Introduction

*(1)The diurnal nature of humans has led to the creation of artificial night light, an invention that engulfs the globe to such an extent that approximately one tenth of the world's population can no longer see the night sky (Cinzano et al. 2001). While artificial light sources are beneficial for humans, their impact on natural communities that neighbor urban areas is primarily negative (Longcore & Rich 2004). Longcore and Rich (2004) along with Schlaepfer et al. (2002) provide evidence that light pollution can cause normal animal behaviors to become maladaptive when the light environment is artificially altered by humans. The shift from a formerly adaptive behavior to a maladaptive one is known as an ecological trap when caused by anthropogenic factors (Schlaepfer et al. 2002). An example of this phenomenon is male jewel beetles, which are known to mate with beer bottles that resemble a beetle carapace until they die. *(4) Ecological traps can be devastating to a population and can eventually lead to local extinction if population sizes become too low and an adaption to the novel stimulus is not obtained (Schlaepfer et al. 2002). *(1) While it is not certain that an ecological trap caused by light pollution is the reason for the decline in moth populations (Frank 1998; Fox 2013), it is apparent that moths are attracted to artificial light and could potentially suffer from decreased fitness due to this attraction (Frank 1998).

*(3) My research project will explicitly test whether light pollution has an effect on the fitness of moths, in order to assess the role of light pollution in recently declining moth populations. I hypothesize that moths in light polluted areas will have lower fitness than those in areas without light pollution because they are expending more energy flying around artificial light sources. In other words, I expect moths found in areas of light pollution to have less available lipid, glucose and glycogen stores that could be used for reproduction compared to those not affected by light pollution.

Methods

*(2) In order to test this hypothesis, I will take measurements of the lipid content, glucose and glycogen stores in 55 nocturnal Lepidoptera collected during the summer of 2015 by Kylee Grenis from areas both affected and not affected by light pollution. The moths were collected 2 times per week in July and August at 10 field sites across the Colorado Front Range (Coyote Run, Westcliff, Mountain View, Glen Eagle, Ute Trail, Loveland Trail, Forest Park, Jackass Hill, and Horseshoe Park). One lighted bucket trap was dropped off at the sites around 19:00 and picked up by 9:00 in the morning. The trapped insects were killed with carbon dioxide before being moved to vials. The collected insects are currently in the freezer at the University of Denver until the energy store analyses can be completed.

For each moth collected, I will first record a wet and dry weight of the samples in order to measure the water content for each moth. The dry samples will then be pulverized using a grinding machine in order to prepare the samples for the energy store analyses. In order to calculate the lipid content of each sample, the lipids will first be extracted using chloroform methanol and then analyzed using a vanillin assay and spectrophotometer. Following this, an anthrone solution will be used on the samples to separate the glycogen and glucose, which will then be analyzed using a spectrophotometer in order to calculate the sugar content of each moth sample. The moths will also be sexed so that males and females are tested separately, in order to evaluate any differences between the sexes.

Significance

*(2) My research will provide more information regarding the impacts of light pollution on moth populations. Specifically, if a negative relationship is found between light pollution and

moth fitness, it will provide a potential explanation for observed reductions in moth community richness and abundance in areas affected by artificial night lighting. Knowing and understanding the potential effects of light pollution on moth populations is important, because moths are essential nocturnal pollinators and play a crucial role in their ecological communities. My research will also provide insight as to why it is important to study the effects of light pollution on the natural world.

Experience/Personal Goals

***(1)** I worked in Dr. Murphy's lab learning ecology lab techniques for 2 quarters last year and I think that experience has provided me with the skills necessary to complete this project. ***(1)** My end goal for this project is to write a thesis on it in order to receive distinction in biology. ***(1)** Overall, I think this project will help me improve my research and lab skills, which will undoubtedly be useful for my future career in the biological sciences.

(Author could spend more time elaborating on the specific work/skills that make up their background, explaining the specifics of the final product, and detailing the specific research and lab skills they hope to gain).

References

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