

Research Project:

Habituation Behavior of the California Ground Squirrel at Big Chico Creek Ecological Reserve

Tony Yang

Department of Biological Sciences

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Don Miller

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Abstract

The California Ground Squirrel, *Otospermophilus beecheyi*, are a vigilant species which exhibit great examples of habituation. Being vigilant assists the species in regards to the examination of their environment which helps determine any potential dangers in the area while mitigating the chances of venturing far from the natal area. The objective of this research is to observe the vigilant behavior among the California Ground Squirrel within an area of moderate human activities and interaction to determine whether the species has become habituated using natural sounds. The location of this research is at the Big Chico Creek Ecological Reserve towards the north east of the headquarters.

Introduction

Established in 1999, the Big Chico Creek Ecological Reserve(BCCER) has become a location which many plants and animals depend on. The reserve consists of 3,950 ac of diverse canyon and ridge habitat which includes 4.5 mi of Big Chico Creek. Over the past decades, the Big Chico Creek Ecological Reserve has had some property damages involving a certain mammal species. The California Ground Squirrel, *Otospermophilus beecheyi* or also known as the Beechy Squirrel, has been causing damage towards employee vehicles and their Off Highway Vehicle(OHV) such as gnawing of wires.

With a wide range of habitat preference, California Ground Squirrels can be located in areas such as colonizing fields, pastures, grasslands and in open areas such as oak woodland within the elevation range of 0-2000 m. Being **polyandrous**, meaning a female pairs with several males, these species live within a burrow system and breed along multiple generations. Current employees of the BCCER have also provided information pertaining to the ground squirrels

origin which dates back to the purchasing of the land. This means that the ground squirrel has been residing within the BCCER for approximately 20 years and possibly even before the establishment of the reserve. With that being said, the California Ground Squirrel do not migrate far from their natal area which means that the BCCER has become a potential habitat for the ground squirrels.

I conducted the observation at the Big Chico Creek Ecological Reserve during the months of September through December of Fall 2021. Owned by Chico State Enterprise, the BCCER is an area that is located approximately 15 mi north east from Chico on HWY 32 which helps Chico State provide educational opportunities pertaining to natural resources while supporting research and teaching. The location also provided public outreach and education, while providing natural habitats for multiple species of animals.

In my study, I collected data to test the habituation hypothesis which suggests that the decrease in response is a result of repeated stimulation which is not due to peripheral processes like adaptation or muscular fatigue. The following behaviors that were recorded consisted of: vigilant on two/four legs, foraging or moving, social interaction, self grooming, dusting bathing, resting, digging and calling. The eight specific behaviors can be found on table 1 which provides more detail of the behavior selected. I observed the said behavior for a total of 10 minutes or 600 seconds per focal squirrel throughout the duration of the research.

I predicted that the California Ground Squirrels will behave more vigilant when sounds such as a Peregrine Falcon call are produced compared to a construction site ambience which mimics the noise of the BCCER environment. The major objective of the research is to understand the behaviors of California Ground Squirrels and figure out a solution to combat

against the damages towards employee vehicles without using harmful force towards the species.

Methods/Materials

Before conducting any test, I had to ensure that there were potential burrow sites that showed evidence of ground squirrel activity. Thanks to an employee of the BCCER, he informed me of an app which I downloaded on my phone which was called Avenza Maps. This app allows for a geographical pinpoint of the potential burrow sites while capturing the photo of the site. With three potential locations: east of the headquarters, maintenance shop & the barn, I was able to pinpoint 104 potential burrow sites. What is a potential burrow site and how does it differ from a normal hole? A potential burrow site is a hole that has been dug up by the ground squirrel and is shown to have active movement in and out of the hole. As for a normal hole, it lacks active movement resulting in debris pile up or blockage to the entrance. These vacant holes may often be used by other species as a source of habitat as well.

The area that I chose within the BCCER was east of the headquarters due to active ground squirrel movement compared to the other two potential locations. Not only that but this location had good visibility for observation while also being far enough to not conflict with employees at the BCCER. In addition to that, the area had wooden poles that used to be for fencing the area which it no longer does. There were three specific wood poles that the ground squirrel would occasionally climb on. These poles had a height which consisted of 5'2 ft, 4'2 ft, and 4'5 ft. Other materials that were used was a JBL JR POP speaker that provided enough noise to ensure that the ground squirrel could hear the noise that was being emitted. This speaker was hung from Triple Crown Trident Fishin' Stix or commonly known as a fishing rod holder and

