Proposed Effects of Lunar Phase on Barn Owl (*Tyto alba*) Predatory Success

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Background

Oregon has 14 species of native owls including the barn owl (*Tyto Alba*),. In Oregon, five of these owls are on the red list of endangered species *(Oregon Department of Fish and Wildlife, year)*. Native owls are vital to maintaining and often restoring balance to ecosystems. Owls are important members of their ecosystems and keep rodent populations in check. Rodents are attracted to crops and can cause food spoilage for the agricultural industry. Chemicals, like rat poison, are commonly used as pest control, but cause damage to ecosystems by causing secondary poisoning to non-targeted species (Zaitzove-Raz, 2020). Additionally, rats are vectors which can spread zoonotic disease contributing to public health concerns (Meyer, 2008). Owls play an important role in rodent population management and can be an alternative to using ecologically harmful chemicals. Barn owls, may occupy nesting boxes provided by farmers and offering a more cost-effective pest control option (Browning, et al., 2016). However, the conditions affecting owl rodent control success is undocumented.

Many species become prey during full moon nights, due to lunar reflectance, which allows nocturnal predators to have better vision while hunting. Owls' activity increases as the lunar cycle approaches 100 percent reflectance, during which time owl calls and visual displays to conspecifics occur more frequently (Penteriani, et al., 2010). San Jose and colleagues (2019) found that owls' hunting success during the full moon relative to new moons can vary on based on the coloration of the owl. They found that red barn owls were only successful on nights with little moonlight, while white barn owls were successful in both the full moon and new moon cycles. White owls light reflected feathers may temporarily serve to confuse prey, owls then exploit that momentary confusion (San-Jose, et al., 2019). Additionally, Clarke (1983) studied short eared owls and found that the owls' hunting efficacy is greater during the waxing moon. The Short-eared owls took much less time to find prey as reflected moonlight increased.

The purpose of this study is to further clarify the role of lunar lighting on barn owl predation. Optimal Foraging Theory (OFT) assumes that natural selection will favor hunting strategies that boost fitness (Nordell & Valone, 2021). The great grey owl optimizes its foraging by eating the smaller prey at the kill site and larger prey in the nest (Bull 1989). In addition to variability in consumption location, perhaps predation strategy shifts relative to lunar cycle as predation success changes.

Empirical Question: ***How does lunar cycle (and weather conditions) affect barn owl predation success?***

Proposed Method

Target Species

For this study, the research team would identify an adult barn owl, which nests in a local barn, with ample prey available. We would examine the bird to ensure that it is healthy before using it for the study.

Materials

Materials will include a weather application, such as the app called "weather underground" to track the weather pattern (such as humidity and precipitation, clouds, fog, wind patterns) and lunar phase. All data will be logged into a Microsoft excel spreadsheet for later analysis. Additionally, the team will install a camera in the hay loft to record any additional qualitative data for possible use in the study.

Design and Procedure

This descriptive study will examine hunting success, as measured by in barn owl pellet castings, within a hay loft, with confirmed owlets. This study will observe an established owl nest using animal signs, feathers, castings, and fecal evidence. The nest will be monitored for eggs and owlets. The observation period will begin at hatching and last three months, because fledging occurs twelve weeks after hatching. The incubation period in owls is approximately 1 month and parental care of the owlet lasts approximately three to seven weeks. Other measured variables will be atmospheric context (e.g., temperature, weather, humidity, visibility, precipitation) across the lunar cycle (i.e., percent waxing, waning, new and full moon). Each day researchers will come to the barn and collect that day's owl pellets and log and the number of them into our data spreadsheet.

Image 1
Barn Owl (*Tyto alba*) Predatory Behavior

Photo credit: www.myinnnerowl.com

Image 2
Barn Owl (*Tyto alba*) Prey Casting Regurgitation

Photo Credit: *Blendspace*

Proposed Results

In order to assess the prediction that owls will be more successful during new moon (i.e., minimum light conditions), a Pearson r coloration will be conducted between lunar phase (or moon percent visible) and the number of predatory castings. It is anticipated that a main effect will exist for lunar phase (i.e., new moon will result in greater predatory success) and for weather condition (i.e., overcast conditions will result in greater predation) and perhaps an interaction for lunar phase by weather conditions.

Four lunar phases (new moon, waning, waxing, full moon) and two weather conditions (clear or overcast) will be analyzed using analysis of variance to assess the effects of weather and lunar phase on predatory success (i.e., number of castings). Continuous data (i.e., percent lunar phase) relative to number of owl castings will be correlated using Pearson's r for significance. Further descriptive data will be collected and recorded in a table identifying frequencies of castings relative to atmospheric data.

Conclusions

The findings of this study will be of use for future conservation, because establishing the role that lighting changes can play on owls. As Adams (2019) asserts, anthropogenic light can attract or repel birds and has an affect on birds' habitats and nesting behavior. Kyba and Hölker, (2013) in an editorial on the role of artificial light on biodiversity, assert that nighttime skyglow is one of the biggest man-made impacts on the biosphere; and that skyglow is projected to increase by 3-6% each year. Artificial illumination limits nocturnal animals' movement and is detrimental to nocturnal biodiversity. Russart and Nelson (2019) state that these responses to artificial light are maladaptive for life in the wild. They also state that lighting changes in the environment can affect animals' natural circadian rhythm, daily behavior, and the seasonal behavior of animals in their natural habitat. Photoperiodic animals rely on the length of daylight to determine the season, thus, artificial lighting at night can deceive animal perception of the seasons (Russart & Nelson, 2019). Animals in northern latitudes are more vulnerable to seasonal changes such as daylight length which affects the timing of nocturnal rodents' foraging behavior, the chief prey item of owls (Russart, 2019).

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