoid mycorrhizal fungi on flowering and floral traits in 9 cultivars of *Vaccinium corymbosum* (Highbush Blueberry) at a single farm in central Vermont. We subsequently examined differences among inoculated and non-inoculated plants in investment in floral rewards and attractiveness to pollinators at 3 farms in central Vermont. In some cultivars, inoculation of roots with fungal spores enhanced floral display size and resulted in differences in flower morphology. At 1 farm, inoculation with mycorrhizal fungi had a significant effect on flower production. Pollinator visitation rates differed among cultivars but did not differ between inoculated and non-inoculated plants of the same cultivar. However, visitation rates differed strongly between farms, reflecting differences in the pollinator communities. Thus, the importance of mycorrhizal fungi to flowering traits and reproductive success is likely to depend on differences in resource availability to plants among farms or natural communities, and the abundance and diversity of pollinators.

Sat-1-A-3   Oral Session: The Effects of Belowground Interactions on Aboveground

Mallard Hybridization with Feral Conspecifics Results in Adaptive Differences in Eastern North America

Joshua I. Brown (UTEP EEB, El Paso TX) Michael L. Schummer (SUNY ESF, Syracuse NY), and Philip Lavretsky (UTEP EEB, El Paso TX)

Abstract - *Anas platyrhynchos* (Mallard) were uncommon in eastern North America prior to 1900, but game-farm releases are among the reasons they are now the most common duck in the region. Recent molecular work has determined that the release of game-farm Mallards has resulted in extensive hybridization with wild conspecifics in eastern North America. Given that domestic-origin Mallards originate from Eurasia, the introduction of foreign genetics is hypothesized to have decreased the adaptability of local wild Mallards. Here, we examine the effects of game-farm Mallard introgression on adaptability and future adaptive potential in eastern Mallard populations (feral × wild Mallard hybrids) as compared to western populations (pure wild Mallards). We sequenced thousands of markers throughout the genomes of 1542 wild, game-farm, and putative hybrid Mallards collected across the Atlantic and western flyways (Central and Pacific flyways). We used these markers to estimate rates of gene flow from game-farm into wild Mallards, understand the effects of this introgression on local demographics, and to test for differences in genotype–environment associations (GEA). First, we report significant introgression from game-farm Mallard variants into eastern North American populations to the point that only ~5% of Atlantic flyway Mallards were characterized as genetically pure. Next, estimating demographic history, we found significant differences in demographic histories between wild, game-farm, and game-farm × wild Mallard hybrids. Together, we conclude that strong selection during domestication is responsible for multiple bottleneck events detected in various eastern populations. Domestication can significantly reduce genetic diversity and is likely responsible for the lowered estimates of contemporary effective population size (a metric of genetic diversity) recovered in eastern Mallards as compared to western populations. Finally, using GEA analysis, we report that the adaptive range for Mallards with wild × game-farm ancestry was significantly reduced as compared to those of pure ancestry, and that there was minimal overlap in the modeled genetic-niche space between these groups. This suggests that game-farm Mallards are, in fact, maladapted to eastern North America, and that the continued introgression of game-farm genes into wild populations could threaten the ability of wild Mallard populations to adapt to changing environmental conditions.

Fri-2-D-3   Oral Session: Waterfowl and Wetlands Science and Conservation

Grasses, Sedges, Rushes

Lauren Brown (Branford, CT) and **Ted Elliman** (Wayland, MA)

Abstract - Grasses, sedges, and rushes are a remarkably varied and ecologically significant group of plants, but given their superficial similarity in appearance, species identification is often challenging for beginning naturalists and for many non-specialists. In 1979, Lauren Brown's *Grasses: An Identification Guide*, published by Houghton Mifflin, introduced a non-technical approach to solving the identification riddles posed by these plants. Written in plain English, the book's key, line drawings, and descriptions provided a pathway for the layperson to learn the identities of these plants and more fully appreciate their place in the landscape. Now, she and Ted Elliman have teamed up to produce a new edition, *Grasses, Sedges, Rushes: an Identification Guide* published in 2020 by Yale University Press, with color photographs to complement the original line drawings, updated names, and other helpful features. This talk will introduce our approach to the identification of these abundant and beautiful plants.

Fri-3-B-4   Oral Session: New Natural History Books: Insights from the Authors

A Framework for Dynamic Biodiversity Sampling with Citizen Science

Corey T. Callaghan (German Centre for Integrative Biodiversity Research (iDiv) Halle-Jena-Leipzig, Leipzig, Germany)

Abstract - Scientists are increasingly using citizen science data to monitor biodiversity. But these data are "noisy", with redundancies and gaps arising from unstructured human behaviors in space and time. Consequently, despite impressive growth in global biodiversity data, knowledge about the occurrence of species in many parts of the world remains incomplete. The collective effort of citizen scientists can generate a great deal of data quickly, but can this data-collection process prioritize the powerful—but finite—effort? I will discuss whether the information content of these data can be maximized for different biodiversity conservation objectives. Using citizen science data from the eBird platform as a case study, I will demonstrate 2 different quantitative frameworks of how citizen science sampling and initiatives can be prioritized. First, I will illustrate how biodiversity sampling can be optimized in space and time for the purpose of population-trend estimation. Second, I will illustrate how biodiversity sampling could simultaneously consider both the completeness of biodiversity sampling and the risk of habitat conversion for the purpose of quantifying biodiversity assemblages. Biodiversity monitoring will continue to rely on a diverse set of end-users and contributors, including citizen science data. The capacity to prioritize where biodiversity data are most urgently needed will provide the fundamental data to improve environmental decision-making.

Sat-1-C-3   Oral Session: How to Make Meaning of Citizen Science Biodiversity Data I

The Impact of Corn Harvesting on Mammals

Samantha Callaway (Saint Michael's College, Colchester VT), Julia Bowen (Saint Michael's College, Colchester VT), Lilia Deangelis Saint Michael's College, Colchester VT), and Declan McCabe (Saint Michael's College, Colchester VT), Lina Swislocki (Intervale Center, Colchester VT)

Abstract - Three students in the Biology Department at Saint Michael's College collaborated with the Intervale Center, a nonprofit managing 146 ha (360 ac) of mixed farm and recreational land, to track mammals in the lower Winooski River basin using trail cameras. The purpose of this presentation is to see if there is a correlation between the harvest of *Zea mays* (Corn) and the abundance of mammals that pass through the farm landscape. We documented the number of species, and the total abundance of all mammals captured by trail cameras for 10 days before harvest and for 10 days after the harvest. We focused on the most abundant species before and after harvest. To track abundance, we are utilizing 1 trail camera placed between Winooski River and the Corn field, and 2 additional cameras placed in the riparian zone of a Winooski River tributary that bordered the Corn field. We placed the motion-activated trail cameras on trees where trails and mammal footprints suggested regular mammal traffic. We identified and recorded the mammals, the time they came on camera, temperature, and the direction of movement. During our research, we found that the Corn harvest dramatically increased the abundance of mammals. The number of mammal species that we found was consistent at 7–8 before, during, and after the harvest. Before harvest, the average mammal abundance we recorded was 53.3 mammals per camera per week. After harvest average abundance increased to 116 mammals per camera per week, doubling the count prior to the harvest. These findings are important because changes in mammal abundance suggests that ripe fields of Corn represent a resource that attracts mammals and limits their ranging movements across a landscape.

Fri-3-D-2   Oral Session: Trail Camera Wildlife Monitoring in Human-dominated

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Population Response of the Endangered Karner Blue to Recovery Efforts at the Albany Pine Bush Preserve

Steven P. Campbell (Albany Pine Bush Preserve Commission, Albany, NY), Neil A. Gifford (Albany Pine Bush Preserve Commission, Albany, NY), and Amanda M. Dillon (Albany Pine Bush Preserve Commission, Albany, NY)

Abstract - *Plebejus samuelis* (Karner Blue) is an endangered butterfly of pine barrens and oak savanna ecosystems. One of the few remaining populations of this species occurs in the Albany Pine Bush Preserve, which protects remnants of a northeastern interior pine barrens ecosystem in eastern New York. One of the ecological communities that comprise this ecosystem is the globally rare inland *Pinus rigida–Quercus ilicifolia* (Pitch Pine–Scrub Oak [PPSO]) barrens, which is a fire-adapted, early successional community that provides habitat for the Karner Blue. This community has been degraded by decades of fire suppression and species invasions and its restoration is critical to Karner Blue recovery in the northeastern US. In conjunction with state, private, and federal partners, we have been restoring inland PPSO barrens using a combination of system-based management actions, such as removing invasive and overabundant native species, planting native species, mowing, and prescribed burning. We are also employing species-based management actions aimed directly at increasing the Karner Blue's population size, such as planting its host plant (*Lupinus pilosus* [Blue Lupine]) and captive rearing and release. To evaluate the effectiveness of these efforts, we have been monitoring adult population size annually since 2007 at multiple sites throughout the preserve using distance sampling methodology. For all sites combined, the population size increased between 2007 and 2015 from <1000 to almost 19,000 butterflies. Since 2015, the population decreased slightly and fluctuated around 12,000 until 2020 when the population increased to >46,000. Total population sizes exceeded state and federal recovery thresholds (>3000 individuals) for the first time in 2013 and have remained over that threshold ever since. These results suggest that, on the whole, response to management has been positive and recovery efforts are succeeding. Nevertheless, examination of individual sites reveals a more variable response to management within and among sites. The variation is likely due to a complex combination of type and timing of management, site conditions, and weather; understanding this variation requires further study. We continue to monitor the population to ensure that recovery is maintained, to develop a mechanistic understanding of population response to management, and to document the influence of long-term processes such as climate change.

Sun-1-D-2   Oral Session: Biodiversity in Pine Barrens and Heathlands II

Integrating Larval Movement and Adult Oviposition to Estimate Rates of Disease Spread in the Baltimore Checkerspot Butterfly

Brendan D. Carson (Tufts University, Medford, MA), Elizabeth Crone (Tufts University, Medford, MA), and Colin Orians (Tufts University, Medford, MA)

Abstract - Disease is widely known to play an important role in the lives of all living organisms. Despite this, we know very little about the circumstances that lead to pathogen spread and subsequent impacts on host populations. It was recently discovered that a novel densovirus (JcDNV) is ubiquitous in populations of *Euphydryas phaeton* (Baltimore Checkerspot) in the northeastern US. In the past ,*E. phaeton* populations have been observed to undergo declines in a manner consistent with a density-driven disease. Because JcDNV is primarily transmitted during larval foraging, the degree to which larvae are clustered or diffused across potential habitat will influence the potential for disease to spread through a population. In this study, we investigate whether oviposition decisions made by females (i.e., non-random use of available habitat) will influence the potential for disease spread among their offspring. By integrating spatial data describing the distribution of stationary early-instar larval webs with movement data describing the foraging dispersal of later-instar larvae, we asked whether different populations of *E. phaeton* exhibit differential risk of JcDNV transmission.

Sun-1-B-1   Oral Session: Insect Movement, Phenology, and Conservation

Under a Rock: Where does Weft Fern (*Crepidomanes intricatum*) Grow in New England?

Matthew Charpentier (Oxbow Associates Inc., Boxborough Mass.) and **Laura Green** (Southern Connecticut State University, New Haven CT)

Abstract - *Crepidomanes intricatum* (Weft Fern) is an enigmatic member of the Hymenophyllaceae known only from its gametophyte form and considered regionally rare in New England. During the 2018 and 2019 field seasons, we developed a basic habitat model for Weft Fern. Subsequent de novo surveys tripled the number of known stations in New England and extended its known range into Canada. We will share our experiences identifying Weft Fern, methods used to locate potential habitat, and the value of these insights towards the identification of rare species' habitats throughout the region.

Sat-1-E-2   Oral Session: New England Flora: Continued Need For Study

Phylogenetic Utility of the Avian Pectoral Girdle and Forelimb Skeleton

Albert Chen (University of Bath, Bath, UK & University of Cambridge, Cambridge, UK), Roger B.J. Benson (University of Oxford, Oxford, UK), and Daniel J. Field (University of Cambridge, Cambridge, UK)

Abstract - Although recent phylogenomic analyses have clarified the interrelationships among crown-group birds, the results of these studies nonetheless exhibit notable incongruities with each other and with morphology-based hypotheses. However, evaluating the merits of applying morphological data to avian phylogenetics is challenging, because existing crown-avian morphological datasets are often limited by restricted taxon or character sampling, inconsistent character construction, incorrect scoring, or a combination of several of these factors. This in turn hampers our understanding of the early evolution of crown-birds and the affinities of enigmatic fossil avians. In this study, we focused on identifying phylogenetically informative characters of the avian pectoral girdle and forelimb skeleton, elements of which are commonly preserved as avian fossils. A dataset of 190 characters was assembled based on personal observations and previous literature, then scored for a phylogenetically diverse group of 62 extant avian taxa and analysed in preliminary phylogenetic analyses. Although these analyses do not recover identical topologies to recent molecular analyses, implementation of molecular scaffolds allows identification of diagnostic character combinations for several clades previously only recognized through molecular data, and potentially provides an independent avenue with which to assess support for alternative molecular topologies.

Sat-3-A-3   Oral Session: To the Sky and Back: The Natural History of Flight and

Beyond Presence/Absence Data: Assessing Wildlife Populations and Habitat Use Through Continual Camera Trap Monitoring

Lynn Christenson (Vassar College, Poughkeepsie NY), **Stephen Kovari** (Vassar College, Poughkeepsie NY), and Shijie Guo (Vassar College, Poughkeepsie NY)

Abstract - In an ever changing world, the presence and persistence of wildlife species common to an area can indicate suitable habitat conditions as well as refugia for species that are less common. Changes in species presence and activity, such as fewer to no sightings, may point to shifting conditions not suitable for the species rarely found or absent. Camera-trap monitoring allows for continuous, non-obtrusive observation of many different species of wildlife and can be used as part of our understanding of current suitability of habitat. To better understand integrated forest conditions, we established a camera-trap network located at the Hubbard Brook Experimental Forest in the White Mountains of central New Hampshire. We installed 24 camera stations across the valley and have tracked wildlife presence and activity and made natural history observations, including general health conditions of individuals over the past 3 years (2018–2020). We have also used this data to validate a spatial habitat model to predict suitable habitat for *Alces alces* (Moose) in this area during both summer and winter seasons. The cameras have logged over 1500 wildlife observations, confirming the presence of many species, including those not previously reported such as *Martes americana* (American Marten) and *Lontra canadensis* (North American River Otter). A total of 15 mammal species have been detected, and cameras have also been effective at detecting some bird species, including *Circus cyaneus* (Northern Harrier). Natural history observations have provided insight into the lives of the species detected, including reproduction (bull Moose following cows during rut, Moose calves, *Odocoileus virginianus* [White-tailed Deer] fawns), predation (*Vulpes vulpes* [Red Fox] with *Lepus americanus* [Snow-shoe Hare]) and presence of parasites (*Dermacentor albipictus* [Winter Tick] on Moose with hairless shoulders). Camera-trap data was able to validate spatial habitat modeling (using vegetation as food and cover, distance to water, temperature, and slope) for Moose in the winter season, but was less effective at predicting Moose habitat use in summer.

Sat-3-D-4   Oral Session: Use of Trail Cameras in Mammal Conservation

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Ecology, Distribution, and Microbiome of Juvenile American Horseshoe Crabs at Plumb Beach, Jamaica Bay, NY

Christina P. Colon (CUNY KBCC, New York, NY), Mark Botton (Fordham University, New York, NY), Jessica Joyner (Georgia State University Atlanta, GA), Regina Lamandella (Juniata College, Huntingdon, PA), Kera Mansfield (CUNY KBCC) Joan Petersen (CUNY QCC, New York, NY), and Justin Wright (Wright Labs, Huntingdon, PA)

Abstract - A long term, student-based study of juvenile *Limulus polyphemus* (American Horseshoe Crab) at Plumb Beach ran from 2011 to 2019. Each spring and summer, undergraduate students, volunteers, and faculty collected sediment-core samples within 3 quadrats in both disturbed and undisturbed regions of the beach at the mid-tide zone. We took samples after each full moon spawning peak and processed them to separate and categorize eggs as either alive, dead, or embroys about to hatch. These data have allowed each cohort of research students to compare egg density at both sites and across time, before and after beach re-nourishment and SuperStorm Sandy. Consistently higher counts on the eastern portion of the beach reveal that the restoration did not result in immediate increases in spawning activity but did alter sediment characteristics. Concurrent, timed visual surveys of juvenile crabs on the tidal flats at both ends of the beach and in a nearby tidal creek illuminated the importance of habitat refugia for juveniles. Population density in the undisturbed eastern portion of the beach showed high volatility with an initial decline followed by a gradual recovery. Shed carapaces along the beach revealed evidence of larger juveniles inhabiting the sub-tidal zone. High counts in the tidal creek also gradually declined, while juveniles on the disturbed western stretch remained virtually absent despite a mass-hatching event in 2014. In 2017 and 2018, we sequenced DNA from the guts and feces of juvenile crabs along with sediment from the 3 aforementioned regions of the beach. These data reveal similar microbial diversity in each area but distinct assemblages with Vibrionales, Flavobacteriales, and Alteromonadales common throughout. Common eukaryotic taxa included *Selenidium*, Podocopida, and Enoplida, with higher diversity in the tidal creek sediments. Gut and fecal samples did not amplify well, yet showed high variability and differences from surrounding sediment. Eukaryotic analysis lacked sufficient resolution to reveal much about juvenile diets, but the study was a preliminary step toward characterizing the microbiome and eukaryome of these crabs and the microbial characteristics of their preferred habitat.

Sun-1-A-1   Oral Session: Horseshoe Crab Ecology I

Tidal Marsh Sparrows in Urban Marshes of New York City in Dire Need of Habitat Restoration

Alexandra Cook (SUNY ESF, Syracuse, NY), Alison Kocek (SUNY ESF, Syracuse, NY), and Jonathan Cohen (SUNY ESF, Syracuse, NY)

Abstract - In New York City, saltmarshes are estimated to have declined by 80% over the last century. As climate change increases rates of sea-level rise (SLR), marshes are facing greater losses and shifts in vegetation composition. Managers of Idlewild marsh, in Queens, NY, are concerned how SLR coupled with urban fragmentation will impact breeding *Ammospiza caudacuta* (Saltmarsh Sparrow) and *Ammospiza maritima* (Seaside Sparrow). Our study aimed to determine how nest-site selection and nest survival were affected by marsh characteristics, to inform restoration design. In 2018 and 2019, we conducted intensive demographic monitoring of tidal marsh bird nests, collected vegetation data and high-resolution elevation measurements at nests and random points, and collected water-level measurements using water loggers at Idlewild and 2 control sites in western Long Island that were less urban. We analyzed site-level vegetation characteristics, nest construction, nest-site selection, and nest survival using linear and logistic models and compared the data between sites. At Idlewild, average daily maximum tide height was 0.57 m higher than average elevation, which is a concern for ground-nesting sparrows. This dramatic difference between water level and elevation was not observed at our control sites. In response to these high levels of tidal flow, sparrows at Idlewild used higher proportions of tall, rigid, low-elevation vegetation species in nests and built nests significantly higher off the ground than at control sites and other less-urban sites throughout their range. Despite this adaptation, nest survival of Saltmarsh and Seaside Sparrows was lowest at Idlewild, and our results suggest that nests there are experiencing failure from a combination of inundation and other factors. These results, along with those from previous studies, indicate that tidal marsh Sparrows are capable of displaying plasticity in their nesting strategies; nevertheless, as urban marshes continue to experience SLR coupled with fragmentation, it is likely the extent of their adaptive capacity will be reached, and nest survival will continue to decline. Studies in urban marshes like Idlewild can offer insight into how these species respond to highly degraded systems, and the restoration of these marshes will be critical to the persistence of these species.

Sun-1-C-2   Oral Session: Urban Ecology and Environmental Justice II

Anthropogenic Deserts: How We Can Reverse Course to Assist Pollinators

Elizabeth A. Cowles (Eastern Connecticut State University, Willimantic, CT)

Abstract - Human activities have decreased flowering plant populations. Habitat degradation, agricultural practices, pesticide use, and climate change not only impact plants but their pollinators, including many native bee populations. In this presentation, I will describe mitigation efforts on farms (including Christmas tree farms), parks, and golf courses. I will suggest good nectar- and pollen-producing plants to attract and maintain pollinators.

Sun-2-C-1   Oral Session: Native Plants and Native Pollinators II: Conservation

The Influence of Salinity and Fluctuating Temperature Regimes on Wood Frog Tadpoles Within Vernal Pools

Nicole Dahrouge (University of Connecticut, Storrs, CT) and Tracy A.G. Rittenhouse (University of Connecticut, Storrs, CT)

Abstract - Within vernal pools, stressors, such as road salt, may compound the effects of climate change, potentially threatening species that are vernal pool obligates. Shifts in winter conditions are resulting in earlier breeding of *Lithobates sylvaticus* (Wood Frog) in vernal pools, yet date of metamorphosis in early summer has not shifted earlier by the same number of days, potentially because early breeding may result in tadpoles experiencing cool or more variable temperature conditions. Using mesocosms and Arduino microcontrollers to monitor and manipulate water temperatures, we created 4 temperature treatments to model what could occur within vernal pools over the next century and evaluated their effects on Wood Frog tadpole populations. We included high (1900–2000 µS/cm) and low (50–75 µS/cm) salinity variations of each temperature treatment, to explore potential additive or synergistic effects of multiple stressors. Temperature treatments included elevated (+3 °C above ambient), flux (fluctuating weekly between ambient and +3 °C), nightly (removal of nightly lows), and spike (+6 °C above ambient every third week). Survival, growth, and development under the salt treatments were as expected based on previous research, and we did not detect an interaction between salt and the temperature treatments. Tadpoles did not respond to temperature treatments as expected. Most notably, time to metamorphosis did not differ between treatments ($P = 0.328$). Tadpole survival was reduced by the spike but not the other treatments ($P = 0.017$). We observed contradictory outcomes within the flux treatment, with 3 tanks experiencing 100% mortality, and 2 tanks with 87% survival. While means did not differ, we observed considerable variation in development rate both among and within tanks and treatments. While the lack of synergistic and interacting effects between road salt and temperature may be good for amphibian conservation, our results suggest that there is more to learn about when and how variable environmental conditions affect amphibians and their vernal pool habitat.

Sun-2-B-2   Oral Session: Herps: Imacts of the Anthropocene

Effects of Rainfall on Movement Patterns of Mammals at Wooded Riparian Areas as Measured Using Camera Traps in a Vermont Public Farmland

Lilia M. DeAngelis (Department of Biology, Saint Michaels College, Colchester, VT) and Declan J. McCabe (Department of Biology, Saint Michaels College, Colchester, VT)

Abstract - Wooded riparian zones serve as important mammal corridors connecting between areas of core habitat. Mammals utilizing these routes are afforded cover in addition to water and feeding opportunities. Large rainfall events that produce riparian flooding are very likely to influence mammalian movement patterns in riparian zones. Mobile species may well seek higher ground as floodwaters rise, although the impact on more arboreal species may be less. We hypothesized that fewer mammal species and lower total abundance would be observed at riparian sites during rainfall events and that direction of travel would be biased toward upstream travel to higher ground. To address this hypothesis, we placed camera traps at 4 riparian sites and at 4 control locations in the Interval area in the lower Winooski River valley in Burlington, VT. Cameras remained running between mid-June 2020 and mid-October 2020. Species observed included *Urocyon cinereoargenteus* (Gray Fox), *Lynx rufus* (Bobcat), *Sylvilagus floridanus* (Eastern Cottontail), *Canis latrans* (Coyote), *Sciurus carolinensis* (Eastern Gray Squirrel), *Odeocoileus virginianus* (White-tailed Deer), *Procyon lotor* (Raccoon), and *Didelphis virginiana* (Virginia Opossum).

Sat-3-D-2   Oral Session: Use of Trail Cameras in Mammal Conservation

The Core Of It All: From the Forest To the Concrete Jungle

Ayo Andra J. Deas (CUNY, New York, NY), Sarah Slack (NYC Department of Education, Brooklyn, NY), Reginald Blake (NASA Climate Change Research Initiative, New York, NY), and Hamidreza Norouzi (NASA Climate Change Research Initiative, New York, NY)

Abstract - Since the urban heat island (UHI) effect was first described by P.K. Rao in 1972, studies of this phenomena in which urban areas tend to be warmer than their non-urban surroundings have shown how human-impacted landscapes have the ability to alter climate at a local scale. Factors such as area of impervious surface, type and amount of vegetative cover, albedo, and the shape of the built environment can all contribute to the variation of surface temperature in cities compared to suburban areas. More recent studies have tended to zero in on local variation in land surface temperatures (LST) created by differences in land use and land cover on a neighborhood or even a block-by-block basis. A better understanding of the extent and variability of UHI impacts within a city can identify areas where people are most vulnerable to the effects of extreme heat events, reveal the need for mitigation strategies, and promote better land use planning in the future. Our research is focused on describing the scope and variability of the urban heat island effect in Brooklyn, NY, with an emphasis on the relationship between tree cover and land surface temperature, the variation in LST across Brooklyn public middle schools, the ways in which ground-based measurements can enhance satellite data, and strategies to engage citizen scientists in the collection of ground-based measurements. A comprehensive understanding of the urban heat island effect will help communities develop more effective adaptive mitigation strategies in the face of continued increases in global temperatures.

Fri-3-C-3   Oral Session: Climate Change Ecophysiology

On the Wings of Change: Modeling the Origins of Pterosaur Flight

T. Alexander Dececchi (Mount Marty University, Yankton, SD) and Nicholas Gardner (Staff Librarian, Mary F. Shipper Library, Potomac State College, WV)

Abstract - Powered flight has only evolved 3 times in vertebrates, with Pterosauria not only being the first to achieve it, but also including the largest fliers ever to evolve. Recent findings have linked them to a group of small, primarily terrestrial archosaurs closely related to but outside of Dinosauria, though we still do not have intermediate forms to document to origins of pterosaurs' most famous feature: a hyper-elongated, wing-supporting fourth digit. Here we reconstruct the likely bauplan for the pre-flight pterosaur outgroup using inferences from comparative anatomy, developmental biology, and aerodynamic modeling. We find that a small (~60 g) animal with a similar bodyplan to the closely related taxa *Scleromochlus* or *Kongonaphon* could have achieved aerial capabilities similar to contemporary "gliding lizards" of the Kuehneosaurids. We find, depending on the extent of patagium-based wing we select, wing loading, aspect ratio, glide speed, and even terminal velocity values comparable with *Kuehneosuchus*, though the aspect ratio and terminal velocity values suggest it would have been a parachuting animal similar to *Kuehneosaurus*. Given the elongated hindlimb anatomy of the known pterosauromorphs this finding suggests that the origins of pterosaur flight developed from a vertical clinging and leaping life-history strategy similar to what is seen in tarsier and other small primates.

Sat-3-A-1   Oral Session: To the Sky and Back: The Natural History of Flight and

Monitoring the Use of Culverts by Animals in the Appalachian Region of Quebec

Jaynina Deku (Concordia University, Montreal, QC, Canada), **Jennifer Donnini** (Concordia University, Montreal, QC, Canada), and Jochen Jaeger (Concordia University, Montreal, QC, Canada)

Abstract - Our research focuses on the overarching goal to increase landscape connectivity and reduce road mortality on Autoroute 10 by investigating the use of underground passages by wildlife within Quebec's Appalachians. The construction of the highway has blocked the movement of many animals, and hundreds of animals risk their lives by attempting to cross the road to reach their destinations. We installed 4 cameras in each culvert and a train passage to identify which animals are already using underground crossing structures to avoid crossing the highway. The 4 cameras allow us to view animals that approach the entrances and see which ones do not enter the culverts. One culvert includes a wooden shelf to facilitate passage for medium-sized and small mammals, and the train passage is unique for its dual use by humans and wildlife, which influences animal use. The animals identified the most often are *Procyon lotor* (Raccoon), *Felis catus* (Domestic Cat), and *Odocoileus virginianus* (White-tailed Deer). The results will inform the Ministry of Transportation of Quebec in their decision about the need for dedicated wildlife passages for greater conservation and restoration of landscape connectivity along Autoroute 10.

Fri-3-D-3   Oral Session: Trail Camera Wildlife Monitoring in Human-dominated

Studying the Solitary Bee Community and its Response to Management at the Albany Pine Bush Preserve

Amanda Dillon (Albany Pine Bush Preserve Commission, Albany, NY), Neil A. Gifford (Albany Pine Bush Preserve Commission, Albany, NY), Steve P. Campbell (Albany Pine Bush Preserve Commission, Albany, NY), and M. Sam Adams (New York State Museum, Albany, NY)

Abstract - The decline of early successional habitat in the northeastern US has resulted in increased concern about the conservation of wildlife that depend on these communities. *Pinus rigida–Quercus ilicifolia* (Pitch Pine–Scrub Oak) barrens (PPSOB) are the rarest and most persistent type of upland early successional habitat in the Northeast region and are hotspots for invertebrate biodiversity. Until recently, little was known about solitary bees in these globally rare barrens. Since 2010, we have been assessing solitary bee diversity and their response to management at the Albany Pine Bush Preserve (APBP), which protects one of the best remaining examples of PPSOB. Using pan traps, sweep-net surveys, and malaise traps, we have documented 180 species of solitary bees in the APBP. We have shown previously that mowing and chemical thinning of Scrub Oak significantly affected species composition, likey due to an increase in abundance and visibility of nectar resources and open sandy areas for ground-nesting species. Currently, we are documenting the effects of mowing and prescribed burning on the bee community as part of a regional study of pollinators in xeric habitats of the Northeast. We are also working with the New York State Museum to compare specimens collected in the 1980s and early 1990s with present-day samples collected at the same site using a similar methodology. Preliminary findings suggest shifts in the community such as the loss of *Bombus affinis* and *Bombus ashtoni* and the introduction of the non-native species *Hylaeus pictipes* and *Anthidium oblongatum*. Additionally we have documented range extensions for the coastal species *Andrena braccata* and *Nomada electa*. Our work continues to demonstrate that PPSOB are biodiversity hotspots for solitary bees. Understanding how management of this habitat affects the bee community is therefore crucial to ensuring that we can maintain these areas as hotspots into the future.

Sun-1-D-3   Oral Session: Biodiversity in Pine Barrens and Heathlands II

A New Approach in Shadbush Species Delimitation

Eric T. Doucette (Massachusetts College of Liberal Arts, North Adams, MA)

Abstract - Identification of *Amelanchier* (shadbushes) has a deserved reputation for difficulty. The genus has well-documented characteristics that are responsible for morphological complexity; frequent interspecific gene flow, multiple ploidy levels with presence of higher ploidies driven by hybridization, and near-obligate apomixis in polyploids. These processes create entities that fill the phenotypic space between both diploids and other polyploids, and they weaken taxon cohesion. Many of these polyploid derivatives are geographically restricted, yet morphologically distinguishable "microspecies", while others, such as *A. laevis* (Smooth Shadbush) have become widespread, successful polyploid species. Recognizing all microspecies as species may burden the taxonomy and nomenclature of the group, and mischaracterize the temporal position of the speciation process in these taxa. Conversely, including all of this diversity into the conventional, currently circumscribed species greatly widens their morphological breadth, and obscures real morphological, ecological, and phenological differences between them. A third approach is to recognize diploid species and distinct widespread polyploid species, and use morphology to align hybrid-derived microspecies with diploid-centered species complexes. This approach serves the goals of recognizing taxa and the mechanisms that form them, minimizes the identification error rate prevalent in the field and herbaria, acknowledges the frequent inter-complex hybridization, and does not burden the formal taxonomy.

Sat-1-E-3   Oral Session: New England Flora: Continued Need For Study

Utilizing Camera Traps to Evaluate American Marten Distribution and Density in New Hampshire

Donovan Drummey (University of Massachusetts Amherst, Amherst, MA), Christopher Sutherland (University of St Andrews, Fife, UK), Jillian Kilborn (New Hampshire Fish and Game Department, Pittsburg NH), and Alexej Sirén (University of New Hampshire, Durham NH)

Abstract - The historical range of *Martes americana* (American Marten) included much of the northeastern United States, but due to extensive trapping and deforestation, populations have declined or disappeared in several states. Through a combination of natural dispersal from remnant populations and reintroduction efforts, American Martens have since recolonized parts of their historic range, including the state of New Hampshire. The apparent recovery in New Hampshire can be attributed, at least in part, to the closure of marten trapping and reforestation following field abandonment. Recent signs of recovery in New Hampshire and neighboring states has led to delisting, and the focus now is on population monitoring in order to effectively and sustainably manage the species. Our purpose was to develop state-wide population estimates of American Marten in New Hampshire, generate information on habitat requirements, and determine how habitat influences variation in population density. We deployed clusters of camera traps across a large part of the American Marten's range in New Hampshire using an innovative camera-station design that allows for individual recognition based on their unique throat patches. The cluster design resulted in individual detections at multiple camera stations ,which provides information about individual movement patterns. We analyzed this data using spatial capture–recapture methods to estimate density and space use, and investigate how these aspects of American Marten's spatial ecology are influenced by biotic and abiotic factors.

Sat-3-D-3   Oral Session: Use of Trail Cameras in Mammal Conservation

Exotic and Wild Bee Fauna of Bridgeport, CT, a Coastal Urban Habitat

James Durrell (UB, Bridgeport, Connecticut), Tracy Zarrillo (Connecticut Agricultural Experiment Station, New Haven, CT), Kim Stoner (Connecticut Agricultural Experiment Station, New Haven, CT), William Landesman (University of Bridgeport, Bridgeport, CT), and Kathleen Engelmann (University of Bridgeport, Bridgeport, CT)

Abstract - The urban landscape is rapidly increasing on a global scale. Urban centers offer a mosaic of suitable habitats for many insects, but the composition of urban bee communities is still not well understood. We surveyed the bee fauna of a coastal urban city, Bridgeport, in southwestern Connecticut. We collected bees from 2015 to 2020 using bee-bowls and sweep netting from multiple sites that varied in habitat type including native plant and agricultural gardens. We documented several notable bee species for Connecticut including *Bombus fervidus* (Golden Northern Bumble Bee) and *Triepeolus lunatus* (Lunate Longhorn Cuckoo Bee), both have very few records in the last 10 years. In addition to general surveying, we tried to further expand the floral record for bee species captured.

