The Effects of Light Pollution on the Activity of Ocelots in Panama

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Abstract

The ocelot (Leopardus pardalis), an elegant cat famous for its dark spots, has been listed as an endangered species for over 50 years. As nocturnal creatures, the question is raised if light pollution is negatively impacting them. This study aimed 1) to calculate the active hours of ocelots in reference to their distance from humans and 2) to determine if the type of light pollution has an effect on ocelot activity (villages/roads/etc.). We predict that as distance from humans decrease, ocelots will be active later in the night and that villages will have the greatest effect on ocelot activity. We used data from the WildCam Darien Lab and used R-studio cloud to perform the statistical analysis. Our results suggested that as distance from humans increases, the activity of ocelots also increases. There was no significant relationship between the type of light pollution and the time of captured activity. Using the information, many countries will be able to better cater to ocelot habitat conservation by being considerate of nearby human civilization and light pollution. More in-depth research concerning the intensity of light pollution on ocelot activity is recommended.

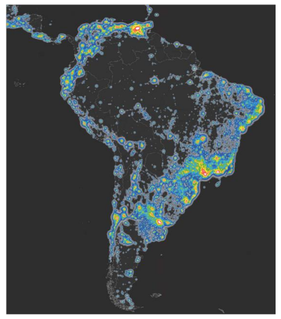


Figure 1: Light pollution in South America

Introduction

The ocelot (Leopardus pardalis), an elegant cat famous for its dark spots, has been listed as an endangered species for over 50 years. Before the 1980s, this magnificent creature was hunted for its skin to be sold through international markets (6). Since its ban, the current major threat to the ocelot has shifted to habitat loss. The ocelot lives within neotropical zones, habitating most of Central and South America while including parts of southern Texas (1). As civilization grows and cities infringe upon tropical forests there are many detrimental effects to the ecosystem and to ocelots. One effect has not been investigated thoroughly- light pollution. Ecological light pollution (or ELP) has many recorded destructive impacts on ecosystems, ranging from the attraction/repulsion of organisms, increased predation, altered species relationships, and the degradation of community structure (3). To reduce competition among other carnivores, ocelots have evolved to become nocturnal (4). This strategy of temporal segregation has been advantageous, but could very well be sabotaged by the ever-increasing effect of light pollution. With conservation efforts in full motion, is light pollution negatively impacting ocelots?

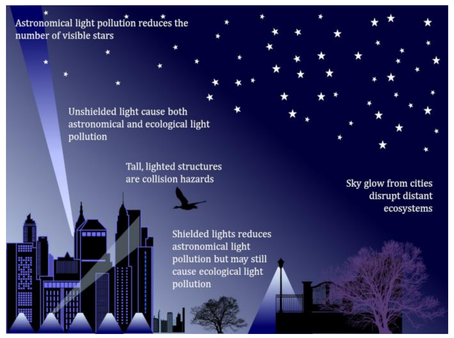


Figure 2: Effects of light pollution (4)

Objectives

- **Aim 1**: to calculate the active hours of ocelots in reference to their distance from humans. We predict that as distance decreases, ocelots will start being active later in the night.
- **Aim 2**: to determine if the type of light pollution has an effect on ocelot activity (villages/roads/etc). We believe that villages will have the greatest effect, resulting in later times of sightings.

Methodology

- Camera trap data taken from 2 parks in Panama- Soberania and Darien National parks. The time period was categorized and the distance from humans was measured in meters.
- **Activity Categories:**
  - Day: 6:17 a.m.- 6:27 p.m.
  - Dusk: 6:28-6:49 p.m.
  - Night: 6:50 p.m.- 5:54 a.m.
  - Dawn: 5:55-6:16 a.m.
- **R-Studio Analysis:**
  - 2 way ANOVA tests
  - Interaction Plots
  - Packages: ggplot2, dplyr, interactions

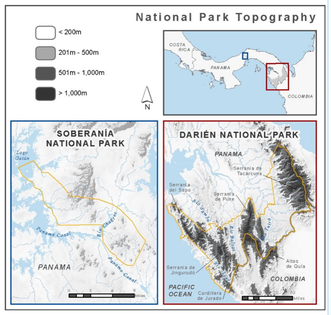


Figure 3: Soberania and Darien National park

*__Note:__ In this study we assume that light pollution is proportional to the distance from humans

