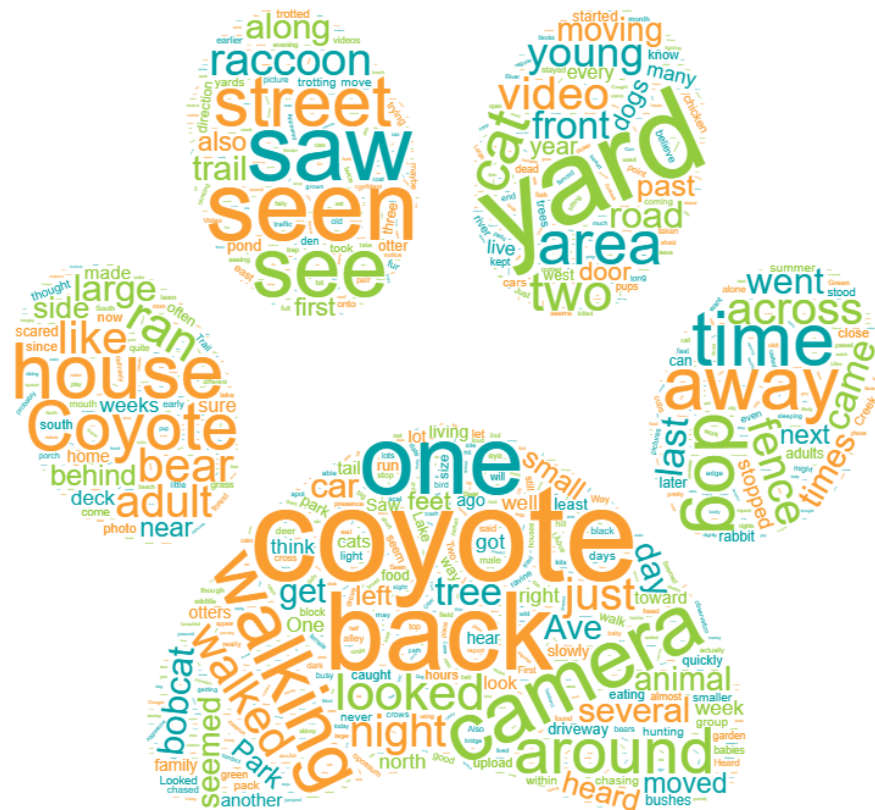




Prepared by  
Brittany Amaral & Jackelyn Garcia  
for Woodland Park Zoo



## **Abstract**

Woodland Park Zoo and Seattle University collaboratively launched Carnivore Spotter, a web-based carnivore reporting tool, on August 12, 2019. Since then, we have collected over 4,000 reports thanks to the support of our community members who have submitted carnivore sightings through the online website. We analyzed these data and found that all eight of our focal species were present within greater Seattle, with coyotes being the most commonly reported species. We found that the majority of reports were made within northern Seattle, with the highest number of reports in Ravenna. We learned that these carnivores interact with urban spaces in a variety of ways as means for transportation, food, and amusement. About 5% of reports described instances where a carnivore interacted with a human-made object. Other reports also described events that include interactions with people, pets, and livestock. Only ~0.04% of reports involved direct carnivore-human interactions. About 19% of those interactions occurred with the presence of a pet dog with the majority unleashed. Predation of a pet or domestic animal was also a rare occurrence within reports with only 1% of all reports describing a carnivore actively eating or trying to eat a domestic animal. Now that we are aware of the types of interactions that occur in sharing space with urban carnivores, we can continue to increase our understanding of urban carnivores and to work to support coexistence with these species in the future.

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## Introduction

As you may know and have experienced, the Pacific Northwest is home to a diversity of carnivores, such as bobcats, coyotes, bears and more. With the growth of suburban and urban areas worldwide, interactions and conflicts between carnivores and humans are becoming more common. The Seattle Urban Carnivore Project is working to support coexistence between people and carnivores in urban ecosystems across the greater Seattle area.

With the Seattle Urban Carnivore Project (SUCP), we aim to increase our understanding of urban carnivores by studying how carnivores live and interact with people across urban and suburban areas in the greater Seattle region, ensuring that we also listen to both your excitement and concerns about these interactions. SUCP is a collaborative project among Woodland Park Zoo, Seattle University, and community members— like you!

