

ABSTRACTS

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Platform Presentations

Fishing gear selectivity of fish traits in coral reefs off northeastern Brazil

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Small-scale reef fisheries are important commercial and subsistence activities that support the livelihoods of millions of people in tropical regions. Tropical marine fisheries typically target a diversity of species caught by a matching diversity of fishing gears and practices. High fishing pressure, however, often leads to the overexploitation of coral reef fish assemblages. Here, we explored how multiple fishing gears select for distinct functional traits and how they affect the function of fish assemblages inside a large multiple use MPA off northeastern Brazil. In 1,888 landing interviews with local fishers, we identified 101 species, which were categorized according to six traits: body size, schooling behavior, mobility, position in the water column, diet and period of activity. We found a low competitive interaction between different gear types, meaning there was a low overlap in trait selectivity between fishing gears. We also found direct associations between gears and fish functional traits: hooks and line targeted species that exhibit limited mobility capabilities, making these species more vulnerable to local levels of fishing effort. In contrast, nets and fish corrals targeted mobile species that exhibited a greater diversity of functional traits. Some of our results contrasted with the current literature on the topic, with differences calling for more research to clarify global patterns of trait selectivity per gear type. Our results have implications for fisheries management in northeastern Brazil: gear bans and effort caps are commonly used management measures that can foster fisheries sustainability by minimizing impacts to fish assemblage functions.

Experimental evidence that diversity stabilizes communities through asynchrony

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As the variability of ecological systems increases under global change, the need to identify the mechanisms through which biodiversity stabilizes communities and ecosystems has increased. Asynchronous population dynamics that arise from species interactions and differential responses to environmental conditions may stabilize community dynamics. In a zooplankton mesocosm experiment, we tested the roles biodiversity, community composition, and environmental variability play in inducing the mechanisms that may stabilize ecological communities. As diversity increased, community-wide asynchrony increased. While the role of environmental variability was less clear, it did encourage asynchronies between one pair of dominant species. Mesocosms connected to the regional species pool via dispersal resulted in the highest levels of diversity and consequently resulted in the highest levels of asynchrony and stability. These results demonstrate that biodiversity can stabilize communities by generating asynchronous population dynamics, but that those effects are largely dependent on the specifics of community composition and how composition responds to environmental fluctuations and dispersal.

V-SCI: Connecting Science with Local Environmental Advocacy

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The Virginia Scientist-Community Interface (V-SCI) is a volunteer graduate student group founded in 2019 at the University of Virginia that provides non-profit organizations and advocacy groups with scientific research support. Starting in January 2020, a group of IGC fellows joined V-SCI. The group has since expanded to include collaborators from multiple universities and independent organizations. We have since completed two reports analysing environmental impacts from the Atlantic Coast and Mountain Valley Pipelines. These reports were submitted as referenced public comments to the U.S. Fish and Wildlife Service and the

U.S. Forest Service. In our comments, we identified inadequacies not recognized by relevant agencies and companies involved in the projects, including inappropriate model assumptions and underestimations of the potential impacts of sedimentation on populations of endangered species residing in the proposed pipeline pathways. V-SCI has provided the participating IGC fellows with the unique opportunity to collaborate on research that supports science-based decision-making regarding local, real world environmental issues. We learn more with each new project and the organization continues to expand in size and scope to work with a larger and more diverse set of topics.

Learning by doing: an IGC fellow's experience in invasive species policy with a professional society

