Cranberry Lake Biological Station Research Symposium, Session A

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Ecological Monitoring and Biodiversity Assessment (EFB202) is the one of the keystone courses in the Environmental and Forest Biology curriculum. Students enrolled in this immersive course live at the Cranberry Lake Biological Station for three weeks. During the first two weeks of the course, students study a wide variety of taxonomic groups of organisms, and are introduced to a broad range of field, laboratory and analytical methods. Students then complete a group research project during the third and final week of the course. The research projects require proficiency in field sampling methods, basic experimental design and statistical analysis, and the ability to cooperatively solve problems.

The course culminates in a research symposium during which groups present their findings to their peers and a panel of judges.
Forest Bird Behavior in Response to the Calls of Native and Non-Native Owl Species at Cranberry Lake Biological Station in Clifton, NY

Shannon Booth, Cameron Piper, Mikayla Call, Emma Buckardt, Madison Hand

SHIELDS RESEARCH AWARD

When forest birds feel threatened by the presence of a potential predator, they may respond with an anti-predator strategy called mobbing. Mobbing is a set of behaviors intended to harass and drive a predator away. In order to observe the response of forest birds to native and non-native owl calls, 3 separate species’ calls were played 4 times a day for 4 days at 8 different locations (n=31, 1 point was discarded due to severe weather). Four calls were broadcasted: the Black-Capped Chickadee (*Poecile atricapillus*) as the control, the Barred Owl (*Strix varia*) as the native predator, and the Spotted Owl (*Strix occidentalis*) and Eurasian Tawny Owl (*Strix aluco*) as non-native predators. During and after the broadcasted calls, the number of forest birds that flew in and the strength of the alarm calls (based on a scale), both characteristics of mobbing behavior, were recorded. Using an ANOVA and Tukey Test, it was concluded that the number of birds that flew into the area in response to the native Barred Owl was statistically different than the Black-Capped Chickadee, Spotted Owl and Eurasian Tawny Owl. However, the response to the Black-Capped Chickadee, Spotted Owl, and Eurasian Tawny Owl was statistically similar. Based on the Chi-Squared test, the difference between the strength of alarm calls in response to the different species of owls was found to be statistically significant. It was found that the forest birds at Cranberry Lake Biological Station tended to exhibit mobbing behavior more often in response to the native Barred Owl than to the non-native Spotted Owl and Eurasian Tawny Owl.
Quit Bugging Us: The Effectiveness of Plant-based Insect Repellents on Diptera

Kristen Baxter, Amanda Christiano, Joel Mabie, and Jalina Pannafino

Deterrence of biting insects capable of spreading harmful diseases is necessary to maintaining the health of human populations. In this experiment, we examine the insect repelling properties of local plants. The bulbs of wild leeks, *Allium triccocum* and wintergreen leaves, *Gaultheria procumbens* were collected at Cranberry Lake Biological Station (CLBS) and tinctures were created in ethanol, then diluted 1:1 with DI water. A positive control of 25% DEET, a negative control of diluted ethanol, and the two tinctures were tested separately on the left arm of four individuals and the control on the right at two locations twice a day. Each individual counted the frequency of insect landings of the order Diptera for 10 minutes per treatment. The diversity of wild leeks and wintergreen were assessed by sampling four 100 m transects that were each separated by 90° and began at the same random point. A Shannon Weiner index value could not be assigned due to the lack of data and the need to divide by 0. Since these plants were found and used in this experiment, we determined that they are rare at CBLS. A General Linear Model was used to show that people did not have significantly different frequencies of landing (p=0.23), but the treatments did have a significant effect (p=0.001). A one-way ANOVA and Tukey’s Pairwise Comparison were used to establish which treatments were different and determined that the control varied significantly from all treatments but the

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Cryptic Shade and Hue Gradients of *Anaxyrus americanus* from Stream to Forest Habitats