SUCP focuses on studying and supporting coexistence with the following species: black bears, bobcats, cougars/mountain lions, coyotes, Virginia opossums, raccoons, river otters and red foxes, which are terrestrial mammals in the taxonomic order Carnivora (except for opossums, which are marsupials) and are mammals that tend to be present in developed regions.

One of the approaches we have taken to accomplish this work has been through our camera trapping research, where we collect data from camera traps installed in green spaces by Seattle-area residents, university students, and Woodland Park Zoo volunteers. Another approach we have taken is through the launch of Carnivore Spotter on August 12, 2019, a tool available as a mobile site or on <https://carnivorespotter.org/> that allows the community to report sightings of these carnivore species and the interactions that occur. Through this work, we hope to foster connection, empathy, and coexistence with our local carnivores.

Thanks to your efforts and enthusiasm in partnering with us, you are helping us strengthen our understanding of how we can coexist better, together. It has been a year since Carnivore Spotter's launch, and we are very excited to share Carnivore Spotter's first annual report. Within two months of Carnivore Spotter's launch, more than 2,200 observations of local carnivores were made! And within one year, a total of 4,217 carnivore sightings were submitted. This research would have never come to fruition without you, and we would like to sincerely convey our utmost gratitude to you for your active engagement, and willingness to learn and coexist. Thank you so much!

The data from Carnivore Spotter complements the data collected from the camera trapping research. The observations submitted to Carnivore Spotter will be analyzed together with the data collected from the camera traps to explore urban carnivore distribution, habitat use and connectivity, population dynamics, and how these species live and interact with people across the region. For the purpose of writing Carnivore Spotter's first annual report, however, we refer only to sightings submitted through Carnivore Spotter.

In this report, we analyzed all the sightings reported through Carnivore Spotter for the types of interactions carnivores had with people, with human-made objects, and with domestic/wild animals. We also summarized where these interactions occurred geographically, as well as categorized the types of comments people submitted with their reports. This report is intended to summarize our findings of the data to which you contributed, and is also meant to inform how we can better serve the community. Reports that include photos, video or audio are reviewed by project staff and are verified for the correct animal identification; however, reports with no media cannot be verified but do appear in the data. **It is important to note that the observations of local carnivores are based on reports made, and do not necessarily reflect all the places where animals occur, how many there are, or most importantly where they do not occur.** This means that although the number of reports for a carnivore may be high or low in a certain location, this only indicates that the species are present in the area, were observed there by people who reported the observations to Carnivore Spotter and does not accurately represent their abundance within that area.

## Methods

### Study Area of Carnivore Spotter

Carnivore Spotter serves the greater Seattle area, including more than 126 cities, and more than 300 neighborhoods. While there are no restrictions on where reports can be made, for the purpose of this analysis, we only included sightings within Washington state, incorporating neighborhoods located in all Washington State counties.

### Methods of Analysis

Before we analyzed the reports observers submitted to Carnivore Spotter, all reports submitted were reviewed by project staff. As reports are submitted to Carnivore Spotter, project staff review all observations with media (i.e., photo, video, or audio) and correct the animal identification if necessary; the only other edits project staff make to observations are:

1. If the observer did not select a location.

If the observer did not select a location, the observation is logged at a default latitude and longitude (the default location). For every observation at the default location, if contact information is available, project staff attempt to obtain the correct location from the observer and update the observation to this location. If no contact information was provided or a correct location could not be obtained from the observer, observations at the default location are deleted.

2. If the observation is not of a live carnivore.

Observations of dead animals or of tracks or scat not accompanied by a direct observation of the carnivore are deleted.

3. If the media does not match with the observation or is not of a species included in the project (e.g., a photo of a domestic cat marked “Bobcat”), the observation is deleted.

Once all reports submitted to Carnivore Spotter underwent this review process, all remaining reports of carnivore sightings submitted through Carnivore Spotter from August 12, 2019 – July 20, 2020 were analyzed relative to the types of interactions carnivores had with humans, with human-related objects, with domestic or other species of wild animals, and the geographic locations from which reports were submitted.