Fri-1-C-1   Oral Session: Native Plants and Native Pollinators I: Wild Bee Faunas

Leafminers of North America

Charley Eiseman (Northfield, MA)

Abstract - Leafminers are insects that spend part or all of their larval lives feeding between the epidermal layers of leaves. They tend to be highly host-specific, and each species forms a characteristic feeding pattern (mine). I have drawn from over 1000 literature sources and nearly a decade of personal observations to create a "complete" guide to North American leafminers. Following a 30-page introduction to the biology and terminology of leafminers and over 100 pages about their parasitoids and predators, nearly 250 pages are dedicated to overviews of the various groups of leaf-mining insects, which include 50+ families and 2000+ species of moths, flies, beetles, and sawflies. The nearly 1500 remaining pages consist of illustrated keys to the leaf mines occurring on each North American plant genus, along with species accounts detailing the biology, host range, and geographic distribution of each leafminer. I have chosen to self-publish this guide as a serial e-book, in part because printing a full-color book of this size would be prohibitively expensive. It also solves the problem of "completeness" being a moving target due to new discoveries being made on an almost daily basis. Rather than being paralyzed by an overwhelming amount of information, I was able to focus on 1 chapter at a time and release the full first edition in 18 monthly installments. After a 6-month break, I began releasing the fully revised and updated second edition in January 2020.

Fri-3-B-1   Oral Session: New Natural History Books: Insights from the Authors

Can Post-industrial Sites Provide Adequate Habitat for American Woodcock?

Kathleen E. Farley (Rutgers University-Newark, Newark, NJ) and Claus Holzapfel (Rutgers University-Newark, Newark, NJ)

Abstract - Habitat-selection tenets (e.g., ideal free distribution) assume animals are well-informed regarding habitat quality before establishing breeding territory. However, for migratory animals this assumption is unlikely to be upheld. In regions of urbanization and industrial sprawl, wildlife must identify quality territory where habitat is limited and former cues may no longer provide useful information. Spontaneously regenerated post-industrial sites (old rail yards, landfills, etc.) visually appear similar to early successional habitat, but these altered habitats may contain pollutants, altered hydrological regimes, delayed succession, and modified floral and fauna communities. Despite these alterations, degraded landscapes may mitigate habitat loss by providing habitat options within a region while leading to shifts in behavior and habitat usage. To evaluate the potential of post-industrial habitat for wildlife, I studied *Scolopax minor* (American Woodcock), an early successional bird that serves as an umbrella species for other declining wildlife including *Heterodon platirhinos* (Eastern Hognose), *Sylvilagus transitionalis* (New England Cottontail), and *Vermivora chrysoptera* (Golden-winged Warbler). Beginning in 2016, I investigated the use of degraded and natural habitats as singing-ground sites for male American Woodcock during their migration and breeding season. Results from a linear-effects mixed model indicate woodcock do not differentiate between degraded and natural habitat for courtship displays. Exploring the system further, I monitored woodcock courtship displays, community structure, and food availability along an urban/degradation gradient in New Jersey. Collectively early results suggest that habitat quality and availability at fine and broad scales work in concert to influence behavior of American Woodcock. Preliminary results indicate that while woodcock do not discern differences between post-industrial and non-industrial habitat for courtship displays, the sites differ in critical resources leading to changes in the length of courtship regionally, which in turn may influence population trends.

Sun-1-C-3   Oral Session: Urban Ecology and Environmental Justice II

Fucus serratus **(Fucaceae) In Nova Scotia Forms A New Pattern Of Intertidal Zonation In The Western Atlantic**

Megan P. Fass (Saint Francis Xavier University, Antigonish, NS, Canada), David Garbary (Saint Francis Xavier University, Antigonish, NS, Canada), Herb Vandermeulen (Saint Francis Xavier University, Antigonish, NS, Canada), and Carolyn Bird (Chester Basin, NS, Canada)

Abstract - *Fucus serratus* (Serrated, Toothed, or Saw Wrack) is a non-native species in Nova Scotia that, since its introduction in the 19th century, has become widely distributed, and is known primarily as a subtidal species. New observations starting in August 2020 showed a pattern of *F. serratus* in which the species had become a dominant canopy-forming species in the low intertidal zone. Here it was replacing the previously characterized zone-forming species, *Chondrus crispus* (Irish Moss)*,* and was becoming a dominant in parts of the lower shore that would have been occupied by *Ascophyllum nodosum* (Rockweed). Qualitative evidence in the form of photographs and the occurrence of *F. serratus* in wrack demonstrated abundant populations along sites examined over 30 km and 40 km stretches of outer coast in Yarmouth and Lunenburg counties, respectively. Our quantitative estimates of cover based on transects at Chebogue Point and Kingsburg indicate dramatic changes in intertidal zonation along the Atlantic coast of Nova Scotia in which 10–15 m of intertidal zone comprising 15% to 40% of the horizontal extent of the shore had 75% to 100% cover of *F. serratus*. Further surveys are needed to confirm the overall distribution and impact of this invasive fucoid on intertidal communities. We are currently conducting experimental evaluation of colonization to further characterize the dynamics of this process, and the potential threat to the commercial harvest of *Ascophyllum*.

Sat-2-B-4   Oral Session: Coastal Marine Habitats of the Northwest Atlantic

Return Rates of Black Skimmers Banded as Juveniles in New Jersey

Lisa Ferguson (The Wetlands Institute, Stone Harbor, NJ), Samantha Collins (The Wetlands Institute, Stone Harbor, NJ), Christina Davis (NJ Division of Fish and Wildlife, Tuckahoe, NJ), Emily Heiser (NJ Division of Fish and Wildlife, Tuckahoe, NJ), and Brittany Morey (The Wetlands Institute, Stone Harbor, NJ)

Abstract - Over the past decade, the population of *Rynchops niger* (Black Skimmer) in New Jersey (NJ) during the breeding season has held relatively stable, varying from 2000–2500 individuals in most years. There are indicators, however, that the number and habitat conditions of colonies may be declining in the state. We initiated a banding study to better understand population dynamics and management needs in the state, with an initial focus on examining inter-annual return to nesting and natal sites, and inter-colony movements. As breeding adults, skimmers begin returning to NJ colonies in May for the start of the breeding season and disperse from colonies by late September. Black Skimmers typically begin breeding at 2–3 years, and natal site fidelity is not thought to be high, though these characteristics have not been well described. Between 2017 and 2020, we banded 206 hatch-year (HY) from 3 colonies with coded blue plastic bands. Resighted individuals were reported across their range from formal surveys of colonies, staging, and wintering sites and from public observations. To date, 128 HY banded birds (62.1%) have been resighted across all years and locations, and approximately half (50.1 ± 4.7%) were resighted in each year. As of 2020, 36 HY-banded skimmers (23.1%) have returned to NJ during the breeding season. Most birds were observed at their natal site, and several made visits to other colonies in NJ. Only one of the HY-banded skimmers has been documented breeding, which was in its second year at the natal site. Others may be nonbreeding birds associated with colonies. There was no detectable difference in proportion of HY-banded skimmers returning to NJ after 1 or 2+ years ($\chi^2 = 0.24$, $P = 0.6$). May 31 was the earliest observation of a HY-banded skimmer at a NJ colony. The majority of observations were made in July and August, and by September and October most observations were at staging locations, following typical patterns of breeding adults. Continued study of the banded population will provide the opportunity to build on these initial insights to establish a stronger understanding of the demographic parameters of the NJ skimmer population.

Fri-2-E-2   Oral Session: Avian Breeding Season Ecology Along the Coast

Introduction to SPARCnet and *Plethodon cinereus* (Eastern Red-backed Salamander)

M. Caitlin Fisher-Reid (Bridgewater State University, Bridgewater, MA), Jill Fleming (USGS, Turners Falls, MA), Evan H. Campbell Grant (USGS, Turners Falls, MA), Kristine Grayson (University of Richmond, Richmond, VA), Tanya Hawley Matlaga (Susquehanna University, Selinsgrove, PA), Maisie MacKnight (Pennsylvania State University, University Park, PA), Louise Mead (Michigan State University, East Lansing, MI), David A.W. Miller (Pennsylvania State University, University Park, PA), Bethany Shaw (SUNY Oneonta, Oneonta, NY), Sean C. Sterrett (Monmouth University, West Long Branch, NJ), Chris Sutherland (University of St. Andrews, St. Andrews, Scotland), and Alexa Warwick (Michigan State University, East Lansing, MI)

Abstract - Terrestrial salamanders in the genus *Plethodon* are often studied as indicators of forest community and ecosystem health. As lungless amphibians that breathe entirely through their skin, these salamanders are sensitive to changes in forest-floor temperatures and moisture levels. As mid-level consumers, it is believed that terrestrial salamanders play an important role in nutrient and energy cycling in eastern North American forests. Within the genus, *Plethodon cinereus* (Eastern Red-backed Salamander) is particularly well-studied, in part because of its large geographic range and high population densities where it is found. The natural history of the species has been well documented over the past 100 years, with a large fraction of the studies coming from a small number of populations in Virginia and Ohio. In recent years, many studies from other populations throughout the range have found both similar and contrasting patterns in behavior, life-history traits, and even habitat preferences, suggesting a strong case for local adaptation. The Salamander Population and Adaptation Research Collaboration Network (SPARCnet) was founded in 2013 by researchers at Pennsylvania State University and the USGS Northeast Amphibian and Research Monitoring Initiative (NEARMI). It has since grown to include 32 field locations throughout the range of *P. cinereus*, managed by researchers from diverse settings including K–12 schools, community colleges, public and private universities, nature centers, and government organizations across both the United States and Canada. SPARCnet members use a common set of sampling methods and a cover-board plot design to collect seasonal demographic data to better understand salamander populations through time. Many members use mark–recapture to track individual salamanders over time, and most sites now have several years of data. Additionally, given the educational role that many SPARCnet members have, we have been actively developing course-based research experiences for use in the classroom. This talk will introduce you to our network, our focal species, and open the SPARCnet session at NENHC 2021.

Sat-2-D-1   Oral Session: SPARCnet: The Salamander Population and Adaptation

Range-wide Density Estimates of a Forest Indicator Species

Jill Fleming (USGS Patuxent Wildlife Research Center), Evan H. Campbell Grant (USGS Patuxent Wildlife Research Center), Catherine Devlin (Greenfield Community College), Kristen Epp (Eastern Connecticut University), Caitlin Fisher-Reid (Bridgewater State University), Kristine Grayson (University of Richmond), Amanda Hyde (Greenfield Community College), Michael Losito (State University of New York Cobleskill), Tanya Matlaga (Susquehanna University), Louise Mead (Michigan State University), David Muñoz (Pennsylvania State University), Bill Peterman (Ohio State University), Veronica Puza (New Jersey School of Conservation), Sean Sterrett (Monmouth University), Chris Sutherland (University of St Andrews), Lily Thompson (University of Richmond), Alexa Warwick (Michigan State University), Kerry Yurewicz (Plymouth State University), and David A.W. Miller (Pennsylvania State University)

Abstract - Variation in populations across a species range is a central interest of ecology. Conservation biology likewise has recognized the importance for the distribution of abundance, and how this covaries with environmental conditions at large spatial scales. The pace and scale of environmental changes makes characterizing the variation in population density at large geographic scales an important baseline for addressing fundamental and applied questions in ecology. A recent large-scale collaborative research network (Salamander Population Adaptation Collaborative Research network [SPARCnet]) established standardized survey plots across much of the range of *Plethodon cinereus* (Red-Backed Salamander). The network is composed of researchers, educators, and citizen scientists whose common objective is to identify local and regional drivers of population dynamics to better predict the impacts of management and environmental change. Here, we report on salamander densities from 19 sites from across this salamander's range.

Sat-2-D-2   Oral Session: SPARCnet: The Salamander Population and Adaptation

Investigating Non-invasive Methods of Hormone Quantification in Great Black-backed Gulls

Francesca Foltz (Loyola Marymount University; Los Angeles, CA), Kristen Covino (Loyola Marymount University; Los Angeles, CA), Sarah J. Courchesne (Northern Essex Community College; Haverhill, MA), and Mary E. Everett (Gulls of Appledore Research Group, ME)

Abstract - Hormones mediate a wide range of avian physiological and behavioral traits, but repeated blood sampling for hormones is not possible in every study species and system. In *Larus marinus* (Great Black-backed Gull), the link between testosterone and aggression is understudied, and concern over disruption of breeding activities requires a non-invasive approach to sampling. Determining hormone levels from excreta is a non-invasive approach, as obtaining samples can be done repeatedly, with minimal disturbance, and without the need to capture and handle study individuals. With excreta samples collected from gulls throughout their breeding season on Appledore Island, ME, and categorically scored aggression levels, our research focuses on developing, testing, and validating the laboratory protocols necessary for accurate hormone determination from excreta, using scientific literature about excreta testing on other species as a starting point. To date, we have established laboratory protocols for the freeze-drying and grinding of excreta samples and the extraction of hormones from those samples. With repeated testing of samples with enzyme immunoassay protocols, we have also established protocols for pre-assay dilution and extraction efficiency tests. We are in the process of running final laboratory assays on our 36 excreta samples collected during the 2019 breeding season. Additionally, we will compare testosterone levels from excreta to those from plasma samples to validate how well excreta hormone levels represent baseline circulating testosterone levels in this species. After these validation steps are complete, we will compare the quantified testosterone levels from excreta to aggression scores of individual gulls. Ultimately, once we genetically determine sex on our focal individuals, we will also explore the effect of sex on aggression, testosterone, and the interaction between the two. Data will be analyzed via R statistical analysis software. If successful, this study will validate the usefulness of excreta samples for hormone quantification in Great Black-backed Gulls and will allow for further exploration into hormonal drivers of behavior in this relatively understudied species.

Fri-2-E-3   Oral Session: Avian Breeding Season Ecology Along the Coast

Rusty Blackbird Research: A Motus Case Study

Carol Foss (NH Audubon, Concord, NH)

Abstract - *Euphagus carolinus* (Rusty Blackbird) has experienced dramatic and largely unexplained declines, on the order of 85–95% in the past 50 years, across much of its range. Conservation actions on its behalf have been hampered by a lack of information about significant portions of its life history, especially migration and stopover. The expanding Motus Wildlife Tracking System has already provided key insights into aspects of movement ecology of Rusty Blackbirds, and this species provides a case study in how Motus can supply answers to questions that were until recently difficult or impossible to answer.

Sat-2-E-3   Oral Session: Expanding the Northeastern Motus Network

Unpaid Work In STEM: Barriers and Examples of Improvement

Auriel M.V. Fournier (Forbes Biological Station–Bellrose Waterfowl Research Center, Illinois Natural History Survey, Prairie Research Institute, University of Illinois at Urbana-Champaign, IL)

Abstract - Across science professions, there has long been a large lack of diversity in the workforce at all levels. While this has been improving slowly over the last few decades, barriers still exist that are limiting access to careers in the scientific workforce in a way that disproportionately impacts underrepresented groups. One of these barriers is unpaid work, often in the form of seasonal lab/field technician positions that are taken by early career ecologists, during or after their undergraduate degrees. Many early career ecologists are told unpaid work is a way of demonstrating their dedication to the field, or getting their "foot in the door" towards later employment. The problem is that working unpaid full time for weeks or months is not possible for those who do not have the financial resources, which makes financial resources an unwritten requirement for unpaid jobs. I'll discuss the current state of the research on this question, how the conversations have developed since my 2019 paper, and share some examples of individuals and organizations that are taking on this issue seriously and working to change the culture of their disciplines

Sat-3-C-4   Oral Session: Urban Ecology and Environmental Justice I

Measuring Activity of Saltmarsh Sparrows and Seaside Sparrows in Relation to Tide Levels and Weather Variables

Jose P. Francisco (University of North Carolina Wilmington, Wilmington, NC), Raymond M. Danner (University of North Carolina Wilmington, Wilmington, NC), Marae C. Lindquist (University of North Carolina Wilmington, Wilmington, NC), and Evangelyn L. Buckland (University of North Carolina Wilmington, Wilmington, NC)

Abstract - With populations experiencing decreasing trends and marsh habitats undergoing loss of functionality and landmass, *Ammospiza caudacuta* (Saltmarsh Sparrow [SALS]) and *Ammospiza maritima* (Seaside Sparrow [SESP]) are of particular interest within North Carolina. Our study describes the relationships in the activity patterns of Seaside Sparrows and Saltmarsh Sparrows with the variation in tide levels, air temperature, and environmental temperature in southeastern North Carolina. Understanding these relationships will provide us with a deeper understanding of the habitat needs of SALS and SESP in their wintering months, thus allowing for a more effective marsh conservation approach. We deployed radio transmitter tags on 11 sparrows and collected data in February 2020 at Fort Fisher, NC. We recorded signal strength from radio receivers over 1-minute intervals in the field at a variety of tide levels and weather conditions. We then used computer software to quantify the number of changes in signal strength within the 1-minute intervals. Changes in signal strength indicate movement. Preliminary results show a negative relationship between activity levels and the tide height, with differences between species (all $P < 0.01$). These findings suggest that SALS and SESP are foraging primarily during low tide, likely utilizing the lower marsh as their foraging habitat. Preliminary results do not show a strong interaction between activity patterns and air temperature or environmental temperature. However, a larger sample size with greater variation in temperature data over a longer period may show a relationship between these variables.

Fri-2-A-2   Oral Session: Climate Effects on Birds

Invasive Plant Regulations in the US are Reactive and Inconsistent

Emily J. Fusco (University of Massachusetts Amherst, Amherst, MA), Evelyn M. Beaury (University of Massachusetts, Amherst, MA), Jenica Allen (Mount Holyoke College, Miller Worley Center for the Environment, South Hadley, MA), and Bethany A. Bradley (University of Massachusetts, Amherst, MA)

Abstract - US Federal and state regulations restrict the introduction and spread of several hundred invasive plant species in an effort to reduce their negative impacts. Regulations are most likely to reduce invasive species spread if they are consistently enacted across political borders and proactively restrict species early in the invasion process. A more unified regulatory landscape is particularly important given imminent large-scale range shifts of invasive species across the US. However, the degree of consistency and proactivity in invasive plant regulation remains unclear. Using invasive plant and noxious weed legislation for the lower 48 United States, we assessed consistency among regulated invasive plant lists based on similarities in adjacent states' regulatory lists. We assessed proactivity by comparing regulatory lists to species' current and potential distributions given occurrence records and habitat suitability models under climate change. States regulate from 0 to 162 taxa, with an average of only 16.8% overlap of regulated taxa between adjacent states. However, 36 states listed at least 1 species proactively (regulated but not present in the state). Of the 48 proactively listed species with habitat suitability models, we identified 41 cases (38 species in 21 states) where listing was "climate proactive" (regulated, not present, and where climate could be suitable for establishment by mid-century). Coordination among states is imperative given the gaps in regional defenses against invasion and projected invasive plant range shifts under climate change. Increasing the level of proactivity and consistency of plant regulations across state borders is paramount to preventing the next wave of plant invasions.

Fri-1-D-1   Oral Session: Invasive Species in the Northeast: Regulatory Approaches and

Birding in Connecticut: A Comprehensive Site Guide

Frank Gallo (Sunrise Birding LLC, New Cannan, CT)

Abstract - *Birding in Connecticut* is a guide to where, when and, how to find birds in the state, that is designed to provide information to birders of all skill levels, and is meant to be a resource on the habits and habitats of Connecticut's birdlife. My aim was to expand the scope of the standard bird-finding guide by incorporating technology, adding additional appendices, and color photos and maps, with the hope that it would be both attractive (especially to new birders) and extremely user friendly. As far as I know, it is the first such guide to offer QR code links to continually updated information on the occurrence and abundance of birds at each location and to be illustrated with color photographs and maps. Most traditional bird-finding guides get you to a site, but then leave you on your own. As an environmental educator, I took a more holistic approach to the design, and provide strategies for birding the site, where to park, and even the location of the nearest restroom, along with other modifications that I will review during the talk.

Fri-3-B-3   Oral Session: New Natural History Books: Insights from the Authors

New Ancient DNA for *Aenocyon* (formerly *Canis*) *dirus* Shakes up "Wolf-like" Canid Family Tree

Nicholas M. Gardner (Mary F. Shipper Library, Potomac State College, West Virginia University, Keyser, WV)

Abstract - New ancient DNA and paleoproteomic studies of fossil *Aenocyon dirus* (formerly *Canis dirus*) (Dire Wolf) specimens have reshaped family tree of Canina ("wolf-like" canids), placing *Aenocyon* at the base of Canina, diverging prior to *Lupulella* (jackals) and *Lycaon* (African wild dog). Previous morphology-only studies or combined morphology-molecular studies agreed in placing *A. dirus* deep within Canina, close to *C. lupus* (Gray Wolf) or to *C. lupus* + *C. latrans* (Coyote). The new study focused only on the relationships of Canina known from molecular data, leaving a question whether other *Canis* spp. typically close to *A. dirus* within *Canis* were also part of an earlier branching lineage. We reanalyzed 3 existing morphological data sets of fossil and living Canina using molecular scaffolds based on the new ancient DNA and fossilized peptides. Our analysis of the new data sets consistently recovered several Plio-Pleistocene European fossil *Canis* species as branching with *A. dirus* separate from other "wolf-like" canids, as well as unsurprisingly pairing the Pleistocene North American *Canis armbrusteri* (Armbuster's Wolf) as the sister to *A. dirus*. This finding suggests that the *Aenocyon* clade originated around the Mediterranean, along with other "wolf-like" canids. This new hypothesis is a better biogeographic fit, with the ancestors of *A. armbrusteri* and *A. dirus* migrating along with other "wolf-like" canid species to the New World. We also deleted hypercarnivorous characters from data sets and still recovered the same results, suggesting this expanded *Aenocyon* clade is not linked solely by ecological characters. Future research should include wider morphological studies of "wolf-like" canids within the context of the new molecular tree as well as increased sampling of "wolf-like" canid fossils for ancient DNA and other fossilized molecular remains.

Fri-1-B-2   Oral Session: Paleozoology: Feathers, Fins, and Fur

Bats Are Boring: No Evidence for Multiple Convergences in Flight or Echolocation in Bat Phylogeny

Nicholas M. Gardner (Mary F. Shipper Library, Potomac State College, West Virginia University, Keyser, WV) and T. Alexander Dececchi (Division of Natural Sciences, Mount Marty University, Yankton, SD)

Abstract - Despite robust debate amongst bat researchers in the 1980s through 1990s, a scientific consensus has largely been reached, through the accumulation of evidence from the fossil record, anatomy, and molecular data, that Chiroptera is monophyletic. At present, among bat evolutionary biologists, the debate largely remains focused on whether flight or echolocation evolved first or whether they evolved in tandem. A recent review of bat evolution has presented a novel hypothesis that powered flight might have evolved as many as 3 times (in megabats and the 2 "microbat" clades) and that laryngeal echolocation evolved twice (in the 2 "microbat" clades) as 3 separate lineages of handwing gliders. We note fossil, character evolution, and developmental evidence contradicts this new hypothesis, and we tested the proponents' handwing gliding model and found it aerodynamically implausible. We conclude the traditional view of bat evolution is more plausible.

Sat-3-A-5   Oral Session: To the Sky and Back: The Natural History of Flight and

Thoughts on and Life History of the Spotted Lanternfly, *Lycorma delicatula,* from Observations in Northern Berks County, PA

Richard Gardner (T&A Research, Berks County, PA) and Heather Cuthbert (T&A Research, Berks County, PA)

Abstract - This presentation is a summation of several years of field research on the Spotted Lanternfly, *Lycorma delicatula*, near my home in northern Berks County, PA. It starts with my thoughts and concludes with a complete life history of this invasive species based on observations from the 2019 field season. My conclusions about the Spotted Lanternfly are that it is unstoppable and is neither an agricultural nor a forest armageddon. The only plants of real concern in both cases are *Vitus* spp.

Fri-1-D-3   Oral Session: Invasive Species in the Northeast: Regulatory Approaches and

Song of *Cistothorus platensis* (Grass Wren) in a Resident South Temperate Population from Mendoza, Argentina

Paula S. Garrido Coria (IADIZA, CCT CONICET, Mendoza, Argentina), Drew Rendall (ULeth and UNB, Canada), Rosario Panasiti Ros (UNCuyo, Mendoza, Argentina), Natalia C. García (MACN, CONICET, Buenos Aires, Argentina), and Paulo E. Llambías (IADIZA, CCT CONICET, Mendoza, Argentina)

Abstract - The study of geographic variation in birdsong provides insights into vocal evolution. Despite longstanding interest in the role of song to understand the evolution of communication signals, baseline knowledge of many species' songs is often incomplete. Due to its broad Neotropical distribution (from Cape Horn to Mesoamerica), *Cistothorus platensis* (Grass Wren) is an outstanding model to evaluate geographic variation between populations. We used a large sample of song recordings of Grass Wrens to provide a detailed description of song sharing, structure, and organization for a resident south temperate population. Over 2 breeding seasons (October–February, 2016–2018) we recorded 29 color-banded males in the Uspallata Valley, Mendoza, Argentina. We analyzed 27,795 songs and estimated syllable and song-type repertoires for each male through a simple enumeration technique. We also determined the number of syllables and song types that males shared. Males often delivered singing bouts perched from the tallest inflorescences of *Cortaderia selloana* (Pampa Grass) and repeated a sequence of 2 or 3 song types several times before switching song types. The shape and structure of syllables was highly preserved within and between different males. We identified a total of 187 different syllable types and 228 different song types. The males from which we recorded the greatest numbers of songs had repertoires of an average of 100 syllables and 97 songs. Males shared 81.28% of syllable types and 68.86% of song types. Our results confirmed the expected relationship between site fidelity and song sharing, and contributed with data from a south temperate continental population that is essential for a compressive analysis of the geographic variation of the *Cistothorus* wren song.

Sat-3-E-2   Oral Session: Behavior and Ecology of Neotropical Birds

BEECOLOGY: Conserving Native Pollination Systems Through the Power of Citizen Science

Robert J. Gegear (Department of Biology, University of Massachusetts – Dartmouth, Dartmouth, MA)

Abstract - Over the past 2 decades, human activity has significantly degraded the integrity of pollination systems across New England, with many of our historically abundant native flowing plant and pollinator species now locally extinct and others soon to follow if do not take immediate conservation action. The loss of plant–pollinator systems poses a significant threat to the diversity and functioning of natural ecosystems due to the fundamental role that "pollination products" play in supporting wildlife across trophic levels. However, we currently lack the ecological data needed to develop effective conservation and restoration strategies for pollination systems at risk. In this talk, I will discuss how my laboratory is crowdsourcing the collection and dissemination of such ecological data through the Beecology Citizen Science Project. I will also highlight the Beecology "eco-technology" that has been developed with WPI collaborators to aid in the collection, storage, visualization, and communication of species-level ecological data on bumblebee pollination systems. My talk will conclude with an overview of how Beecology, through the power of citizen science, has significantly advanced pollination system conservation and restoration efforts in Massachusetts over the past 3 years.

Fri-1-E-1   Oral Session: Citizen and Community Science

Conservation Behavior of Native Plant–Pollinator Systems

Robert J. Gegear (Department of Biology, University of Massachusetts – Dartmouth, Dartmouth, MA)

Abstract - Wild plant-pollinator systems are being degraded at an alarming rate worldwide, posing a significant threat to the diversity and functioning of natural ecosystems. Although the cause of pollinator decline is currently unknown, habitat loss, pesticides, disease, exotic species, and climate change are widely thought to be significant contributing factors. In this talk, I will discuss how laboratory and field research on pollinator behavior can be used to develop and implement effective conservation strategies for pollination systems at risk of local extinction. Using bumblebees as a model, I will show individual "floral generalist" species are far more specialized in their foraging preferences than previously thought, which has important implications for our current view of "pollinator-friendly" habitat. My talk will conclude with a brief overview of how I am leveraging public interest across New England to accelerate the collection of "big data" on pollinator-plant species interactions and to "build" native biodiversity through wild pollination systems at different spatial scales.

Sun-2-C-4   Oral Session: Native Plants and Native Pollinators II: Conservation

Watered Down Stewardship: How Residential and State Stewardship Regimes Inform Juvenile Tree Survivorship

Nicholas Geron (Clark University, Worcester, MA), John Rogan (Clark University, Worcester, MA), Deborah Martin (Clark University, Worcester, MA), Marc Healy (Clark University, Worcester, MA), Lara Roman (USFS, Philadelphia, PA), and Juliette Gale (Clark University, Worcester, MA)

Abstract - Trees in urban neighborhoods benefit residents by reducing building energy costs, cleaning the air, and reducing surface runoff. These benefits are not equitably distributed; neighborhoods that are historically populated by people of color have lower percentages of tree canopy cover. Municipal and state governments are planting more trees in targeted environmental justice zones; however, the socio-ecological benefits derived from planted trees are dependent on juvenile trees surviving to reach maturity. Stewardship has been shown to be an important determinant for the survival of urban trees, yet little is known about how resident stewardship practices and motivations impact tree survivorship. This study will address 3 research questions using the Massachusetts Greening the Gateway Cities Program (GGCP) in Chicopee as a case study: (1) how does the survivorship of residential tree stewardship compare to public trees stewarded by trained foresters? (2) what are the important biophysical and social factors that influence residential tree survivorship and stewardship? (3) how do residents' attitudes about stewardship impact residential tree survivorship? The GGCP aims to increase tree canopy cover by 10% in midsized cities by planting trees on private resident's land and in public spaces. We surveyed 767 residential and public trees in 4 cities for common biophysical variables using the newly released urban tree monitoring field guide developed by the US Forest Service. We conducted interviews with residents and state foresters on their stewardship attitudes and practices and analyzed using the principle-agent relationship (PAR) framework. Initial results are that trees stewarded by residents had significantly lower survivorship. Factors that significantly impacted survivorship were the number of trees per resident, building age, and tax parcel value. PAR analysis shows that targeted outreach by state foresters to residents in older multifamily buildings or residents with more than 3 trees could increase survivorship.

Sun-1-C-1   Oral Session: Urban Ecology and Environmental Justice II

Western Atlantic Torpedo Strandings on Cape Cod from August 2020 through January 2021, Including a Mass Stranding Event on Long Point, Provincetown, MA

Jack N. Gerrior (New England Coastal Wildlife Alliance & Massachusetts Maritime Academy, Bourne, MA), **Carol D. Carson** (New England Coastal Wildlife Alliance & Bridgewater State University, Middleboro, MA), John Chisholm (Anderson Cabot Center for Ocean Life, Boston, MA), Austyn Morin (Stonehill College and NECWA, North Easton, MA), and Dr. Christopher Bloch (Bridgewater State University, Bridgewater, MA)

Abstract - The batoid species *Tetronarce occidentalis* (Western Atlantic Torpedo) inhabits the coastal waters of the Gulf of Maine, though little is understood regarding its movements, habits, and life history. Since 2011, researchers with the New England Coastal Wildlife Alliance (NECWA) have informally documented Torpedo strandings each fall and early winter in the New England area, predominantly on the northern shores of Cape Cod. In 2020, NECWA decided to formally investigate these annual strandings and documented 63 carcasses (34 Female, 15 Male, 14 undetermined) from 1 August 2020 through 12 January 2021. All but 1 animal stranded dead, and this male died shortly after stranding. Documentation involved the collection of positional information and photographs to support photo-ID analysis and to confirm sex. For all specimens except those that were heavily scavenged or extremely decomposed, body measurements were collected that included total length (TL), disk width (DW), disk length (DL) and tail length (CL). Through external and internal examinations, NECWA was able to determine the sex of 49 carcasses. The sex of the remaining 14 carcasses could not be identified, as the gonads were missing due to extensive body decomposition and scavenging activity. We obtained weight for only 1 carcass because the team did not develop a means of obtaining this measurement until towards the end of the season. We examined the digestive tracts of 35 carcasses, and only 7 contained food items. Of these 7 individuals, all contained various species of decomposed fish, and 1 large female contained a whole *Clangula hyemalis* (Long-tailed Duck) in her stomach. In late December, NECWA documented a mass stranding of 41 Torpedoes on a 2.1-km stretch of beach on Long Point, Provincetown, MA. Historical records indicate the occurrence of large numbers of Torpedos in the vicinity of Provincetown, including strandings on the eastern shore of Long Point, located west of Provincetown. Annual strandings of the Western Atlantic Torpedo on Cape Cod remind us how little is known regarding the biology and ecology of this species and encourages further investigation into the causes of both singular and mass stranding events.