was placed in the middle of the potential burrow location. The sounds that were played consisted of two soundtracks: Peregrine Falcon calls(Sound P)and Construction site ambience(Sound C). The source of the soundtracks that were used was from Youtube videos called “Peregrine Falcon Calling - The fastest bird in the world - Bird Sound/Call - Natural Song” by Marius Travell and “30 MINUTES: Construction Site Ambience (CC BY 4.0)” by The Sound Gallery. The Peregrine Falcon call was used to test if there was a significant difference in vigilance behavior while the construction site ambience was the control sound. This sound consisted of multiple noises such as: hammering, drilling, sawing, heavy machinery, and the mumble of people talking. The reason why I chose the construction site ambience as a control sound was because the ground squirrel would typically hear these types of sounds all the time at the BCCER from the employees who work in the maintenance shop. After placing the speaker on the potential location, I was approximately 60 ft away with binoculars observing the ground squirrels. Using a tablet, I was able to measure the amount of seconds that the ground squirrel was behaving during the sounds.

To begin the experiment, I would have a grace period of 10 minutes to acclimate the ground squirrels to the natural environment. I would next find a focal squirrel while emitting the soundtrack. Each soundtrack would go on for 10 minutes or until the focal squirrel is no longer in sight. Another note is that the squirrels may disappear for a couple of seconds and reappear which has a high percentage of happening. There were eight selected behaviors which helped determine the activity the squirrel was participating in during the experiment.

Table 1. Categories of behaviors observed for California Ground Squirrel

Behavior	Definition
- Vigilant on two/ four legs	- Is alert and scanning the surroundings. On hindleg and solid surface not chewing or eating any food. Active upright tail movement and quick movement.
- Foraging or moving	- Visually chewing food. Movement to and from natal area
- Social interaction	- Any physical contact with other squirrels or other non predator species such as a an American Bushtit
- Self grooming	- Squirrel cleaning itself with paws or mouth
- Dusting bathing	- Rolling around on the ground
- Resting	- On all four legs, not scanning area. Not alert
- Digging	- Displacement of dirt
- Calling	- Vocal or loud cries to from squirrel

The data consisted of the amount of seconds that the focal squirrel was behaving in through the selected time. After the time was up, I would find a new focal squirrel and play sound C while recording the behavior of that squirrel as well.

Results

I was able to gather a sample size of seven trails using the Peregrine Falcon call and another seven trails using the construction site ambience sound equalling a total of 14 trails. Figure 1 depicts the amount of total percentage in which the squirrel behaved while the Peregrine Falcon call was emitted. As for Figure 2, it also depicts the amount of total percentage the squirrel behaved while the construction site was emitted. From our figures, we can see that ground squirrels were 71% vigilant while the Peregrine Falcon call was used compared to the

ground squirrels that were 10% vigilant with the construction site sound. To add onto that, the Peregrine Falcon call had a vigilant mean of 237.06 seconds while the construction site sound had a vigilant mean of 53.41 seconds. With that being said, I performed a t-test with the data and had a P-value of 0.015.

Discussion

The objective of this study was to observe the vigilant behavior among the California Ground Squirrel within an area of moderate human activities and interaction to determine whether the species has become habituated. The Big Chico Creek Ecological Reserve provided a great location to test the habituation hypothesis which suggests that the decrease in response is a result of repeated stimulation which is not due to peripheral processes like adaptation or muscular fatigue. Our prediction was that California Ground Squirrels will behave more vigilant when sounds such as a Peregrine Falcon call are produced compared to a construction site ambience, we can also develop other predictions to test the hypothesis. The result of our data which had a P- Value of 0.015 which we concluded that we must reject the null hypothesis and accept the alternative hypothesis. This means that there are statistically significant differences between vigilant behavior and change in habituation behavior among the California Ground Squirrel in response to natural sounds.

As we interpret our data, we can also develop other possible predictions to test the hypothesis. Instead of using sound as a tool to test our hypothesis, would the presence of a predator or human change the outcomes of the dataset. As we conclude our study, it brings forth reasoning for why this is important which is the risk between wildlife and human interactions. When visiting national parks or the outdoors, there are potential risks of coming

across wildlife and it is often best to resist the urge to approach, touch, or feed the animal. The reason we should mitigate the amount of interaction is because we would not want the animals to become habituated with human presents. Other negative effects from this is animals coming into contact or close to the human environment. For example, animals eating human trash resulting in them being dependent on it. Not only is habituation an issue, there are potential disease transfers between human and wildlife. Many pets that come into contact with wildlife may carry diseases that will harm the wildlife and ecosystems in the process. As a result, this was one of the main reasons behind this study so people can understand that this is an ongoing issue that needs to be addressed.