The comments submitted by reporters were also analyzed for various themes relating to their concerns about interactions with carnivores, and general feelings expressed related to urban carnivores were categorized as either positive or negative. We analyzed the following themes in further detail:

1. The frequency of reports made for each carnivore species, and where these reports were occurring geographically, to better understand what regions of Washington are utilizing Carnivore Spotter and what regions are not.

2. The types of interactions observed between carnivores and humans or human-related objects, such as fencing, gardens, trash bins, and birdfeeders.

These interactions were categorized based on the type of interaction and/or conflict that occurred. Therefore, they were categorized as either a neutral or a potentially negative interaction, from a human perspective. For example, a carnivore’s interaction with trash bins could be seen as a negative interaction for the human.

3. The types of interactions observed between carnivores and domestic animals.

These interactions were categorized based on the type of interaction and/or conflict that occurred as well, and included any carnivore’s display of playful behavior, a carnivore physically attacking other animals, and the act of predation/feeding, which was included when it was reported that the carnivore killed and consumed an animal, or was witnessed feeding on an animal.

4. We manually coded the types of feelings the reporter expressed towards the carnivore(s) in any comments included with observations.
  - a. Positive feelings such as curiosity, excitement, etc.
  - b. Negative feelings such as concern related to the carnivore, such as feeling unsafe with their presence, or feeling their presence is problematic.

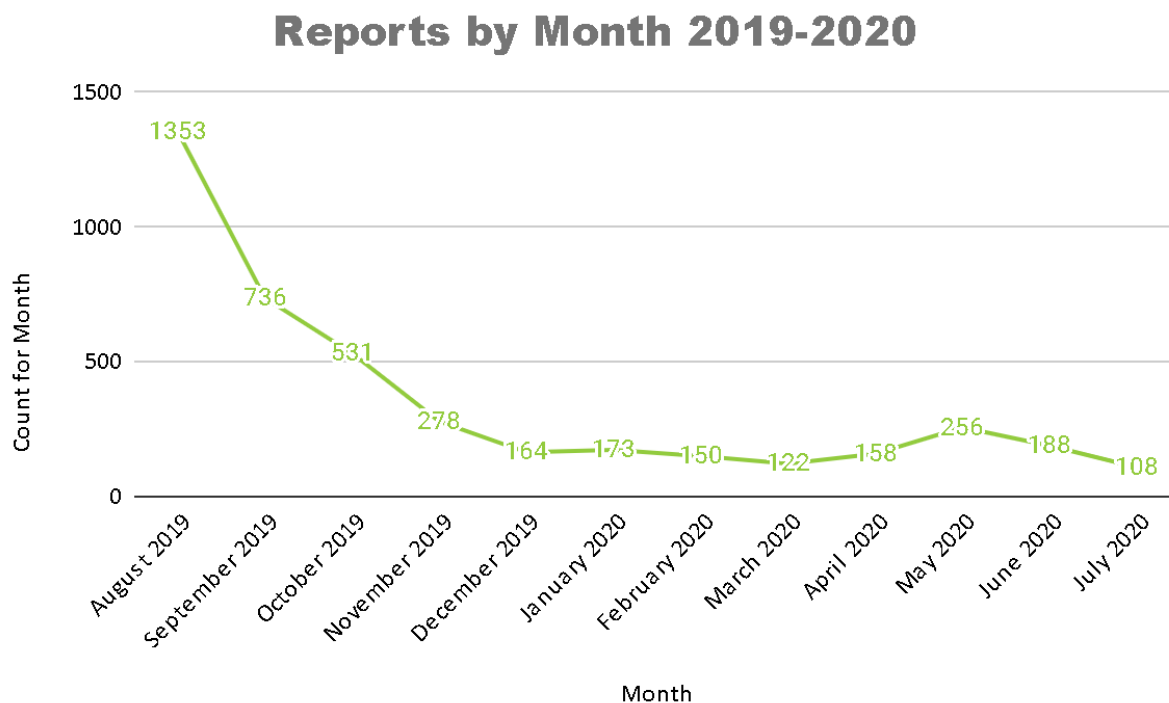
These themes were assigned a distinct code (Appendix I) to allow descriptive statistical summaries to be made.

## Results

### Introduction to Results

In the first year since Carnivore Spotter's launch, a total of 4,217 reports were submitted. The number of reports was highest following its initial release in August 2019, and declined until December 2019 with 164 reports (Figure 1). The number of reports remained under 200 until May 2020, where they increased to 256 reports and then declined again in the following months.