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Invasive species are one of the most problematic facets of global change, whose impacts on biodiversity, human health, and national and local economies continue to accelerate in our increasingly interconnected world. Harmful species introductions, intentional or unintentional, are the focus of preventative and curative policy, which navigates a tangle of conflicting interests, stakeholders, and existing regulations. Graduate education in invasion biology increasingly strives to give future professionals a glimpse into the complexity of state, federal, and international policy affecting the regulation and funding of invasion prevention and mitigation. One way to curate such experiences is through scientific and professional societies that include science policy departments. Having completed a term as a science policy fellow with the Weed Science Society of America (WSSA) in 2020-21, the presenter (VTL) had the privilege of learning about and participating in the society's and other invasion-focused groups' engagement of U.S. federal agencies and policymakers. This experience included numerous meetings with society constituents, academic researchers, industry advocates, congressional staffers, and federal scientists. Duties as a science policy fellow included drafting comments on

behalf of WSSA regarding proposed documents and decisions for the U.S. Department of Agriculture's Animal and Plant Health Inspection Service (APHIS), the Environmental Protection Agency, and the Department of the Interior. Despite its virtual format due to the global pandemic, this immersive fellowship profoundly complemented the policy-oriented portions of the IGC curriculum. Pursuing similar experiences through relevant disciplinary societies could help other IGC fellows assess their own interest in pursuing careers in science policy.

Hypothalamic-pituitary-adrenal axis regulation and organization in urban and rural song sparrows

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Individuals in urban habitats experience frequent disturbances and are expected to respond efficiently and recover quickly from challenges to persist in these novel habitats. The glucocorticoid stress response is a physiological response to a stressor during which glucocorticoid concentration increases in order to activate behavioral and physiological mechanisms to recover homeostasis. Differences in the duration of glucocorticoid secretion are modulated by the efficiency of negative feedback mechanisms, which is achieved primarily through the binding of glucocorticoid receptors (GRs) in the hippocampus by glucocorticoids. We investigated if male song sparrows (*Melospiza melodia*) in urban habitats show more efficient negative feedback of the glucocorticoid stress response than their rural counterparts. Males from each habitat were exposed to restraint stress to increase corticosterone, the primary avian glucocorticoid, then injected with either saline or a synthetic glucocorticoid (dexamethasone), to induce a negative feedback response. Additionally, we quantified GR mRNA in the hippocampus using qPCR in a separate cohort of birds. Our results show that dexamethasone suppressed relative corticosterone concentration below that of saline, but no habitat differences in response to dexamethasone were detected. We found that stress induced corticosterone was significantly lower in urban birds, however previous research has shown variation in stress induced levels of glucocorticoids across years in this population. Urban song sparrows did have lower hippocampal mRNA levels of GR than rural song sparrows. Urbanization therefore does not consistently affect the glucocorticoid stress response, but can cause structural changes in the hippocampus, the functional effects of which remain to be elucidated.

Nonbreeding Foraging Ecology of the Brown-headed Nuthatch: Resilience Amidst Habitat Change

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Prior to European expansion, pine-savanna comprised two-thirds of the Atlantic Coastal Plain from Virginia to Texas, a habitat historically dominated by Longleaf Pine (*Pinus palustris*). Over roughly three-hundred years, ninety-five percent of the pine-savanna was eliminated by the resin industry, agriculture, and logging, with partial reforestation by twentieth century Loblolly Pine (*Pinus taeda*) plantations. In order to investigate the impact of these massive land cover shifts on pine-savanna wildlife, I am studying the foraging and multi-species flocking behavior of the Brown-headed Nuthatch (*Sitta pusilla*), which feeds heavily on both Longleaf and Loblolly seeds when available. By comparing rates of nuthatch pine foraging and multi-species flocking at divergent sites (Marine Corps Base Camp Lejeune and the Sandhills Gamelands, NC), I demonstrate examples of a pine-savanna species' resilience despite shifting habitat parameters. As recent pine-savanna reconstruction efforts and the increasing effects of climate change may serve to reduce Loblolly Pine prevalence, I also expound upon ways that pine-savanna wildlife could be impacted in the future.