Christopher Cruz, Robert Pedian, Connor Hassler, Matthew Wuertzer

CRANBERRY LAKE DIRECTOR’S CHOICE AWARD

Camouflage is a form of protection deployed by a wide variety of species to render themselves to prevent detection. We examined how the background substrate of the environment, in this case being the transition from streams to deciduous forests, affects the coloration of the American Toad (*Anaxyrus americanus*), a noxious and cryptically colored amphibian found across the Eastern United States. The general color transition from streams, with a prevalence of lighter colors, to deciduous forest, consisting of red leaf debris and dark tree shadow, should be seen in this cryptic coloration of *A. americanus*. Six-mile creek, Chair rock creek, East creek and Sucker brook located at Cranberry Lake, NY were selected to survey American toads. Three 100x10m belt transects, each 100m apart were run perpendicular to each stream, and the dorsal coloration of toads found inside these transects were recorded using the Munsell soil color chart. Hue and darkness of each specimen were recorded along with the distance away from the stream it was found. The distance away from the stream will be categorized into ranges and colors will be place within these ranges, so that a chi-square test would be conducted. We hypothesize that *A. americanus* is darker and redder as distance away from streams and into deciduous forest increases. Preliminary results have found support of this hypothesis in regards to darkness however, no significant difference in hue has been found. This indicates that toads are ecologically adapted to their respective habitat types in regards to cryptic coloration.
ethanol (p=0.001). The results of this experiment inform us that plant-derived alternatives to DEET local to CLBS are capable of preventing insect landings.

**Light Trapping and the Effects of Ecological Light Pollution on Moth Populations**

*Nathan Kiel, Odin Bernardo, Levi O’Brien and Matt Lobenhofer*

Ecological light pollution is a growing issue, bringing artificial lighting to historically dark areas. This poses a serious threat to many nocturnal species that use astrological light to navigate, as it interferes with their natural travel mechanisms. Moths, one of the most diverse nocturnal organisms, use light as a primary mode of navigation. We hypothesized that the white light from incandescent light bulbs projected on a screen will attract a greater abundance of moths and higher family richness than the blue light from incandescent light bulbs. A UV black light was used as a control to show the abundance and richness of moths in the area. Two sheets were set up 5 meters apart in the marina of the Cranberry Lake Biological Station. White light from an incandescent bulb was projected on one sheet, while blue light from an incandescent bulb was projected on the other. Abundance, identification, and size were recorded for moths that landed on the sheet and on the light fixture. We observed the sheets from 10 p.m. to 1 a.m. for three successive nights to collect our data. A two t-test statistical method was employed. It was found that moths are attracted more to the incandescent light than to the blue light. Further understanding ecological light pollution’s effect on moth populations helps move towards a solution to halt this decline and reverse it.

**A Comparison of Genera Richness of Anisopteran Nymphs in Aquatic Habitats**

*Shannon Cellan, Rachel Whitman, Gabrielle Sisson, Lauren Ness*

Dragonfly nymphs (*Odonata anisoptera*) are macroinvertebrates whose habitat preference has already been dutifully studied across the globe. Anisopteran nymphs are known to prefer lentic, as opposed to lotic, environments. Lentic waters are characterized by lower water velocity, smaller sediment size, and greater vegetation as compared to lotic waters. Therefore, the genera richness of dragonfly nymphs should be greater in ponds (lentic habitats) than in streams (lotic habitats). Ten sample units of 1 meter x 1 meter quadrants were set up approximately five meters apart along the shoreline of each habitat type. Velocity was recorded at the first quadrant. Next, at every quadrant, the average sediment size was calculated via a modified Wolmann Pebble count; then, the average vegetation was visually noted by estimating percent ground cover within that quadrant. An analysis of the data showed a greater richness in Anisopteran nymph genera in ponds (mean value: 3.33) than in streams (mean value: 1.00). Additionally, a t-test of the data showed t-value = 3.5, p-value = 0.039 with df = 3 and α = 0.05. By looking at the genera richness of Anisoptera in the Cranberry Lake region, a greater understanding of the local aquatic ecology can be obtained.

**Effects of Pool Retention Time on Zooplankton Diversity**

*Natalee Wrege, Amelia Sorlie, Dennis Grant, Alyssa Burgio, Heather Morris*
Zooplankton are small (2 µm-200mm) animals that live suspended in the water column and are a critical link in many aquatic food webs. Zooplankton are unable to attach to substrates or swim against the current; therefore, they cannot withstand a high velocity aquatic system. It is important to understand the role of zooplankton because they serve as the foundation of the aquatic food system. We hypothesized that greater retention time in pools allows for the establishment of more diverse populations of zooplankton. Pools with longer retention times will likely maintain nutrients for extended periods of time, allowing zooplankton populations to thrive. To test our hypothesis, we estimated retention times of five pools (experimental unit) and used five plankton net sweeps per pool (sampling unit) to collect zooplankton. To further differentiate between our pools we collected data on abiotic factors including pH, temperature and dissolved oxygen. The Shannon-Wiener index was used to calculate the diversity of zooplankton found in each pool. Data were analyzed using a regression model to determine if retention time is correlated with diversity. Our $R^2$ value of 3% and $P$-value of 0.779 indicate that there is no significant correlation between retention time and zooplankton diversity. However, further studies on zooplankton populations in lentic systems can be applied to knowledge of basic aquatic ecosystems and water quality given their role as indicator species.