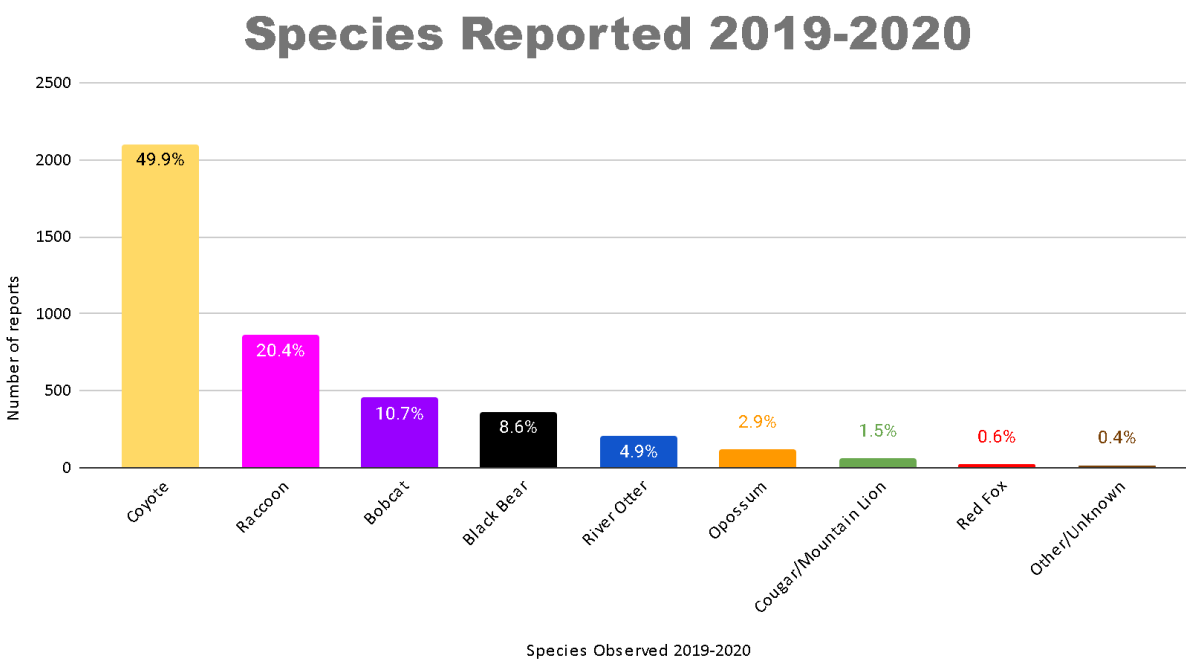
Figure 1. Reports by Month 2019-2020.



### Species Reports

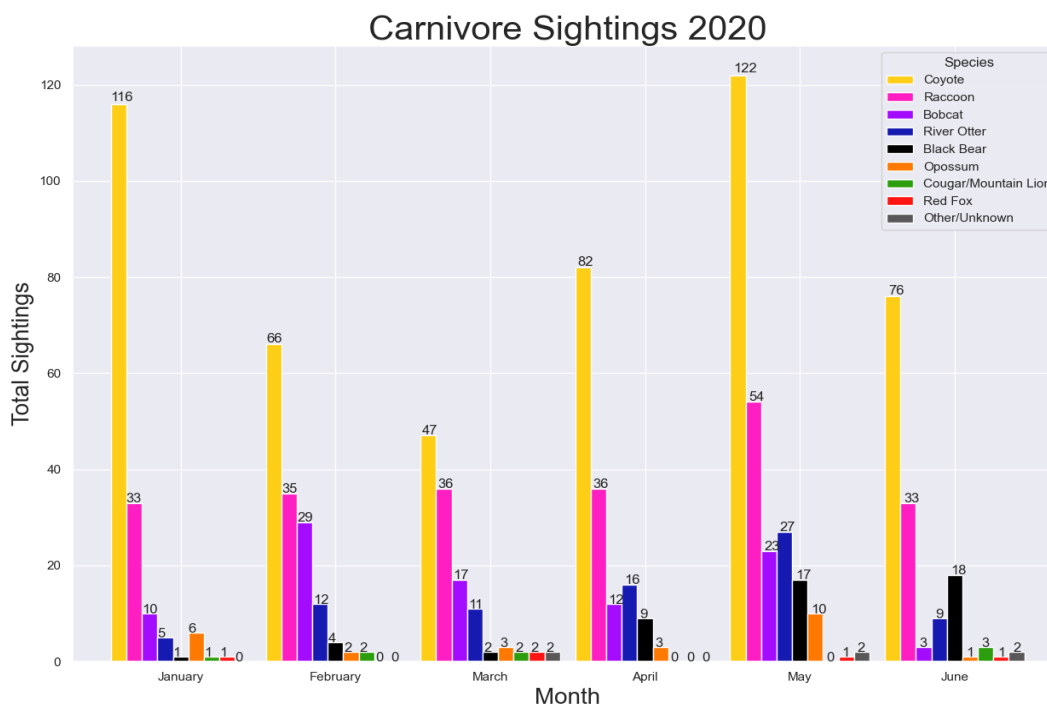
Coyotes were the most reported species, making up almost 50% of all reports. Raccoons were also frequently reported, making up about 20% of all reports, followed by bobcats and black bears (Figure 2). Red foxes held the fewest number of reports, and none of these reports included photos or video, making their confirmation impossible. These results do not represent the number of these carnivores within Seattle, but only suggests that these carnivores are present within the greater Seattle area.