Fri-2-B-2   Oral Session: Beach-stranded Marine Fishes: Lessons Learned about Poorly

Shifting Paradigms: Ecosystem Restoration is not Maintenance in Degraded Pitch Pine–Scrub Oak Barrens

Neil Gifford (Albany Pine Bush Preserve Commission, Albany, NY), Tyler Briggs (Albany Pine Bush Preserve Commission, Albany, NY), Amanda Dillon (Albany Pine Bush Preserve Commission, Albany, NY), and Steve Campbell (Albany Pine Bush Preserve Commission, Albany, NY)

Abstract - Attempting to restore ecosystem dynamics and endangered wildlife habitat in highly degraded fire-dependent ecosystems by simply applying what we know of historical disturbance regimes can be logistically challenging and ecologically ineffective. *Pinus rigida–Quercus ilicifolia* (Pitch Pine–Scrub Oak) barrens (PPSOB) are rare, fire-dependent ecological communities in the Northeastern United states that support large assemblages of rare species. The 1376-ha Albany Pine Bush Preserve in eastern NY contains one of the best remaining examples of an inland PPSOB and provides habitat for >70 of New York's 366 wildlife species of greatest conservation need (SGCN), including the federally endangered butterfly *Plebejus melissa samuelis* (Karner Blue). Working with state and federal partners, the Albany Pine Bush Preserve Commission has employed a variety of strategies to restore fire's fundamental role in this landscape. More than 1100 ha of fire-suppressed PPSOB have been treated with prescribed fire. Initially (1991–2002) managers relied exclusively on dormant-season fire, but those fires had limited success in restoring PPSOB and the rare wildlife they support, and were counterproductive in areas invaded with mesophytic native and non-native hardwoods. High flame lengths and rates-of-spread also presented significant challenges in the wildland–urban interface of the state capital city. However, chemical and mechanical treatments followed by growing-season prescribed burns consistently produce manageable fire and smoke behavior and achieved multiple management goals. These treatments improved ecosystem viability and increased the distribution and abundance of fire-dependent SGCN wildlife, including the complete recovery of the local Karner Blue metapopulation and the return of *Antrostomus vociferus* (Eastern Whip-poor-will). This presentation will examine solutions to the many logistical challenges associated with successfully using fire in a fragmented urban landscape and highlight important differences between restoration and maintenance fire regimes.

Sun-2-D-1   Oral Session: Pitch Pines and Pine Barrens: Natural History and Human

Breeding Bird Species Richness in a Small Highly Disturbed Woodlot in Syracuse, NY

Luke Giunta (Le Moyne College, Syracuse, NY), **Eh Moemo Qui** (Le Moyne College, Syracuse, NY), Jason Luscier (Le Moyne College, Syracuse, NY), and Donald McCrimmon (Le Moyne College, Syracuse, NY)

Abstract - Urban forest fragments may be important bird-breeding habitats. Plant diversity, successional stage, and proximity to anthropogenic activities may describe patterns in habitat use by bird species. In 2019 and 2020, we evaluated breeding-bird populations and communities within a 12.7-ha woodlot in Syracuse, NY. We conducted 10-min bird surveys at 10 points 200 m apart. There were 3 observations at each in 2019 and 1 in 2020. We used the program SPECRICH1 to estimate bird species richness. We ranked a candidate set of models evaluating the effects of multiple habitat variables on estimated species richness, e.g., number of trees, tree species richness, percent coverage of vegetation, amount of light, distance to nearest edge, and distance to nearest trail. Bird species richness (SE) varied from 9.0 (1.4) to 56.1 (16.9) species in 2019 and from 11.0 (2.8) to 32.9 (9.9) species in 2020. For 2019, the top-ranked model indicated bird species richness was constant across habitat variables. Conversely, in 2020 there were 3 equally plausible top models: (1) the null model, (2) edge model, and (3) the model examining the number of trees, distance to nearest edge, and distance to nearest trail. Species richness increased from 14.6 (3.4) species at 26 m from the edge to 27.1 (5.8) species at 131 m from the edge. Bird species richness increased from 15.0 (3.3) species at 26 trees/ha to 27.6 (6.5) species at 842 trees/ha. Bird species richness decreased from 21.9 (4.5) to 15.45 (4.2) species with increasing distance from trails. The number of observations per point varied between years, possibly contributing to the divergence of models between years. Despite this paradox due to sampling effort, 2020 results are consistent with concepts of edge effect. We expect bird species richness positively relates to habitat diversity. This hypothesis is supported by the results for increasing numbers of bird species as tree density increases.

Sat-1-F-1   Oral Session: Avian Habitat Use and Ecology I: Human Impacts

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Where We eBird Matters: Sample Selection Bias in eBird Checklist Locations by Race and Income in the Boston Metropolitan Area

Aaron M. Grade (Clark University, Worcester, MA), Nathan W. Chan (University of Massachusetts Amherst, Amherst, MA), Prashikdivya Gajbhiye (University of Massachusetts Amherst, Amherst, MA), and Paige S. Warren (University of Massachusetts Amherst, Amherst, MA)

Abstract - As ecologists seek to obtain and analyze data on urban biodiversity, crowdsourced datasets, such as eBird, are an attractive source for obtaining geographically widespread data at fine scales. A strength of eBird's semi-structured sampling model is that it capitalizes on users' willingness to document bird sightings opportunistically wherever they go. This also presents a challenge in that eBird checklist locations are nonrandom, and are based on who is using the platform and the locations they prefer to visit. Additionally, there are well-known issues with safe access to green space and inclusivity in the birding community, which could contribute to biases in the coverage of eBird checklists. In this study, we assess eBird checklist location sample selection bias by race and income in the Boston metropolitan statistical area, incorporating urban, suburban, and rural census tracts. We found that even when controlling for percentage of public green space and total area, census tracts that had a higher percentage of white residents and higher median household incomes also had more eBird checklists. This kind of bias, known as sample-selection bias, might affect analyses and interpretations of data, potentially leading to spurious inferences regarding the relationship between biodiversity and socioeconomic status. Engaging with underrepresented communities will be crucial for addressing the dual goals of inclusivity in the birding community and rigorous data collection for scientific study.

Sat-3-C-1   Oral Session: Urban Ecology and Environmental Justice I

Monitoring Nightjar Nests through the Post-fledging Period Reveals the Importance of Evaluating Chick Survival beyond the Nestling Stage

Elora R.M. Grahame (Norris Lab, University of Guelph, Guelph, ON, Canada)

Abstract - Nests of nightjars (Caprimulgidae spp.) are inherently difficult to monitor due to the highly cryptic breeding strategies of these nocturnal species. As chicks are well camouflaged and become increasingly mobile with each day of growth, monitoring nests past hatching and through the nestling period can be exceedingly challenging. Given these hurdles, published nest-success estimates for these species are extremely limited, and available studies have varied in when they call a nest successful from at the time of hatching to 15 days post hatching. Over 3 consecutive seasons (2018–2020) of research on *Chordeiles minor* (Common Nighthawk) and *Antrostomus vociferous* (Eastern Whip-poor-will) breeding at our study site in Muskoka, ON, Canada, I monitored 23 and 19 nests, respectively. I used radio-transmitters to monitor survival of breeding adults and nestlings from both species through the post-fledging period. My work thus far indicates that parental care for these species lasts up to 4 weeks after hatching—nearly twice as long as expected based on available evidence—and partial or total nest failure can occur when chicks are between approximately 10 and 25 days old. Mayfield estimates for daily nest survival in my study were 0.07 for Common Nighthawks and 0.38 for Eastern Whip-poor-wills, both of which are lower than expected based on available data. As both species are federally protected in Canada and as aerial insectivores continue to decline across the globe, my findings suggest that understanding potential causes for declining nightjar populations requires a more robust nest-monitoring approach that includes evaluating nest success beyond the first 2 weeks of the nestling period.

Sun-1-E-2   Oral Session: Full-cycle Nightjar Monitoring in Eastern North America

Spatial and Temporal Patterns in the Drought Vulnerability of the Maples (*Acer* spp.)

Jake J. Grossman (Swarthmore College, Swarthmore, PA)

Abstract - Over the last 60 million years, the genus *Acer* (maples) has radiated from its origins in present-day China to include roughly 158 species spread across the temperate North, with distinct maple floras occurring in East Asia, Europe and Western Asia (Eurasia), and North America. Originating under a warm, wet Eocene climate, the maples diversified and radiated across these 3 bioregions over a period of gradual climatic cooling and drying culminating in the cyclic Ice Ages of the Pliocene and Pleistocene. They are now confronted with the rapidly warming and more drought-prone conditions engendered by anthropogenic climate change. Using species-distribution modeling, field observations, and benchtop physiological experiments, I explored spatial (biogeographic) and temporal (phenological) patterns in the maples' ecological niches and capacity to withstand climatic stresses associated with climate change, such as drought. My work shows that this resistance to climate change is not distributed in a spatially uniform way throughout the genus. Eurasian species are, on average, more drought-tolerant than East Asian species, with North American species intermediate. This physiological pattern is reflected in the maples' niches: Eurasian species occupy only relatively dry conditions compared to other species. Furthermore, drought tolerance is not stationary in time; across leaves and stems, I find a pattern of increasing tolerance to desiccation over the course of the growing season. Together, these findings inform ongoing maple conservation by highlighting places and times of year in which maples will be most vulnerable to the drought stress likely to occur in a changing climate.

Fri-3-C-5   Oral Session: Climate Change Ecophysiology

Anatomy of Hinge Formation during Leaf Prostration of the Wintergreen Fern *Polystichum acrostichoides*

Jinyan Guo (SUNY Oswego, Oswego, NY), Eric Leonte (SUNY Oswego, Oswego, NY), and Robert Salerno (SUNY Oswego, Oswego, NY)

Abstract - *Polystichum acrostichoides* (Christmas Fern), a prominent member of the understory vegetation from the Northeast, forms a hinge region near the base of its petiole, which enables the leaf to acquire a prostrate position in the early winter. Previous studies showed that prostrate leaves are capable of photosynthesis, and that vascular tissues in the hinge region are intact. However, no detailed data on the anatomical changes that give rise to the formation of a hinge were available. This study uses a combination of free-hand sections of fresh tissues and microtome sections of wax-embedded tissues to cut across petioles of prostrate leaves, focusing on the hinge region. Data collected using a stereo microscope and a light microscope show that the outline of the cross section of the petiole is more or less oval with a relatively flat surface on the adaxial side in the non-hinge region. This outline is deformed in the hinge region by the formation of indentations between the 2 rows of adaxial and abaxial vascular bundles which cause the petiole to fold. At the indentations, the hypodermis, which consists of a few layers of sclerenchyma with thick secondary cell walls, is compressed and deformed. The formation of indentations in the hinge region is caused by the degeneration of the protoplast of the cortex cells, leaving only a compressed network of interconnected primary cell walls, except those few layers of cortex cells that immediately enclose the vascular bundles. In the transition zone between the non-hinge region and the hinge region, most cortex cells are largely deformed while still maintaining some protoplast, whereas in the non-hinge region, the cortex cells are more or less round in cross sections with intact protoplast and intercellular spaces. The vascular bundles form a branching network in the petiole, with irregular branches connecting the adaxial and abaxial bundles and between 2 adaxial or abaxial bundles, which are intact in the hinge region. Hinge formation was found in regions with or without branching vascular bundles. This study demonstrated that, anatomically, the degeneration of the vast majority of cortex cells in the hinge region is largely responsible for leaf prostration.

Sat-3-B-1   Oral Session: Botany

Illustrations Clarify and Promote Biological Research

Gretchen Kai Halpert (Scientific Illustration Distance Program, Elmira, NY)

Abstract - Coalescing biological data and observations with drawings, tables, and animations can support and promote biological research by drawing attention to concepts or discoveries in field and laboratory work. Biological data and observations may be enhanced through well-planned and executed scientific illustrations, by the researcher or professional illustrator. Scientists can save time and funding by considering effective visual documentation prior to publication preparation. Effective visual documentation includes accurate species renderings, info-graphics, and theoretical concepts, while considering audience and final output of print or web. The use of planning tools to map visual ideas simplifies this process.

Sat-1-B-1   Oral Session: Natural HIstory Education and Communication

A Multi-Pronged Approach to Understanding Vermont's Wild Bee Fauna

Spencer Hardy (Vermont Center for Ecostudies, Norwich, VT), Joan Milam (University of Massachusetts, Amherst, MA), Michael Veit (Lawrence Academy, Groton, MA), Leif Richardson (Stone Environmental, Montpelier, VT), Mark Ferguson (Vermont Department of Fish & Wildlife, Montpelier, VT), Charlie Nicholson (University of California, Davis, CA), Nathaniel Sharp (Vermont Center for Ecostudies, Norwich, VT), and Kent McFarland (Vermont Center for Ecostudies, Norwich, VT)

Abstract - From 2012 to 2014, the Vermont Center of Ecostudies conducted the Vermont Bumble Bee Atlas to better understand *Bombus* (bumble bee) diversity and distribution in Vermont. This multi-year atlas documented the recent extirpation of 3 previously widespread species, as well as significant changes in the relative abundance of the remaining 13 species. Data from this project helped to list *Bombus affinis* (Rusty-patched Bumble Bee) as a federally endangered species as well as listing 3 additional species as threatened and dndangered in Vermont. Though bumble bees are the best known bee genus in the state, they represent only 5% of the more than 300 wild bee species now known in Vermont. In 2019, we launched the Vermont Wild Bee Survey to expand our bumble bee work to the remaining 36 bee genera. After 2 full seasons, we have a relatively complete faunal list for the state, as well as the data necessary to identify areas of conservation importance and determine conservation ranks for most species. In 2021, we will survey key areas that may harbor a few bee species not yet documented in the state while continuing to build the capacity of our volunteer bee watchers through online platforms like iNaturalist. Observations uploaded to iNaturalist and identified by experts are virtually free and instantaneous, while a single specimen can cost upwards of $5 and take over a year to process. Though accessible identification resources are still lacking, nearly half of Vermont's bee species can be identified from clear photos. By synthesizing and disseminating information on important field marks, natural history, and distribution, we plan to build a robust network of community scientists that will be crucial for long-term monitoring at a broad spatial scale.

Fri-1-C-3   Oral Session: Native Plants and Native Pollinators I: Wild Bee Faunas

Operationalizing a Late Origin of Avian Flight

Scott A. Hartman (UW-Madison, Madison, WI) and Adam Fitch (Virginia Tech, Blacksburg, VA)

Abstract - Investigations into the origin of avian flight typically center around well-known taxa with either historical importance, such as *Archaeopteryx*, and/or exceptional preservation, such as the dromaeosaurid *Microraptor*. These investigations often link the origins of avian flight to unknown Middle Jurassic theropods, equating pennaceous-feathered wings, which first appear in pennaraptoran theropods in the late Middle Jurassic, with flight ability. Biomechanical work has shown that aerial locomotion requires far more than flapping wings, and several recent phylogenetic studies have concluded that incipient aerial locomotion in *Archaeopteryx* and *Microrator* was acquired independently of the origin of modern birds. As the origin of avian flight shifts crownward, time-calibrated paravian phylogenies suggest aerial locomotion truly ancestral to avian flight may have been a Late Jurassic or Early Cretaceous phenomenon. This hypothesis raises the possibility that rather than modeling hypothetical ancestral theropods, the stages of avian flight mechanics may be found among the exceptionally well-documented Early Cretaceous avialan fossil record. Here we present initial results, mapping key features associated with avian flight onto Early Cretaceous avialans. We find evidence for several stages of aerial locomotion restricted to Euavialae, with the fundamental components of the avian flight apparatus only becoming fully present in Ornithothoraces.

Sat-3-A-4   Oral Session: To the Sky and Back: The Natural History of Flight and

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A Case Study: Wood Duck Nest Competition and Clutch Genetic Composition

Kayla Harvey (Delaware Department of Natural Resources and Environmental Control, Smyrna, DE), Phillip Lavretsky (University of Texas-El Paso, El Paso, TX), Justyn Foth (Delaware Department of Natural Resources and Environmental Control, Smyrna, DE), and Christopher Williams (University of Delaware, Newark, DE)

Abstract - Nest parasitism is a common reproductive strategy used by many species of cavity-nesting waterfowl, including *Aix Sponsa* (Wood Duck). Here, we investigated the genetic relationship of 2 female Wood Ducks competing over an artificial nesting box in Delaware, including the continued incubation of 1 female despite the death and body remains of the other female throughout the incubation process. We test whether such an extreme case of nest parasitism can be explained by relatedness, egg-lineage composition, or a combination of other factors. To do so, we extracted genomic and mitochondrial DNA from blood and tissue of the females, as well as chorioallantoic membranes of all viable and inviable eggs. Subsequently, we assessed relatedness among females and eggs based on hundreds of nuclear loci and the mtDNA control region. We concluded that (1) the 2 incubating females were entirely unrelated, (2) the single clutch is in fact represented by a minimum of 4 unrelated females, and (3) a single female can lay eggs sired by different males. The latter finding is the first direct evidence for successful extra-pair copulation in Wood Ducks. With decreasing costs and increasing effectiveness, genomic methods have the potential to provide important insights into more complex ecological and evolutionary tactics of avian populations.

Fri-2-D-2   Oral Session: Waterfowl and Wetlands Science and Conservation

Effects of Coverboard Age and Aging on Salamander Usage

Brandon P. Hedrick (Louisiana State University Health Sciences Center, New Orleans, LA), Chris Sutherland (University of St. Andrews, St. Andrews, Scotland), George Bancroft (University of Massachusetts–Amherst, Amherst, MA), and Fanny Riand (University of Massachusetts–Amherst, Amherst, MA)

Abstract - Salamanders represent exceptional indicators for understanding environmental change and forest degradation. Coverboards, a type of artificial cover object, have become a popular tool for censusing salamanders given their low cost of installation and lack of danger to the environment and animals. Previous work has suggested that a variety of factors including wood type, coverboard size, and array design may impact coverboard usage by salamanders, potentially confounding experimental results. Therefore, when comparing salamander counts across studies, or within multi-year studies, it is necessary to standardize study designs. Using arrays composed of boards with 3 different ages (0, 1, and 5 years) in Pelham, MA, from 2017 to 2019, we assessed how coverboard age and the coverboard-aging process affects coverboard usage by *Plethodon cinereus* (Red-Backed Salamander). Based on the probability of observing a salamander under a coverboard, we found no difference in preference between 0- and 1-year-old boards, but that preference for 5-year-old boards was significantly higher than for younger boards. Further, the aging process of individual boards did not strongly impact preference, suggesting that abundance is affected by board age and not by the board-aging process. These results suggest that coverboard integration times are non-linear. Moreover, snout–vent length and age class were not associated with board age. For multi-year studies greater than 2 years, we recommend minimizing variation in board age, and if it is unavoidable, incorporating board age into analyses. Standardizing coverboard study designs will likely eliminate many of the conflicting results that are found in coverboard literature.

Sat-2-D-3   Oral Session: SPARCnet: The Salamander Population and Adaptation

The Race to the Top: Elevational and Latitudinal Shifts in Montane Birds

Jason M. Hill (Vermont Center for Ecostudies, Norwich, VT) and Jeremy J. Kirchman (New York State Museum, Albany, NY)

Abstract - Climate change is causing mountains to warm twice as fast as the rest of the world, and mountaintops perhaps at 5 times the global rate. Distributions of many montane plant and animal species are already shifting poleward and to higher elevations; evidence from long-term datasets suggests that this rate of movement is increasing for some species (e.g., *Ochotona princeps* [American Pika]). Here in the northeastern US, simulation models predict that >50% of the *Picea* spp.-–*Abies balsamea* (spruce-Balsam Fir) forest will be lost to the upslope movement of hardwoods over the next 2 centuries. Unsurprisingly, species-distribution models in conjunction with forecasts of climate change predict that most of the existing breeding-bird species of the spruce–fir zone will be absent as breeders from the northeastern US by the end of this century. Here, we use 10 years of community science data (>20,000 point counts from >700 high-elevation sampling locations) from the Mountain Birdwatch program to model the rate of elevational and latitudinal shifts in breeding-bird species of the northeastern US, including *Catharus bicknelli* (Bicknell's Thrush), *Setophaga striata* (Blackpoll Warbler), and *Zonotrichia albicollis* (White-throated Sparrow). We used N-mixture models within a Bayesian framework to calculate elevational-specific population trends and population trajectories from both the southern (i.e., the Catskill Mountains of New York) and northern periphery of the breeding range for these species in our region. We hope our results spur targeted, regional conservation and management actions, and help to improve connectivity and species-distribution modeling efforts in the future.

Sat-3-F-1   Oral Session: Avian Biogeography and Climate Change

Climate-Driven Dietary Change in Miocene Giant Threshers and Megatoothed Sharks

Mason Hintermeister (Independent Researcher, Mount Airy, Maryland)

Abstract - The Early Miocene period had a relatively stable warm climate that culminated in the Mid-Miocene Climatic Optimum (MMCO) (18–14 million years before present). The MMCO was followed by sharp declines in temperature causing a minor extinction event known as the Mid-Miocene Disruption (MMD). The Calvert Formation of Maryland preserves fossil shark teeth from the Early Miocene to the Middle Miocene, allowing insights into climatic influences on faunal compositions through time. *Alopias grandis* (Giant Thresher Shark) was a widely distributed, uncommon shark which occupied a high trophic level making it highly susceptible to environmental change. Initial data supports the conclusion that warming climates in the Early Miocene promoted a dietary shift toward a higher reliance on larger animals marked by the development of serrations on the crown as it transitioned into *Alopias palatasi* (Giant Serrated Thresher). These trends are also reflected in the otodontid *Carcharocles* (megatoothed sharks). The cusped morph *Carcharocles chubutensis* appears to have been gradually replaced by the cuspless morph *Carcharocles megalodon*. The climatic downturn that caused the MMD led to an ecological bottleneck that likely contributed to the extinction of *A. grandis*, *A. palatasi*, and *C. chubutensis*. Further quantitative studies will help verify this pattern.

Fri-1-B-3   Oral Session: Paleozoology: Feathers, Fins, and Fur

Freshwater Fish Parasite Ecology in a Lentic System

Genevieve M. Ivec (SUNY ESF, Syracuse, NY) and Christopher M. Whipps (SUNY ESF, Syracuse, NY)

Abstract - Understanding fish health is essential for the conservation of natural ecosystems and for optimizing managed fisheries. Parasites are a component of a healthy ecosystem, but can also impact fish health and fitness. In this study, a comprehensive survey was conducted on parasite communities in 3 fish species at a private lake near Dalton, PA. We sampled *Lepomis macrochirus* (Bluegill) and *Pomoxis nigromaculatus* (Black Crappie) using a fyke net, and *Micropterus salmoides* (Largemouth Bass) using hook-and-line gear. We found 13 species of parasites in all hosts combined. Bluegill and Largemouth Bass each had 10 of those species, while Black Crappie only had 6 species. Parasites represented the following taxonomic groups: nematodes (3 species), trematodes (3 species), monogeneans (3 species), copepods (2 species), and cestodes (2 species)). Bluegill and bass each had 2 species of nematodes, while none were in crappie. The most abundant parasite in Bluegill and bass was the metacercarial stage of the digenean *Posthodiplostomum minimum*, with 100% prevalence. Mean abundance of this parasite was also high with 2346 parasites per fish in Bluegill and 2709 parasites per fish in bass. Infected Bluegill and bass had disseminated infections in the kidneys, liver, and spleen. Infections of the heart tissue were common in Bluegill, but almost always absent in bass. Notably, this parasite was completely absent in crappie. *Ergasilus* sp., a copepod parasite, was also absent in crappie and occurred rarely in bass, but had a 66% prevalence in Bluegill with mean abundance of 22 parasites per fish. One of the monogenean species was only found in bass, suggesting that it is a specialist. Future directions with this work includes using otolith microchemistry to analyze correlations between levels of heavy metal concentrations and parasite load.

Fri-2-C-4   Oral Session: Parasite Ecology

Cross-ecosystem Subsidies in Acadia: How Invertebrates can Help us Understand Mercury Exposure in Songbirds

Allyson K. Jackson (Purchase College, SUNY, Purchase, NY), Leo Frampton (Purchase College, SUNY, Purchase, NY), Matthew Garafalo (Purchase College, SUNY, Purchase, NY), Dr. Stephen Harris (Purchase College, SUNY, Purchase, NY), Batya Nightingale (Purchase College, SUNY, Purchase, NY), and Alex Youre-Moses (Purchase College, SUNY, Purchase, NY)

Abstract - As they emerge from freshwater ecosystems and take flight, aquatic insects play an important role for the surrounding terrestrial ecosystem. This pulse of resources out of the aquatic system and into the surrounding terrestrial ecosystem creates a rich food source for birds living near the water. Furthermore, aquatic emergence can occur at a critical time in the spring before terrestrial invertebrate prey become plentiful. With these important cross-ecosystem subsidies, unfortunately, also come aquatic contaminants. Mercury, in particular, moves through emergent aquatic insects to riparian birds. In June and July 2018, we collected aquatic, terrestrial, and emerged aquatic insects at 4 sites in Acadia National Park, ME, to quantify the movement of resources and mercury out of freshwater systems and determine how they impact the surrounding bird community. Our objectives were to (1) quantify abundance, diversity, and biomass of emergent aquatic insects throughout the spring and summer, (2) calculate temporal changes in invertebrate diversity and abundance in riparian zones during the critical songbird breeding season, and (3) correlate riparian songbird mercury contamination with emergent insect biomass. Additionally, we taught park visitors about the connection between emergent aquatic insects, contaminants, and riparian areas, by recruiting help from citizen scientists for the invertebrate collections. Documenting, understanding, and protecting cross-ecosystem subsidies now is critical as we manage for resilient ecosystems in the second century of stewardship at Acadia.

Sat-1-F-2   Oral Session: Avian Habitat Use and Ecology I: Human Impacts

Response of Wild Bee Assemblages to Management of Restored Wetlands

Molly M. Jacobson (SUNY-ESF, Syracuse NY), Michael Schummer (SUNY-ESF, Syracuse NY), Melissa Fierke (SUNY-ESF, Syracuse NY), and Donald Leopold (SUNY-ESF, Syracuse NY)

Abstract - In the northeastern US, efforts in the last several decades to restore degraded wetlands have been successful in creating habitat for waterfowl and other migratory birds. However, our understanding of other ecosystem services provided by restored wetlands remains limited. Specifically, information is lacking about wild pollinators that use the floral resources in restored wetlands and whether current management techniques influence their spatial and temporal use. Wetland treatments in our study area were full drawdown (near 100% water removal during the growing season), partial drawdown (20–50% water removal), and passive wetlands (no active water removal). We conducted surveys of plant communities and bee assemblages while monitoring hydrological data among these treatments, June–September 2019 and 2020. Using sweep surveys and bee bowls, we collected 9046 bees comprised of 25 genera and ≥80 species of bees. We detected that frequency of monotypic stands of *Typha* spp. (cattail) were greatest in passive wetlands, and percent cover of open water was least in full drawdown wetlands. Entomophilous plant species richness decreased with increasing open water and monotypic cattail cover, and bee richness varied negatively with amount of open water, but plant species and bee richness did not differ among treatments. Most documented bee species were generalist flower visitors, and expected species turnover across the growing season was the strongest predictor for assemblage composition. Poorly known plant–pollinator interactions were elucidated through flower sweeps that deepen our understanding of the ecological niches of native pollinators in wetlands. Results suggest the majority of bee pollinators utilizing wetlands are habitat generalists opportunistically taking advantage of resources when present, especially in late summer. Our findings illustrate how wetlands regardless of management type provide floral resources to support both generalist and specialist bees, and that the restoration and maintenance of wetlands contribute to the conservation of wild pollinators alongside other wildlife.

Fri-2-D-1   Oral Session: Waterfowl and Wetlands Science and Conservation

Making Field Guides Work

Jerry Jenkins (Northern Forest Atlas Foundation, Lake Placid, NY)

Abstract - Field Guides are small-format books that illustrate and identify. They developed in the early 1900s, diversified in the 1950s, and have become a unique literary form: compact, intricate, focused, beautiful, and useful. The best ones take a lifetime of experience to write and illustrate, and remain useful for decades after they are published. Designing them is hard. Multiple trade-offs are involved. The constraints, measured by ratios of words per species versus species per graphic page, are severe. Currently, there are 3 main solutions. Mini-monographs, with 1 page or more per species, have great detail and poor comparison. Classic guides, in the Peterson format, have good amounts of text per species and the best comparative pages of any guides. Integrated-text guides, like the Sibley guides, have high usability, poor text per species, and moderately good comparison. There are great guides in all these formats, but no great botanical guides in any of them. Botanists need guides that filter the species pool ecologically and compare plants using multiple characters. No such guides exist. They will require a new design: we have created one for the Atlas Project. We first make an integrated species guide, in Sibley style; we then precede that by a full set of character-based comparisons, as did Symonds; and then we precede that by a section of ecological maps of our own design. We think of it as an emulation of the way field botanists work: filter by ecology, filter by characters, confirm by details. Our first full guide in this format, *Woody Plants of the Northern Forest*, is about 2 years away. I will show our working designs and sample pages in the talk

Fri-3-B-5   Oral Session: New Natural History Books: Insights from the Authors

An Assessment of Interclutch Variability in Egg Characteristics in Two Species of Rail

Emily W. Johnson (East Carolina University, Greenville, NC) and Susan B. McRae (East Carolina University, Greenville, NC)

Abstract - Maternal egg signatures are recognized in some avian species, but quantifying interclutch variability has proved challenging. The focus of our study was to use image analysis to attempt to match the eggs of *Rallus elegans* (King Rail) and *Gallinula chloropus chloropus* (Common Moorhen) to their clutches using the computer program NaturePatternMatch (NPM). We ran 66 King Rail clutches ($n = 338$ eggs) and 58 Common Moorhen clutches ($n = 364$ eggs) through NPM to generate the proportion of correct clutch matches. Additionally, for Common Moorhens, we calculated the proportion of times the correct hen was matched. We performed non-metric multidimensional scaling (NMDS) and permutational analysis of variance (PERMANOVA) using the best egg-match output. NMDS analysis based on spot-pattern data extracted using NPM was only able to match eggs to the correct clutch 19% (King Rails) or 18% (Common Moorhens) of the time. When correct hen-matching was considered for Common Moorhens, matching increased to 21%. We also investigated whether eggs could be grouped using a combination of pattern data derived from NPM output and egg dimensions. We performed linear discriminant analyses using hen and clutch as grouping variables and percent of eggshell pigmented, number of features, scale of the largest feature, dominant orientation of the largest feature, and egg length, width, and mass as covariates. Combining these variables in linear discriminant analysis moderately improved the proportion of clutches that could be discriminated (King Rails mean percent correctly classified = 20%, Common Moorhen mean percent correctly classified = 33%). However, these analyses failed to discriminate the majority of clutches. We discuss why King Rail eggs were less often correctly classified than Common Moorhen eggs and consider possible avenues for achieving better discrimination.

Sat-2-F-1   Oral Session: Avian Nesting Biology

The Future of Vermont Yankee: What Does the Land Tell Us?

Alec Kaisand (Antioch University New England, Keene, NH), Christa Daniels (Antioch University New England, Keene, NH), and the Antioch Spatial Analysis Lab (Antioch University New England, Keene, NH)

Abstract - Antioch University New England, through the Center for Climate Preparedness and Community Resilience, has entered a unique, strategic partnership with NorthStar, the Town of Vernon, VT, and a spokesperson for the Elnu Abenaki Tribe of Vermont to create an innovative model of collaboration for site-restoration planning that will support redevelopment efforts at the Vermont Yankee Nuclear Power Plant site once it realizes decommissioning. Geographic Information System (GIS) graduate students with the Antioch Spatial Analysis Lab conducted a landscape inventory and suitability analysis for the property to inventory the natural and built features and analyze the suitability of the property for commercial redevelopment. The parameters utilized for the landscape inventory and analysis included: built infrastructure features, land-cover types, hydrology, geology, solar radiation, natural communities and notable species, and archaeological sensitivity. Based on the results of the analysis, the GIS consultants designed potential land-use scenarios to present to stakeholders and assist future municipal planning consultants with redevelopment plans. The results of this inventory and analysis were compiled in an interactive ArcGIS Online StoryMap that can be viewed by the public and all stakeholders for the future of the site. The StoryMap is meant to be a living document to assist in the decision-making process and provide transparency for community members and stakeholders. The StoryMap will be updated as the project progresses to incorporate overall lessons learned in guiding best management practices moving forward for subsequent site decommissioning(s) and arrangements for restoration and redevelopment. To view the Landscape Inventory of the Vermont Yankee Decommissioning Site StoryMap, visit https://aune-es.maps.arcgis.com/apps/MapJournal/index.html?appid=5087ed52388b4e7fb818acc61b0fa043.

Sat-1-B-2   Oral Session: Natural HIstory Education and Communication

Effects of Urbanization and Non-native Plantations on Icelandic Birchwood Songbird Populations

Gregory S. Keller (Gordon College, Wenham, MA) and Gunnar Þór Hallgrímsson[2] (University of Iceland, Reykjavik, Iceland)

Abstract - Wooded habitat in Iceland has been reduced from 25% to 1% of the overall landscape, potentially influencing habitat availability for woodland songbirds. Afforestation efforts currently involve planting non-native and potentially invasive coniferous species (*Pinus contorta* [Lodgepole Pine] and *Picea sitchensis* [Sitka Spruce]), which may positively affect habitat availability for songbirds. In addition, potential habitat exists in the form of parklands and gardens, which may be considered urban hotspots in areas with limited woodland. We compared the impacts of coniferous afforestation to native birchwoods and wooded parklands and gardens on abundance of *Acanthis flammea* (Common Redpoll), *Loxia curvirostra* (Red Crossbill), *Turdus iliacus* (Redwing), *Anthus pratensis* (Meadow Pipit), *Troglodytes troglodytes* (Eurasian Wren), *Turdus merula* (Eurasian Blackbird), *Motacilla alba* (White Wagtail), and *Regulus regulus* (Goldcrest) during the 2018 and 2019 breeding seasons. The 45 study sites were located along a gradient from 0% to 85% urbanized. Meadow Pipit was negatively associated with urbanization, whereas Common Redpoll and Eurasian Blackbird had greater abundance in more urbanized sites. Habitat associations were species-specific and did not follow typical patterns that we predicted (e.g., Common Redpoll less abundant in birchwood habitat). Redwing appeared to breed early in coniferous and parkland sites near Reykjavik, moving to more rural birchwood sites later in the breeding season. Overall, avian responses to urbanization and habitat afforestation in Iceland illustrate differential effects on species, potentially providing insight into an otherwise overlooked system and allowing more effective conservation decisions based on the patterns detected in the avifauna.