Life Among the Tardigrades: Investigating Tardigrade Density in the Various Microbiomes of Sucker Brook, Cranberry Lake, New York

Elizabeth Jamison, Nicholas Stosiek, Reilly Carlson, Sarah Lynch and Kiera Hyacinthe

Tardigrades are a lesser known phylum of invertebrates, closely related to Arthropoda and Onychophora, found in the interstitial water of various microbiomes including moss, lichen, and sediment. This experiment aimed to answer the question of whether tardigrade density differs between microbiomes. It is expected that there would be a greater tardigrade density in moss (*Leucobyrum* spp.) compared to sediment or foliose lichen (number of tardigrade/ 2 grams of sample). Samples of each microbiome were collected along approximately 83 m transects spanning the length of Sucker Brook, Cranberry Lake, NY (n= 10). Two grams of moss, 2 g of lichen, and 10 g of sediment were extracted from each sample and soaked in distilled water for 12 hours. Dissecting scopes were used to count tardigrades and other meiofauna. The average tardigrade density was greatest in foliose lichen (5.5 tardigrades/ 2 g of lichen, 1.9 tardigrades/ 2 g of moss, and 0.065 tardigrades/ 2 g of sediment). Statistical analysis using ANOVA and Tukey’s test showed a significant statistical difference between foliose lichen and sediment but that moss (*Leucobyrum* spp.) was statistically similar to both foliose lichen and sediment (F value= 4.48, p value= 0.021). Future studies should focus on the relationship between water content, microbiome, and tardigrade density for a further understanding.

Growth and Diversity of Arboreal Lichen on Coniferous and Deciduous Trees

Jennifer Cain, Abigail Odinak, Frances DiDonato, Victoria Hernandez

Lichens are poorly understood organisms. As an indicator species for environmental pollution, the factors attributing to their growth and diversity are important to understand. Some of these factors may include tree species, tree size, bark texture, and canopy cover. In
this study, diameter at breast height (DBH), canopy cover, bark ridge depth, lichen percent coverage, and lichen species richness on American beech (*Fagus grandifolia*), red spruce (*Picea rubens*), eastern hemlock (*Tsuga canadensis*), sugar maple (*Acer saccharum*), and red maple (*Acer rubrum*) were examined. It was predicted that there will be a higher lichen species richness and lichen percent coverage on deciduous trees than coniferous trees. 150 trees were sampled in 22 plots. Correlation, ANOVA, and Tukey’s pairwise comparison tests were conducted. No correlation was found between bark texture and lichen species richness and lichen percent coverage. Deciduous tree species had a significantly higher average of lichen diversity and lichen percent coverage than coniferous tree species. Additionally, the *Acer* species had the highest lichen percent coverage and lichen species richness while the red spruce had the lowest lichen species richness and lowest lichen percent coverage. The *Acer* species may be more successful because of their ability to retain moisture. Further study could test both moisture content and bark pH across tree species in order to better understand lichen growth and diversity.

**Where the wood fern grows: A study of fern diversity in relation to hardwood canopy coverage**  
*Jessica Druze, Julia Ober, Ella Farmer, Heather Kase*

Ferns are adaptable to various conditions, and are essential to micro- and mega-fauna of Northern Hardwood forests. In general, areas with moist soil and shaded coverage are preferred by ferns. We conducted a study on native fern diversity in the Northern Hardwood forests of the Adirondacks region of New York, and how the species richness differs in 9 different locations with adjacent closed canopy areas and canopy areas with a gap. Tree densities were taken at each of the 18 sites within a 10 meter radius to calculate the percent coverage of the forest canopy. Five 1 by 1 meter quadrats were used at each site to count the species richness and abundance of ferns. We compared the diversity and abundance of ferns in a closed forest canopy versus a forest canopy with a gap using a paired-t test to conclude that there is no significant difference of fern diversity or abundance. We also compared the percent cover of trees to fern diversity and abundance using a regression analysis to conclude that there was no significant difference between the two. This study is important because ferns can be used as an indicator species of disturbance, soil moisture, and amount of light in an area.