Figure 2. Species Reported 2019-2020.



Based on an initial analysis of reports from January through July 2020 provided by the staff of Critigen (the geospatial design service company that built Carnivore Spotter), the number of reports of each species do vary from month to month (Figure 3). Future years of Carnivore Spotter reports will help us to further analyze these trends.

Figure 3. Carnivore Sightings 2020.





Of the 4,217 reports that were submitted to Carnivore Spotter, 836 of them included media (i.e., photo, video, or audio). These reports allowed a staff member to review and confirm the species that was listed. Of reports made with media attached, the majority were confirmed to be coyotes, followed by raccoons, bobcats, and black bears. This matches the overall trend of species reported (Figure 4).

Figure 4. Reports with Media 2019-2020.

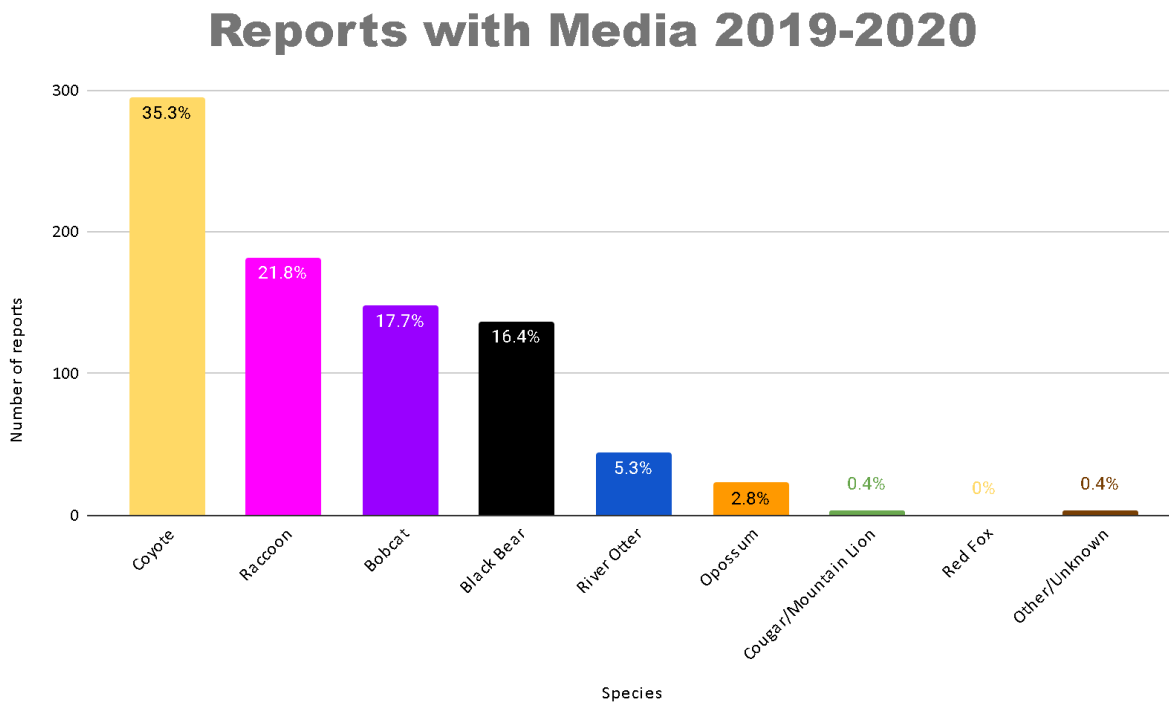
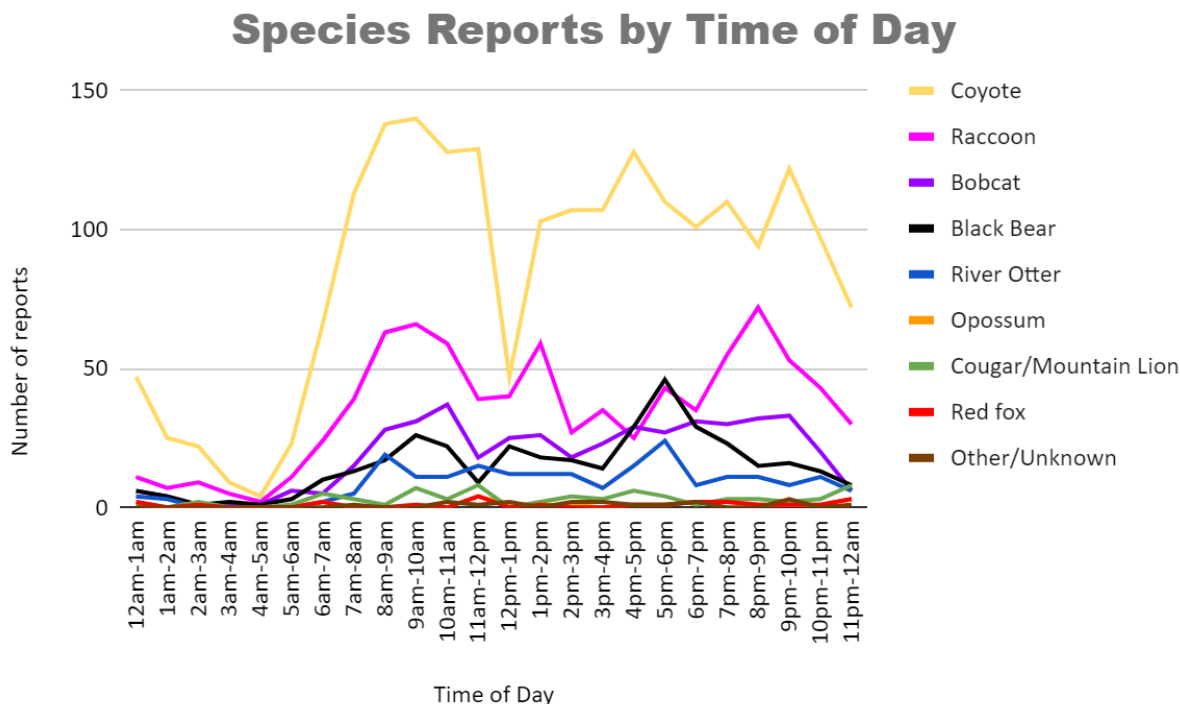


Figure 5 plots the times of day that each species was reported. Over the reporting period (August 12, 2019 to July 20, 2020), most reports were made between the hours of 5 am and 10 pm (Figure 5). The number of reports made dropped between 10 pm and 5 am. It's important to note that these are the times that people reported carnivores and does not indicate that carnivores are more or less present at these times of day.

Figure 5. Species Reports by Time of Day.