Fri-3-E-2   Oral Session: Avian Ecology in Urban Areas

New Educational Materials and a New *Birds of New York* Exhibit at the New York State Museum

Jeremy J. Kirchman (New York State Museum, Albany, NY)

Abstract - In 2020, the New York State Museum (NYSM) in Albany, NY, completed a years-long renovation of their iconic permanent exhibit *Birds of New York*. The renovation involved deconstruction and restoration of 17 habitat dioramas displaying 140 taxidermy bird mounts. The entire gallery has been reinterpreted with new maps and graphic panels describing bird adaptations, ecology, and conservation. New taxidermy mounts were commissioned for 27 species. Historic specimens of extinct bird species are on display for the first time in a new section of the exhibit devoted to bird extinction and conservation. To accompany the re-opening of the gallery, I worked with museum educators to develop new laboratory exercises that visiting high-school and college classes perform at the NYSM using specimens (eggs and skeletons) from our collection. Downloadable versions of these labs can be performed with loaned specimens or with downloadable digital photos of specimens. In this talk, I will discuss the challenges and rewards of restoring historic natural history exhibits and of developing and delivering specimen-based learning materials.

Fri-3-F-3   Oral Session: Education, Collections, and Citizen Science to Promote

Collaboratively Counting Birds: Harnessing the Skillsets of a Transdisciplinary Team to Improve Wildlife Surveys

Logan R. Kline (Department of Wildlife, Fisheries, and Conservation Biology, University of Maine, Orono, ME), Meredith A. Lewis (Department of Wildlife, Fisheries, and Conservation Biology, University of Maine, Orono, ME), Lauren Maher (Department of Wildlife, Fisheries, and Conservation Biology, University of Maine, Orono, ME), Alexander Revello (School of Computing and Information Science, University of Maine, Orono, ME), David Sandilands (School of Forest Resources, University of Maine, Orono, ME ; Barbara Wheatland Geospatial Analysis Laboratory, University of Maine, Orono, ME), Roy M. Turner (School of Computing and Information Science, University of Maine, Orono, ME ; University of Maine Software Agents/AI Laboratory (MaineSAIL), University of Maine, Orono, ME), Daniel J. Hayes (School of Forest Resources, University of Maine, Orono, ME ; Barbara Wheatland Geospatial Analysis Laboratory, University of Maine, Orono, ME), and Cynthia S. Loftin (US Geological Survey, Maine Cooperative Fish and Wildlife Research Unit, Orono, ME).

Abstract - Ecological research can be advanced by harnessing knowledge from various fields, such as computer science and remote sensing. The rapidly emerging field of artificial intelligence (AI) holds great promise for applications in ecology; however, applying AI to address ecological questions requires integrating the skillset of computer scientists familiar with programming structures and an ecologist's understanding of the ecological system to pose relevant questions. Transdisciplinary cooperation and innovation offer promise for providing unique solutions to biological problems, yet creating partnerships that connect people with relevant knowledge domains can be challenging. The outcome of transdisciplinary teamwork is often desirable, however, as differences in how scientists from diverse disciplines approach research questions can improve work efficiency and influence project outcomes. Our research provides a case study using transdisciplinary innovation and project-based learning to answer a seemingly simple biological question: How can we better count birds? We have engaged teams of undergraduate and graduate students, faculty researchers, and professional wildlife biologists to investigate this question. Our collaboration has evolved as we explore research questions and learn about the knowledge and interest of our partners. Our team spans experience levels and multiple disciplines, including computer science, remote sensing, ecology, and geospatial information science, and includes students, faculty, and practicing professionals. We integrate classroom- and capstone-based instruction and academic research in the university setting guided by consultations with resource professionals to develop the means to solve this "real-world" conservation problem. Our work has resulted in a suite of tools to visualize count data; photogrammetry-derived innovations in processing avian imagery with AI; and we are developing an open-source program to increase accessibility of computer-based tools for biologists and citizen scientists interested in monitoring bird populations. These achievements have resulted from building a multilayered network among diversely experienced teams working together to explore the complexities of our focal question.

Fri-3-F-5   Oral Session: Education, Collections, and Citizen Science to Promote

The Big Boom Theory: Interpretation and Application of the Common Nighthawk Wingboom Display

Elly Knight (Bioacoustic Unit, Department of Biological Sciences, University of Alberta, Edmonton, AB, Canada) and : R. Mark Brigham (University of Regina, Regina, SK), and Erin M. Bayne (University of Alberta, Edmonton, AB)

Abstract - Management of most avian landbird species uses auditory cues from displaying males for determining habitat relationships. Unfortunately, using cues that signal territory boundaries can underestimate home-range size and lead to inaccurate or imprecise conclusions. Differentiating home ranges from territories and understanding the behavioral context of the two is therefore important for effective species management. *Chordeiles minor* (Common Nighthawk) is a poorly understood but widespread species whose populations are declining across most of North America. Nighthawks breed in a broad spectrum of habitats but little is known about their specific habitat requirements and space use. The mechanical wingboom display of this species has the potential to facilitate habitat modelling and breeding ground conservation for Common Nighthawks because it is thought to be a territorial display, potentially linked to the nest location. We captured, tagged, and tracked 21 male Common Nighthawks in northeastern Alberta to confirm the biological significance of the wingboom display and describe Common Nighthawk territoriality. We found minimal overlap of wingboom-use distributions between males, suggesting the wingboom does indicate an exclusive territory. We used a resource-selection function to show that male Common Nighthawks select areas near the nest to perform wingboom displays. We then used bioacoustic recordings from Alberta's boreal forest to separate wingboom detections from vocal detections and thus differentiate between territorial nesting and home-range habitat. We showed that the scale of effect, habitat relationships, and the importance of disturbance differ between territorial and home-range habitat for the Common Nighthawk. Our study highlights an important tool for Common Nighthawk conservation, provides new insights into the habitat requirements of this species in the boreal forest, and emphasizes the importance of understanding the behavioral context of avian space use

Sun-1-E-4   Oral Session: Full-cycle Nightjar Monitoring in Eastern North America

Use of a Spatial Capture–Recapture Approach to Model Density of Tidal Marsh Sparrows at Breeding Sites

Alison R. Kocek (SUNY-ESF, Syracuse, NY), Jonathan B. Cohen (SUNY-ESF, Syracuse, NY), J. Andrew Royle (USGS, Annapolis, MD), Samantha Apgar (University of Connecticut, Storrs, CT), Bri Benvenuti (USFWS, Wells, ME), Alexandra M. Cook (SUNY-ESF, Syracuse, NY), Chris S. Elphick (University of Connecticut, Storrs, CT), Chris M. Field (University of Maryland, Annapolis, MD), Laura Garey (University of Maine, Orono, ME), Adrienne I. Kovach (University of New Hampshire, Durham, NH), Brian J. Olsen (University of Maine, Orono, ME), Katharine J. Ruskin (University of Maine, Orono, ME), and W. Gregory Shriver (University of Delaware, Newark, DE)

Abstract - Tidal marshes are an imperiled habitat, having suffered losses of over 70% in many places along the Northeast Atlantic coast of the United States and continuing to be imperiled by sea-level rise and anthropogenic factors. Species such as tidal marsh sparrows that depend on this habitat may not be able to adapt at the rates tidal marshes are being lost. Tracking trends in the breeding density of local tidal marsh sparrows in response to a changing environment and management actions is difficult because these birds are secretive and have quiet songs, hindering common methods of estimating abundance. Spatial capture–recapture (SCR) approaches offer a potentially robust, although labor intensive, means of overcoming this obstacle. As part of the Saltmarsh Habitat and Avian Research Project (SHARP), we systematically mist-netted tidal marsh sparrows monthly throughout the breeding season at 18 locations from Maine to New York between 2014 and 2019. Using Bayesian SCR models, we estimated abundance and densities for each sex of 3 tidal marsh sparrow species (*Ammospiza caudacuta* [Saltmarsh Sparrow], *Ammospiza nelsoni* [Nelson's Sparrow], and *Ammospiza maritima* [Seaside Sparrow]). Densities varied between sites, species, and by sex (for Saltmarsh and Nelson's Sparrows), and relationships with covariates (high marsh habitat composition, marsh complex size, proximity to urbanization) are currently under analysis. We have demonstrated that SCR modeling can provide viable density estimates for tidal marsh sparrows that will aid strategies determining where to focus resources to protect and restore tidal marshes that will support these imperiled birds.

Fri-2-E-4   Oral Session: Avian Breeding Season Ecology Along the Coast

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Determining Origins of Mallards Harvested in the Atlantic Flyway Using a Stable Isotope Approach

Samuel R. Kucia (SUNY ESF, Syracuse, NY) and Michael L. Schummer (SUNY ESF, Syracuse, NY)

Abstract - The eastern population of *Anas platyrhynchos* (Mallard) has declined by about 40% since 1997. Causes of this decline are not well understood. Production and survival estimates have not changed significantly in the past 20 years, suggesting potential biases somewhere in available data. Due to this decline and need to identify potential biases, determining duckling-production areas of Mallards harvested in the Atlantic flyway is important. Due to limited banding effort in northern latitudes in the range of the eastern Mallard population, banding records are insufficient for identifying key breeding areas throughout the eastern Mallard breeding range. We used stable-hydrogen isotope analyses of feathers (δ^2H_f, deuterium) from hatch-year Mallards harvested during the 2018−2019 and 2019−2020 hunting seasons in the Atlantic flyway ($n = 1261$). We created a raw deuterium isoscape, and one weighted by banding records to inform raw deuterium results. We then applied Bayesian assignment approaches to estimate probability of origin. We detected that ≥80% of hatch-year Mallards were produced in Canada compared to the US. Our results suggest that the majority of Mallard duckling production occurs in Canada, which contrasts with long-term population estimates that suggest the majority of the breeding pairs of eastern Mallards occur in the US.

Fri-2-D-4   Oral Session: Waterfowl and Wetlands Science and Conservation

Whole-room Ultraviolet Sanitization as a Method for the Site-level Treatment of *Pseudogymnoascus destructans*

Robert Kwait (Rutgers, the State University of New Jersey, New Brunswick, NJ), Carl Herzog (New York State Department of Environmental Conservation, Albany, NY), Kathleen Kerwin (Rutgers, the State University of New Jersey, New Brunswick, NJ), Joan Bennett (Rutgers, the State University of New Jersey, New Brunswick, NJ), Sally Padhi (Rutgers, the State University of New Jersey, New Brunswick, NJ), and Brooke Maslo (Rutgers, the State University of New Jersey, New Brunswick, NJ)

Abstract - White-nose syndrome (WNS) is a multi-host disease of hibernating bats caused by the fungal pathogen *Pseudogymnoascus destructans* (White-nose Syndrome Fungus). Infected bats surviving the winter can clear infection, but because the pathogen persists in hibernacula in the absence of bats, individuals are re-infected the following year. Ultraviolet (UV) radiation technology is a common sanitization method in the medical, ventilation, and water quality industry and has been shown to kill *P. destructans* in a lab setting. We used a simulated hibernaculum to test the feasibility of using whole-room UV sanitization technology in delivering a germicidal dose of UV-C light to *P. destructans*. We quantified the effect of distance and angle on measured irradiance to determine the practical limits of whole-room sanitizers in treating hibernacula. Whole-room UV-C sanitization reduced *P. destructans* coverage on experimental plates by an average of 97.3% relative to the controls. Measurable UV-C irradiance surface normal to the sanitizer extended a maximum of 21.3 m; incident angles of 45º and 90º reduced treatment distance. Whole-room UV sanitization is a promising technique for reducing *P. destructans* prevalence in environmental reservoirs at the hibernaculum scale. Hibernaculum size and surface topography will influence the time required for delivery of a germicidal dose and must be considered along with other logistics (i.e., power supply, hibernaculum accessibility) prior to field deployment.

Sun-2-F-4   Oral Session: Bat Conservation: Light Pollution and White Nose Syndrome

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Enhancing Tropical Avian Behavioral Ecology Via ddRAD-seq: *Melanoptila glabrirostris* as a Case Study

Joshua B. LaPergola (Princeton University, Princeton, NJ, USA), Christina P. Riehl (Princeton University, Princeton, NJ, USA), Blanca Roldán-Clarà (Universidad Autónoma de Occidente, Mazatlán, Sinaloa México), Juan E. Martínez-Gómez (Instituto de Ecología AC, Xalapa, Veracruz, México), and Robert L. Curry (Villanova University, Villanova, PA, USA)

Abstract - Avian behavioral ecology suffers from a temperate zone bias: most empirical work has involved species at temperate (especially northern) latitudes despite most avian diversity occurring in the tropics. In particular, the mating and social systems of tropical species remain poorly known, reducing the generalizability of comparative studies attempting to test broader theories. Robustly describing mating and social systems depends, in part, on the use of genetic resources for parentage assignment and quantifying the relatedness of group members. One means of addressing this bias is via leveraging a next-generation sequencing technique, double-digestion restriction associated DNA sequencing (ddRAD-seq), to develop genetic resources for poorly studied and "non-model" tropical species. We will present a case study from the Riehl lab to demonstrate the utility of ddRAD-seq to identify single nucleotide polymorphisms (SNPs) in poorly known tropical species. We characterize the genetic mating system of *Melanoptila glabrirostris* (Black Catbird), a species endemic to the Yucatán Peninsula. In this species, the use of SNP data permitted parentage analyses without the need for the expensive and time-intensive steps of microsatellite loci discovery. We advocate for the application of ddRAD-seq to the study of tropical avian behavioral ecology. The Riehl lab encourages tropical ornithologists who have the necessary samples for parentage and/or relatedness analyses but lacking the institutional and/or genomic resources to perform them, to contact us regarding the possibility of collaboration.

Sat-3-E-5   Oral Session: Behavior and Ecology of Neotropical Birds

A Tale of Two Trees: Effects of Climate Change on Growth of *Pinus rigida* and *Pinus banksiana* at Opposing Range Margins

Mark Lesser (SUNY Plattsburgh, Plattsburgh, NY), Linh Le (SUNY Plattsburgh, Plattsburgh, NY), and Michael Hurban (SUNY Plattsburgh, Plattsburgh, NY)

Abstract - Species' range margins may indicate climatic niche limits that the species cannot grow beyond. However, with ongoing climate change, a species' response at a range margin may vary depending on the geographic position of the margin (i. e., north vs. south). To study how species are dealing with climate change at their range margins, we assessed annual growth trends in 2 long-lived tree species, *Pinus banksiana* (Jack Pine) and *Pinus rigida* (Pitch Pine) at the Altona Flat Rock pine barrens in northern New York. At this site, Jack Pine is near its southernmost limit while Pitch Pine is near its northernmost limit. We hypothesized that with warming climate, environmental conditions may be becoming unsuitable for Jack Pine while Pitch Pine will potentially thrive with warming temperatures. We collected increment cores from 75 Jack Pine and 75 Pitch Pine at the Altona Flat Rock. We also sampled 17 Jack Pine at a population just north of Altona and 23 Pitch Pine at a population just south of Altona. All cores were measured and crossdated using standard dendrochronological techniques. We modeled annual ring-width against a suite of regional temperature and precipitation variables to determine what factors each species was responding to over time. Results showed that Jack Pine growth has remained relatively stable over the past century, while Pitch Pine showed an increasing trend in growth since the 1960s. However, over the past ~10 years, both Jack Pine and Pitch Pine showed decreasing growth trends. Jack Pine showed a low correlation with both temperature and precipitation, suggesting that climate is not a determining factor for growth at this site, and range limits may be set by other factors (e.g., competition). Pitch Pine showed a stronger correlation to climate, with fall temperature and annual precipitation having the largest influence on growth. This study will increase our knowledge of how tree species are responding to ongoing climate change, and inform management decisions in regard to species vulnerability and forest biodiversity along range margins.

Sun-2-D-2   Oral Session: Pitch Pines and Pine Barrens: Natural History and Human

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Latitude and Urban Green-space Size Influence Raptor Species Richness and Functional Composition in Neotropical Cities

Lucas Leveau (IEGEBA-CONICET, Buenos Aires, Argentina)

Abstract - Urban areas are expanding continuously inducing changes in raptor communities. However, our knowledge about urbanization impacts on raptor communities at continental scales is scarce. Therefore, the aim of this study is to relate geographical (city location) and environmental characteristics of cities with raptor species richness, taxonomic composition, and functional composition in urban green spaces (UGS) of Neotropical cities. I compiled data about raptor species present in UGS through search of scientific articles and theses in databases. Raptor species richness increased in the tropics, and also increased with the increasing UGS area of studies. Species composition dissimilarity was influenced by the geographic location of cities, and was dominated by species turnover between cities. Scavengers were more frequent in cities of the east coast of Brazil, whereas diet-generalist and semi-open habitat species were more frequent in southern South American cities. UGS size was related positively with raptor body size. The results obtained confirmed the pattern of increasing raptor species richness in the tropics. However, anthropogenic factors such as loss of green spaces in urban areas may influence the macrogeographic patterns of raptor species richness. The species composition dissimilarity between cities is dominated by a pattern of species replacements related to species distributions in the Neotropics. Species functional traits were affected by macrogeographic factors and also by green space size, suggesting that urbanization may alter ecosystem processes provided by raptors. In short, the conservation and planning of large UGS is fundamental to maintain raptor communities in the Neotropical cities.

Fri-3-E-3   Oral Session: Avian Ecology in Urban Areas

Instream Habitat and *Salvelinus fontinalis* (Eastern Brook Trout) Response to Over Ten Years of Stream Habitat Restoration

Katharine Lewis (Tin Mountain Conservation Center, Albany, NH) and **Rick Van de Poll** (Tin Mountain Conservation Center, Albany, NH)

Abstract - For the past 11 years, Tin Mountain Conservation Center staff, interns, and volunteers have completed stream habitat enhancement actions on 24 first- and second-order streams in Carroll County, NH, by adding large woody material to the streams. Two centuries of intensive agriculture and silviculture have led to diminished instream habitat quality for freshwater species such as *Salvelinus fontinalis* (Eastern Brook Trout). Increasingly severe storm events over the last 10–15 years have further incised stream channels and caused bank erosion and downstream siltation. The purpose of the additions of large woody debris is to reduce stream velocity, trap sediments and rafted organic material, increase nutrient retention, and increase pool depth to benefit trout and other cold-water species. Secondary benefits include the re-engagement of lateral floodplains and the general lowering of stream temperatures to improve habitat conditions. With over 10 years of data, we evaluated the impact that additons of large woody debris had on selected streams, and determined the change over time in trout populations and instream habitat characteristics. A comparison between pre- and post-treatment data indicated an increase in average riffle depth (0.29 m pre-treatment versus 0.37 m post treatment) and maximum pool depth (0.23 m pre-treatment versus 0.34 m post-treatment), and an increase in the percent of hiding and resting cover in habitat units (pools: 22.9% pre-treatment versus 50.3% post treatment; riffles: 25.1% pre-treatment versus 51.8% post treatment; $P < 0.05$). We also found that average water temperatures decreased after treatment (15.8 °C pre-treatment versus 14.6 °C post treatment; $P < 0.06$). We found varying associations between Eastern Brook Trout biomass (g/m) and density (n/m) over the years. Trout density and habitat unit depths were positively associated with the number of years post treatment ($P < 0.05$), but we did not find any significant associations between trout biomass and the covariates we measured. Our data indicate that adding large woody material to first- and second-order streams enhances habitat conditions that are conducive to Brook Trout survival, and continues to be a legitimate method of restoration for stream systems in general.

Fri-1-A-2   Oral Session: Fish Biology I: Population Biology

Overwinter Intertidal Movements and the Impacts of Sea-level Rise on Saltmarsh and Seaside Sparrows in North Carolina

Marae C. Lindquist (University of North Carolina Wilmington, Wilmington, NC), Raymond M. Danner (University of North Carolina Wilmington, Wilmington, NC), and Evangelyn L. Buckland (University of North Carolina Wilmington, Wilmington, NC)

Abstract - There are large gaps in knowledge regarding the wintering movements of *Ammospiza caudacuta* (Saltmarsh Sparrow [SALS]) and *Ammospiza maritima* (Seaside Sparrow [SESP]). Marsh species are losing essential habitat due to sea-level rise, development, and other anthropogenic impacts. Both species are listed as species of greatest conservation need in the North Carolina Wildlife Action Plan and the US Fish and Wildlife Service will determine if SALS should be federally listed as threatened or endangered in 2023. Understanding winter movements and habitat utilization of SALS and SESP throughout their winter stationary period is important to understand the impacts of sea-level rise and design effective conservation solutions. During the winters of 2019 through 2022, we are researching SALS and SESP at 5 sites in southeastern North Carolina using a combination of mark–recapture and radio-telemetry. Both species use regularly flooded tidal marshes, and their movements track the tidal cycle, suggesting that both supratidal roosting and intertidal foraging areas are important to conserve. The extent of their daily range differs significantly between species, leading to different patterns of habitat use, which suggests a need for different management priorities for each species. Both SALS and SESP have high site fidelity within seasons, suggesting little flexibility in habitat use. We are using Sea Level Affecting Marshes Model (SLAMM) to determine habitat loss through 2060. This study will provide information about habitats that must be maintained to conserve wintering grounds for SALS and SESP.

Sat-3-F-3   Oral Session: Avian Biogeography and Climate Change

Prevalence and Genetics of Gammaherpesvirus and Parvovirus Infections in Vermont Bobcats (*Lynx rufus*)

Dagan A. Loisel (Saint Michael's College, Colchester, VT), Owen Sanborn (Saint Michael's College, Colchester, VT), Lauren Walsh (Saint Michael's College, Colchester, VT), Emily Ferreri (Saint Michael's College, Colchester, VT), and Megan McCauley (Saint Michael's College, Colchester, VT)

Abstract - Viral pathogens play an important role in shaping the health of wildlife populations. Apex predators, such as *Lynx rufus* (Bobcat), are exposed to and impacted by a number of diverse viral diseases. To better understand the frequency and potential impact of viral infections on Bobcat population health, we conducted a molecular epidemiological study of 2 viruses in the Vermont (VT) Bobcat population. Specifically, we used endpoint and quantitative real-time PCR and DNA sequencing to investigate the presence, prevalence, and genetic identity of the Bobcat gammaherpesvirus (GHV), LruGHV1, and of viruses in the *Protoparvovirus* genus (i.e., parvoviruses). The results indicate that LruGHV1 infection was common and widespread in Bobcats, with LruGHV1 DNA being detected in ~ 64% of all animals. In contrast, parvovirus infection was significantly less common, with parvovirus DNA being detected in only ~8% of animals. These 2 viruses also differed markedly in levels of genetic variation observed in the VT population: only a single sequence was observed for the LruGHV1 gene, *Glycoprotein B*, while 11 different sequence variants of the parvovirus *VP2* gene were detected in the population. The clear differences in prevalence and genetic diversity of these viruses may reflect differences in viral ecology, transmission, and replication dynamics, as well as variation in host factors, such as age, sex, and immunocompetence.

Fri-2-C-1   Oral Session: Parasite Ecology

Surveying Insect Populations and Vegetation in Nonagricultural Landscapes Within the Mianus River Gorge

Sydney Lonker (White Plains High School, White Plains, NY) and **Madeline Buehrer** (Pelham Memorial High School, Pelham, NY)

Abstract - Past research has presented evidence suggesting the decline of pollinator populations, which is now increasingly apparent on a global scale. As more attention is being focused on the influence of land-use change regarding agricultural production and resource availability, researchers are looking towards sampling vegetation to further understand the influence that it plays on current pollinator population dynamics. The Empire State Native Pollinator Survey is a study that is currently running to gain an understanding of what native insect pollinators currently inhabit New York state. This study has given us a strong idea of what pollinators are currently present in the Mianus River Gorge, as well as the effects that vegetation has on these species. We tested a diverse set of meadows and landscapes to gain a stronger understanding of what flora attracts a more favorable population of pollinators to improve the meadows' pollination and growth rates. This information will then be used to create management implications for the meadows at Mianus River Gorge to benefit its overall ecosystems. Additionally, we used a program called the Seek app by iNaturalist to identify the plants within the meadows. The quantity and variety of vegetation have been recorded, and assessments have been made comparing the varying vegetation compositions of different meadow types.

Sun-2-C-3   Oral Session: Native Plants and Native Pollinators II: Conservation

Community Science with CatTracker: A Smartphone App for Understanding Distributional Patterns of Free-roaming House Cats

Jason D. Luscier (Le Moyne College, Syracuse, NY)

Abstract - There is ample evidence for the negative effects of free-roaming *Felis catus* (Domestic Cat) on wildlife globally; however, the dynamics of specific distributional patterns and comprehensive trophic effects are unclear. Ultimately, we need more information regarding effects of Domestic Cats on urban food-web dynamics and community structures so as to better inform management of native wildlife. One of the most effective ways to gather fine-scale data regarding Domestic Cat distributions over expansive geographic areas is to rely on community science data. In urban settings, community engagement in data collection can be extremely useful for understanding distributional patterns with the added benefit of enhanced awareness of and connection to local urban ecosystems. CatTracker is a free smartphone app for reporting sightings of free-roaming Domestic Cats anywhere in the world. Observers record location, date, and time of a sighting as well as the number of Domestic Cats and behaviors observed. Currently this app is being used in 35 states and in 22 countries around the world. I have used these community-based data to model Domestic Cat distributions in Syracuse, NY. Data gathered from CatTracker can be used by conservationists and Cat advocates alike to inform management programs. Community-based science with CatTracker is an excellent way to amass detection data and to increase awareness in the hopes of finding solutions to this conservation challenge.

Sat-3-C-3   Oral Session: Urban Ecology and Environmental Justice I

Population Genetics of Diamondback Terrapins at Their Northern Range Edge

Amanda L. Lyons (Department of Ecology and Evolutionary Biology and Institute at Brown for Environment and Society, Brown University, Providence, RI), Bianca R.P. Brown (Department of Ecology and Evolutionary Biology and Institute at Brown for Environment and Society, Brown University, Providence, RI), Rebecca Y. Kartzinel (Department of Ecology and Evolutionary Biology, Brown University, Providence, RI), Scott W. Buchanan (Rhode Island Division of Fish and Wildlife, West Kingston, RI), Lisa Ferguson (The Wetlands Institute, Stone Harbor, NJ), Brian Williamson (The Wetlands Institute, Stone Harbor, NJ), and Tyler R. Kartzinel (Department of Ecology and Evolutionary Biology and Institute at Brown for Environment and Society, Brown University, Providence, RI)

Abstract - *Malaclemys terrapin* (Diamondback Terrapin) is a brackish water turtle recognized as a keystone predator of herbivorous crabs and snails in salt marsh ecosystems across the east coast of the United States. Due to habitat destruction, bycatch in commercial crab traps, road mortality, and historical overharvesting, populations have declined and disappeared from parts of the terrapin's range. It is particularly threatened in the northeastern part of its distribution from New York through Massachusetts, where coastal impacts of the megacity on salt marshes have been pronounced. In order to elucidate levels and partitioning of genetic variation of populations of Diamondback Terrapins in this region, we performed a genetic analysis based on restriction-site–associated DNA sequencing (RADseq). We obtained high quality genetic data from 178 individuals sampled across 17 populations from Cape May, NJ, to Wellfleet, MA. We tested the hypotheses that: (1) the genetic diversity of populations would decline from New Jersey, nearer the central core of the species' mid-Atlantic distribution, to its northern range edge in Massachusetts; and (2) populations would exhibit an isolation-by-distance pattern of genetic variation throughout this region. Consistent with our hypotheses, genetic diversity declined significantly from south to north (expected heterozygosity min–max: 0.08–0.14) and exhibited a significant pattern of isolation by distance (Mantel's $r = 0.20$, $P = 0.001$). Northern range-edge populations maintain comparatively low genetic diversity and are relatively isolated from populations that contain greater levels of genetic variation to the south. These results advance regional and state-level conservation priorities for preserving populations of Diamondback Terrapins by expanding our understanding of their genetic history in the Northeast.

Sun-2-B-3   Oral Session: Herps: Imacts of the Anthropocene

Influence of Established Overstory Trees on the Mycorrhizal Status of *Betula lenta* (Black Birch) Seedlings

Allison Lyubomirskaya (Mianus River Gorge; Bedford, NY) and Andrew Cortese (SUNY ESF, Syracuse, NY)

Abstract - The benefits of mycorrhizal colonization towards seedling growth are widely known; however, the variables that affect the colonization of seedlings by ectomycorrhizal (ECM) fungi are often overlooked. In this study, we examined the effects of distance from established trees colonized by ECM on percent ECM colonization and ECM fungal morphotype richness of *Betula lenta* (Black Birch) seedlings located in a second-growth forest. Black Birch seedlings were collected in the second-growth forest of the Mianus River Gorge and examined for percent ECM colonization as well as morphotype richness. It is important to note that morphotype measurements were an approximation of the fungal diversity present in each Black Birch seedling root system. Distance from each sample to the nearest established ECM tree with a DBH greater than 10 cm was measured. We then calculated average percent colonization and morphotype richness for each sample and found a significant, negative relationship between both percent colonization as well as ECM morphotype richness of seedlings and distance from an established ECM tree species. Our results demonstrated that as distance increases, fungal percent colonization and species richness of birch seedlings decreases. This relationship provides insight into the factors that influence seedling growth and survival in a second-growth forest. Furthermore, both relationships provide a new approach to forest restoration regarding the insurance that seedling survival will be enhanced due to increased fungal colonization and species richness closer to the established tree.

Sat-1-A-1   Oral Session: The Effects of Belowground Interactions on Aboveground

What Can Motus Do for You?

Stu Mackenzie (Birds Canada, Port Rowan, ON, Canada)

Abstract - With the expected completion within 3 years of a Northeast-wide, 150-site Motus network from Maryland and Delaware to Maine, many researchers are wondering how best to use this powerful new wildlife telemetry tool. As with any technology, the Motus Wildlife Tracking System has advantages and disadvantages that are important for scientists to understand when considering adopting this technology for their studies. This presentation will help participants understand what Motus can and can't do, and what kinds of research questions it's best suited to answer.

Sat-2-E-2   Oral Session: Expanding the Northeastern Motus Network

Methods for Surveying *Plethodon cinereus* Using Passive Integrated Transponder (PIT) Tags in a Forested Habitat

Maisie MacKnight (Penn State University, University Park, PA) and David A.W. Miller (Penn State University, University Park, PA)

Abstract As ectotherms, salamanders are highly sensitive to environmental variables, which limit their activity and migration phenology. Climate-driven alterations in activity and movement patterns have implications for local populations and the larger-range dynamics of a species. The development of passive integrated transponder (PIT) tags provides a novel way to monitor movement, particularly of fossorial species. This is especially exciting, as recent developments have allowed researchers to tag increasingly small species, such as *Plethodon cinereus* (Easteern Red-backed Salamander). Although this method has proven to be a useful tool in understanding small-scale movement patterns, much work is needed. In this talk, I summarize my findings while surveying for Red-backed Salamanders in their native forest habitat using pre-established SPARCnet coverboard plots. I present my results from 3 seasons of PIT tag surveys and propose future directions for the use of PIT tags in salamander research.

Sat-2-D-4   Oral Session: SPARCnet: The Salamander Population and Adaptation

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Impacts of Remedial Activities on Freshwater Mussel Populations in the Upper Hudson River

Denise A. Mayer (New York State Museum, Albany, NY), Teresa Newton (USGS-Upper Midwest Environmental Science Center, La Crosse, WI), Brian Gray (USGS-Upper Midwest Environmental Science Center, La Crosse, WI), and Sean Madden (NYS Department of Environmental Conservation, Albany, NY)

Abstract - The Upper Hudson River, north of Troy, NY, was the site of a massive Superfund remediation project from 2009 to 2016 to remove polychlorinated biphenyl (PCB) contaminated sediments from the river. While there was anecdotal evidence of mussels residing in the Upper Hudson River, quantitative data on mussel assemblages were lacking. Starting in 2013 with federal and state partners, we implemented systematic quantitative surveys for native mussels in a total of 6 river pools including a reference pool located upstream of the sites of contamination and 5 contaminated pools downstream from the source of contamination. Surveys were designed to estimate species composition, relative abundance, population size, population structure, and ecological services (i.e., biomass and filtration) of mussel communities prior to and after remedial actions to remove PCB-contaminated sediments (i.e., dredged and subsequently capped and/or backfilled). We found that the pools contained a robust assemblage of mussels with the following characteristics: (1) *Elliptio complanata* (Eastern Elliptio) was the dominant species in all pools; (2) juveniles comprised 13–26% of the mussel assemblage; (3) 6 of the 9 species were represented by juveniles; (4) 5 of the 6 species with juveniles also contained multiple age classes; and (5) the presence of few fresh dead mussels (<0.05%) suggesting little recent mortality. Within-pool differences in several biological traits (i.e., density, age and length distributions, biomass, and filtration) between remediated and non-remediated areas suggested that remedial activities dramatically altered mussel assemblages. Pool areas that had recently been remediated were almost devoid of mussels relative to non-remediated areas. Natural recovery of native mussel populations in the Upper Hudson River is anticipated to be relatively slow, on the scale of decades. We plan to continue surveys on a 5-year cycle to monitor and document the recovery, if it should occur, of the mussel community over time.