**Amphibian Abundance in Coniferous and Deciduous Stands at Cranberry Lake, New York:**  
The effect of multiple variables on amphibian populations  
*James Lee, Sarah Kirkpatrick, Kristen Baker, Sierra Ciciarelli*

Amphibians provide a variety of ecological functions, and are known to be indicators of ecological health and change. Coniferous forests are often more acidic than deciduous forests because of the difference in tree species. We predicted there would be a higher number of amphibians across four stands of deciduous forests versus four stands of coniferous forests. Each stand, defined by a minimum area of 50 by 50 meters, was sectioned off into four plots, each ten by ten meters. Plots were thoroughly searched for amphibians and species encountered were recorded. Amphibian abundance is affected by other factors, including
availability of coarse woody debris coverage, over story density and basal area, soil pH, and leaf litter depth. The coverage of coarse woody debris was measured along four, twenty-five meter transects, each ten meters apart, at each stand site. Leaf litter depth was measured at each corner of each plot. Over story density was measured with the point-centered quarter method at three randomly selected spots in the stand. It was found that there was no difference in abundance of amphibians between deciduous stands and coniferous stands. There was a strong correlation between leaf litter depth in deciduous stands and invertebrate abundance. Using the Shannon-Wiener Index, there was a higher overall diversity and greater evenness of amphibians within the deciduous stands. There were moderate correlations between leaf litter depth and amphibian abundance, invertebrate abundance and amphibian abundance, and leaf litter depth and amphibian abundance. Although there was a greater diversity of amphibian species within the deciduous stands, there was not enough statistical evidence to support a difference in abundance.

Color Transition in American Toads (*Anaxyrus americanus*)

at Cranberry Lake Biological Station

_Julia Cunfer, Isabelle Clemens, Hollis Abbott, Meagan Hughes_

American toads (*A. americanus*) display a cryptic response in their coloration as a result of changes in their environment. A toad’s ability to adjust to its surroundings directly impacts its ability to avoid predation. We hypothesized that: 1. Juvenile American toads will alter their coloration at a higher rate (number of shades per minute) than the adults, and 2. The transition from a light coloration to a darker one will be faster than the transition from a dark coloration to a lighter one for both adults and juveniles. A total of twelve toads, six juveniles and six adults, were collected from various locations on the Cranberry Lake Biological Station. Three trials were run with two adults and two juveniles in each, each was subject to either dark or light environments and scored with Munsell’s Soil Color Chart. Six 2-sample t-tests were performed to compare the time of the first and final shade changes and the rate of shade change in shades per minute. No significant difference in transition time between adults and juveniles or in the transition from dark to light versus light to dark was found; therefore we failed to reject our null hypotheses. From our results we found that neither age nor direction of color change have a significant impact on transition rate. We believe we got these results because the toads did not actively choose the substrate which they were exposed to. This study could be taken further by investigating differences between male and female transition rates.

A Case Study of Salamander Forest Habitat Preferences

in the Cranberry Lake Region of the Adirondacks in New York State

_Sarah Calzada, Tyler Rose, Andy Bachmann, Nolan Maher, Vivian Viscosi Steinbaugh_

Salamanders are a family of amphibians that are highly ecologically important and fairly sensitive to environmental disturbance, and therefore important to environmental health. Coarse woody debris, primarily in the form of fallen logs, provides habitat for various species of salamanders. In the Cranberry Lake region of the Adirondacks, there is a range of deciduous, coniferous, and mixed forest stands for salamanders to inhabit. We hypothesized that
salamanders are likely to be more abundant in deciduous forests and logs than in coniferous forests and logs because deciduous stands tend to be less acidic, more moist, and have greater amounts of ground cover. To test our hypothesis, we hiked the Cranberry 50, a fifty-mile trail around the perimeter of Cranberry Lake, and tested 20 sample sites along the trail by flipping logs in area plots along transects. We analyzed our data for forest type using a Chi-square test, an ANOVA and Tukey's test, and a t-test, and our data for log type was analyzed using a Chi-square test. All of these results showed no significant difference in the amount of salamanders in the deciduous and coniferous forests and logs sampled. We fail to reject our null hypothesis and conclude that there is no significant difference in the amount of salamanders present in deciduous and coniferous forests and logs in the Cranberry Lake region of the Adirondacks.