### Geographic Distribution of Carnivore Reports

Reports of carnivores came from various regions across Washington. Of all species, coyote reports, which make up the majority of all Carnivore Spotter reports, show the greatest geographic distribution. Coyote reports were more common in the northern Seattle region, with many reports coming from the east side of central and south Seattle, and additional reports from other places within and outside of Seattle (Appendix II). In the regions outside of Seattle, reports of coyotes become less prevalent. Reports of raccoons, which make up the second most reported carnivore, mostly occurred in northern and central Seattle, with many reports submitted from various areas within and outside of Seattle (Appendix III). Bobcats were mostly reported across Bothell, Shoreline, Redmond, Bellevue, Issaquah, Renton and Snoqualmie (Appendix IV). Reports of black bears were higher in numbers in Union Hill and Issaquah relative to other regions (Appendix V), while reports of Cougars were more sparsely distributed across the greater Seattle area (Appendix VI). River otters were typically reported near water bodies such as Elliot Bay, Lake Washington, and Puget Sound, with others reported from smaller bodies of water in various areas inside and outside of Seattle (Appendix VII). Opossums were primarily reported in the northern region of Seattle but are also sparsely distributed across different areas in and out of Seattle (Appendix VIII). The distribution of red fox reports is sparse, and come from various locations within and outside of Seattle (Appendix IX).

## **Carnivore Reports in Seattle**

From the 4,217 total reports of carnivores, we tabulated the ten neighborhoods with the most reports. Of these ten neighborhoods, eight were located in northern Seattle, with Ravenna showing the most reports, while Olympic View, which had the tenth most reports, had about four times fewer reports than Ravenna (Appendix X). When initially tabulating the ten neighborhoods with the most reports, reports with an “Unknown” neighborhood placed first, showing 1,120 reports. When reports are submitted from certain suburban or rural areas that Carnivore Spotter cannot recognize, Carnivore Spotter automatically groups them into the neighborhood category “Unknown.” The Seattle Urban Carnivore Team is aware of this issue, and are working to address it. As many of these reports in the neighborhood “Unknown” can be from varying geographic areas, we chose to exclude these reports in computing the neighborhoods with the most reports.

We also tabulated the number of reports submitted across different neighborhoods within Seattle. Most reports overall were submitted from northern Seattle. Reports in this area were localized in the southern end of northern Seattle, occurring primarily in Ravenna, Wedgwood, Maple Leaf, Phinney Ridge, and Green Lake (Figure 6). In comparison, the total number of carnivore reports generally decreased towards central and southern Seattle.

**Legend**  
 # of Sightings  
 0  
 223  
 WPZ SU  
 Puget Sound

City of Seattle, Bureau of Land Management, Esri Canada, Esri, HERE, Garmin, INCREMENT P, USGS, METI/NASA, EPA, USDA



**Figure 7. Reports of Carnivores in Seattle Parks.**

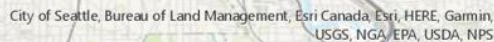


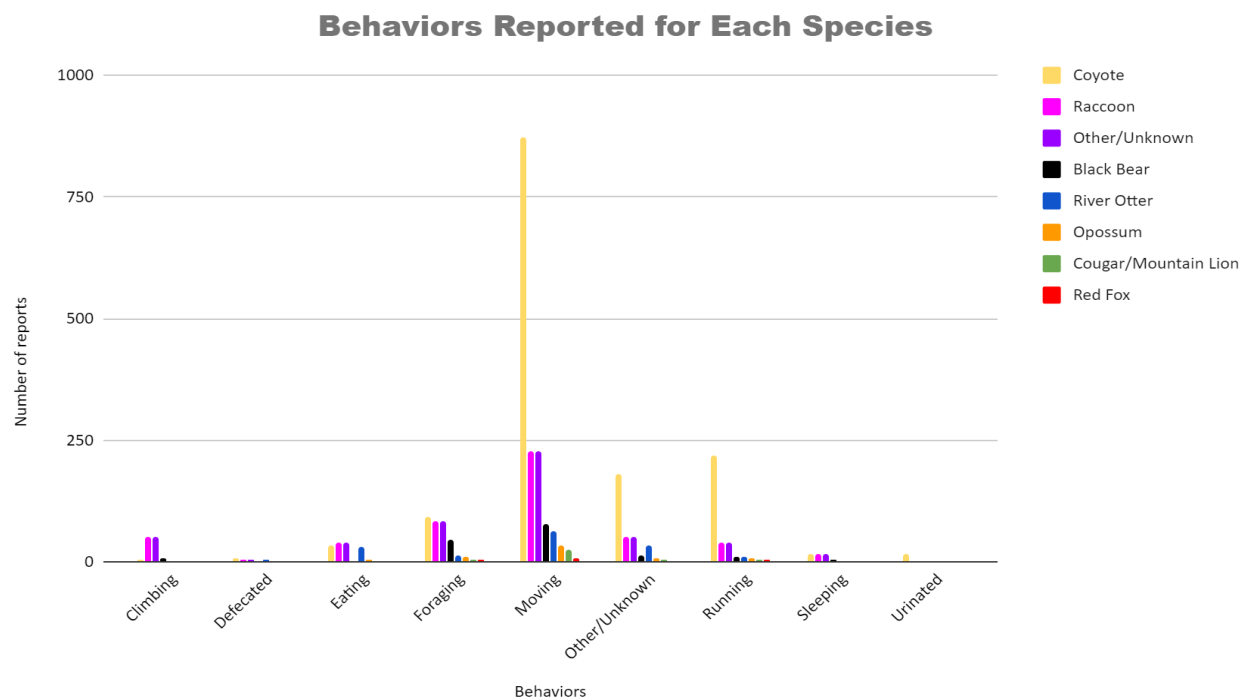
Table 1. Sightings of Carnivores Within Seattle Parks.