Fri-3-A-1   Oral Session: Native Freshwater Mussels: Exploring Threats, Restoration

Use of Trail Cameras as a Model System in Undergraduate Research and Teaching

Declan J. McCabe (Saint Michael's College, Colchester, VT)

Abstract - Using trapping methodology to study mammals causes stress to the animals and, in unskilled hands, can inadvertently lead to injury or even death of study organisms. Rightfully, this work requires permitting, oversight by institutional animal care and use committees, and should only be performed by well-trained mammologists. Furthermore, it is quite difficult to observe many mammal species in the wild, and particularly so for nocturnal species. These ethical, practical, and logistical barriers in combination have placed mammal study out of reach for most teachers and generalist field biology researchers at undergraduate institutions. Increased availability of low-cost trail cameras, or camera traps, has effectively lowered these barriers, making it easy and practical for students to conduct mammal-research studies. At Saint Michael's College, we have increased use of trail cameras from a single camera in 2015 to more than 20 cameras in 2021, and have documented 19 mammal species on our campus. Students deploy cameras in contrasting habitats, leaving them in place for weeks to months. By carefully designing studies using multiple cameras and treating each as a replicate, students can gather informative data sets. In addition to measures of mammal abundance, richness, relative abundance of each species, cameras record time, date, and temperature. On the one hand, by combining these response variables with field measurements such as tree density, distances from trails, waterways, or other landscape features, student projects can be as statistically sophisticated as one could wish for in a meaningful undergraduate research experience. On the other hand, a teacher could simply ask and answer grade-school appropriate questions such as: what animals visit our school yard? This presentation will include lessons learned from 5 years of trail-camera use, example data sets, and tips for successful deployment.

Sat-3-D-5   Oral Session: Use of Trail Cameras in Mammal Conservation

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Comparison of Growth and Development of the Northern Sand Lance from Two Natal Habitats in the Gulf of Maine

Molly E. McCutcheon (Stonehill College, North Easton, MA), Martha J. Hauff (Stonehill College, North Easton, MA,), David Wiley (NOAA/NOS/Stellwagen Bank National Marine Sanctuary, Scituate, MA,), Abrielle Remick (Stonehill College, North Easton, MA), Joel K. Llopiz (Woods Hole Oceanographic Institution, Woods Hole, MA)

Abstract - *Ammodytes dubius* (Northern Sand Lance) are small fish with an enormous impact. As one of a few dominant species of forage fish on the Northeast Continental Shelf (NE US Shelf), they are a critical and, in many cases, obligate prey type for whales, Bluefin Tunas, and Puffins and 15 other species of seabirds. Yet, despite their import, our understanding of the early life stages of these fish is surprisingly limited. In recent decades, Sand Lance populations have fluctuated greatly, both spatially and interannually. To determine if this variability in adult occurrence might be related to recruitment dynamics mediated by spatial differences in larval growth and/or survival, we collected larvae from 2 of 3 known hot spots for sand lance on the NE US Shelf: Stellwagen Bank and Nantucket Shoals/Great South Channel. We collected larval Northern Sand Lance in ichthyoplankton tows conducted in late winter and early spring of 2018. Larvae were sorted, identified and measured, yielding comparative regional abundances and size distributions. Because otoliths in larval fishes accumulate visible increments that are deposited daily, we were also able to use otolith microstructure analysis to obtain larval hatch dates and growth rates. Based on this information, we were able to assess relative differences in larval hatch dates, abundances, growth, and survivorship among the 2 hot spots, shedding light on the relative potential for these different areas to contribute to region-wide recruitment and population dynamics. Northern Sand Lance play an important role in our NE US Shelf ecosystem, and building our knowledge of their early life history will help us to conserve these fish and the coastal community that that relies on them.

Fri-1-A-1   Oral Session: Fish Biology I: Population Biology

Patterns of *Bdelloura candida* Infestation in a Population of *Limulus polyphemus* from Jamaica Bay, NY

Royall McMahon Ward (Fordham University, New York, NY) and Mark Botton (Fordham University, New York, NY)

Abstract - We assessed the overall prevalence of *Bdelloura candida* infestation in Plumb Beach (Jamaica Bay, NY) on adult and juvenile *Limulus polyphemus* (American Horseshoe Crab). In addition, we investigated if the size, sex, or carapace condition of the adult Horseshoe Crabs affected the prevalence of the infection. We randomly selected adult Horseshoe Crabs and recorded their carapace condition on a scale of 1–3, with 1 being the best condition to 3 being the poorest condition, the sex of the crab, and the extent of infestation of flatworms in the legs and in the gills and the density of egg cocoons in the gill leaflets. We examined 93 adult Horseshoe Crabs, with 100% being infected by egg cocoons and/or adult worms, and we examined 40 juveniles with 0% infection. We found that prosoma width of males alone showed no significant correlation with worm infestation; however when females and males were pooled, there were significant correlations between size and infestation score for adult flatworms on legs ($R = 0.331$, df = 82, $P < 0.01$), adult flatworms on gills ($R = 0.435$, df = 90, $P < 0.01$), and cocoons on gills ($R = 0.421$, df = 91, $P < 0.01$). Female horseshoe crabs had a significantly heavier infestation for all categories than for males. We also found that males that were in poorer condition were more heavily infected by adult flatworms in legs ($R = 0.354$, df = 58, $P < 0.01$), and they were more heavily infected by egg cocoons in gills ($R = 0.435$, df = 58, $P < 0.01$).

Sun-2-A-3   Oral Session: Horseshoe Crab Ecology II

The Ants of Mount Auburn Cemetery

Amy Mertl (Lesley University, Cambridge, MA), Wynne Johnson (Lesley University, Cambridge, MA), and Paul Kwiatkowski (Mount Auburn Cemetery, Cambridge, MA)

Abstract - Mount Auburn Cemetery is a unique urban green space: a 70-ha cemetery managed as a wildlife sanctuary. As part of a collaborative effort to monitor biodiversity and engage visitors as citizen scientists, we used using standard ant survey techniques (baiting, litter-searching, hand-collecting) to sample the diversity of ant species occupying this habitat. We also invited visitors to take part in our survey with innovative "ant collection kits". We found a high diversity of ant species at Mount Auburn in comparison with other urban green spaces such as parks. The citizen scientists who took part in our "ant collection kit" project did not record as much ant diversity as standard ant-collection techniques, though the educational value of such projects will also be highlighted.

Fri-1-E-3   Oral Session: Citizen and Community Science

Changes in Phenology Predict Abundance Trends in Massachusetts Butterflies

James Michielini (Tufts University, Medford, MA), Elizabeth Crone (Tufts University, Medford, MA), and Erik Dopman (Tufts University, Medford, MA)

Abstract - Changes in organisms' seasonal timing have been widely documented across many taxa, but we seldom understand how such changes in phenology affect population dynamics. Butterflies have been observed advancing their spring emergence in recent decades in response to warming temperatures. Using citizen science data collected from the Massachusetts Butterfly Club, we correlated changes in flight onset, the end of flight, and the full flight period, with trends in relative abundance across 89 butterfly species over the 27-year study period. Elongated flight periods were the most strongly correlated with trends in abundance; species which over time emerged earlier in spring and persisted later into autumn showed higher relative abundance than species that did not. These changes may in part be driven by range shifts and the addition of entire or partial generations within the year, as species from the south and multivoltine species were significantly more often extending their phenology and increasing in relative abundance. Our results reveal the importance of evaluating phenological changes in the context of population and community dynamics to better understand the consequences of climate change on insect populations.

Sun-1-B-3   Oral Session: Insect Movement, Phenology, and Conservation

Evaluation of Small Unmanned Aerial Systems for Monitoring Nest Abundance and Survival of Wading Birds

Rostam E. Mirzadi (Harte Research Institute, Texas A&M Corpus Christi, Corpus Christi, TX) and Dale Gawlik (Harte Research Institute, Texas A&M Corpus Christi, Corpus Christi, TX)

Abstract - Wetlands around the world have been impacted from drainage and increased water allocation for human needs. In the Everglades of Florida, these alterations to the hydrologic regime have reduced the ability of wading birds to forage and reproduce successfully, resulting in a decline in numbers of nests and a shift in the timing and location of nests. Because wading birds have shown such a stark response to hydrologic changes, and much is known regarding their habitat requirements and historical nesting patterns, their reproduction is monitored as an indicator of ecosystem change and restoration progress. Monitoring birds over such a large area (>103,600 ha) with traditional fixed-wing aircraft is costly and can have high error rates in detection. Our study tests whether the efficiency of wading-bird monitoring can be improved through the use small unmanned aerial systems (sUAS). We compared the efficiency of sUAS for monitoring nests of colonies of *Egretta thula* (Snowy Egret), *Egretta triclor* (Tricolored Heron), and *Ardea alba* (Great Egret). We photographed colonies monthly and rendered the resulting images into a single RGB image through post-processing software to estimate nest abundance, survival, and brood size at fledging. We compared preliminary results to those produced through a combination of standard aerial surveys from a fixed-wing aircraft and standard ground-based surveys. Our findings indicate that sUAS-surveys detect a greater number of light-colored wading birds nesting above the canopy and detect a lower number of dark-colored wading birds nesting below the canopy, in comparison to estimates produced through traditional survey techniques. If sUAS surveys can be used to accurately record nest abundance, survival, and fledging success, it will be possible to survey a greater number of colonies and nests with a higher degree of accuracy and improved safety of observers.

Fri-2-F-1   Oral Session: Views from Above: Remote Sensing and Synoptic Mapping

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Japanese Knotweed Management and Restoring Native Species to a Riparian Zone in the Mid-Hudson Valley

Gabriel Mongeau (Marist College, Environmental Science and Policy, Poughkeepsie, NY), **Hartley Walker Money** (Marist College, Environmental Science and Policy, Poughkeepsie, NY), and Richard Feldman (Marist College, Department Chair; Associate Professor of Environmental Science, Poughkeepsie, NY)

Abstract – We clearcut the invasive plant *Reynoutria japonica* (Japanese Knotweed) along a 30-m stretch of the riparian zone of a small tributary stream to the Hudson River allowing for the select planting of native woody species acquired from the NYSDEC program, Trees for Tribs, in an attempt to reclaim native forest flora. We chose 13 different species, making up 58 individuals, based on the difference in soil and canopy characteristics across the site: *Acer saccharinum* (Silver Maple), *Alnus serrulata* (Smooth Alder), *Cephalanthus occidentalis* (Buttonbush), *Cornus amomum* (Silky Dogwood), *Cornus florida* (Flowering Dogwood), *Cornus sericea* (Red-Osier Dogwood), *Rosa palustris* (Swamp Rose), *Salix discolor* (Pussy Willow), *Sambucus nigra* ssp. *canadensis* (American Black Elderberry), *Nyssa sylvatica* (Black Gum), *Viburnum dentatum* (Arrowwood Viburnum), *Viburnum lentago* (Nannyberry), and *Viburnum trilobum* (Cranberry Bush Viburnum). The objective of this project was to restore native species to the riparian zone in an attempt to compete with Japanese Knotweed. In turn, this will help stabilize the stream banks and return native habitat to a damaged ecosystem.

Sun-2-C-2   Oral Session: Native Plants and Native Pollinators II: Conservation

How Citizen Science Can Help to Update Agency and Park Biodiversity Lists

Toni Lyn Morelli (US Geological Survey – Northeast Climate Adaptation Science Center, Amherst, MA), Amanda Katzer (University of Kansas - Ecology & Evolutionary Biology, Lawrence, KS), Michael Akresh (Antioch University New England - Dept. of Environmental Studies, Keene, NH), Kelsey Cooper (Indiana University Bloomington - O'Neill School of Public and Environmental Affairs, Bloomington, IN), Jennifer Briggs (Colorado School of Mines, Office of Graduate Studies, Golden, CO), Vijay Barve (Florida Museum, University of Florida, Gainesville, FL), Lena Lee (Santa Monica Mountains National Recreation Area, National Park Service, Woodland Hills, CA), and Erin Boydston (U.S. Geological Survey, Western Ecological Research Center, Los Angeles, CA)

Abstract - Global change and declining funding are increasingly complicating the accurate maintenance of species inventories for agencies and parks, threatening the effective management and conservation of species in the face of climate change and other major stressors. Fortunately, citizen science provides an opportunity to engage non-scientists in increasing and updating data collection for institutions. We developed a framework to compare citizen science observations shared publicly via the iNaturalist app during the 2016 Nation Park Service (NPS) Centennial Bioblitz. In this study, our goals were to develop an automated system to capitalize on and evaluate outcomes of national bioblitz surveys and their possible biodiversity and conservation insights, including, but not limited to, documenting previously unrecorded species on NPS lands and the implications of NPS bioblitzes for public engagement in biodiversity monitoring. We discovered that verified records, after comparison with existing NPS biodiversity databases, could reveal lists for each park of (1) validated species occurrences; (2) which taxa were most commonly observed by the public; (3) taxonomic mismatches that could help NPS in updating their records; and (4) species unknown to the park, including unrecorded introduced species and range shifters. Over >45,000 entries (>6000 unique species) were recorded in iNaturalist by 1904 unique users at 105 NPS units across the United States for the NPS Bioblitz event. We developed a publicly accessible, automated system that can be used by other parks and agencies to capitalize on their bioblitzes and citizen science data.

Sat-2-C-2   Oral Session: How to Make Meaning of Citizen Science and Biodiversity

Motivations and Barriers: What Brings People to Citizen Science Programs?

Sebastian Moreno (University of Massachusetts, Amherst, MA), Susannah B. Lerman (USDA Forest Service Northern Research Station, Amherst, MA), and Paige S. Warren (University of Massachusetts, Amherst, MA)

Abstract - Citizen science programs have been growing in popularity as a means to understanding the status of urban biodiversity by overcoming the challenges of gaining access to private land. These programs provide scientists an opportunity to engage the general public in various stages of the scientific process. Additionally, the citizen scientists can strengthen connections with nearby nature, increase environmental literacy, and cultivate their sense of place in their community. Most programs, however, typically engage people with the social and financial capital, who tend to be white, affluent, and live in the suburbs. Identifying ways citizen science programs can lower barriers for underrepresented groups to participate is important to provide a more complete understanding of urban ecosystems. Furthermore, citizen science programs are known to experience a decrease in participant effort throughout the years. A combination of skewed demographics and low participant effort might result in a decrease in data quality and a poor representation of what is truly impacting urban biodiversity. We used the theory of planned behavior (TPB) to gauge the effort, attitudes, and motivations of participants in a citizen science program studying the population dynamics of backyard birds. This information can help better identify potential barriers for participants in future programs. We plan to co-develop a research project with an underserved community to address ecological issues relevant to their community. Lowering barriers and broadening participation in citizen science programs will address environmental justice issues while providing a better understanding of the factors impacting urban bird populations.

Sat-3-C-2   Oral Session: Urban Ecology and Environmental Justice I

Urban Birds Related to Habitat, Population Density, and Socioeconomics in Cambridge, Massachusetts, USA: Scaling Biodiversity Immersion in Cities

David C. Morimoto (Lesley University, Cambridge MA)

Abstract - Analyses of breeding birds at 31 locations in Cambridge, MA, revealed significant associations between the numbers of resident and migrant species and individuals and tree canopy cover, impervious surface cover, the ratio of canopy to impervious surface, and human population density. No significant correlations occurred between income or poverty and bird diversity, likely due to the compact, densified nature of Cambridge. Five wooded areas in the western part of the city had the majority of bird species. Most sites were dominated by a few common species, especially *Passer domesticus* (House Sparrow; >50% individuals). Mature residential areas and forested urban areas are of great importance to urban bird diversity, and continuous monitoring is necessary to mitigate the negative impacts of lot- and block-scale urban development on birds. Despite high bird diversity in key areas and well-distributed recreational open space in Cambridge, the potential daily exposure of the bulk of Cambridge's human residents to bird diversity is generally limited, leading to "green inequity". Given the benefits of nature, urban planning and design should strive to scale regional bird diversity as a basic need of citizens, just as all of our body cells need oxygen.

Fri-3-E-4   Oral Session: Avian Ecology in Urban Areas

Predicting Novel Insect–Host interactions in an Expanded Range using Fungal Associates in the Southern Pine Beetle System

Ashley Morris (Stony Brook University, Stony Brook, NY)**Abstract** - Ecological interactions can involve anything from loose associations to obligate relationships that are essential for survival, growth, and/or reproduction. Climate change can alter the context for such relationships, including that of specialist herbivores or parasites and their hosts. Changes in climate can remove abiotic barriers that previously prevented range shifts and blocked such species from attacking a wider range of hosts. *Dendroctonus frontalis* Zimmermann (Southern Pine Beetle [SPB], Coleoptera: Scolytidae), an insect endemic to southern areas of North America, has been able to expand its range into the Northeast due to climatic change, specifically higher minimum winter temperatures. As its range has expanded, SPB has come into contact with novel potential host species like *Pinus rigida* (Pitch Pine) and *Pinus strobus* (Eastern White Pine), with variable success in infesting these species. SPB has both obligate and associated relationships with different fungal species. The fungi that have the strongest associations with SPB are *Entomocorticuim* sp. A and *Ceratocytiopsis ranaculosus*, both of which supplement larval nutrition, and *Ophiostoma minus*

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Sun-2-D-3   Oral Session: Pitch Pines and Pine Barrens: Natural History and Human

Composing the Shot: Trail Cameras as Aids for Relationship-building and Exploring Researcher Positionalities in the Human Dimensions of Wildlife Field

Joshua Morse (University of Vermont Rubenstein School of Environment and Natural Resources, Burlington, Vermont)

Abstract - Trail cameras are increasingly used in environmental education and citizen science contexts as diverse as elementary schools, college classrooms, and outreach programs for land trusts. Such applications' potential to generate useful citizen science data has received growing attention, and their educational benefits are well recognized. However, little work has examined the ways that trail cameras can enrich and augment research and conservation efforts not primarily concerned with generating biological data. This presentation explores one such case, focusing on the supporting use of trail cameras in a social citizen science project that trains Vermont high school students to gather qualitative interviews on community members' experiences with *Canis latrans* (Coyote). In this project, trail-camera images generated by myself and by members of the Vermont trail camera community played a key role in building trust with, and cultivating interest among, high school students across the state's urban–rural gradient. Trail cameras loaned to participating classes also provided a valuable tool for building relationships between myself, student citizen scientists, and diverse landscapes in the context of the COVID-19 pandemic. Finally, trail cameras provided me with an unexpected but powerful lens to explore my own positionality as a researcher, student, urban area resident, and stakeholder in Vermont's public trust wildlife in relationship with collaborating high school classes. This presentation aims to offer trail camera researchers and users with tools for considering how their methods can aid in relationship-building, and enhance researchers' awareness of the identities they bring to their work.

Fri-3-D-4   Oral Session: Trail Camera Wildlife Monitoring in Human-dominated

Using Sonar to Study Horseshoe Crab Behavior at Oyster Farms

Daphne M. Munroe (Haskin Shellfish Research Laboratory, Rutgers University, Port Norris, NJ)

Abstract - *Crassostrea virginica* (Eastern Oyster) farms are commonly located along shallow estuarine shores of the eastern US. The shores of the Delaware Bay are widely used by *Limulus polyphemus* (Atlantic Horseshoe Crab) and migratory shorebirds, yet a small portion is collectively used by crabs for spawning, as shorebird migratory stopover habitat, and is home to intertidal oyster farming. Horseshoe Crabs are economically and ecologically important; their blood is highly valuable in the medical industry, and migratory shorebirds feed on crab eggs when stopping in Delaware Bay. The overlap in both time and space of these iconic and ecologically important species, and oyster farm activities presents a unique opportunity to examine potential ecological interaction among wildlife and shellfish farms. Little data has been collected specifically addressing the ability of Horseshoe Crabs to traverse intertidal rack-and-bag oyster farms to reach their spawning habitat. If crab spawning migrations are impeded by farms, it is possible that crab populations themselves may suffer, and in turn shorebird foraging patterns and opportunities may be altered. In this study, my primary goal was to characterize the interactions of Horseshoe Crabs passing through farms en route to inshore spawning habitat, to determine if the farms themselves present a barrier to crabs reaching beaches to lay eggs, or if crab behavior is altered as they traverse farms. During the 2019 crab-spawning season, I used sonar to observe behavior of Horseshoe Crabs as they moved among an oyster farm and to evaluate if the number of crabs using farm habitat differed from non-farm habitat. Sonar proved an effective tool for observing crab behavior on the farms. My results indicated that crabs can successfully traverse rack-and-bag farms and reach spawning beaches, crabs do not differentially use farm versus non-farm areas, and crab behavior is relatively unaltered by farm gear. These results provide important context for developing frameworks for managing ecological interactions among farms and wildlife species of concern.

Sun-2-A-1   Oral Session: Horseshoe Crab Ecology II

Where are the Wild Things? Incorporating Ecology into Urban Planning

Nate Nardi-Cyrus (Hudson River Estuary Program, New Paltz, NY), Laura Heady (Hudson River Estuary Program, New Paltz, NY), and Ingrid Haeckel (Hudson River Estuary Program, New Paltz, NY)

Abstract - Under home rule, land-use authority resides primarily at the local level in New York and the New England states. Through a partnership between Cornell University and the NYS Department of Environmental Conservation, the Hudson River Estuary Program has been working across the Hudson River estuary watershed to incorporate biodiversity and habitat data into municipal land-use planning and decision-making. Recently, the program has collaborated with several small cities along the Hudson River, which have emerged as models for ecologically mindful land-use planning. This presentation will showcase how these cities are using local habitat and biodiversity data in their planning and explore how this has translated into meaningful conservation success.

Sat-3-C-5   Oral Session: Urban Ecology and Environmental Justice I

The Pterosaur Wing Membrane: An Update

Hebert Bruno N. Campos (Slovak Academy of Sciences, Bratislava, Slovakia)

Abstract - An undescribed pterosaur specimen (MB.R.3531) of the aurorazhdarchid pterosaur *Aurorazhdarcho micronyx* from the Early Jurassic Solnhofen Limestone of southern Germany has been known for over a century and a half and represents one of the best-preserved Jurassic pterosaurs to date. In general, exceptionally well-preserved pterosaurs are very rare and represents a minimal part of the fossil record. I examined the skeleton with integuments of the small pterosaur under UV light and produced macro photographs generating a large panoramic image. The results revealed an exceptional pattern of preservation of soft-tissue, including well-preserved aktinofibrils in both wing membranes and webbed manus/pes, as well as an almost fully extended left dactylopatagium, with the connective tissue wedge and trailing edge. Its anatomy provides new and important information about the functional morphology of the wings, pedal, and manual webbings of pterosaurs, supporting a theoretical biomechanical model adapted to flight and swimming. The new specimen demonstrates, for the first time, that the aktinofibers are not disorganized and allocated in a random manner as previously represented in other pterosaurs, but show an uninterrupted and uniform distribution along the dactylopatagium, and are entirely connected dorsally to the wing finger and ventrally to the trailing edge.

Sat-3-A-2   Oral Session: To the Sky and Back: The Natural History of Flight and

Studying Larval Trematodes in Northeastern Freshwater Snails: A Beginner's Perspective

Allison T. Neal (Norwich University, Northfield, VT)

Abstract - Parasites play an important but often underappreciated role in virtually every ecosystem on the planet, and many adversely affect the health of their hosts. One of the most diverse groups of metazoan endoparasites are the digenetic trematodes, also known as flukes. Digenetic trematodes are flatworm parasites with complex life cycles that often involve 3 separate hosts. At minimum, these life cycles almost all include a vertebrate definitive host and a mollusk (usually snail) intermediate host. Because of the central role snails play in the larval development of trematode parasites, research on this life stage can provide important information about the parasites present in an area; disease dynamics for species that impact human, veterinary, or wildlife health; and interactions between parasites and their hosts/competitors more generally. The study of larval trematodes in snails can also be an excellent tool for safely and ethically introducing students to parasites and parasite life cycles; snails are not dangerous and need not be harmed to retrieve the parasites. I started studying the larval trematodes in Vermont freshwater snails in 2017 and quickly discovered that (1) there were few existing records of larval trematodes from Vermont and (2) methods for collecting and identifying these parasites are primarily either preserved as part of institutional knowledge or recorded in outdated or scattered references. My goal has therefore been to compile information from these disparate resources, including researchers with more expertise than myself, into a single reference that may serve as an introductory guide for others. In this talk, I provide a brief overview of the methods for collecting snails, isolating and examining their parasites, and identifying parasite species. I also present the data I have collected from Vermont, which includes 302 infections comprising at least 27 different trematode species collected at 12 sites from over 4000 snails from 5 different snail families. I end by discussing the limitations of existing methods and future directions for my research on trematodes.

Fri-2-C-3   Oral Session: Parasite Ecology

Assessing Understory Recovery in a Northeastern Forest Following 15 Years of Deer Management

Chloe Ng (Blind Brook HS, NY) and Chris Nagy (Mianus River Gorge Preserve, Bedford, NY)

Abstract - Browsing by highly abundant *Odocoileus virginianus* (White-tailed Deer) limits the regeneration of forest understories in many parts of the northeastern United States. Deer management programs (DMPs) are commonly used by land managers to reduce deer densities in overbrowsed forests. This study examines the impact of a 15-year DMP on the understory of an old-growth *Tsuga* (hemlock) and second-growth hardwood forest in suburban New York. We surveyed 22 plots throughout the study site every 3–4 years from 2004 to 2019. We grouped all woody stems surveyed into 3 height classes: seedlings (<0.3 m), saplings (0.3–0.9 m), and transgressives (>0.9 m). Woody species richness, diversity, and stem density increased substantially in the seedling and sapling size classes but remained relatively constant for the transgressive class. We constructed generalized linear mixed-effects models to examine the impact of deer density, forest type, canopy cover, and time on species richness, native stem density, and total stem density. In the most-supported models, stem density and species richness increased as deer density declined. Models that included forest type (hardwood or coniferous) also performed well, though the factor had a more pronounced effect in the analysis of all stems than the analysis of solely native stems. This finding suggests that the proliferation of invasive species, which are more common in the hardwood plots, make up a substantial portion of the observed increase in stem density. The results indicate that regulating deer density through management programs is extremely important to effectively preserve forest health but progress can take decades and real success in terms of tree recruitment into the canopy has not yet been proven.

Fri-1-F-2   Oral Session: Forest Ecology

Pearlside Story: A Beach-Cast Mesopelagic Fish, Valuable Naturalists' Observations, and a Call for Citizen Science

Owen C. Nichols (Center for Coastal Studies, Provincetown, MA)

Abstract - On 17 February 2019, a specimen of *Maurolicus weitzmani* (Weitzman's Pearlside) was found in the wrack line on Coast Guard Beach in Eastham, MA. This small mesopelagic species is fairly well known offshore in deeper water, but there are only a few published records from the coast. Social media posts about the seemingly rare find and photographs of its glowing bioluminescent organs circulated widely, leading to regional media coverage, which in turn led to several other reports of the species from local beachcombers and naturalists. Several additional coastal/beach-cast records of *M. weitzmani* in the area were found in "gray" or historical literature. While these beach-cast records are a relatively small contribution to our knowledge of the distributional ecology of the species, they highlight the need for citizen science and published observations.

Fri-2-B-1   Oral Session: Beach-stranded Marine Fishes: Lessons Learned about Poorly

Introducing Natural History to Urban Biology and Health Science Majors

Kathleen A. Nolan (St. Francis College, Brooklyn, NY)

Abstract - The students at our New York City commuter college who major in biology and health science courses can be somewhat resistant to studying the natural world. I have devised a variety of educational materials to introduce the students to natural history and perhaps even hook them on this broader topic. Examples include: a DNA barcoding project in which students use DNA sequences to identify "mislabeled" seafood. Here the students also have to research and report on the natural history of the fish species they are studying. Another project involves determining properties of fish that could contribute to a healthy diet, in which the students are required to know about the migration patterns of these fish that are normally known only as a fillet. In an ecology project titled "Find Your Park", the students are required to take photos of plants and post them on iNaturalist so that they can see that there is a thriving community of naturalists out there. Through these and similar projects, I am attempting to make connections between the students' rather narrow focus on the health field and topics relating to the wildlife and natural history that often surrounds them.

Sat-1-B-3   Oral Session: Natural HIstory Education and Communication

An Overview of the New England Interior Motus Project

Marc Nutter (NH Audubon, Concord, NH)

Abstract - In 2020, the US Fish and Wildlife Service awarded a 3-year competitive state wildlife grant to create a network of 50 Motus Wildlife Tracking System receiver stations at inland sites across New England, an effort being led by the NH Fish and Game Department, NH Audubon, and the Northeast Motus Collaboration. The Motus network uses automated telemetry receiver stations to track miniature transmitters small enough for birds, bats, and butterflies. This session will provide an update on site installations to date, an overview of plans for the next 3 years, and how the New England effort builds on a recently completed mid-Atlantic Motus array and regional plans at various stages of development elsewhere in North America, Latin America, and the Caribbean.

Sat-2-E-1   Oral Session: Expanding the Northeastern Motus Network

Panel Discussion: Motus Questions and Answers

Moderator: **Marc Nutter** (NH Audubon, Concord, NH). Panelists: **Carol Foss** (NH Audubon, Concord, NH), **Stu Mackenzie** (Birds Canada, Port Rowan, ON, Canada), **Scott Weidensaul** (Northeast Motus Collaboration and Ned Smith Center for Nature and Art, Millersburg, PA), **Todd Alleger** (Project Technician, Northeast Motus Collaboration, www.northeastmotus.com), and **Alison Fetterman** (Northeast Motus Collaboration and Willerston Conservation Trust, Chester County, Newtown Square, PA)

Abstract - The core team involved in planning and installing the New England Motus array will discuss current regional siting plans, solicit input from participants on potential receiver locations, and answer questions about how Motus can work in various research approaches.

Sat-2-E-4   Oral Session: Expanding the Northeastern Motus Network

Effects of Ericoid Mycorrhizal Fungi on Reproductive Traits in *Vaccinium corymbosum*

Erin O'Neill (University of Vermont, Burlington, VT) and Alison K. Brody (University of Vermont, Burlington, VT)

Abstract - Mycorrhizal fungi are among the world's oldest and most important mutualisms, dating back more than 400 million years and forming symbiotic relationships with 90% of extant land plants. Ericoid mycorrhizae (ericoids or ErMF) involve a relatively specialized group of fungi that form symbioses with plants in the Ericaceae. In this work, we are asking whether, given mycorrhizal fungi can increase the health of plants, the plants can change resource allocation to benefit the development of their reproductive organs with increased input from the ericoid mycorrhizal relationship. A member of the Ericaceae family, *Vaccinium corymbosum* (Highbush Blueberry) preforms buds in the fall. If ericoids enhance resources, then inoculation with ErMF may change the number of *V. corymbosum* buds and flowers and/or affect floral traits that are important to pollinators. We tested the following hypothesis: inoculation with ericoid mycorrhizal fungi alters plant investment in buds and inflorescences. To test this hypothesis, we inoculated 360, three-year old *V. corymbosum* plants in the spring of 2018 and randomly assigned them to among 4 treatments: (1) commercial inoculum, (2) local soil, (3) commercial inoculum and local soil, and (4) a control group with no inoculum. Plants were then grown and overwintered in a common garden. Plants did not differ in ericoid colonization prior to inoculation ($F_{4,71} = 1.25$, $P > 0.30$). There was no significant effect of inoculation treatment ($F_{3,361} = 2.57$, $P = 0.05$) nor date ($F_{3,361} = 1.05$, $P = 0.37$) on root colonization by ericoids. During the field season, we collected data including inflorescence buds, and flower number. Interestingly, we found significant effects of treatment on reproductive traits. Our results elucidate the importance of ericoids for the development of reproductive traits. It will also help us further understand the ways in which belowground interactions could drive aboveground interactions.

Sat-1-A-2   Oral Session: The Effects of Belowground Interactions on Aboveground

The GSO Project: Using Citizen Science to Document the Dispersal of Tropical Fish in the Northwest Atlantic

Michael E. O'Neill (New England Aquarium, Boston, MA; University of Massachusetts, Boston, MA)

Abstract - The Gulf Stream is responsible for transporting massive amounts of water from the tropics northward across the Atlantic Ocean. Through meandering eddies and warm core rings (WCRs), there is ample opportunity for organisms contained within this water to reach a broad distribution of North America's Atlantic coastline. Each summer, water temperatures along the coast of New England reach levels that allow these species transported by the Gulf Stream to survive temporarily beyond their native range. For decades research institutions, universities, aquariums, divers, and beach walkers have observed this seasonal phenomenon and have independently and informally collected data documenting their occurrence. In 2015, the Gulf Stream Orphan Project (www.gsoproject.org) launched to promote collaboration and build a network of citizen scientists to better understand this phenomenon. Through this effort, the GSO Project has documented over 70 species across 37 taxonomic families and thousands of individual fishes. These data have helped illuminate many aspects of the phenomenon as well as raised questions regarding the biological aspects that shape it, the ecological impacts, and the implications of this dispersal as climate change alters marine ecosystems.

Fri-2-B-3   Oral Session: Beach-stranded Marine Fishes: Lessons Learned about Poorly

Cordilleran Flycatcher Brood Food Delivery: Does it Change Along the Day?

Martha I. Ortiz-Carvallo (Universidad Autónoma del Estado de Hidalgo, Mexico) and Raul Ortiz-Pulido (Universidad Autónoma del Estado de Hidalgo, México)

Abstract - Brood food delivery is the provision of food by parents to their descendants. Success in food delivery determines vital aspects of a species, such as its conservation. In this study, we propose 4 models (constant, increasing, decreasing, and variable) to show how food delivery could occur in nesting birds. We tested such an approach with field data at 1 location for *Empidonax occidentalis* (Cordilleran Flycatcher), a species of bird for which there is little data on the subject and whose populations worldwide are declining. We recorded that the nest-visitation rate (5.3 ± 0.52 times for each 10 minutes [mean $\pm$ 1 SE], $n = 142$), the time that parents remind on the nest (2.46 ± 0.31 seconds, $n = 93$) and the sanitization rate (0.77 ± 0.13 times for each 10 minutes, $n = 20$) did not significantly change throughout the day. We conclude that the model followed by the parents studied was the constant model. In the future, this information could be used to help the conservation of the species.