**Eastern Red-backed Salamander (Plethodon cinereus) Abundance and Correlation in pH, Light Penetration and Log Abundance**

*Sarah Ganter, Alana Mihok, Rebecca Terry, Alex Johnson*

The most common salamander found in the Adirondack Park is the Eastern red-backed salamander (Plethodon cinereus). We compared the difference of Eastern red-backed salamander abundance based on the pH of soil and light penetration, as well as log size and abundance. We hypothesized that with a higher pH, there will be a higher abundance of red-backed salamanders and a higher average length and weight; this is because red-backed salamanders prefer basic soil. PH, percent overstory density, and a transect line for each plot was collected and recorded. Red-backed salamander weight (g) and length (cm) was also recorded. We found that there was a very weak correlation between red-backed salamander abundance and the pH of the soil. We also found that there was no correlation between either log abundance/size and salamander abundance nor percent overstory density and salamander abundance in a given area. Our results show the need for further research on red-backed salamander habitat preference by sampling more plots with a wider geographic range with varying pH’s. This experiment will show whether or not the red-backed salamander species will survive in different pH habitats if ever an event occurs that changes the pH of the forest.

**Niche Space of Frog Calls**

*Michael Preminger, Cassandra Schlosser, Rebecca Rolnick*

In an effort to better understand Anuran distribution and conservation, the United States Geological Survey (USGS) developed a citizen science program allowing its users to estimate frog presence based on mating call intensity. Problematically, frogs call at different intensities throughout a given night, and thus it is unclear when these citizen samples would be best performed. In an effort to resolve this, this experiment used the USGS Amphibian Calling Index (ACI) to measure frog calling intensity throughout a single night. At four different ponds, 10-minute call samples were taken every 90 minutes from 7:30 PM to 6:00 AM. It was predicted that for 75% of a night, frogs would achieve a “plateau” of calling intensity, where they occupied all the available acoustic niche space. It was thought that this niche would be limited by the frogs’ ability to ensure that a single individual’s call would be distinguishable from the
chorus. A One Way ANOVA and Tukey’s Test were used to determine if each sampling time was statistically similar to the others, and the prediction was found to be correct, with ACI values remaining statistically categorized together from 9:00 PM to 4:30 AM. While it can be concluded that frogs observe an acoustic niche of some kind, the determination of the specific factors Anurans react to (ex. frequency or decibel level of calls) requires further study.

A Comparison of Herptiles in Ponds and Streams Fractured by Beaver Dams
Kimberly Mansfield, Elise Matos, Cara Miller, Antonia Morano

Beavers (Castor canadensis) are well known and documented throughout the Adirondack Mountains; they have built many dams along the various ponds at Cranberry Lake Biological Station. As a result, they have fractured the ponds and streams that connect to each other, creating both lotic and lentic environments for amphibians and reptiles to inhabit. It was hypothesized that the species abundance and diversity of herptiles would be different in ponds compared to streams. To test this, we set up a 50 meter transect along both ponds and streams at three different sites. Data collection was conducted through visual surveys along the transect lines, searching every other five meters for a total of 25 meters. Each trial was conducted at the same time of day to remain consistent throughout the experiment. Using a paired t-test, we found a p-value of 0.187, showing that there was no statistical difference in the abundance of herptiles in ponds and streams. With another paired t-test, we also calculated a p-value of 0.184, showing that there was no statistical difference in the diversity of amphibians and reptiles in streams and ponds. To reduce error associated with this experiment, more trials would need to be conducted at multiple different beaver ponds. Fluctuations in weather and temperature may also account for error. In conclusion, we found no difference in herptile populations with regard to ponds and streams.

A comparative analysis of brown bullhead (Ameiurus nebulosus) dietary composition in the different stream inflows, Cranberry Lake, NY
Ben Trowbridge, David Chen, Evan Dlugos, Tyler Duby, Luke Nye-Smith

The purpose of this study was to determine if the generalist feeding ecology of brown bullhead have contributed to their continued success after invasive and non-native species have been introduced to the lake. Brown bullhead are a native sportfish that have not appeared to have declined after non-native introduction like many other natives have declined, such as brook trout (Salvelinus fontinalis). Therefore their feeding ecology may play a role in this phenomenon. To test this hypothesis, Fyke nets were set in the lake inflows of Six-mile Creek, Chair Rock Creek, and Sucker Brook to sample Brown bullhead for three days. Stomach contents of each Brown bullhead were obtained by dissection due to the inefficiency of gastric lavage methods on Brown bullhead. Fish found in stomach contents were identified to species while other organisms such as insects were identified to orders. Diversity indices were calculated for both the stomach contents and the fish communities at each site. To determine if Brown bullheads are true generalist feeders a regression calculation between fish community diversity and stomach content diversity was done. If Brown bullheads are generalists it was expected that stomach content diversity should increase as fish community diversity increases.
It is anticipated our final results will show a positive regression line between fish community diversity and stomach content diversity showing Brown bullhead are generalist feeders, and a possible explanation why they were not affected by non-native introduction.