Pre-dispersal behavior of juvenile male red-cockaded woodpeckers

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Many cooperative breeders show similar dispersal syndromes, including reliance on frequent forays outside the natal territory prior to dispersal to explore the surrounding habitat and make informed decisions on where to disperse. These species are highly territorial and defend all-purpose territories year-round that contain limited resources required for breeding and

survival, which limits the habitat available to dispersing individuals. Climate change is of special concern for these habitat specialists that have limited capacity to shift their range, and hence must adapt in place or perish. The cooperatively breeding red-cockaded woodpecker, a federally listed endangered species endemic to fire dependent pine savannah of the southeastern United States, is one such species. Productivity of this species is increasing in the northern part of its range, but declining in the southwestern portion, showing current effects of climate change. Understanding how dispersing individuals explore and interact with the landscape may enable managers to reduce dispersal-related mortality and increase functional habitat connectivity. Male juveniles can adopt one of two distinct, condition-dependent dispersal syndromes: they can delay dispersal and remain on their natal territory as non-breeding helpers (dominant strategy) or disperse their first year in search of territories with open breeding positions (subordinate strategy). We radio-tagged and followed dominant and subordinate juvenile male pairs from the same brood from winter to the start of the breeding season to observe foray-related dispersal behavior. All radio-tagged males spent time on forays away from their families, although subordinate males forayed significantly more than dominant males. On forays, males foraged significantly less than when with their families, traveled significantly more, and altered their patterns of movement dependent on many habitat and social cues. For subordinate males, foraging culminated into a move to a new location (dispersal) before the beginning of the breeding season, but dominant males remained with their families. Overall, pre-dispersal foraging dominates the process of dispersal and thus is a key element in determining how these birds move in their environment, and how landscape structure influences juvenile movement and mortality.

Seasonal and anthropogenic influences on home range size and foraging behavior of the critically endangered golden-crowned sifaka

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Protected areas and conservation planning require careful consideration of target species resource needs over space and time. Understanding animal movement and foraging patterns is crucial to developing management plans across naturally and anthropogenically dynamic landscapes. While Madagascar currently has extensive protected area coverage, most protected areas were created to encompass large, remaining forests rather than out of consideration for target species resource needs. Specifically, golden-crowned sifakas (*Propithecus tattersalli*) are a critically endangered lemur species endemic to forest fragments across a range of forest types in one protected area in northeastern Madagascar, but little is

known about their space or resource needs. To better understand sifaka space use and foraging behavior for developing management plans, we combined individual animal follows with Dynamic Brownian Bridge Movement Models. We also examined the influence of abiotic, biotic, and anthropogenic factors on sifaka home range size and foraging patterns. We found that home range size differed between seasons (rainy or dry), with increased core area use and movement in the rainy season. Human infrastructure also played a role in sifaka foraging behavior as lemur groups in humid and dry deciduous forests avoided road networks and human villages when selecting foraging resources. Our study illustrates the importance of understanding seasonal patterns, forest type, and human disturbance when determining dynamic primate spatial needs. Accounting for behavioral variation in response to these factors will allow conservationists to best manage protected area coverage (*i.e.*, via reforestation) for sifakas in light of ongoing and future climate and land cover change.

Scientific Information About Local Environmental Risks in Newspapers: The case of the Radford Army Ammunition Plant

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This study explores how local news media covers environmental risks and what factors contribute to the inclusion of scientific information in that reporting. We conducted a content analysis of news articles about environmental issues associated with the Radford Army Ammunition Plant (RAAP), in Radford, VA. We coded 116 articles published between 2000 and 2019, with four coding criteria: the inclusion of scientific information, sources of scientific information, claims-makers, and risk assertions. The preponderance of news articles quote claims from RAAP officials (44.8%), followed by State officials (32.8%), community activists (25.0%), and others (17.2%). Only 35.3% of articles include scientific information and the source of such information is typically government officials and reports (54.9% of scientific claims). While all articles coded focus on environmental issues, most (59.5%) do not include explicit risk assertions (*i.e.*, claims of risks present and/or their absence). Logistic regression analysis indicates that when an article includes claims made by state officials, it is 4.5 times more likely to include scientific information. When an article includes claims made by community activists, it is 84% less likely to include scientific information. When an article explicitly asserts the existence of environmental risks, it is 12 times more likely to include scientific information. This paper further explores possible reasons why certain sources are cited and information claims reproduced in the news media.