Sat-2-F-4   Oral Session: Avian Nesting Biology

Increases in Avian Diversity Following Group-selection Timber Harvests in West-central New Hampshire

Sam Parks (Plymouth State University, Plymouth, NH) and Len Reitsma (Plymouth State University, Plymouth, NH)

Abstract - Rapid loss of Neotropical migrant songbirds (44% population decline in the past 50 years) necessitates an urgent call for conservation. Disturbance-dependent, early successional species have experienced an especially large decrease at 58%. The greatest cause for these declines is habitat loss, both breeding and overwintering habitat. Throughout the northeastern United States, post-European arrival, cultural shifts in land-use have led to even-aged, mid-successional forests becoming the dominant forested habitat types on the landscape. This transition has resulted in a loss of young forest habitats required by scrub-shrub birds for nesting and by many forest-interior birds for critical post-fledging cover and foraging. We used point counts to assess songbird community response to group-selection harvesting (0.2–1.0-ha openings) in a mixed hardwood/softwood forest and in a *Tsuga canadensis* (Eastern Hemlock)-dominated forest. Counts in the mixed-wood forest were part of a 9-year-post-harvest study, while those in the Eastern Hemlock forest were conducted 1-year before and 1-year after a timber harvest. Group-selection openings in the mixed-wood stand created a multi-aged forest mosaic, leading to a fluctuation of avian diversity as the shrub layer grew in but an overall net significant increase by year 9 post-harvest. Further, in the mixed-wood forest, we mapped territories of 60 individuals from 5 species across 2-years and found that territory sizes are generally smaller for scrub-shrubland species, like *Geothlypis trichas* (Common Yellowthroat) and *Setophaga pensylvanica* (Chestnut-sided Warbler), than for forest-interior species, like *Setophaga caerulescens* (Black-throated Blue Warbler) and *Mniotilta varia* (Black-and-white Warbler). However, all mapped species utilize the scrub-shrubland habitat created from the timber harvest during the breeding season. We have observed a significant increase in avian diversity and overall avian abundance in the Eastern Hemlock-dominated property immediately post-harvest. As we continue monitoring the Eastern Hemlock-dominated property, we expect an increase in avian diversity that will last longer due to a slower regeneration time that is characteristic of Eastern Hemlock forests compared to mixed-wood forests.

Sun-2-E-5   Oral Session: Management Impact on Birds

Students as Citizen Scientists: How to Make Use of Non-systematic Data on Wildlife Sightings

Sarah Partan (Hampshire College, Amherst, MA) and Tieran Rosefield (Hampshire College, Amherst, MA)

Abstract - In an effort to contribute to collective data on how wild animals are faring through environmental change, we have begun a student-based project on our college campus to document the presence of wildlife. Our campus has 324 ha (800 ac) of woodland, farmland, and mixed-use area. We are using iNaturalist as our data repository, and our methods include direct observations and the use of remote trail cameras. In addition to the joyful process of exploring and learning about the world around us, we are also encountering many common pitfalls with citizen science: untrained observers, incomplete data, occurrence-only data, and unequal effort across seasons. In this talk, we will grapple with some of these problems and present what data we have been able to obtain on species diversity and distribution across area, time of day, and season. We are enthusiastic about citizen science and have found the project and iNaturalist to be great ways for students to actively engage with their environment and learn about biodiversity. We hope to find ways to make the data useful for scientific and conservation purposes as well, especially now that the contributions of citizen scientists have so much potential to expand our efforts to document biodiversity in the midst of rapid global change.

Sat-1-C-1   Oral Session: How to Make Meaning of Citizen Science Biodiversity Data I

Panel on How to Make Meaning from Citizen Science Biodiversity Data

Sarah Partan (Hampshire College, Amherst, MA), **Michael Belitz** (Florida Museum of Natural History, Gainesville, FL), **Corey Callaghan** (German Centre for Integrative Biodiversity Research (iDiv) Halle-Jena-Leipzig; Leipzig, Germany), **Toni Lyn Morelli** (US Geological Survey – Northeast Climate Adaptation Science Center, Amherst, MA), **Orin Robinson** (Cornell Lab of Ornithology, Ithaca, NY), **Viviana Ruiz Gutierrez** (Cornell Lab of Ornithology, Ithaca, NY), and **Vaughn Shirey** (Department of Biology, Georgetown University, Washington, DC)

Abstract - Faced with imminent biodiversity loss we are at an "all hands on deck" moment to collect all the data on the natural world that we can. If we can harness the power of citizen science to promote collective action, we can magnify our data-collection potential enormously. Citizen science data projects are indeed proliferating and generating lots of data and excitement. The data, however, can be tricky to analyze when it is collected by non-experts, sometimes on an ad libitum or non-systematic basis, with gaps and inconsistencies. This panel will discuss data analysis issues with citizen science in the hope that by addressing these concerns, we can work together toward ensuring that citizen science data is as useful as possible in helping tackle our pressing problems.

Sat-2-C-3   Oral Session: How to Make Meaning of Citizen Science and Biodiversity

Individual and Population Differences in Schooling Behavior

Simon P. Pearish (Norwich University, Northfield, VT)

Abstract - In this presentation, I will discuss ongoing research on individual- and population-level differences in schooling behavior. The talk will feature data from my most recent study, which was aimed at determining how habitat differences affect schooling behavior of *Culaea inconstans* (Brook Stickleback), a species of freshwater fish that is common in northern North America. In this study, I examined differences in schooling in fish collected from a densely vegetated wetland and an adjacent gravel-bottomed stream. Groups of fish were placed in a circular pool and observed every 15 seconds for 3 minutes. I found that river fish exhibited schooling behavior more often than wetland fish, which might be due to a shift to reliance on "safety in numbers" to avoid predation in the sparsely-vegetated river habitat. Interestingly, there are regular opportunities for migration between the 2 habitats, so behavioral differences are not likely to be explained by genetic differences between populations due to geographic isolation.

Sat-2-A-4   Oral Session: Fish Biology II: Anatomy, Physiology, Behavior

Aquatic Ecosystem Stoichiometry, Structure, and Function Over Gradients of N and P Deposition

Lindsey A. Pett (University of Vermont, Burlington, VT), Nicholas J. Gotelli (University of Vermont, Burlington, VT), and Angélica L. Gonzalez (Rutgers University, Camden, NJ)

Abstract – We conducted a survey of the model system *Sarracenia purpurea* (Northern Pitcher Plant) over gradients of nitrogen and phosphorus deposition from the Florida Panhandle to Maine. We examined the response of the following system components: pitcher fluid, plant tissue, detritus, invertebrates, and microbial community. Stoichiometry of the components were analyzed, obligate invertebrates and plankton were sampled for community structure, and fluid parameters of dissolved oxygen, total dissolved solids, electrical conductivity, pH, and temperature were measured. We found phosphorus in plant tissue significantly correlated with Phosphorus deposition. There was also a significant relationship between the N:P ratio of atmospheric deposition and the N:P ratio found in both the pitcher fluid and the plant tissue. Latitude and growing season had a significant effect on the amount of phosphorous in the plant tissue.

Sat-3-B-5   Oral Session: Botany

Searching for *Schwalbea:* History and Habitat Suitability Modelling

Michael Piantedosi (Director of Conservation, Native Plant Trust)

Abstract - The federally endangered species *Schwalbea americana* (American Chaffseed) has been the focus of years of conservation efforts throughout its range along the eastern continental US. This study peformed by the Native Plant Trust (formerly New England Wild Flower Society) was focused on surveying historic and de novo locations on Cape Cod, Martha's Vineyard, and/or Nantucket, MA, based on the US Fish and Wildlife Service (USFWS) American chaffseed predictive habitat model (or species distribution model), combined with analysis of potentially suitable habitat and historic records to select de novo survey locations. Native Plant Trust searched 26 total locations across Massachusetts (including 10 historic sites) based on a combination of the USFWS habitat suitability model (HSM), Native Plant Trust revisions to ground-truth the HSM, historical data, and herbarium record data.

Sat-1-E-1   Oral Session: New England Flora: Continued Need For Study

The Influence of Rising Water Temperature on Eelgrass in the Northeast USA

Holly K. Plaisted (National Park Service, Kingston, RI), Erin C Shields (Virginia Institute of Marine Science, Gloucester Point, VA), Alyssa B Novak (Boston University, Boston, MA), Jillian Carr (Massachusetts Bay National Estuary Partnership, Boston, MA), N. Tay Evans (Massachusetts Division of Marine Fisheries, Boston, MA), Sophia E Fox (National Park Service, Cape Cod National Seashore, MA), Stephen M Heck (Stony Brook University, Stony Brook, NY), Robbie Hudson (Rodger Williams University, Providence, RI), Kenneth A Moore (Virginia Institute of Marine Science, Gloucester Point, VA), Hilary A Neckles (USGS Patuxent Wildlife Research Center, Laurel, MD), Betty Neikirk (Virginia Institute of Marine Science, Gloucester Point, VA), David B Parrish (Virginia Institute of Marine Science, Gloucester Point, VA), Bradley J Peterson (Stony Brook University, Stony Brook, NY), Forest Schenck (Massachusetts Division of Marine Fisheries, Boston, MA), and Frederick T. Short (University of New Hampshire, Durham, NH)

Abstract - Sea surface temperature (SST) has increased worldwide since the beginning of the 20th century and is expected to rise. Changes in SST can have significant impacts on marine biota, including, population-level shifts and alterations in community structure and diversity. Seagrasses are a group of foundation species that grow in shallow coastal and estuarine systems. They provide many ecosystem services. *Zostera marinia* (Eelgrass) is the dominant seagrass species in the Northeast US. Multiple factors have been cited for losses in the region, including light reduction, eutrophication, and physical disturbance. Warming of coastal waters has the potential to exacerbate losses. Temperature stress can result in altered growth rates, distribution shifts, and changes in patterns of sexual reproduction of seagrasses. Here, we use data from 8 SeagrassNet monitoring sites located along the coast of the northeast United States (Maryland to New Hampshire) to investigate the relationship between changes in Eelgrass abundance in relation to SST and other environmental variables. Preliminary results indicate significant negative relationships between increased summer water temperature and Eelgrass percent cover on a regional scale. However, local site-specific factors appeared to outweigh the influence of temperature at some sites. The regional responses to increased temperature foreshadow future impacts of warming coastal waters and likely future trends in seagrass communities throughout the region.

Sat-2-B-3   Oral Session: Coastal Marine Habitats of the Northwest Atlantic

What the Pluck? Extraction of Mammal Hair by Tits (Paridae) is a Rarely Documented but Common Behavior with Potentially Important Fitness Implications

Henry S. Pollock (University of Illinois at Urbana-Champaign, Urbana, IL), Sean E. MacDonald (UIUC, Urbana, IL), Jeferson Vizentin-Bugoni (UIUC, Urbana, IL), Zachary Sutton (UIUC, Urbana, IL), Jeffrey D. Brawn (UIUC, Urbana, IL), and Mark E. Hauber (UIUC, Urbana, IL)

Abstract - Birds across diverse lineages collect and incorporate mammalian hair into their nests. However, most accounts of this behavior are anecdotal, and its frequency and extent remain unclear. Here, we review the use of mammal fur or hair in nests by Tits (Paridae), a globally distributed, cavity-nesting passerine bird family. A global analysis based on standardized nesting information from Birdsoftheworld.org confirmed that the use of hair in nests by Parids is geographically widespread, occurring in 44 of 51 (86%) species for which information on nesting material was available. In turn, we found 10 published studies of 4 Parid species, which showed that hairs from a diverse suite of mammals (>30 species) were found in nests. Geographically, hair use was more common in temperate and subtropical species than tropical species, suggesting that the behavior functions to provide thermal insulation against colder air temperatures. To determine how birds were sourcing hair, we also conducted a literature review of hair extraction ("kleptotrichy") from live, fur-bearing mammals by Paridae. We found only 4 anecdotal reports of hair extraction by 1 species (*Baeolophus bicolor* [Tufted Titmice]) in the published literature, compared to dozens of examples in the popular media and anecdotal records. Based on geographic patterns of hair use in Parid nests and the relative commonness of kleptotrichy in the popular media, we propose that hair extraction may be an underappreciated behavior with potentially important fitness implications.

Sat-2-F-3   Oral Session: Avian Nesting Biology

Muscles of Our Rivers: The Power of Unionids

Isabel Porto-Hannes (University at Buffalo, NY) and Brandon Sansom (US Geological Survey – Columbia Environmental Research Center, MO; University at Buffalo, NY)

Abstract - Freshwater pearly mussels or unionids (Order: Unionida) live in the sediments of rivers, streams, and lakes. Approximately 300 species are found in North America including the Great Lakes watershed. Some people see unionids as plain, boring, living rocks, but after closer inspection, they reveal their importance as river engineers! Unionids are mighty filter-feeders—cycling nutrients and removing algae, bacteria, and contaminants from the water. They also provide food and habitat to other organisms and, when in high numbers, can stabilize the sediment where they live. As diverse and ecologically important as these animals are, nearly 30 species have gone extinct in the last 100 years. About 65% of the remaining species are considered endangered, threatened, or vulnerable of becoming extinct as a result of human impacts such as overharvesting, pollution, habitat modification or destruction, and the introduction of non-native species. We will tell the story of the rise and fall of native mussel populations in Western New York, and how can we use them to improve water and habitat quality in our local water bodies.

Fri-3-A-2   Oral Session: Native Freshwater Mussels: Exploring Threats, Restoration

Lady Beetles of Vermont: Invasions, Extirpations, and Recent Discoveries from Community Scientists

Julia M. Pupko (VCE, Norwich, VT) and Kent McFarland (VCE, Norwich, VT)

Abstract - Many studies in North America have reported that lady beetle (Coccinellidae) species assemblages have undergone dramatic changes over the past 50 years, likely due to the introduction of exotic lady beetle species. Some native lady beetles may now be extirpated from parts of their range. Despite these alarming trends, lady beetles have been little studied in Vermont following the publication of a checklist and county record project that was completed in 1976. We digitized historic and modern lady beetle records from literature, museum collections, and crowd-sourced databases to assess the current status of lady beetles in Vermont. Of Vermont's 35 native species, 12 have not been recorded since the completion of the 1976 checklist. In 2015, three of the species that remain missing from Vermont were designated as "species of greatest conservation need" in New York: *Adalia bipunctata* (Two-spotted Lady Beetle), *Coccinella novemnotata* (Nine-spotted Lady Beetle), and *C. transversoguttata* (Transverse Lady Beetle). The Nine-spotted Lady Beetle was recently declared "endangered" in Canada. These designations emphasize the urgency for mapping Vermont's lady beetle species. In 2020, we piloted the Vermont Lady Beetle Atlas, which will be expanded throughout the state in 2021. This project is modeled after other successful community science projects with the Vermont Atlas of Life as well as the Lost Ladybug Project at Cornell University, which successfully found 2 species of lady beetle previously thought to be extinct in New York. Using a community science framework will allow for a greater chance of discovering more missing lady beetles while engaging Vermonters of all ages in science and natural history. We have already had great success with volunteer data; volunteer community scientists have recently rediscovered 4 species that had not been reported for over 40 years in the state. Additionally, volunteers have discovered 3 new species for the state. Due to the critical pest control role played by lady beetles in Vermont's ecosystems, it is important to understand how these species are faring in Vermont so conservation measures can be implemented if needed before it is too late.

Sun-1-B-2   Oral Session: Insect Movement, Phenology, and Conservation

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Heading off the Loss: Freshwater Mussel Relocation to Jump Start Restoration on the Grasse River, Massena NY

Rebecca Quail (NYS Department of Environmental Conservation, Albany, NY), Denise Mayer (NYS Museum, Albany, NY), Corbin Gosier (NYS Department of Environmental Conservation, Albany NY), Leah Gorman (NYS Department of Environmental Conservation, Albany NY), and Jennifer Ryan (NYS Department of Environmental Conservation, Albany NY)

Abstract - The lower 11.6 km (7.2 mi) of the Grasse River in Massena, NY, is a US EPA Superfund Site due to historical PCB contamination from Arconic Inc. (formerly Alcoa) industrial facilities. Extensive sediment dredging and capping is ongoing throughout the 11.6 km (7.2 mi). Prior to remediation, surveys of the project reach found a diverse and abundant unionid mussel community, documenting 10 species and estimating over 1 million individual mussels. Four recorded species were NYS designated species of greatest conservation need (SGCN) – *Lampsilis cardium (*Plain Pocketbook)*, Ligumia nasuta* (Eastern Pondmussel), *Utterbackia imbecillis* (Paper Pondshell), and *Potamilus alatus* (Pink Heelsplitter)—the latter of which was abundant. As a result of the remediation, we expect extensive loss of the mussel community, and with no efforts to offset the loss or restore the mussels, recovery is expected to be minimal. The NYSDEC has implemented 2 separate diver-collection projects to assist in post-remediation mussel community recovery. The first project involved the collection and caging of mussels to provide "founder colonies" in affected areas. The second, and ongoing project, involved the collection of mussels in affected areas and immediate release into unaffected portions of the river. During the collection efforts, nearly 400,000 mussels were recovered, with an additional 6 species of mussels identified. We have assessed the health of the caged mussels with glycogen analysis. An additional season of mussel collection is planned with the possibility of replacement of mussels in affected areas in the future.

Fri-3-A-5   Oral Session: Native Freshwater Mussels: Exploring Threats, Restoration

Ecophysiological Models: Some Assembly, Disassembly, and Reassembly Required

Tom Radomski (University of Minnesota - Twin Cities, Minneapolis, MN), Sam Hargrove (University of the Highlands and Islands), Owen Bachhuber (University of Minnesota - Twin Cities, Minneapolis, MN), Brandon Deitschman (University of Minnesota - Twin Cities, Minneapolis, MN), Olivia Hanson (University of Minnesota - Twin Cities, Minneapolis, MN), Nolan Kerr (University of Minnesota - Twin Cities, Minneapolis, MN), and Kenneth H. Kozak (University of Minnesota - Twin Cities, Minneapolis, MN)

Abstract - Given ongoing environmental change, ecologists have increasingly pointed out the need for realistic models of species' distributions. Accordingly, mechanistic niche models, which use species' traits or demography, have increased in use. Because these models are grounded in "ecological reality", they are assumed to be reliable, but we argue that more empirical verification is required. Here, we dissect a biophysical model developed for terrestrial, lungless salamanders. First, we found some assumptions to be questionable based on existing information. Second, we collected ecophysiological data to implement the biophysical model for *Plethodon meridianus* (South Mountains Gray-cheeked Salamander), a microendemic species from southern Appalachia. Finally, we tested the ability of the model to predict *P. meridianus* activity in the field. Based on our findings, we discuss several ways of tractably improving mechanistic niche models in general.

Fri-3-C-1   Oral Session: Climate Change Ecophysiology

The Influence of Pine Management on Grassland-nesting Birds Overwintering in Central Louisiana, USA

Nancy M. Raginski (Louisiana State University, Baton Rouge, LA) and Ashley M. Long (Louisiana State University, Baton Rouge, LA)

Abstract - Pine forests cover ~28 million ha in the southeastern US and are most often used for commercial timber and recreational hunting. Management practices used to reach desired vegetative conditions in these forests (e.g., thinning, prescribed fire) may simultaneously influence distributions of overwintering songbirds, including several species of conservation concern that breed in grasslands of the northern US and throughout Canada (e.g., *Centronyx henslowii* [Henslow's Sparrow]). From December to February of 2018–2020, we surveyed 27 study sites in *Pinus palustris* (Longleaf Pine) and *P. taeda* (Loblolly Pine) stands to examine the influence of pine management on grassland-nesting songbirds overwintering in central Louisiana. We used single-season occupancy and N-mixture models to estimate occupancy and density of the grassland-nesting species of conservation concern that we detected during our surveys. We recorded 9014 detections of 63 species, including 6 grassland-nesting species, and we detected grassland-nesting species 2–8 times more in Longleaf Pine stands compared to Loblolly Pine stands. The predicted probability of Henslow's Sparrow and *Cistothorus platensis* (Sedge Wren) occupancy increased with decreasing percent canopy cover and the predicted probability of *Peucaea aestivalis* (Bachman's Sparrow) occupancy was greatest in Longleaf Pine stands. We found that Henslow's Sparrow and Bachman's Sparrow density decreased with increasing percent canopy cover in both Longleaf Pine and Loblolly Pine stands. We also found Bachman's Sparrow increased with increasing percent herbaceous cover in both stand types. We did not detect Sedge Wrens in Loblolly Pine stands but found Sedge Wren density also increased with increasing percent herbaceous cover in Longleaf Pine stands. In addition, overall species richness and the species richness of grassland-nesting songbirds was greatest in Longleaf Pine sites burned within 2 years of our surveys. Our research will help quantify winter habitat relationships for species of conservation concern and inform management prescriptions for grassland-nesting songbirds overwintering in pine forests of the southeastern US.

Sun-2-E-4   Oral Session: Management Impact on Birds

Effects of Drought on Two Species of Shortgrass Prairie Sparrows in Southern Colorado

Claire Varian Ramos (Colorado State University – Pueblo, Pueblo, CO), Alexandria Sinker (Colorado State University – Pueblo, Pueblo, CO), and Natalia Wicker (Colorado State University – Pueblo, Pueblo, CO)

Abstract - The North American prairies are perhaps the most imperiled ecosystem on this continent. Much of the eastern part of Colorado is comprised of shortgrass prairie, which has received considerably less research attention than the tallgrass prairie of the Midwest. Shortgrass prairie is threatened by conversion to agriculture use, changes in fire and grazing regimes, fragmentation, and, increasingly, climate change. Climate models indicate increased probability of hotter, dryer summers across much of the region. Likely because of these stressors, prairie birds are experiencing steep declines, more dramatic than for any other community of birds. Nevertheless, shortgrass prairie birds remain significantly understudied. Here we studied the reproductive behavior and success of 2 declining shortgrass prairie sparrows, *Peucaea cassinii* (Cassin's Sparrow) and *Calamospiza melanocorys* (Lark Bunting), at the US Army Pueblo Chemical Depot, a relatively undisturbed shortgrass prairie ecosystem in southern Colorado. Over the 4 years of this study (2017–2020), southern Colorado experienced 2 summer droughts and 2 summers with above average rainfall. Abundance was measured from May through August through weekly point counts at six 1-km^2 plots across the range of shortgrass prairie habitats present at the Pueblo Chemical Depot. Reproductive success was determined by monitoring nests of both species at these plots three times per week until either fledging or failure. Cassin's Sparrows and Lark Buntings responded to these variable rainfall conditions differently. Lark Buntings were only present and breeding at the Pueblo Chemical Depot during wet summers. In dry summers, they were entirely absent from the site after migration. Cassin's Sparrows, in contrast, bred at the site every year, however, their reproductive success was lower in drought years than in wet years. These differences in response to drought may reflect differences in behavioral plasticity, which may make Lark Buntings better able to adjust to the effects of climate change, whereas Cassin's Sparrows may be more sensitive to these effects. Findings from this study could be critical in determining future management strategies to conserve these declining species.

Fri-2-A-4   Oral Session: Climate Effects on Birds

Factors Influencing Clutch Size and Egg Mass in Gray Catbirds

Lucas J. Redmond (Penn State Schuylkill, Schuylkill Haven, PA)

Abstract - Birds invest substantial amounts of time and energy into their offspring through several mechanisms across the reproductive cycle that increase the prospects of survival of young and, thus, increase fitness. The allocation of resources by females into producing either larger clutches or eggs is an energetic investment resulting in direct fitness benefits. Several factors have been identified as important sources of variation in clutch size and egg mass in birds. For example, temperature and precipitation during periods when eggs are forming can influence both clutch size and egg mass. Female characteristics such as body size, quality, and age also influence the quantity and size of eggs. I studied sources of variation in clutch size and egg mass of *Dumetella carolinensis* (Gray Catbird) breeding on and around the Pennsylvania State University – Schuylkill campus in southeastern Pennsylvania from 2016 to 2020. Several factors that potentially influence clutch size and egg mass were considered and included intrinsic factors such as female morphological measurements and extrinsic factors such as clutch initiation date and mean temperature and precipitation values around the time of laying. Clutch size declined across the breeding season and was larger in first broods compared to later broods. Egg mass was inversely related to clutch size, increased as the season progressed, and was larger in later broods. An information theoretic-based multimodel comparison of the importance of intrinsic and extrinsic factors indicated that weather and female morphology were not related to either clutch size or egg mass. These results suggest that although later broods are represented by fewer offspring, females increase investment into individual young as the season progresses. Larger eggs may allow for faster development and thus earlier departure from the nest and independence from parents, which could either be a mechanism to reduce nest predation or increase juvenile survival of offspring in later broods.

Sat-2-F-2   Oral Session: Avian Nesting Biology

The Herbaceous Understory, but Not Trees, May Hear the Forest for the Trees

Ian J. Renne (Youngstown State University, Youngstown, OH)

Abstract - Plant regeneration strategies are a major factor contributing to spatiotemporal diversity, and the modes employed are many. This should be unsurprising, as establishment is the most limiting life-history stage to the population growth of most plants. Seed dormancy is a strategy important to many lineages, and is appropriately viewed as a form of bet hedging to reduce risk in fitness variance. It can also be considered as a factor enhancing fitness, but only if ecological signals reliably correlate to establishment probability at the time a germination decision is made. Here, I introduce the biochemical recognition hypothesis (BRH) as it relates to forest-dwelling plants. The BRH postulates that there can be selective advantages for seeds to chemically recognize potential competitor presence and defer germination until better establishment conditions occur—this "eavesdrop-and-wait" competition-avoidance strategy has been well documented in several systems. I outline the ecological conditions where biochemical recognition may evolve, highlighting 2 critically important factors: competition-dependent establishment probability and soil seed-bank longevity. I find that while ample literature suggests most canopy species generally do not form persistent soil seed banks, there is more potential for those in the herbaceous understory to do so, and thus more potential for biochemical recognition to be present. Mounting theoretical and empirical evidence suggests phytochemical-induced, adaptive germination inhibition may be common to some systems, but remains wholly unexplored in forests. As such, I conclude by indicating specific and promising areas of research in this emerging field.

Fri-1-F-3   Oral Session: Forest Ecology

Predicting Swainson's Warbler Habitat in the Appalachians Using Infrared Satellite Imagery

Garrett Rhyne (Louisiana State University, Baton Rouge, LA) and Ashley Peele (Virginia Tech, Blacksburg, VA)

Abstract - Southern Appalachian forests provide crucial breeding habitat for many threatened Neotropical migrant passerines. Swainson's Warbler (*Limnothlypis swainsonii*) is a ground-dwelling species of conservation concern that require dense evergreen understory for breeding territories in *Rhododendron* spp. (rhododendron) and *Calmia latifolia* (Mountain Laurel) patches in Appalachia. Due to their secretive nature, impenetrable habitat, and low detection from roadside surveys, current distribution and population status are poorly understood. We used novel methods to predict breeding habitat in 2 historic breeding regions of southwestern Virginia. We overlaid winter infrared satellite imagery in ArcGIS to outline broad areas of concentrated evergreen understories by distinguishing understory vegetation reflectance (light pink coloration, blurred by the dormant canopy) from canopy reflectance (dark pink-red with sharp contours). We then generated random points inside these regions, capturing both evergreen and deciduous understories. In the summer of 2018, we surveyed for Swainson's Warblers and recorded vegetation structure at 100 points. We detected 34 individuals at 27 points, with 82% occupying evergreen-dominated understories. We found our infrared imagery method to be effective in identifying Swainson's Warbler habitat in the Appalachians and concluded that they persist at higher densities in southwestern Virginia than previously thought. This method can be implemented for future studies to better inform conservation planning of this enigmatic species.

Fri-2-F-2   Oral Session: Views from Above: Remote Sensing and Synoptic Mapping

The El Niño – Southern Oscillation Dramatically Influences the Probability of Reproduction and Reproductive Rate of a Tropical Forest Bird

Christina Riehl (Princeton University, Princeton NJ), Zachariah Fox Smart (Princeton University, Princeton NJ), and Maria G. Smith (Princeton University, Princeton NJ)

Abstract - Although climate change has been implicated in population declines of tropical forest birds, there is a critical lack of data on the mechanisms underlying these declines. Attempts to link climatic factors to variation in adult survival, fecundity, or nest success have been largely inconclusive. Recent community-scale analyses have suggested that tropical birds may be less likely to breed under adverse conditions, but long-term data on individual reproduction is needed to test this hypothesis. Here we leverage 12 years of data on a lowland forest bird, *Crotophaga major* (Greater Ani), to investigate how demographic parameters vary with phase of the El Niño – Southern Oscillation (ENSO), a major driver of climatic conditions in tropical wet forest. The likelihood of breeding and annual reproductive rate both decreased dramatically in El Niño-like years, with only 37.5% of adults attempting breeding in 2015 (a strong El Niño year). For birds that did breed, however, clutch size and daily nest predation rate were unaffected by climate. Of the local climate variables investigated, dry season length and the frequency of high temperatures were most closely associated with reproductive failure. These results indicate that El Niño conditions alter the demography of Greater Anis by reducing the likelihood of reproduction, a response that may be more widespread than currently recognized. We suggest that reduced reproduction under adverse conditions represents an important and understudied aspect of the life histories of tropical forest birds, one that should be considered when predicting how tropical species will respond to climate change.

Fri-2-A-3   Oral Session: Climate Effects on Birds

Stakeholder Perceptions and Priorities of Bird–Window Collision Mitigation and Prevention

Georgia J. Riggs (Oklahoma State University, Stillwater, OK), Scott R. Loss (Oklahoma State University, Stillwater, OK), and Omkar Joshi (Oklahoma State University, Stillwater, OK)

Abstract - Bird–window collisions are a major source of human-caused avian mortality for which there are multiple mitigation and prevention options available. However, minimal research has been conducted to understand human perspectives related to this issue. This information gap limits understanding about the most effective ways to engage the public in helping to reduce bird–window collisions. We investigated stakeholder perceptions and priorities of bird–window collision mitigation and prevention using a strengths, weaknesses, opportunities, and threats (SWOT) – Analytic Hierarchy Process (AHP) framework. Our results demonstrate that respondents from 2 stakeholder groups, homeowners and conservation practitioners, have an overall positive perception toward reducing bird–window collisions and that they believe the benefits of implementing mitigation and prevention techniques outweigh obstacles that may impede such measures. However, policy and financial-related obstacles (e.g., a lack of policy/guidelines to require or guide mitigation activities, and the cost of implement such activities) were perceived as potential roadblocks to reducing bird–window collisions. Our results indicate that the general public may be receptive to education on this issue and that targeted and active education may be successful in garnering public support for and participation in bird–window collision mitigation and prevention.

Fri-3-F-1   Oral Session: Education, Collections, and Citizen Science to Promote

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Overwinter Status of Bicknell's Thrush (*Catharus bicknelli*) in Eastern Cuba

Chris Rimmer (Vermont Center for Ecsotudies, Norwich, VT), Nicasio Viña Davila (Centro Oriental de Ecosistemas y Biodiversidad, Santiago de Cuba, Cuba) John Lloyd (American Wind Wildlife Institute, Washington, DC) Yves Aubry (Canadian Wildlife Service, Quebec City, QC, Canada), Yasit Segovia Vega (Centro Oriental de Ecosistemas y Biodiversidad, Santiago de Cuba, Cuba), and Carmen Placencia León (Centro Oriental de Ecosistemas y Biodiversidad, Santiago de Cuba, Cuba)

Abstract - To clarify the distribution, relative abundance, and habitat associations of overwintering *Catharus bicknelli* (Bicknell's Thrush) in eastern Cuba, we conducted field surveys in 4 winters between 1998 and 2005 and in the winters of 2017–2020, in a variety of forested habitats at varied elevations. During the earlier period, we detected a total of 86 Bicknell's Thrushes at 56 discrete sampling points, while in 2017–2020, we detected 33 individual thrushes at 21 points. All thrushes detected in 1998–2005 and 29 (87%) of those found in 2017–2020 occupied cloud-forest habitats at elevations between ~1250 and 1850 m above sea level (asl) in Sierra Maestra. Extensive surveys in lower-elevation forests of Sierra Maestra and other geographic regions of eastern Cuba documented 4 individual thrushes in non-cloud forest habitat during February of 2019. These were found in close proximity to one another at an elevation of 650 m asl on the south slope of the Humboldt range; follow-up surveys 1 year later detected no thrushes in the area. Our survey results in Parque Nacional Pico Turquino yielded markedly lower numbers of individuals than those detected during early and mid-winter periods from 1998–2005. Our results suggest that Bicknell's Thrush is a rare to locally uncommon overwintering species on Cuba, restricted almost entirely to high-elevation cloud forests. These forests are generally secure and well-protected from direct anthropogenic disturbance or degradation. Our findings further suggest that Cuba harbors an overwintering population of Bicknell's Thrush second only to Hispaniola's in abundance, and that Cuba is of strategic importance as a refugium for conservation of this globally vulnerable passerine on its restricted wintering range.