Figure 1. Peregrine Falcon Call

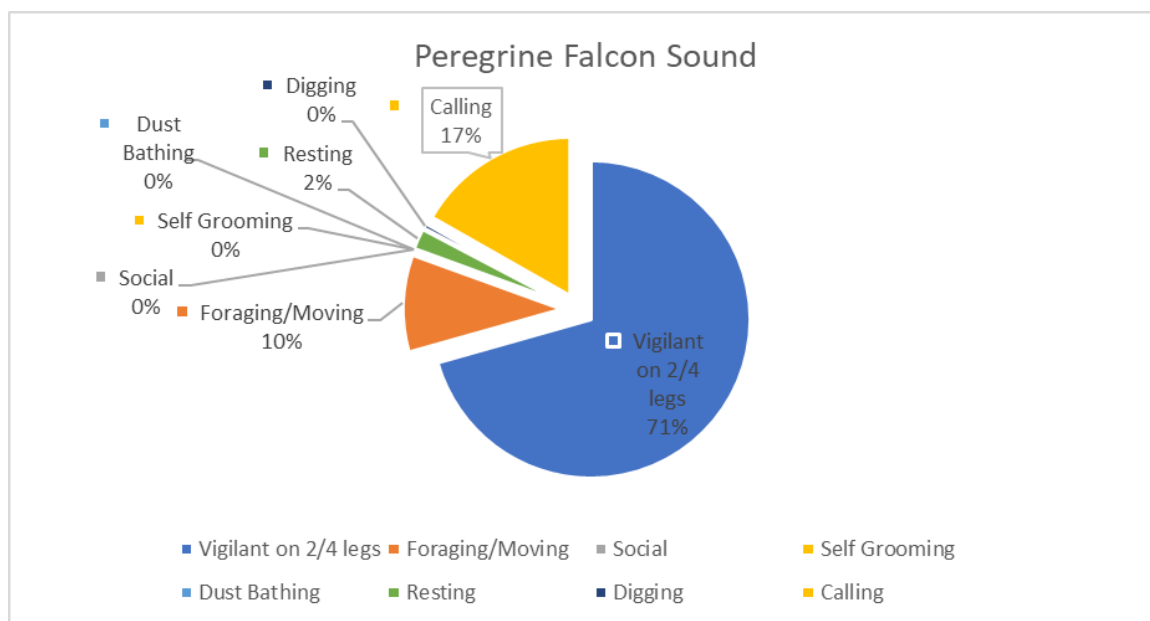
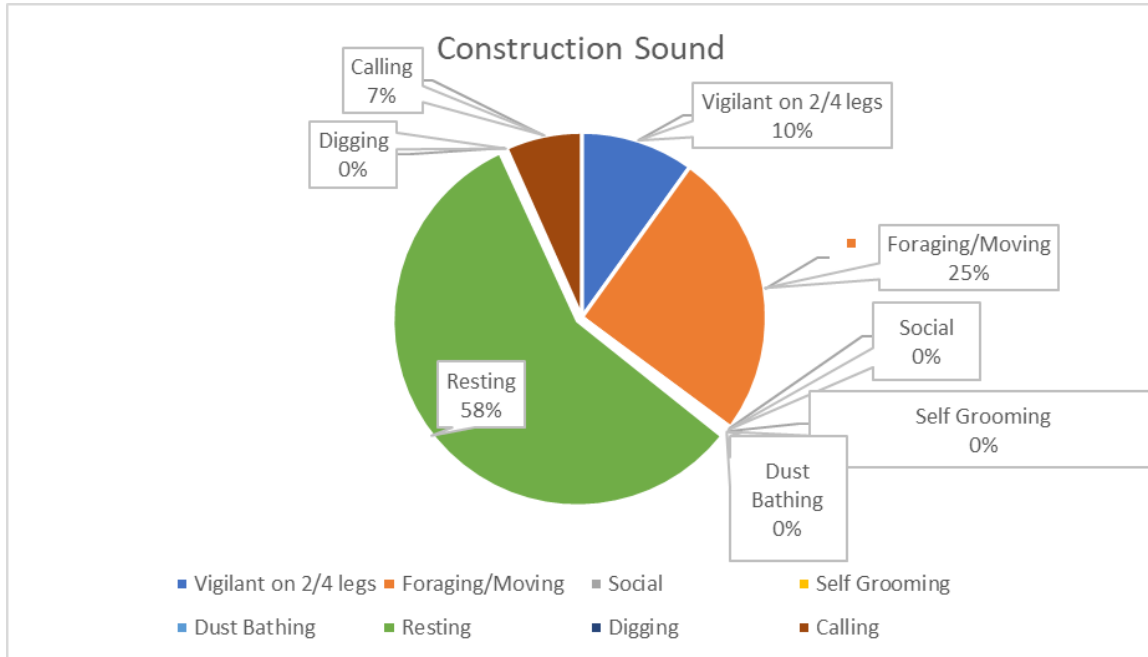


Figure 2. Construction Site Ambience Sound



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