Scale dependencies of intrinsic climate sensitivity for freshwater fishes of the United States

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Assessing sensitivity of freshwater species to climate change is essential to prioritizing conservation efforts. Sensitivity can be evaluated across multiple species by comparing measurable attributes such as traits, range size, and climate niche breadth; however, the degree to which spatial scale influences outcomes of such assessments is unclear. The effects of spatial extent may cause scale dependencies that decouple the outcomes of analyses performed at regional and national scales. To address this knowledge gap, we assessed intrinsic climate sensitivity for 144 native freshwater fishes of the United States using publicly available occurrence data from the Global Biodiversity Information Facility (GBIF). Results indicate that for regional species pools, mean sensitivity values did not differ between assessments at national and regional scales. However, regional assessments revealed that the intrinsic sensitivity of individual species often varied significantly between geographic regions in which they occur. This suggests that species' intrinsic sensitivity is strongly influenced by the scale or extent of the assessment. As conservation practitioners consider regional management actions for at-risk species, it is vital to ensure that the vulnerability assessments informing those decisions have been conducted at the appropriate scale.

Climate change, time spent outdoors, and physical activity in a moist subtropical climate in the Southeast United States

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Previous studies have indicated high temperature/humidity is a barrier to meeting physical activity (PA) guidelines. As heat wave days increase with climate change, characterizing changes in PA and implications for chronic disease health outcomes are needed. Evidence shows time spent outdoors is positively associated with PA. We hypothesized even a small amount of increased outdoor time in summer may promote PA while bringing minimally increased heat exposure. Urban and rural participants (total = 180) were asked to perform normal activities on Days 1-2 (baseline) and spend an additional 30 minutes outdoors on Days 3-7 (intervention). Participants wore thermometers clipped to their shoes to estimate individually experienced heat index (HI) and pedometers. Linear mixed models were fitted to estimate relationships between PA measured by pedometer steps and individually experienced HI on baseline versus intervention days, accounting for ambient conditions (HI, rain, wind speed). Participants carried out the intervention on 736 (83%) person-days. Rain, heat, and time conflicts were top self-reported reasons for non-compliance. Participants on average walked 637 (95%CI 83-1192) more steps during intervention compared to baseline. Participants had a 0.59°C (95%CI 0.30-0.88) lower mean individually experienced heat index during intervention, accounting for ambient conditions and individual-level factors. The intervention benefit was greater in rural residents who were less active at baseline, compared to urban residents. This study presents methods for estimating how PA is related to heat exposure and time outdoors, integrating wearable sensor data and ambient weather conditions.

Too big to see: large viruses are overlooked players in the ocean's nutrient cycles

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While several viruses can cause deadly human diseases, such as COVID-19, many viruses do not. In the ocean, viruses infect microbes like algae and bacteria, killing up to 15% of bacteria each day. By infecting microbes, viruses release their host's organic material into the ocean, which impacts food webs and nutrient cycles, such as the carbon pump. How we study viruses in the ocean tends to bias toward smaller ones. We use filters to remove cells from seawater samples and concentrate for virus particles. However, exceptionally large viruses have recently been uncovered in environments around the world. These large viruses can be even bigger than some bacterial and algal cells. One group of these viruses is called jumbo phages. Jumbo phages infect bacteria and are four times the size of most known phages. Because our methods bias

against jumbo phages, they are thought to be rare in nature. In this study, we sought to determine how rare jumbo phages are in the ocean versus the extent that current methods' overlook them. We searched for jumbo phages in metagenomic data (DNA sequences of all organisms in a sample) deriving from seawater that was enriched for bacteria rather than for viruses, and we uncovered 91 jumbo phages present throughout Earth's ocean. Many of these phages are highly active and encode genes important to nutrient cycles that their microbial hosts drive. Our results suggest that how we study viruses must be revisited to better understand the impact of viruses on ecosystem health.