Sun-1-F-2   Oral Session: Avian Habitat Use and Ecology II: Forests Here and There

Macroinvertebrates as a Gateway Drug for Citizen Scientists: Thirteen Years of Vermont EPSCoR Outreach

Janel J. Roberge (VT EPSCoR, Burlington, VT) and Declan J. McCabe (Saint Michael's College, Colchester, VT)

Abstract - Macroinvertebrates are ubiquitous in freshwater systems and are useful indicators of differences in water and habitat quality. Collecting these organisms is inexpensive, and identification even to family level reveals meaningful differences between habitats. With some basic training, citizen scientists can gather valuable datasets to answer interesting scientific questions. Vermont EPSCoR has successfully trained high school research teams from Vermont, Massachusetts, New York, and Puerto Rico to use macroinvertebrates, water-quality metrics, habitat assessment, and landscape variables to ask and answer an array of important scientific questions. Our program was designed to facilitate big science using rich data sets without overburdening any one team's workload or responsibility. Each team sampled just 2 streams within reasonable commuting distance of their school. All schools uploaded their data to a central dataset that was accessible to all. Prizes awarded to teams that best utilized the broad dataset motivated larger research questions. Teams compared replicated urban streams in East Boston and San Juan to agricultural streams in the Northeast Kingdom of Vermont. Some teams took longer views and used multiple years of data to detect changes over time. Other teams compared forested streams to agricultural streams, and on at least 2 occasions, Puerto Rican teams compared parameters before and after devastating hurricanes traversed their island. After a summer training at Saint Michael's College, the teams returned home to gather their data and upload to the database. All teams returned to Saint Michael's College the following spring to present their findings in research symposia that included their peers and also undergraduate researchers from Vermont EPSCoR laboratories. The program provided authentic research experiences for up to 20 teams each year, and many of the high school participants have matriculated to successful scientific careers.

Fri-1-E-2   Oral Session: Citizen and Community Science

Amazonian Ant-following Bird Networks Collapse Following Experimental Forest Fragmentation

Patricia F. Rodrigues (Louisiana State University, Baton Rouge, LA)

Abstract - Neotropical ant-following birds that forage on arthropods fleeing from swarms of the army ant *Eciton burchellii* rely on obligate ant-follower—those that forage almost exclusively at swarms—to locate food. These same obligate species are particularly vulnerable to anthropogenic disturbance such as forest fragmentation and are often the first to disappear from fragmented forests. To examine the effects of fragmentation, and the subsequent loss of obligate species, on ant-following bird networks, we used 40 years of bird capture data from the Biological Dynamics of Forest Fragments Project (BDFFP) in central Amazonia to retroactively assemble virtual ant-following bird flocks. Networks in 1-ha and 10-ha forest patches had fewer species associations, were less diverse, and less cohesive compared to those in primary forest. Even as capture rates of ant-followers increased with time post-isolation, this increase did not translate to more cohesive or stable networks, suggesting that ecological interactions may not recover even as species return to regenerating forest.

Sun-2-E-3   Oral Session: Management Impact on Birds

Environmental Predictability: A Missing Link in Climate Change Sensitivity Research

Moey Rojas (Swarthmore College, Swarthmore, PA0 and Kit Yu Karen Chan (Swarthmore College, Swarthmore, PA)

Abstract - While ocean acidification (OA) has broadly negative effects on a significant number of marine organisms, their responses are highly variable and could be a reflection of local adaptation. Coastal organisms, in particular, routinely experience pH fluctuations greater than the predicted 0.3–0.4 pH unit decrease in mean global pH by 2100 due to significant seasonal, tidal, and diel cycles in seawater carbonate chemistry. These fluctuations are expected to increase in their unpredictability, magnitude, and frequency as atmospheric CO_2 levels continue to rise. Here, we conduct a meta-analysis of the responses to OA for over 100 species of the economically and ecologically important echinoderm phylum and compare the observed vulnerability against long-term oceanographic carbonate chemistry data at the collection location. pH fluctuations are common around the globe with both longer-term seasonal trends and short-term autocorrelated patterns. The geospatial pattern of predictability varies with upwelling and latitude. In addition to between-order differences in OA sensitivity, there was also a negative relationship between organismal OA sensitivity and increasing predictability in the frequency and magnitude of pH fluctuations in the organismal location of origin. Our work suggests that organismal responses to future ocean conditions are limited by both their evolutionary history and current local environmental conditions.

Fri-3-C-4   Oral Session: Climate Change Ecophysiology

Effect of Helpers on Nestling Growth and Survival in a Neotropical Host of a Brood Parasitic Cowbird

Juan Manuel Rojas Ripari (Universidad de Buenos Aires - CONICET, Buenos Aires, Argenitna), Juan Carlos Reboreda (Universidad de Buenos Aires - CONICET, Buenos Aires, Argenitna), and María Cecilia De Mársico (Universidad de Buenos Aires - CONICET, Buenos Aires, Argenitna)

Abstract - Cooperative breeding in birds is a reproductive system in which 1 or more adults (helpers) assist others in rearing their offspring. It has been found that cooperative breeding is more prevalent among hosts of obligate brood parasites than non-host species in Australasian and sub-Saharan African avifaunas. This pattern suggests possible evolutionary and ecological interactions between cooperative breeding and brood parasitism, but the interplay between these 2 systems is poorly understood. The presence of helpers at the nest could benefit host parents if it reduces the costs of parental effort and/or enhances nesting success by limiting within-brood competition at parasitized nests. In turn, brood parasites could benefit from using cooperatively breeding hosts if they obtain more resources at helped nests. Here we examined the association between cooperative breeding and nestling growth and survival in nests of *Agelaioides badius* (Greyish Baywing, hereafter Baywing), primary host of the specialist *Molothrus rufoaxillaris* (Screaming Cowbird). We intensively monitored 84 breeding attempts over 4 breeding seasons (2015–2018) and collected data on brood composition, daily mass growth of host and parasitic nestlings ($n = 107$ and 47, respectively), group size (parents plus helpers), and nest-predation events. Richard's models of mass growth of Baywing and Screaming Cowbird nestlings did not detect differences in growth patterns between nests with and without helpers. However, Baywing nestlings showed reduced mass growth in nests with multiple parasitisms. Generalized linear models of nest predation revealed a negative association between the presence of helpers and nest-predation rates during the nestling stage. Our results suggest that helpers' contribution to nest provisioning does not enhance mass growth of host and parasitic nestlings, nor does it fully compensate for the detrimental effects of parasitism on body condition of host broods. However, cooperative breeding could be beneficial to both Baywing and Screaming Cowbird in terms of reducing nest-predation rates. Whether this effect is the result of collective nest defense or a side effect of larger groups occupying safer territories needs further investigation.

Sat-3-E-4   Oral Session: Behavior and Ecology of Neotropical Birds

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The Effect of Human Activity, Shoreline Characteristics, and Landscape Measures on Sea Duck Populations on the North Shore of Massachusetts

Rebekah A. Runey (Gordon College, Wenham, MA), Rebekah Runey (Gordon College, Wenham, MA), Caris Lyons (Gordon College, Wenham, MA), Karoline Niles (Gordon College, Wenham, MA), and Greg Keller (Gordon College, Wenham, MA)

Abstract - The Massachusetts North Shore provides habitats for migratory and wintering sea duck species, yet there is a lack robust scientific research explaining what variables could be affecting population levels. The purpose of this study was to evaluate how human activity, shoreline characteristics, and landscape measures affect populations by comparing abundance of sea ducks at different sites along the North Shore. From October to November 2018–2020, we conducted duck surveys for 9 focal species at 29 sites with either rocky or sandy substrates. We used ArcGIS to evaluate distance to wind farms, site orientation, exposure (1 was a cove, 10 were peninsulas), and the extent of coastal wetland habitat, natural land, impervious surfaces, and residential development within 500 m of each site. Additionally, we used the Akaike information criterion corrected for small sample size (AICc) to analyze the relationship between individual duck species' abundance compared to human activity, shoreline characteristics, and landscape measures to identify competitive models. Results for the 5 most abundant species showed interesting trends related to habitat use and foraging guild. For example, *Bucephala albeola* (Bufflehead) was more abundant at rocky sites, whereas *Melanitta deglandi* (White-winged Scoter) was more abundant at sandy sites. *Gavia immer* (Common Loon) was positively influenced by amount of natural land, and *Somateria mollissima* (Common Eider) abundance was negatively associated with amount of impervious surface and amount of natural land. These results will provide insight into the influence of broad-scale landscape features and show how species characteristics impact habitat use.

Sat-1-F-3   Oral Session: Avian Habitat Use and Ecology I: Human Impacts

Will a Changing Climate Affect Hatching Success in Cavity-nesting Birds?

Scott A. Rush (Mississippi State University, Mississippi State, MS), Spencer Weitzel (Mississippi State University, Mississippi State, MS), John Trent (Alabama Department of Conservation and Natural Resources, Midway, AL), and Eric C. Soehren (Alabama Department of Conservation and Natural Resources, Midway, AL)

Abstract - Climate change is affecting the phenology of flora and fauna worldwide that use proximate environmental cues to time various events throughout their life. Many studies have documented shifts in phenology, such as earlier bird migration and nesting dates, as well as earlier flowering dates of various plants. Few studies have assessed whether the success/failure rate of these life-history events may be correlated with this changing environment. In order to investigate the potential effects from climate change on both the phenology and success of an important avian life-history event, we used nest records for *Sialia sialis* (Eastern Bluebird) over a 5-year period to investigate changes to annual nest-initiation dates, as well as variability in hatching success associated with ambient air temperatures during the incubation period. Using a change-point analysis, these data indicate that Eastern Bluebird hatching success was greatest when mean ambient air temperature during incubation was 18.9–22.8 °C (66–73 °F). Date of first egg laid among Eastern Bluebirds has trended earlier by 1.3 days per year from 2011 through 2020, but this relationship is not statistically significant (b_{year} = -1.33, P = 0.17). Date of first egg was statistically significant relative to the strength of the El Niño/La Niña effect among years showing a strong, positive effect of El Niño resulting in later egg-laying among Eastern Bluebirds in our study site. These results reveal that Eastern Bluebird hatching success is highest during a narrow range of temperatures during the incubation period. With the projected continual increase in air temperatures in the southeast United States, we postulate that Eastern Bluebird nest-initiation dates will continue to become earlier to match the ideal temperature conditions for maximal hatching success. Further, we pose that not only will the species' phenology change, but also the success of such events in association with a changing climate. We hypothesize that other cavity-nesting birds may experience similar effects from a warming and more erratic climate in the southeastern United States in the near future.

Sat-3-F-4   Oral Session: Avian Biogeography and Climate Change

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Movement Ecology of Hornbills and Spatial Patterns of Seed Dispersal in Cameroon

Nicholas J. Russo (University of California, Los Angeles, CA), Anthony Chasar (University of California, Los Angeles, CA), Kimberly Holbrook (The Nature Conservancy, Arlington, VA), Thomas V. Dietsch (University of California, Los Angeles; Migratory Bird Division, U.S. Fish and Wildlife Service, Carlsbad, CA), Martin Wikelski (Max Planck Institute of Animal Behavior, Radolfzell, Germany), and Thomas B. Smith (University of California, Los Angeles, CA)

Abstract - *Ceratogymna atrata* (Black-casqued Hornbill) and *Bycanistes albotibialis* (White-thighed Hornbill) disperse the seeds of more than 50 tree species in Central Africa and move among rainforest fragments during seasonal long-distance movements. We used GPS tracking and step selection functions to investigate the roles of landscape structure and phenology as predictors of movements by Black-casqued Hornbill and White-thighed Hornbill. Canopy height was the best predictor of hornbill movements, indicating that both species select for taller canopies as they move through a fragmented Congo Basin landscape. Accordingly, seeds dispersed by Black-casqued and White-thighed Hornbills are more likely to arrive in areas with taller canopies.

Sun-1-F-3   Oral Session: Avian Habitat Use and Ecology II: Forests Here and There

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Birds of a Feather Caught Together: Flocking Species are Overrepresented in Museum Collections

Samantha L. Rutledge (Mansfield University of Pennsylvania, Mansfield, PA) and Sahas Barve (Smithsonian National Museum of Natural History, Washington, DC)

Abstract - Natural history collections are instrumental to biological research, providing insights into studies ranging from biodiversity and ecological assessments to pathological toxicological investigations. However, the number of specimens representing a particular species in a collection may vary due to aspects of that species' behavior, as well as the logistics of collecting. For example, differences in sampling effort (e.g. ease of species identification, site accessibility) or influences of the species' ecology on collection (e.g. temporal and behavioral factors that may hinder/facilitate collection) may result in disparities in the number of specimens representing each species. We investigated whether the flocking behavior of a species drives the number of specimens of that species represented in the collections of the 66 North American museums that are contributors to Vertnet's Aves dataset. We found that flocking species had significantly more specimens in museum collections relative to non-flocking species, more specimens of flocking species were obtained per collection event, and seasonally flocking species were obtained in greater numbers during their respective flocking seasons. Species forming large flocks were also represented by more specimens than species forming smaller groups. Our study highlights how variation in an avian sociality may ultimately result in the overrepresentation of flocking species in biological collections. To account for this disparity in future collection-based studies, targeted collection efforts prioritizing non-flocking taxa may be necessary.

Fri-3-F-2   Oral Session: Education, Collections, and Citizen Science to Promote

Mitigating Contamination for In-vitro Propagation of Dwarf Wedgemussel

Jennifer E. Ryan (Massachusetts Cooperative Fish and Wildlife Research Unit, Department of Environmental Conservation, University of Massachusetts Amherst, Amherst, Massachusetts), Allison H. Roy (US Geological Survey, Massachusetts Cooperative Fish and Wildlife Research Unit, Department of Environmental Conservation, University of Massachusetts Amherst, Amherst, Massachusetts), Peter D. Hazelton (Daniel B. Warnell School of Forestry and Natural Resources, University of Georgia), David L. Perkins (US Fish and Wildlife Service, Richard Cronin Aquatic Resource Center, Sunderland, Massachusetts), and Timothy M. Warren (US Fish and Wildlife Service, Richard Cronin Aquatic Resource Center, Sunderland, Massachusetts)

Abstract - Comprehensive programs are needed to restore more than 70 federally endangered freshwater mussel species in the US, including *Alasmidonta heterodon* (Dwarf Wedgemussel). Lab propagation is a critical component of many restoration plans; however, in small populations where broodstock are limited, more efficient methods of propagation are needed. Given that fungal contamination inhibits successful in-vitro propagation of Dwarf Wedgemussel, and a related species, *Alasmidonta undulata* (Triangle Floater), we assessed 3 methods of contamination mitigation (media change frequency, concentration of the antifungal Amphotericin B, and method of antifungal replenishment). Across all experiments, higher levels of contamination reduced transformation success. Petri dishes that had media changes every other day (vs. those changed daily and every 3 days) had the highest contamination and the lowest glochidia transformation success, suggesting that minimizing opening of dishes may improve success. Treatments with the lowest (0 µg/mL) concentration of Amphotericin B and treatments with low-dose replenishment of Amphotericin B (versus frequent media changes) had the highest transformation success. Surprisingly, we found that contamination is not necessarily mitigated effectively by Amphotericin B and high levels of Amphotericin B may in fact inhibit transformation success. We identified the fungus as *Candida parapsilosis*, a common fungus found in aquatic and human environments, and suggest that future propagation efforts use mitigation methods that are specifically designed to target the fungal contaminant. This propagation is part of a multi-faceted restoration effort, including studies of population genetics, mussel habitat requirements, and fish populations at potential restoration sites, which are all vital for developing an effective species recovery plan.

Fri-3-A-4   Oral Session: Native Freshwater Mussels: Exploring Threats, Restoration

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Morphometrics of Prostrate Leaves of the Wintergreen Ferns *Polystichum acrostichoides* and *Dryopteris intermedia*

Robert J. Salerno (SUNY Oswego, Oswego, NY) and Jinyan Guo (SUNY Oswego, Oswego, NY)

Abstract - During early winter, the wintergreen ferns *Polystichum acrostichoides* (Christmas Fern) and *Dryopteris intermedia* (Intermediate Wood Fern) form a hinge at the proximal region of the petiole, which enables the leaf to become prostrate. This hinge region is formed in petioles of large-, medium-, and small-sized leaves which can be found in early winter, yet the relative location of this hinge region on the petiole in relation to the size of different parts of the leave was not studied previously. In this study, different regions of the prostrate leaves and the fresh leaf weight of the above-hinge region were measured for leaves of all 3 sizes, each with 54 replicates. The leaf lengths for the small, medium, and large size categories were 15–30 cm, 31–45 cm, and 46–75 cm, respectively, for the Christmas Fern, and 15–40 cm, 41–60 cm, and 61–80 cm, respectively, for the Intermediate Wood Fern. This study shows that the average diameter of the petiole of all 3 sizes increases gradually from 0.18 cm in the distal region to 0.35 cm in the proximal end, and from 0.22 cm to 0.37 cm, for the Christmas Fern and Intermediate Wood Fern respectively, indicating stronger mechanical support towards the base region. The average leaf length of the above-hinge region is 23.56 cm, 34.87 cm, and 52.36 cm for the Christmas Fern, and 29.64 cm, 47.18 cm, and 64.02 cm for the Intermediate Wood Fern, for the large-, medium-, and small-sized leaves respectively. The average fresh leaf weight of the above-hinge region is 0.81 g, 2.19 g and 4.66 g for the Christmas Fern, and 0.76 g, 2.01g and 4.65 g for the Intermediate Wood Fern, for the large-, medium-, and small-sized leaves respectively. A positive correlation is only found between the fresh leaf weight of the above-hinge region and the ratio of average leaf length of the above-hinge region over the below-hinge region, indicating that heavier-weighted leaves form a hinge region closer to its base. In conclusion, weight might be the deciding factor of the relative location of the hinge region on the petiole, and this location might be the balance point between the weight of the leaf and the gradually increasing level of mechanical support towards the base of the petiole.

Sat-3-B-2   Oral Session: Botany

Eastern Phoebe Found at Nest Sites Previously Used by Say's Phoebe in the Smoky Hills, Kansas

John M. Schukman (Kansas Ornithological Society, Leavenworth, KS) and A. Townsend Peterson (University of Kansas, Lawrence, KS)

Abstract - The Great Plains of central North America provide opportunities for pairs of closely related species that replace each other from east to west to approach spatially and form contact zones or hybrid zones. *Sayornis saya* (Say's Phoebe) and *S. phoebe* (Eastern Phoebe) overlap across much of the Great Plains where their breeding ranges reach their respective eastern and western range limits. Say's Phoebes selected nest sites primarily in open country with sparse or no surrounding woodland, whereas Eastern Phoebe nested mostly along woodland streams. However, at our follow-up visits, we found Eastern Phoebe at 14 sites previously used by Say's Phoebe. Modeling of bioclimatic variables in the contact zone showed the niche space of the Eastern Phoebe embedded more into that of Say's Phoebe than the converse. Plans are to assess nest-site occupancy in 2021 and evaluate how climate and woodland vegetation have changed over the last 50 years.

Sat-3-F-2   Oral Session: Avian Biogeography and Climate Change

An Experimental Test of the Effects of Artificial Lighting at Night on the Foraging Activity of a Connecticut Bat Community

Chad L. Seewagen (Great Hollow Nature Preserve & Ecological Research Center, New Fairfield, CT; University of Connecticut, Storrs, CT) and Amanda M. Adams (Texas A&M University, College Station, TX; Bat Conservation International, Austin, TX)

Abstract - Artificial light at night (ALAN) is a rapidly intensifying form of environmental degradation that can impact wildlife by altering light-mediated physiological processes that control a broad range of behaviors. Although nocturnal animals are most vulnerable, ALAN's effects on North American bats have been surprisingly understudied. Most of what is known is based on decades-old observations of bats around streetlights with traditional lighting technologies that have been increasingly replaced by energy-efficient broad-spectrum lighting, rendering our understanding of the contemporary effects of ALAN on North American bats even less complete. We experimentally tested the effects of broad-spectrum ALAN on presence/absence, foraging activity, and species composition in a Connecticut bat community by illuminating a wetland foraging habitat with light-emitting diode (LED) floodlights and comparing acoustic recordings between light and dark conditions. Lighting dramatically decreased presence and activity of *Myotis lucifugus* (Little Brown Bat), which we detected on only 14% of light nights compared to 65% of dark (lights off) and 69% of control (lights removed) nights. *Eptesicus fuscus* (Big Brown Bat) activity on light nights averaged only half that of dark and control nights. Lighting did not affect presence/absence of *Lasionycteris noctivagans* (Silver-haired Bat), but decreased its activity. There were no effects on *Lasiurus borealis* (Eastern Red Bat) or *L. cinereus* (Hoary Bat), which have been described previously as light-tolerant. Aversion to lighting by some species but not others significantly changed the community composition, thereby potentially altering competitive balances from natural conditions. Our results demonstrate that only a small degree of ALAN can represent a significant form of habitat degradation for some North American bats, including the endangered Little Brown Bat. Research on the extent to which different lighting technologies, colors, and intensities affect these species is urgently needed and should be a priority in conservation planning for North America's bats.

Sun-2-F-5   Oral Session: Bat Conservation: Light Pollution and White Nose Syndrome

Some Like it Hot: Effects of Climate Change on Salt Marsh Plant Communities

Kerrie M. Sendall (Rider University, Lawrenceville, NJ), Genevieve L. Noyce (Smithsonian Environmental Research Center, Edgewater, MD), Roy L. Rich (Smithsonian Environmental Research Center, Edgewater, MD), and J. Patrick Megonigal (Smithsonian Environmental Research Center, Edgewater, MD)

Abstract - Coastal salt marsh communities provide numerous valuable ecosystem services such as flood and erosion prevention, soil accretion, and essential habitat for coastal wildlife, but are some of the most vulnerable to the threats of climate change. This work investigates the combined effects of 2 climate stressors, elevated temperature and elevated CO_2, on leaf physiological traits of dominant salt marsh plant species. The research took place in 2017 and 2018 at the Salt Marsh Accretion Response to Temperature eXperiment (SMARTX) in the Kirkpatrick Marsh at the Smithsonian Environmental Research Center in Maryland, which includes 2 different plant communities: a C_3 sedge community and a C_4 grass community. SMARTX consists of plots arranged across an active heating gradient consisting of unheated ambient plots and plots that are heated to 1.7, 3.4, and 5.1 °C above ambient. In the C_3 community, there are 6 additional plots with elevated carbon dioxide chambers, half at ambient temperatures and half heated to +5.1 °C above ambient. The warming treatment had smaller effects on leaf physiological traits than expected, which we attribute at least in part to the much higher than average precipitation that fell in 2018. The lack of water stress likely allowed plants to maintain high rates of stomatal opening since water was not limiting, and thus reduce heat stress via evaporative cooling. When we tested the effect of CO_2 addition at the warming extremes (ambient and +5.1 °C) on the C3 sedge, we found significant reductions in stomatal conductance in response to both. We also found a significant positive relationship between the quantum yield of photosynthesis and stomatal conductance for both C_3 and C_4 species growing under ambient CO_2, indicating that declines in stomatal conductance cause higher levels of thermal stress in both plant communities, likely due to reductions in evaporative heat loss.

Fri-3-C-2   Oral Session: Climate Change Ecophysiology

Birder Broker: A Matchmaker Service for Curious Landowners and Experienced Birders

Nathaniel Sharp (Vermont Center for Ecostudies, Norwich, VT), **Bridget Butler** (Bird Diva Consulting, St. Albans, VT), and Kent McFarland (Vermont Center for Ecostudies, Norwich, VT)

Abstract - Over 80% of the forested land in the state of Vermont is privately owned. Currently, most bird monitoring occurs on public land, and most active birders spend a majority of their time documenting the birds present at publicly accessible "hotspots". The Birder Broker project pairs curious landowners with experienced birders to monitor the breeding birds on private lands in Vermont's northern forests. On 3 evenly-spaced dates in June–July, birders visit with their landowner partner(s) to walk a fixed route on the landowner's forested property, documenting the birds they see and hear, along with any breeding evidence noted, using Vermont eBird, a project of the Vermont Atlas of Life. In our 2019 pilot year, 15 birder–landowner pairs met up for several bird-monitoring walks, submitting 41 Vermont eBird checklists and documenting 92 bird species. Dozens of other birders and landowners from across the state have since expressed interest in joining this project. Many birder participants reported their excitement to explore new and unfamiliar places, and developed strong, long-lasting connections with their landowner partners. Landowner participants have reported a deepened connection with their land and the birds it supports, as well as a desire to manage their forested property with bird conservation in mind. To this end, we provided each landowner involved in the project with management recommendations from other projects like Audubon Vermont's Healthy Forest Initiative. By connecting birders with landowners in bird monitoring efforts, Birder Broker has helped foster important partnerships between these often disconnected groups, and has provided a framework for volunteer birders to collect bird population data in previously under-surveyed areas. After our pilot year, we are looking forward to continuing to support these partnerships annually to foster landowner–birder partnerships and to conduct long-term monitoring of forest bird populations on Vermont's private forested lands.

Fri-3-F-4   Oral Session: Education, Collections, and Citizen Science to Promote

Moth Diversity in Managed Pine Barrens and Heathlands of Inland Massachusetts

Sarah Shearer (Antioch University New England, Department of Environmental Studies-Conservation Biology MS Candidate, Keene NH), Michael Akresh, Ph.D (Department of Environmental Studies, Antioch University New England, Keene NH), Mark Mello (Lloyd Center for the Environment, Dartmouth MA), and Chris Buelow (Natural Heritage and Endangered Species Program, Westborough MA)

Abstract - More threatened and endangered moth species rely on pine barren and heathland habitats than any other kind of habitat present in the northeastern United States. Barren habitats contain key larval host plant species such as *Quercus ilicifolia* (Scrub Oak), *Pinus rigida* (Pitch Pine), *Vaccinium angustifolium* (Lowbush Blueberry), and *Vaccinium pallidum* (Blue Ridge Blueberry). We conducted a study in western and central Massachusetts barrens to examine moth diversity, detect the presence of Massachusetts Endangered Species Act (MESA)-listed species, and explore how ongoing forest management is affecting moth diversity and species of greatest conservation need. From May to October 2020, monthly surveys were conducted at 6 inland pine barrens and heathlands that had not previously been studied. We deployed UV Blacklight traps overnight at 3 points spread across each of our 6 primary sites, equaling 108 trap-nights in total. We also conducted 4 nights of targeted surveys at 2 secondary locations, using blacklight traps as well as sheet-lighting techniques. Although some of the identification remains to be completed, we have processed over 6400 moths and identified over 600 species representing at least 25 distinct families. Once all identification is complete, we hope to compare the total species diversity of macro-moths and species of conservation concern at each site. We will also be examining effects of key larval host plants and forest management. Along with many rare barrens obligates, 7 state-listed species have been detected so far, including *Chaetaglaea cerata* (Waxed Sallow), *Psectraglaea carnosa* (Pink Sallow), *Zanclognatha martha* (Pine Barrens Zanclognatha), *Hemaris gracilis* (Graceful Clearwing), *Papaipema appassionata* (Pitcher Plant Borer), *Pyrrhia aurantiago* (Orange Sallow), and *Catocala herodias gerhardia* (Gerhard's Underwing). We also detected *Cerma cora* (Owl-eyed Bird Dropping Moth), which had been thought to be extirpated in Massachusetts. Out of 8 sites, 6 were found to contain at least 1 MESA-listed species. There is still much more to know about rare moth species distribution in Massachusetts, but preliminary results indicate that forest management is benefiting state-listed species, primarily by increasing the abundance of larval host plants that thrive in open canopies, such as Lowbush Blueberry and Scrub Oak.

Sat-1-D-2   Oral Session: Biodiversity in Pine Barrens and Heathlands II

Using Sparse Citizen Science and Museum Data to Detect Signals of Climate Change in Butterfly Communities

Vaughn Shirey (Dept. of Biology, Georgetown University, Washington, DC), Naresh Neupane (Dept. of Biology, Georgetown University, Washington, DC), and Leslie Ries (Dept. of Biology, Georgetown University, Washington, DC)

Abstract - The last decade has presented a rapidly increasing volume of citizen science and museum data that may have potential for use in ecological analysis. Because these data do not come from sampling designs, many biases are present and must be accounted for when attempting to derive biological trends. Our research focuses on assessing the impacts of climate change on subpolar (boreal and tundra) butterflies in North America, some of the most sparsely sampled species and regions on the continent. To address issues of data quality, we use occupancy models that account for a separate ecological and observation process in order to make inferences while accounting for bias. Occupancy modelling has the added benefit of being highly customizable and applicable to a variety of study systems and data types. Here we present results of using occupancy models in our study region and talk about the extensibility of this framework for other research uses.

Sat-1-C-2   Oral Session: How to Make Meaning of Citizen Science Biodiversity Data I

Surviving to Dance in the Rain: Environmental Drivers of Demography and Display in Neotropical Birds

Elsie H. Shogren (University of Rochester, Rochester, NY) and W. Alice Boyle (Kansas State University, Manhattan, KS)

Abstract - The abiotic environment can act as a selective driver, shaping life history directly and indirectly. Precipitation is increasingly recognized as an abiotic selective force that influences demography and mortality of tropical endotherms. The range of rainfall conditions which allow a species to successfully survive and reproduce defines its "hygric niche". Interannual increase or decrease in precipitation should therefore lead to positive or negative changes in demographic rates depending on the population's location within their hygric niche. We tested this framework for understanding and predicting the effects of variation in rainfall in a community of Neotropical birds in a montane primary forest in Costa Rica. Using 7 years of capture–mark–recapture data, we calculated annual estimates of apparent survival for 7 tropical passerines. We found that species did show divergent responses in years with increased rainfall; some species had higher annual apparent survival following rainier years while others had lower or similar demographic rates. One species, *Corapipo altera* (White-ruffed Manakin), did not have altered estimates of apparent survival following rainier years, but overall their demographic rates were dramatically lower than those calculated in a different population subject to about half as much annual rainfall. Because males in this long-lived lekking species derive all reproductive success from courtship display for females, we determined how population-level investment in display, stability of social hierarchies, and use of display sites might be influenced by differences in demography and abiotic environment. We conducted intensive behavioral observations in 2 populations receiving ~8200 mm and ~5000 mm of rain annually, testing predictions of 4 alternative mechanisms linking rainfall to reproductive behavior. We found that use of display sites and investment of individuals in display varied dramatically year-to-year at both sites. Furthermore, shifts in age distribution of males support differences in mortality between populations, which may have consequences for the stability of social hierarchies associated with display sites. Overall, our results are consistent with the hypothesis that rain constitutes an important source of abiotic selection for tropical endotherms and modulates the scope for sexual selection near the extremes of a species' hygric niche.

Sat-3-E-1   Oral Session: Behavior and Ecology of Neotropical Birds

Landscape of Risk: America's Cost Surface

Brittany Simons (Oklahoma State University, Stillwater, Oklahoma), Tim O'Connell (Oklahoma State University, Stillwater, Oklahoma), and Bryan Murray (Oklahoma State University, Stillwater, Oklahoma)

Abstract - Some bird species suffer disproportionately high mortality rates during the migration phase of their full annual cycle. While there are many estimates of the spatially explicit causes for bird mortality across the United States, when and where those threats might affect birds during migration are still a mystery. In our study, we mapped threats for birds across the contiguous United States of America to determine areas of concern that overlap with migratory paths of tagged individuals. We used data for *Catharus* thrushes from the MOTUS wildlife tracking database to map movement of several thousand individuals across the US. To understand the cost of each individual's route during migration, we rastorized threats from major mortality sources for birds to create a cost surface. We used the National Land Cover Database (NLCD) to determine habitat quality, urban areas as a proxy for building-collision risk, and resolution for all other threats. Other collision risks were represented by point data from turbines and communication towers with guy lines. Line data was used for electric lines and road-collision risk. Using ArcGIS Pro and RStudio, we summed threats per cell for the cost surface and overlaid it with individual thrush routes to determine cumulative route costs during migration. This allowed us to compare routes birds could have taken to understand use vs availability in relation to landscape risk during migration.

Fri-2-F-4   Oral Session: Views from Above: Remote Sensing and Synoptic Mapping

A Weather Surveillance Radar View of Alaskan Avian Migration

Ashwin Sivakumar (Flintridge Preparatory School, La Cañada Flintridge, CA), Daniel Sheldon (University of Massachusetts, Amherst, MA), Kevin Winner (University of Massachusetts, Amherst, MA), Carolyn S. Burt (Colorado State University, Fort Collins, CO), and Kyle G. Horton (Colorado State University, Fort Collins, CO)

Abstract - Monitoring avian migration within arctic regions of the globe poses logistical challenges. Populations in these regions often encounter the most rapid effects of changing climates, and these seasonally productive areas are especially important in supporting bird populations—emphasizing the need for monitoring tools and strategies. To this end, we leverage the untapped potential of weather surveillance radar data to quantify active migration through the airspaces of Alaska. We used 400,000 NEXRAD radar scans from 7 stations across the state between 1995 and 2018 (86% of samples derived from 2013 to 2018) to measure spring and fall migration intensity, phenology, and directionality. We identified a large bow-shaped terrestrial migratory system spanning the southern two-thirds of the, with birds generally moving along a northwest–southeast diagonal axis east of the 150th meridian, and along a northeast–southwest axis west of this meridian. Peak migration varied from May 3rd to May 30th in the spring and August 18th to September 12th during the fall, with timing across stations predicted by longitude, rather than latitude. Across all stations, the intensity of migration was greatest during the fall as compared to spring, highlighting the opportunity to measure seasonal indices of net breeding productivity for this important system as additional years of radar measurements are amassed.