Figure 4: Ocelot Sighting in Soberania National park

Results

- Test 1 (Camera /Time Period): Camera has no significant impact on ocelot activity
  - P-value = 0.859 F-value = 0.727
- Test 2 (Distance/Time Period): Evidence of a significant interaction between distance from humans and time of ocelot activity
  - P-value = 0.01 See Figure 5

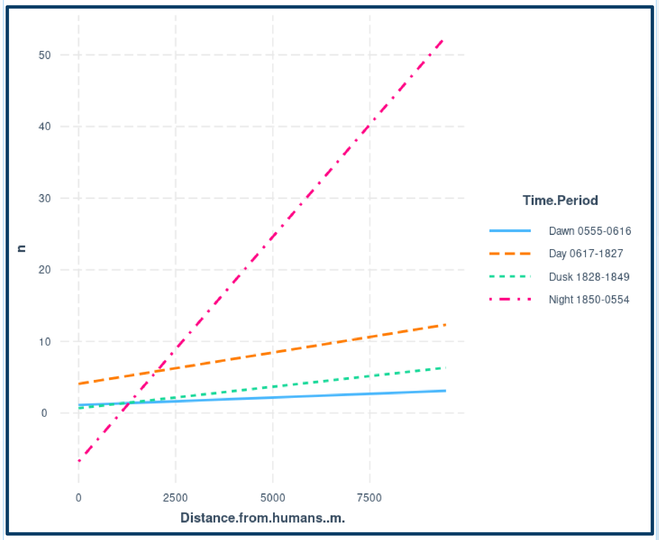
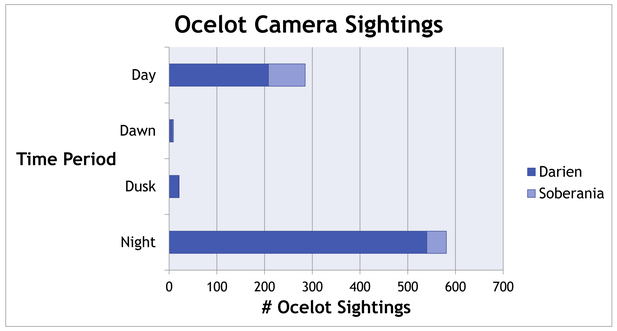


Figure 5: Interaction Plot of Distance from Humans (m) v.s Ocelot Activity (n)

- Test 3 (Type of Human Civil/Time Period): No significant relationship between type of human civilization and time of ocelot activity
  - P-value = 0.915



Conclusion

We conducted test 1 to take into account the possibility of repeat sightings of the same organism. Our statistical values proved this to not be an issue, we can conclude that specific cameras do not significantly impact time of ocelot activity. Our third test contained evidence that our prediction in Aim 2 was incorrect. We predicted that villages would have the strongest effect on time of ocelot activity, but we recorded evidence that suggests that type of light pollution/human civilization had no effect on ocelot activity. We recommend more in-depth research on the measurement of light pollution from different aspects of human society and their effect on times of ocelot activity.

The results of our second were the most impactful. Looking at the Interaction Plot we created in figure 5, we see that as the distance from humans increase, ocelots spotted during the night also increases. This supports our initial prediction in Aim 1. It is possible that the excess light pollution from nearby human civilization is throwing off the natural circadian rhythm of the ocelots. The ocelots may have become sensitive to the light pollution and have responded with fewer ocelots active at night. Ocelots have to wait until later in the night for darkness. What is also curious is that there is almost no change in sightings at the time of dawn. This may also support the fact that ocelots are very sensitive to light, the presence of light decreases ocelot activity. The chart also depicts that ocelot activity during the day slightly increases as distance increases. This could very well be to the fact that ocelots are more comfortable and active with the absence of humans, a species they see as a competitive predator. Another interesting factor is that ocelots closer to humans (x<2500 m) are active more frequently in the day than during the night. We presume that this is because these ocelots have become so insensitive to the presence of light that their activity is not longer as effected by the presence of light than ocelots farther away.

Investigating these issues will help us more fully understand the affect light pollution has on nocturnal organisms. Using the information produced in this study, many countries can better cater to the habitat conservation by being considerate of nearby human civilization and light pollution. More research is needed to further support these preliminary findings.

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