Kelly Murray

UGA Libraries Undergraduate Research Award Essay

Investigating the effects of fish assemblage on a shredding caddisfly (*Phylloicus hansoni*) in Trinidadian streams

When I was preparing to finish high school and enter college at the University of Georgia, I knew that I wanted to engage in some form of scientific research. My summers had consisted of working for scientists on the UGA Tifton campus through the Young Scholars Program. I found the process of inquiry and research a fascinating method for delving into fields of interest, which for me included insect populations and surrounding ecological dynamics. Now, as a senior preparing to graduate with degrees in Ecology and Entomology, I am writing a thesis on the research I have been able to conduct as an undergraduate, encompassing those subjects.

At the start of my sophomore year, I began working in the lab of Distinguished Research Professor Dr. Catherine Pringle, as an intern for PhD student Troy Simon. The work with which I helped is a component of a large study of ecological and evolutionary dynamics of guppy (*Poecilia reticulata*) populations in freshwater streams on the island of Trinidad. To learn more about the project's background, I searched for the initial research papers investigating the phenomenon of rapid evolution of guppies in response to predation from larger fish, as well as more recent studies documenting the ecological change that can result from such rapid adaptation. Utilizing Internet resources such Google Scholar, GIL, and GALILEO, I became more familiar with the context of my internship work and the goals of future research in this system.

The semester following my internship, I was given the chance to explore my own project focusing on a type of insect that lives in these Trinidadian streams. The caddisfly *Phylloicus hansoni* spends its larval stage underwater, feeding upon leaves that fall into the water from streamside vegetation. Thus, it plays an important role as a decomposer in streams, breaking down organic matter to be further used by smaller macroinvertebrates. *Phylloicus* larvae often coexist with both guppies and a species of killifish (*Anablepsoides hartii*). Unlike guppies, insectivorous killifish are large enough to consume *Phylloicus*. We wanted to investigate how the effects of killifish predation on *Phylloicus* differ with and without guppy presence: *how does the fish community influence the populations of a functionally important aquatic insect*?

When I began my study by analyzing samples collected by others in Trinidad, I didn't have much knowledge of caddisflies or even stream ecology in general, so I looked up classic papers online, such as those by esteemed stream ecologist and UGA Professor Emeritus J. Bruce Wallace, and checked out books at the UGA Science Library. The most helpful text in this early stage of my research was *Caddisflies: The Underwater Architects*[1] by Glenn B. Wiggins, which provided an engaging introduction to the ecology, behavior, life cycles, and evolutionary history of these unique insects.

Motivated by this newfound interest in aquatic entomology, I wanted to continue to develop ideas about *Phylloicus*-fish interactions and potential ecological and evolutionary consequences. When most Google Scholar searches for research on *Phylloicus* in particular were lacking in results, I started looking for studies about caddisflies in the same family as *Phylloicus*, Calamoceratidae. This turned out results on a similar Australian genus, which still provided valuable information on the natural

[1] Wiggins, Glenn B. 2004. *Caddisflies: The Underwater Architects*. University of Toronto Press.

history of this insect group. When relevant and intriguing papers were not available online, I was usually able to find them in the Science Library's collection of printed journals (such as *Aquatic Insects*). During my junior year, I discovered (with use of GIL and GALILEO) a suite of studies conducted by Barbara Peckarsky investigating a similar question with mayflies and trout predators in Colorado streams. My evaluation of these previous findings helped me formulate plans for conducting my own studies in Trinidad.

With the support of the UGA Center for Undergraduate Research Opportunities' Summer Fellowship and the Honors International Scholars Program, I traveled to Trinidad last May to collect samples and run experiments. It was my first chance to see the streams and organisms I had been studying from afar for two years and put the methodologies I had researched into practice. I was excited to contribute to the large body of work that had been conducted within this system by concentrating on an insect species with such an important ecological role.

When I had analyzed the data I had collected, one of my main goals was to find a way to fit my work within the context of the larger ecological research community. I started using Web of Science to search for other studies mentioning the occurrence of *Phylloicus* in Neotropical headwater streams, at my advisor's suggestion. The Web of Science database was much more effective at finding relevant studies for my purposes, and I was able to compile reports from across Central and South America, where *Phylloicus* was noted as a prominent leaf-shredding member of a stream community. Establishing the importance this insect species was the first step in justifying my research, and I was able to move on to explore fundamental ecological and evolutionary drivers that applied to this system.

Now, as I am writing my thesis as a synthesis of my projects and the research I into which I have immersed myself, I value any methods to increase efficiency. In our research conference, UGA Librarian Diana Hartle described helpful search strategies, like using the Entomology Abstracts database through ProQuest. She also recommended using EndNote, and explained how it can organize all the citations I have been accumulating to facilitate the writing process.

I plan to continue my journey in graduate school, and am grateful for the opportunities I have had at UGA to begin pursuing scientific research. This process has required a great deal of time and effort throughout my undergraduate career; as a result, I feel that I have experienced growth as a student and future scientist. Hopefully, I will continue endeavoring to contribute to our knowledge about the world around us.

INVESTIGATING THE EFFECTS OF FISH COMMUNITY ASSEMBLAGE ON POPULATIONS OF A SHREDDING CADDISFLY IN TRINIDADIAN STREAMS

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The influence of predators can play a prominent role in shaping characteristics of prey populations, but it is also important to study species interactions within the context of an ecological community. Trinidadian streams are often characterized by high densities of killifish (*Anablepsoides hartii*) upstream of barrier waterfalls, with downstream reaches containing killifish at lower densities and guppies (*Poecilia reticulata*). Previous research has shown that the larvae of the leaf-shredding caddisfly *Phylloicus hansoni* (Trichoptera: Calamoceratidae) is an important prey item of killifish, and has suggested that there is increased predation pressure where guppies are absent. Since larval *Phylloicus* have been found to play a key role in controlling rates of leaf decomposition in Trinidadian streams, predator-mediated effects on *Phylloicus* are important to understand. In this study, we examine the effects of killifish on the size structure of larval *Phylloicus* populations in Trinidadian streams with distinct killifish-only (KO) and killifish+guppy (KG) reaches. Analysis of size frequency distributions of larval *Phylloicus* from KO and KG reaches (n=5 of each reach type) confirmed our prediction that different predation pressure by killifish alter the size structure of *Phylloicus* larvae: KO reaches exhibited a size frequency peak at a smaller size than in KG reaches. These results indicate that predator-prey dynamics can differ at small spatial scales with changes in the surrounding community assemblage.

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