Fri-2-F-3   Oral Session: Views from Above: Remote Sensing and Synoptic Mapping

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Breeding-winter and En Route Migratory Connectivity of Eastern Whip-poor-will from the Midwestern US

Aaron Skinner (The Ohio State University, Columbus, OH), Michael Ward (The University of Illinois, Champaign, IL), Ian Souza-Cole (The University of Illinois, Champaign, IL), Frank Thompson III (The University of Missouri, Columbia, MO), Jay Wright (The Ohio State University, Columbus, OH), Thomas J Benson (The University of Illinois, Champaign, IL), Steven Matthews (The Ohio State University, Columbus, OH), and Christopher Tonra (The Ohio State University, Columbus, OH)

Abstract - *Antrostomus vociferus* (Eastern Whip-poor-will) has declined by 70% in recent decades, yet an understanding of when and where populations are limited throughout the annual cycle remains poorly understood. We deployed 115 archival GPS tags on Whip-poor-wills in the summers of 2017 and 2019 in 5 breeding areas across 4 states in the midwestern US. We extracted data from 52 tags the following years, and identified migratory routes and stopover and overwintering locations, assessed how spatiotemporal overlap varied through migration, and calculated migratory connectivity. Furthermore, by deploying tags across a 9.5-degree latitudinal span, we tested the hypothesis that Whip-poor-wills exhibit a leapfrog migratory connectivity pattern by examining patterns of straight-line migration distance and wintering latitude among breeding sites. Over half of birds that stopped over used a 600-km stretch of a largely forested region between the Ozark Plateau and the plains/forest of Eastern Texas, suggesting that this may be a key stopover region. Whip-poor-wills appear to circumvent the Gulf of Mexico, and thus are funneled from across the study area into a small spatial region in Eastern Texas and Eastern Mexico. Consistent patterns in migration phenology and stopover, regardless of breeding location, resulted in increasing spatiotemporal overlap throughout the migratory period, peaking in early October. Migratory connectivity was low (MC = 0.225 ± 0.128), with extensive overlap of core wintering areas in southern Mexico and Guatemala. Combined evidence from 2 models suggest a telescopic distributional pattern, as opposed to a leapfrog pattern as hypothesized, in which birds breeding across a large latitudinal distribution winter in a much-reduced latitudinal area. Circumventing the Gulf of Mexico seems to play an outsized role in both en-route and breeding-winter connectivity, highlighting the importance of geography in connectivity for this species. Ultimately, this research suggests that geographically dispersed breeding populations overlap in space and time during other phases of the annual cycle, and that non-breeding-season events regulating populations (both positively and negatively) will affect individuals from across the breeding range.

Sun-1-E-3   Oral Session: Full-cycle Nightjar Monitoring in Eastern North America

Habitat Predicts Abundance of Five Freshwater Mussel Species in Massachusetts

Ayla Skorupa (Massachusetts Cooperative Fish and Wildlife Research Unit, Department of Environmental Conservation, University of Massachusetts, Amherst, MA), Allison H. Roy (US Geological Survey, Massachusetts Cooperative Fish and Wildlife Research Unit, Department of Environmental Conservation, University of Massachusetts, Amherst, MA), Peter D. Hazelton (University of Georgia, Daniel B. Warnell School of Forestry and Natural Resources, Athens, GA), Andrew Fisk (Connecticut River Conservancy, Greenfield, MA), David Perkins (US Fish and Wildlife Service, Cronin Aquatic Resource Center, Sunderland, MA), and Timothy Warren (US Fish and Wildlife Service, Cronin Aquatic Resource Center, Sunderland, MA)

Abstract – Species–habitat relationships are critical for assessing population threats and informing conservation actions; however, habitat requirements for many freshwater mussels are unknown. We aimed to better understand habitat characteristics for 5 stream-dwelling freshwater mussel species in Massachusetts: 1 state-endangered species (*Alasmidonta varicose* [Brook Floater]), 1 species of special concern (*Strophitus undulates* [Squawfoot]), and 3 unlisted species (*Alasmidonta undulata* [Triangle Floater], *Elliptio complanata* [Eastern Elliptio], *Margartifera margaritfera* [Eastern Pearlshell]) that are found in overlapping distributions in the state. We delineated the mesohabitat types (riffle, run, dammed pool, scour pool) within twenty-five 100-m river reaches in 10 rivers. In longitudinal lanes, we collected species abundance (mussels/min^{-1}) via snorkeling and habitat variables (e.g., depth, emergent vegetation). Trends in mesohabitat use varied among species: *A. varicosa* and *M. margartifera* had highest abundances in dammed pools, *E. complanata* preferred dammed pools and runs to riffles and scour pools, and *A. undulata* and *S. undulatus* had equal abundances across mesohabitats (except for a low abundance of *A. undulata* in riffles). Despite these trends, mesohabitat type was not a strong predictor of species abundance, and all habitat types were used proportional to their availability for each species, except for *E. complanata* which preferred different mesohabitat types in different rivers. The strongest habitat predictors of *A. varicosa* abundance were second-order polynomial terms of maximum depth and pebble heterogeneity (D84/D16), and linear negative relationships to median particle size (D50) and large wood. Similarly, all species models (except *M. margartifera*) predicted negative relationships with D50, and both *A. undulata* and *E. complanata* had positive relationships with maximum depth. Habitat predictors of *M. margaritifera* were different than other species: negative relationships with algae and emergent vegetation were the strongest. This species-specific habitat modeling suggests that different habitat characteristics are critical to consider for determining management of different mussel species, including population restoration (e.g., where to reintroduce propagated mussels) and protection (e.g., land conservation).

Fri-3-A-3   Oral Session: Native Freshwater Mussels: Exploring Threats, Restoration

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Genetic Diversity of *Leucocytozoon* species Parasites in Songbirds from Central New York

Abigail Snow (SUNY ESF, Syracuse, NY), Brian F. Leydet (SUNY ESF, Syracuse, NY), Britton Grasperge (Louisiana State University School of Veterinary Medicine, Baton Rouge, LA), and Christopher M. Whipps (SUNY ESF, Syracuse, NY)

Abstract - Apicomplexan blood parasites, or haemosporidians, are common and diverse in avian hosts. Most familiar to biologists in general might be *Plasmodium* species, which infect red blood cells and cause avian malaria. Another group of haemosporidians are members of the genus *Leucocytozoon*, which infect white blood cells and are transmitted by biting insects like black flies. In agricultural animals like *Gallus gallus domesticus* (Chicken) and *Meleagris gallopavo* f. *domestica* (Turkey), infections with certain *Leucocytozoon* species have been associated with production losses, but the impacts in wild birds are less well characterized. A first step in more thoroughly understanding the biology and pathology of *Leucocytozoon* species in wild birds is to identify the parasite species present and their host range. There are ~86 described *Leucocytozoon* species, but surveys that incorporate DNA sequence data have identified many other lineages. Here we aimed to characterize the genetic diversity of *Leucocytozoon* species in songbirds from Central New York, leveraging samples collected as part of another project. Blood was collected from 130 birds representing 13 host species. Overall parasite prevalence was 46.2% (60 of 130) in all birds. Notably, the Veery (*Catharus fuscescens*) had a parasite prevalence of 66.6%, and the Song Sparrow (*Melospiza melodia*) had a prevalence of 63.6%. DNA sequencing of the cytochrome b gene identified 10 genetic lineages of *Leucocytozoon*, and there was evidence of mixed infections in several samples. While some genetic lineages infected hosts species broadly, many showed some host specificity. For example, 1 lineage was only found in Veeries. For a subset of samples, we also had stained blood smears to examine the morphology of these different genetic types of *Leucocytozoon*. In 71.9% (41 of 57) of blood samples positive by DNA analysis, no parasites were observed microscopically, highlighting the possibility of cryptic infections and the utility of DNA-based methods for diagnosis. This is the first study to investigate the genetic diversity of avian haemosporidians in Central New York, and provides a foundation for our improved understanding of the diversity and host specificity of *Leucocytozoon* species regionally and broadly.

Fri-2-C-2   Oral Session: Parasite Ecology, Avian Parasites

Development and Regeneration of the Lateral Line Sensory System in the Zebrafish, *Danio rerio*

Aaron B. Steiner (Pace University, Pleasantville, NY), Bryan Volpe (Pace University, Pleasantville, NY), Joana Krause Massaguer (Pace University, Pleasantville, NY), and Alexandria Colamaria (Pace University, Pleasantville, NY)

Abstract - Fishes and many amphibians possess a sensory system known as the lateral line that is responsible for detecting movement in the aquatic environment. The lateral line is composed of sensory hair cells akin to those found in the inner ear along with associated supporting cells, organized into small sensory patches called neuromasts distributed along the skin. Hair cells in the lateral line, unlike those in the mammalian ear, are capable of regeneration throughout life. The neuromasts are connected during larval development by a string of elongated interneuromast cells that can serve as progenitors and proliferate to produce entirely new neuromasts as the larva matures. We and others have demonstrated that interneuromast cells in *Danio rerio* (Zebrafish) are capable of regrowth after injury, closing gaps in the string of cells through protrusive activity. The ability to close such gaps is dependent upon initial gap size, i.e. the extent of damage. In an effort to identify molecular targets that regulate the proliferation of interneuromast cells, we found a chemical inhibitor that induces proliferation of supporting cells within neuromasts leading to larger sensory patches. These findings have implications for the mechanisms controlling organ size and sensory development, and may provide insight into mechanisms restricting proliferative regeneration in the mammalian ear.

Sat-2-A-1   Oral Session: Fish Biology II: Anatomy, Physiology, Behavior

If You Build It, Will They Come? Efficacy of Northern Saw-whet Owl Nest Boxes in Hardwood Forest

Scott H. Stoleson (USDA Forest Service NRS, Irvine, PA) and Joseph M. Elias (Keystone College, La Plume, PA)

Abstract - Nest boxes are a commonly used tool to manage and study species that utilize tree cavities. We examined 11 extant nest boxes erected in 2011 for *Aegolius acadicus* (Northern Saw-whet Owl) in northern Pennsylvania after a hiatus of 9 years. We found no evidence of any owl usage over that time, and most appeared pristine. Standardized playback surveys conducted at each box revealed that owls were indeed present at 8 of the 11 boxes checked. Surveys of tree cavities found an average of 7.7 cavities of a size appropriate for use by Northern Saw-whet Owls within 50 m of each box; extrapolation of cavity densities to a minimal owl territory size of 150 ha suggested that suitable cavities are an abundant and non-limiting resource here. Cavity abundance was likely due in part to the consequences of beech bark disease complex having recently top-killed most large *Fagus grandifolia* (American Beech) trees locally, providing abundant resources for excavating woodpeckers. We suggest that assessing cavity abundance in a system is an essential first step for any management project involving cavity-nesting birds, and that nest boxes be constructed and used only in situations where cavities are limited.

Sun-2-E-1   Oral Session: Management Impact on Birds

Avian Annual Survival Rates Heavily Influenced by Climate Cycles on a Continental Scale

Madison O. Sutton (Marquette University, Milwaukee, WI), T. Luke George (Colorado State University, Fort Collins, CO), Jim Saracco (Institute for Bird Populations, Point Reyes Station, CA), Rodney Siegel (Institute for Bird Populations, Point Reyes Station, CA), and Joseph A. LaManna (Marquette University, Milwaukee, WI)

Abstract - Climate change is a threat to biodiversity and animal populations around the world. Underscoring this general threat, populations of many bird species have been declining dramatically over the past few decades, and any effects of climate on avian annual survival will have important implications for their population trends. Climate cycles like the El Niño Southern Oscillation (ENSO) or the North Atlantic Oscillation (NAO) are predicted to become more extreme as the climate changes, but the effects of climate cycles on animal populations remain uncertain. Here, we use 20 years of mark–recapture data from across the continental United States to evaluate the influence of climate cycles on annual survival rates of 49 bird species. We used data from the Monitoring Avian Productivity and Survivorship (MAPS) network collected during the breeding seasons of 1992–2012 to estimate changes in annual apparent survival and to test whether there is a correlation between ENSO and NAO and annual survival rates for 49 passerine species. ENSO and NAO appear to have a coordinated continental-scale effect on annual survival of bird species, as we found a correlation between ENSO and NAO and annual survival for ~80% of the species studied. These continental-scale results strongly suggest that migratory and resident bird species populations are at substantial risk due to higher variability in these climate cycles predicted to be caused by climate change. Climate cycles are likely influencing survival rates by affecting migration efficiency or by causing phenological mismatches and longer stopover times during migration. Responses of migratory and resident birds to climate phenomena are also likely to have carryover effects on reproductive success, calling for more focus on population trends for species of conservation concern.

Sat-3-F-5   Oral Session: Avian Biogeography and Climate Change

Using Trail Cameras to Survey Mammals in Distinct but Linked Parcels in the Lower Winooski Watershed; Comparing the Intervale, Pine Island, and Sunderland Brook

Lina Swislocki (Intervale Center, Burlington, VT) and Declan McCabe (Saint Michael's College, Burlington, VT)

Abstract - The Winooski River cuts through the "urban" center of Vermont where the adjacent municipalities of Burlington, Colchester, South Burlington, and Winooski have a combined population of 86,252 (which accounts for 14% of the human population of the state.) While much of the land in the area is developed for human habitation, large swaths of it are used for farming or outdoor recreation. In an effort to understand how local animals navigate this human-dominated landscape, the Lower Winooski River Valley Project partnered with St. Michael's College and deployed 25 trail cameras on both sides of the river to track animal abundance and diversity in a variety of habitats and land-uses. Collaborative projects between academic institutions, non-profit organizations, and scientists can serve as excellent starting points to document mammalian communities in these landscapes and demonstrate the conservation value of open spaces in urban and suburban landscapes. This particular project documented more than 17 native mammal species travelling through the cityscape. Here, we use data collected from the game cameras to examine the abundance and diversity of species in 3 geographically connected areas with slightly different uses: (1) the Intervale, 146-ha (360-ac) campus of farmland, trails, and open space along the Winooski River in Burlington, owned by a private non-profit, leased to small organic farmers, and open to the public for walking, biking, and cross-country skiing; (2) Pine Island, a 93-ha (230-ac) mix of riverfront, wetland, pasture, woods, and tillable acreage along the Winooski River in Colchester, owned by a private non-profit, leased to a small group of famers, and largely closed to the public; and (3) Sunderland Brook, a privately owned 81-ha (200-ac) parcel just upstream of Pine Island, used for farming corn and hay, and boarding horses. We believe the data indicate the value and impact of specific land features and uses.

Fri-3-D-5   Oral Session: Trail Camera Wildlife Monitoring in Human-dominated

Effects from Light and Noise Pollution on Gray Treefrogs and Green Frogs In Syracuse, NY

Haley Synan (Le Moyne College, Syracuse, NY), **Anne Christopher** (Le Moyne College, Syracuse, NY), Kylee Wilson (Le Moyne College, Syracuse, NY), and Jason D. Luscier (Le Moyne College, Syracuse, NY)

Abstract - Increased urban light pollution results in decreased habitat availability for nocturnal wildlife. Likewise, noise pollution affects the integrity of vocal communications of nocturnal wildlife. Frogs rely on sound for mate choice and darkness to evade predation, so increased light and noise pollution may impede these processes. To understand the effects of light and noise pollution on urban frog distributions, we evaluated site occupancy of *Hyla versicolor* (Gray Treefrog) and *Lithobates clamitans* (Green Frog) in Syracuse, NY. We conducted three 5-minute frog-call surveys at 26 sites during 2018, 35 sites during 2019, and 43 sites during 2020. We measured light (w/m^2), and sound (dB) during each survey and recorded the percent of tree canopy within a 500-m radius and the distance (km) from each survey point to the nearest standing water. We used the package 'unmarked' in R to evaluate a set of models incorporating effects of habitat variables on site occupancy. Estimated site occupancy was corrected for imperfect detectability. The top-ranked model explaining treefrog occupancy included effects from light pollution; however, models including effects from noise pollution and tree canopy were equally plausible. Gray Treefrog occupancy (SE) declined from 0.66 (0.19) to 0.14 (0.08) with increasing light pollution (0.0–1.5 w/m^2) and from 0.83 (0.16) to 0.33 (0.08) with increasing noise pollution (33–58 dB); however, Gray Treefrog occupancy increased from 0.38 (0.09) to 0.85 (0.19) with increasing tree coverage. Our results indicate that urban Gray Treefrog populations may be sensitive to light pollution and noise pollution. Green Frog occupancy decreased from 0.67 (0.14) to 0.01 (0.02) with increasing distance from standing water (0.0–2.4 km). Green Frog occupancy models incorporating effects from other variables had weak support from the data. These results suggest that cities should consider managing healthy standing bodies of water, increasing overall tree coverage, and decreasing light and sound pollution in order to increase habitat availability for urban anurans.

Sun-2-B-1   Oral Session: Herps: Imacts of the Anthropocene

Augmenting Benthic Habitat Classification with Low-cost Imagery: An Application of the Coastal and Marine Ecological Classification Standard (CMECS)

Sean Terrill (University of Massachusetts Boston, Dorchester, MA), Agnes Mittermayr (Coastal processes and Ecosystems Lab, University of Massachusetts Boston, Dorchester, MA), Bryan Legare (Coastal processes and Ecosystems Lab, University of Massachusetts Boston, Dorchester, MA), and Mark Borrelli (Coastal processes and Ecosystems Lab, University of Massachusetts Boston, Dorchester, MA)

Abstract - Many anthropogenic activities have negative impacts on the coastal marine benthos. One of the first steps of ecosystem-based management is to classify and map habitats. The Coastal and Marine Ecological Classification Standard (CMECS) was adopted by the federal government to standardize habitat classification in coastal US waters. The CMECS provides a hierarchal framework to define and interpret benthic habitats and biotopes but does not prescribe any particular sampling methods to adopt. Benthic imagery has been utilized for many decades in benthic ecology but has not often been employed in habitat classification using the CMECS. Further, no study to date has quantitatively examined the value of incorporating imagery into the classification of benthic habitats using the CMECS. The objective of this study is to describe the study site, a ~1-km^2 near-shore, subtidal area at Herring Cove in Provincetown, MA, in terms of the CMECS, and to quantify the benefit of augmenting benthic-habitat classification with low-cost imagery. We conducted a benthic-habitat survey of the study area in October of 2017 that included grab sampling for grain-size analysis and invertebrate taxonomy, benthic imagery, and water parameter sampling at sampling stations, and acoustic mapping of the study area. We conducted multivariate statistical analyses with PRIMER v.7 to classify biotic communities and link environmental and biological data to classify biotopes. Results showed that benthic imagery improved the resolution of substrate and biotic community classifications. Similarity matrix rank correlation revealed that environmental and biological data were more correlated when benthic imagery was included and that submerged aquatic vegetation (SAV; a benthic imagery variable) alone maximized environmental–biological relatedness. Distance-based redundancy analysis showed that benthic imagery variables improved the linear modelling of environmental–biological relationships and the clustering of biotopes within the study area. These findings imply that the incorporation of low-cost benthic imagery is warranted in coastal benthic biotope classification and mapping studies and should be regularly adopted. Furthermore, benthic imagery provided insights to environmental gradients, associated with biotope structure, that would have not been evident otherwise. These findings have implications for coastal benthic ecologists classifying benthic habitats on a budget and/or within the CMECS framework.

Sat-2-B-2   Oral Session: Coastal Marine Habitats of the Northwest Atlantic

Hard Frost but Not Shade Could Limit the Future Growing Season of *Erythronium americanum*

Jack T. Tessier (SUNY Delhi, Delhi, NY)

Abstract - Changes in climate are leading to modifications in the timing of seasonal events such as migrations and flowering. *Erythronium americanum* (Trout Lily) can break bud early in response to warming, but changes to its growing season may be limited by early shade from canopy trees and frost. I experimentally assessed the impact of shade and frost on senescence in *E. americanum* and descriptively monitored the response of *E. americanum* to vernal air and soil temperatures in a garden setting. Early shade did not affect the timing of senescence. Experimental exposure to frost resulted in increased leaf damage, earlier senescence, and greater corm death than in control plants. However, despite 10 days in which the air temperature dropped below freezing, there was no evidence of leaf damage in the field. These results suggest that early shade from canopy trees will not hasten the end of the future growing season for *E. americanum*, but that late frost could bring about early senescence if that frost is sufficiently hard.

Sat-3-B-3   Oral Session: Botany

Exploring the Natural Communities of Vermont from the Ground Up: Wetland, Woodland, Wildland

Elizabeth Thompson (Vermont Land Trust, Richmond, VT), Eric Sorenson (Natural History Inventory, Vermont Fish and Wildlife Department, Barre, VT), and Robert Zaino (Vermont Fish and Wildlife Department, Barre, VT)

Abstract - Vermont is a small, inland state, but it has a rich array of physical features—calcareous bedrock, fine-textured soils, mountains, cliffs, rivershores, and wetlands—that support a diversity of natural communities. Natural communities have been a focus of inventory and conservation since the beginning of systematic natural areas conservation in Vermont and the Northeast, and we 3 authors, along with many colleagues, have taken great pleasure in exploring and sharing knowledge about these places. The most recent iteration of that sharing is the 2019 edition of *Wetland, Woodland, Wildland: A Guide to the Natural Communities of Vermont*. In this presentation, I will feature a few of Vermont's natural communities from the ground up, exploring their soils, landscape settings, natural processes, and current vegetation. Climate change will bring novel communities, and we don't know what those will look like, but the physical features will remain relatively stable, so understanding those will be critical as we move forward in time. The goal of this talk is to inspire listeners to do some exploring themselves, to learn more about the physical underpinnings of our natural communities, and to revel in the vegetation as it presents itself today.

Fri-3-B-2   Oral Session: New Natural History Books: Insights from the Authors

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Variation in Body Condition and Damage in Eastern Box Turtles (*Terrapene carolina*) on Long Island, New York

Anna Thonis (Stony Brook University, Stony Brook, NY), Lisa Prowant (Culver-Stockton College, Canton, MO), Christopher Werni (Stony Brook University, Stony Brook, NY), Zhen Ye Pan (Stony Brook University, Stony Brook, NY), Kristi Fung (Stony Brook University, Stony Brook, NY), Brittany Ford (Stony Brook University, Stony Brook, NY), and Cosku Ozcelik (Stony Brook University, Stony Brook, NY)

Abstract - A major threat facing *Terrepene carolina carolina* (Woodland Box Turtle)—one of the 6 subspecies of *Terrepene carolina* (Eastern Box Turtle)—inhabiting Long Island, NY, is urbanization and habitat fragmentation. When surveying box turtles, it is common to observe damage to a turtle's carapace or plastron, but there remains uncertainty surrounding the causes of this damage. Although the entirety of the island maintains a high population density and relatively uniform environmental conditions, we sought to identify possible drivers of differences in carapace and plastron damage across the island, as well as any differences in sex ratio, stage ratio, and body condition. To do this, we captured a total of 182 individual woodland box turtles across 27 sites on Long Island over a 2-year period. We evaluated shell damage according to a 5-tier ranking system based on the amount and type of damage an individual turtle exhibited. We calculated a body condition index (BCI) for each individual turtle using each turtle's body weight and carapace length. We compared all damage and body condition data were compared across sites, by sex, and by stage. We then analyzed these relationships against 15 unique environmental variables and 3 unique human-influence variables. Despite the substantial number comparative analyses performed, there remains uncertainty regarding the drivers of differences in shell damage, body condition, and sex and stage ratios for Woodland Box Turtles across Long Island. The results of this study underscore the need for future work on understanding the drivers of Eastern Box Turtle shell damage and body condition.

Sun-2-B-4   Oral Session: Herps: Imacts of the Anthropocene

Effects of the Glyphosate-based Herbicide Roundup® on Survival and Development of American Horseshoe Crab Embryos

Hope VanDerwater (Fordham University, New York, NY), Mark L. Botton (Fordham University, New York, NY), and Karine Khoder (Fordham University, New York, NY)

Abstract - We assessed the toxicity of the glyphosate-based commercial herbicide Roundup® on "stage 20" *Limulus polyphemus* (American Horseshoe Crab) embryos. Based on previously completed Horseshoe Crab toxicology studies, we set up static renewal bioassays with concentrations of Roundup® of 0.00% (control), 1.00%, 2.50%, 5.00%, 7.50%, and 10.00% with a dish for exposure durations of 24 hrs, 48 hrs, and 72 hrs for each concentration. We replaced the test solution with artificial seawater after the determined time and then monitored the dishes at regular intervals to remove and record embryos that hatched into the larval stage or died. We discovered no mortality in the control and 2.5% concentration dishes, higher mortality rates in 7.5% dishes with complete mortality in 10% concentration dishes. Embryonic development was prolonged at higher concentrations of Roundup®. In the control group, most embryos by day 7. The longest average hatching day (12.33 days in the 5% concentration treatments and 12.52 days for all the 48-hr exposures) was nearly twice that of the control treatments (7.075 days). Finally, at higher concentrations, we found 13 dead embryos displaying an unexpected developmental deformity: the embryos were outside their membrane yet still attached to the intact and firm transparent membrane. Although we found a few morphologically different deformities, there were no deformed specimens in the control dishes. The concentrations of Roundup® causing mortality or embryonic abnormalities in Horseshoe Crab embryos were many times greater than those found in the natural environment. Thus, the declines in Horseshoe Crab populations in the Northeast are probably unrelated to the use of this chemical herbicide.

Sun-1-A-2   Oral Session: Horseshoe Crab Ecology I

Patterns of Variation in Size of Fish Scales within Individuals and across Populations

Daniel P. Welsh (Fitchburg State University, Fitchburg, MA)

Abstract - Fish scales play a major role in the interaction between fish and their aquatic habitat, affecting the fish's swimming ability and providing protection from biotic and abiotic environmental factors. Differences in size of fish scales exist between species, but whether variations in size exist within a species has been poorly studied. Understanding if variation is present is essential to understanding life, because, without variation, evolution by natural selection cannot occur. The goal of this study is to measure the variation in size of fish scales and determine whether the variation exists within individual fish and/or between different populations of fish. For this study, I used the Blacknose Dace (*Rhinichthys atratulus*), a prevalent species in rivers of the eastern United States. I caught Dace from 2 populations and measured the area of scales from 8 different regions of the body. Results to date have found that certain regions of the body, especially those closer to the head of the fish, tended to have smaller scales than other parts of the fish's body. Such variation seems to be consistent across populations. These results suggest that Dace do vary in size of fish scales, but that this variation only exists within an individual and not between different populations. Further work is needed to understand why such variation exists and to explore the evolutionary implications of these differences.

Sat-2-A-2   Oral Session: Fish Biology II: Anatomy, Physiology, Behavior

Vegetation Composition and Biogeographical Relationships in Coastal Northeastern Sandplain Grassland: Implications for Conservation

Michael Whittemore (The Nature Conservancy, Vineyard Haven, MA), Polly Weigand (Central Pine Barrens Joint Planning and Policy Commission, Westhampton Beach, NY), Christopher Neill (Woodwell Climate Research Center, Falmouth, MA), Sarah Bois (Linda Loring Nature Foundation, Nantucket, MA), Gretel Clarke (Northampton, MA), Rachael Freeman (Nantucket Islands Land Bank, Nantucket, MA), Kristen Geagan (Sheriff's Meadow Foundation, Vineyard Haven, MA), Russell Hopping (The Trustees, North Andover, MA), Roberta Lombardi (University of Massachusetts, Amherst, MA), Elizabeth Loucks (Sheriff's Meadow Foundation, Vineyard Haven, MA), Kelly Omand (Nantucket Conservation Foundation, Nantucket, MA), William A. Patterson III (University of Massachusetts, Amherst, MA), Pam Polloni (Woods Hole Herbarium, Woods Hole, MA), Julie Russell (Martha's Vineyard Land Bank, Edgartown, MA), Robert Wernerehl (Division of Fisheries & Wildlife, Westborough, MA), and Steve Young (New York Natural Heritage Program, State University of New York - College of Environmental Science and Forestry, Albany, NY)

Abstract - Northeastern sandplain grasslands are a globally imperiled ecosystem that supports high numbers of uncommon and state-listed rare species across the Atlantic Coastal Pine Barrens Ecoregion (ACPBE), yet the total extent of species composition across multiple grassland sites that extend from the New York islands (NY) to coastal Massachusetts (MA), has yet to be examined. To address this issue, we assembled 61 species checklists from 52 known sites across 1583 ha (3911 ac) of sandplain grassland. We analyzed lists for species composition, species life-history attributes, and site characteristics including land-protection status. The lists contained 702 unique identified vascular plant species in 89 families. Non-metric dimensional scaling (NMDS) ordination revealed a difference between species composition found in NY compared to MA. Sites in NY ($n = 22$) accounted for 488 species, while sites in MA ($n = 30$) accounted for 563. The percentage of sandplain grassland sites protected in conservation was less (71%) in NY than MA (87%), with 153 ha (379 ac) and 1120 ha (2768 ac), respectively. MA had more introduced species (174) compared to NY (154); however, introduced species occurred more in NY (731) compared to MA (689). In contrast, MA had a higher number (51) of rare species compared to NY (35). Rare species were present on all sites, though rare species composition varied widely from site to site. Notably, MA had a much higher frequency of rare species occurrences (286) compared to NY (107). On average, a higher percentage of sites in NY (36%) were previously tilled compared to MA (3%). Northeastern sandplain grasslands make up a fraction of land area in the ACPBE across relatively small, isolated areas yet hold a high proportion of rare species and unique assemblages in the region. These disturbance-adapted ecosystems require perpetual management to sustain high biodiversity. Based on numbers and density of rare species supported in MA compared to NY, increased grassland management efforts in NY would likely have large conservation benefits.

Sat-3-B-4   Oral Session: Botany

Birds and the City: FeederWatch Reveals How a Winter Urban Bird Community Can Change In Seven Years

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Abstract - Urban birds face numerous challenges due to human disturbance and environmental threats. On our urban campus in Jersey City, NJ, Project FeederWatch (PFW) has been used for 7 consecutive winter seasons to engage undergraduates in natural history research and to investigate trends in the winter bird community. PFW is an annual winter survey of birds that provides information about changes in bird distribution and abundance across North America. From November to April, birds at and around feeders are counted according to an established protocol and reported to a database managed by Cornell Lab of Ornithology and Bird Studies Canada. Since the start of PFW (2014–2015) at Saint Peter's University, at least 26 species have been counted, but only 5 species have been present every season: *Passer domesticus* (House Sparrow) dominate use of the feeders, *Zenaida macroura* (Mourning Dove) forage below the feeders, *Sturnus vulgaris* (European Starling) maintain a presence, and *Turdus migratorius* (American Robin) and *Mimus polyglottos* (Northern Mockingbird) are attracted to berries and suet. In Summer 2018, a grant enabled us to begin to renovate a portion of the PFW count area by removing English ivy that had overspread the area, restoring natural habitat through planting native wildflowers, and adding a water bath and a second feeder. In the following 2 PFW seasons (2018–2019, 2019–2020), the number of species seen weekly increased significantly with first-time reports of the following native songbirds: *Sitta carolinensis* (White-breasted Nuthatch), *Passerella iliaca* (Fox sparrow), *Carduelis trista* (American Goldfinch), *Melospiza melodia* (Song Sparrow), *Cyanocitta cristata* (Blue Jay), and *Accipiter striatus* (Sharp-shinned Hawk). In the current 2020–2021 season, the average number of species reported weekly has increased further, perhaps influenced by the relatively empty campus resulting from students taking remote classes due to COVID-19 precautions. New native species reported this season include *Poecile atricapilla* (Black-capped Chickadee), *Bombycilla cedrorum* (Cedar Waxwing), and *Picoides villosus* (Hairy Woodpecker).

Fri-3-E-5   Oral Session: Avian Ecology in Urban Areas

The Bee Fauna of an Atlantic Coastal Plain Tidal Marsh Community in Southern New England

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Abstract - With growing evidence of changes in local abundance, geographical range, and species diversity of wild bees, it is imperative to document wild bee communities in representative habitats throughout North America. The Connecticut shoreline has historically been subject to many natural and anthropogenic disturbances, and there is a lack of baseline data regarding bee biodiversity in Connecticut's maritime habitats. In 2011 and 2012, we conductd biweekly surveys at Grass Island Preserve (Guilford, CT) to examine salt-marsh, beach dune, and coastal scrub bee communities adjacent to Long Island Sound using pan traps and effort-based (timed) net collecting from flowers. We collected 3928 individual bees, representing 5 families, 18 genera, and at least 80 species. Floral records for 374 individuals resulted in associations of 35 bee species with 19 species of plants. Seventy percent of the bees captured in the net survey were visiting alien plants, with the exotic *Rosa rugosa* (Beach Rose) having the highest level of bee diversity and relative abundance. The total number of bee species collected in this survey represents ~23% of the known Connecticut fauna, including 4 specialists associated with coastal and wetland habitats. The abundance and diversity of bees visiting alien plants on Grass Island, as well as the occurrence of these sand specialists, may prove to be of conservation concern as the Connecticut shoreline continues to be altered.

Fri-1-C-2   Oral Session: Native Plants and Native Pollinators I: Wild Bee Faunas

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Investigating the Effects of Management of Artificial Nest Boxes on Bird Reproductive Performance in Massachusetts Conservation Areas

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Abstract - Bird populations in North America are declining rapidly. Habitat degradation, climate change, and pesticide use are the primary drivers of this decline. Managers of conservation areas tasked with protecting threatened bird populations often erect artificial nest boxes to mitigate nesting habitat loss. However, human intervention in nest-site selection has the potential to draw birds to nests subject to high predation, competition, or suboptimal foraging habitat, leading to decreased reproductive success for already vulnerable populations. Despite the value of nest boxes for conservation, the direct effects of nest-box management on cavity-nesting bird reproduction remain understudied. Here, we examine the effects of nest-box management on reproduction of *Tachycineta bicolor* (Tree Swallow) across 7 Mass Audubon wildlife sanctuaries. Nest management is defined as the siting of nest boxes in terms of habitat within the foraging radius of the target, box density, and predation-control techniques. We found that all 3 of these nest-management measures significantly impacted reproductive performance. Across conservation areas, Tree Swallow fledging success was lower in nests near forest edges and developed land compared to open field habitats, and was higher in nests spaced 50–100 m from neighboring nests than in densely clustered nest boxes. Further, predation, the primary cause of nest failure across reproductive stages, was significantly higher in boxes protected by pole baffling than in boxes with greased poles. Our findings indicate that nest-box placement and maintenance have the potential to both affect Tree Swallow success and introduce bias into studies of cavity-nesting bird reproduction. By incorporating nest-management metrics into studies of reproductive success and using the results to inform future management strategies, we can better understand and conserve cavity-nesting birds with artificial nests by combatting loss of nesting habitat.

Sun-2-E-2   Oral Session: Management Impact on Birds