



Northern Illinois  
University

## STUDENT ENGAGEMENT FUND SEF FINAL REPORT COVER SHEET

**Please Note:** If more than one individual worked on this project, each SEF student will need to submit a separate cover sheet.

### Student Information:

|                          |  |
|--------------------------|--|
| Project Title:           | Diet analysis of invasive mice using stable isotopes                     |
| Name of Student:         | Kaylee Rosenberger   |
| Major:                   | Biological Sciences  |
| Minor:                   | Chemistry, computer science  |
| Z-ID:                    | Z1816398   |
| Current Address:         | 1509 Reserve Ln, Dekalb, IL 60115  |
| Preferred Phone #:       | 3093104943   |
| Preferred Email Address: | <a href="mailto:Z1816398@students.niu.edu">Z1816398@students.niu.edu</a> |
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### Faculty Supervisor Information:

|                             |                |
|-----------------------------|----------------|
| Name of Faculty Supervisor: | Holly Jones    |
| Faculty Department:         | BIOS/ENVS      |
| Faculty Phone:              | 815-753-7527   |
| Faculty Email:              | hjones@niu.edu |

Student Signature: 

Date: 6 December 2019

Mentor Signature:



Date: 6 Dec 2019

## **SEF Final Report -**

Continuing to participate in this research project has been a beneficial experience for me. This is the fourth semester I have been working under Dr. Jones and my co-mentor, Wieteke Holthuijzen. I have continued to develop my lab skills and gained critical and relevant experience for my future academic and career goals.

### **I. Background**

This project is centered on a small, isolated island system in the Pacific Ocean, northwest of the Hawaiian Islands, called Midway Atoll National Wildlife Refuge (NWR). Historically, Midway Atoll NWR is home to many colonies of seabirds, serving as nesting grounds year after year. Invasive house mice, *Mus musculus*, were inadvertently introduced to the island many years ago, while it was being used as a U.S. Navy base. The ecological impacts of invasive mice on island ecosystems have not been studied in great detail, so in this project, we attempt to explore their potential effects.

Though mice are generally assumed to be harmless, within the recent years, mice on Midway Atoll NWR have begun attacking ground-nesting seabirds. These seabirds have not adapted any anti-predatory responses, as there have never been predators present on the island. Thus, in efforts to protect and preserve the seabird community, a mouse eradication is planned for summer of 2020.

The focus of this project is to analyze the diet of mice from Midway Atoll NWR so that we can predict the effects that the eradication will have on the island. The eradication will directly and positively impact the seabird colonies on the island, but there are many other indirect effects that the eradication will cause. Mice are understood to be omnivores; thus, their diet

encompasses a broad range of diet items meaning that the effect of their eradication could be widespread.

## **II. Overview**

In order to reconstruct the diet of mice, we completed a stable isotope analysis of mouse hair samples obtained from Midway Atoll NWR. Stable isotope analysis can provide a broad look into the diet of an organism. Stable isotope analysis, compared to DNA metabarcoding or other methods, describes the diet of the organism over a longer period of time. Hair contains information, isotopic signatures, from the food consumed by that organism. By completing a stable isotope analysis, we can analyze the isotopic signatures; from this, we can broadly determine the diet of the organism.

Throughout the course of the semester, I have helped to prepare over 300 samples for stable isotope analysis. Preparation includes plucking hair from the samples and separating it from skin and other material, cleaning and drying the hair, and weighing the hair and wrapping it in tin capsules. From here, the stable isotope lab on campus will send us the results based on the mass ratio of the samples. It was our goal to finish the hair samples and stable isotope analysis before the end of the semester, which we have accomplished. Next semester, I will begin to analyze the data to determine the diet of mice.

In addition to preparing samples from present-day Midway Atoll NWR, we obtained historical samples from the Smithsonian Museum. We were able to obtain rat hair samples and mouse hair samples from the island decades ago. These samples could be a useful comparison to our current-day data, as we can see if the diet of rodents on the island has changed over a longer period of time.

### **III. Academic experience**

Since I am planning on attending graduate school in the future, it is beneficial to participate in research projects as an undergraduate. Participating in research projects now will give me a better understanding of what graduate school will be like and give me a competitive edge for applications. I learned that in graduate school, I will be creating my own project, most likely working directly under a professor and designing the project to answer research questions that I have. I am also learning various lab procedures that will help me to be successful later on in my classes, as well as in graduate school and beyond. Having this research experience will make me a more competitive applicant for graduate school programs since I have prior research experience.

In addition to doing lab work, I attended weekly meetings on R, a programming language mainly used for statistical analysis and creating visuals, that a post-doctoral fellow in my lab hosted. While this wasn't expected of me and I attended it outside my normal weekly hours, I appreciated the opportunity to learn a new skill. Learning the basics of R will help me during my data analysis next semester, and during biostatistics, which I will also be taking next semester.

### **IV. Career experience**

Participating in research as an undergraduate is a valuable experience that will stand out on my resume when I apply for future jobs or internships. Furthermore, this project has inspired me to think critically about what I would like to pursue in my later academics. When I started this project, I intended on attending pharmacy school. I learned a lot in this project, and I had never experienced work with ecology beforehand, and I figured out that I really enjoy it. I decided not to pursue pharmacy school anymore. I am still exploring my options, but I am interested in

continuing to work in ecology. Gaining experience in R through this project has me interested in learning bioinformatics and biostatistics as well.

## **V. Future goals**

For next semester, my goal is to begin analyzing the data. Specifically, I want to determine the trophic niche breadth of mice by habitat type. In other words, I will be exploring whether the diets of mice change depending on the habitat they reside in. On Midway Atoll NWR, there are a variety of different habitat types that vary based on plant community composition, for example. I hypothesize that there will be differences depending on the specific habitat type. Since mice predate on plants, seeds, and insects, and occasionally forage, I expect that their diets will vary depending on what diet item is most prevalent in that specific habitat type.

To accomplish this, I will be using R to analyze the data, using bi-plots, specifically using a mixing model framework. Mixing models are commonly used to estimate the contribution of different sources to a diet and are commonly used on ecology and biology.

We also hope to obtain samples of mice hair from other islands that are also housing invasive house mice. Comparing the diets of invasive mice from other islands would give a more wholistic view of the diet of mice on island ecosystems.

Reconstructing the diet of invasive mice on island ecosystems will benefit conservation efforts for Midway Atoll NWR, as well as other islands with invasive mice. In reconstructing the diet, we can informatively estimate the effects that mice have on the ecosystem and predict the trophic shifts following an eradication.