Sightings of Carnivores Within Seattle Parks	
Species	Number of Reports
Brown Bear	0
Bobcat	2
Cougar/Mountain Lion	0
Coyote	139
Opossum	2
Raccoon	14
Red Fox	1
River Otter	24

## Behavioral Results

When submitting a report in Carnivore Spotter, it is optional for observers to select the behavior of the animal(s) they encountered from a dropdown list with the options: moving, foraging, eating, running, sleeping, urinating, defecating, and other. However, observers may also provide notes in written comments about the behaviors observed. Of the 2,705 reports that listed the carnivore's behavior when encountered, the majority of people selected “Moving” as the behavior observed (Figure 8). Only raccoons, river otters, and unidentified animals were reported to be climbing. All other options for behavior were also observed and reported. People also noted in their comments instances of carnivores displaying playful behavior, and this was observed in coyotes, black bears, raccoons, and river otters.

Figure 8. Behaviors Reported for Each Species.



## Interactions with Urban Carnivores

Reports showing themes of actions and interactions were identified through the observers optional selection from a dropdown list of interactions that could have occurred with the options: Animal made physical contact with pet or livestock, animal made physical contact with human(s), interacted with human-related item or place (e.g., trash can, bird feeder, fence/yard, attic); and/or by their description of the interaction through the optional comments they submitted.

Of the 4,217 reports, 528 of them (12%) showed themes of actions and interactions. The majority of those reports listed interactions with human-made objects (such as cars, decks, fences, fountains, toys, trash, etc.) with only 33 (~6%) of them being considered a negative interaction from a human perspective, such as those that interacted with cars or trash. Only 21 (~4%) of the reports described a direct interaction between a human and a carnivore. Out of these 21 reports, 4 (~19%) of them indicated a pet dog was present during the encounter with mostly raccoons as the carnivore in these interactions and unleashed pets. In interactions between humans and carnivores, the majority of people stayed quiet, while others shouted/made noise or walked away. 87 of all reports (~16%) describe a direct interaction between a carnivore and a domestic animal (pet or livestock) with 52 of them being instances where a carnivore was eating or trying to eat the domestic animal and almost succeeded. Examples of reports that fell into the latter category was when observers indicated in their comments that the carnivore had the domestic animal in their mouths and/or carrying them away. An example of a report with a comment like this would be, “Coyote was attempting to catch a domestic cat but we scared it away It was very close to catching it”, or “Killed pet duck. Carried it off. Jump straight to top of 5' wood fence carrying duck in mouth.” In relation to the bigger data set, out of all 4,217 reports, only about 1% included interactions in which a carnivore was eating or trying to eat a pet or livestock animal.

Table 2. Themes related to actions and interactions.

Categories of CS Reports (Actions)	Number reported
All interactions with human-made objects	244
Interaction with a domestic animal	87
Interaction with other wild animal	69
Predation / feeding	60
Carnivore was playful	34
Negative Interactions with human-made objects	33
All interactions with humans	21
Carnivore physically attacks domestic animal	13
Negative Interactions with humans	11

## Analysis of Human Sentiment Towards Carnivores

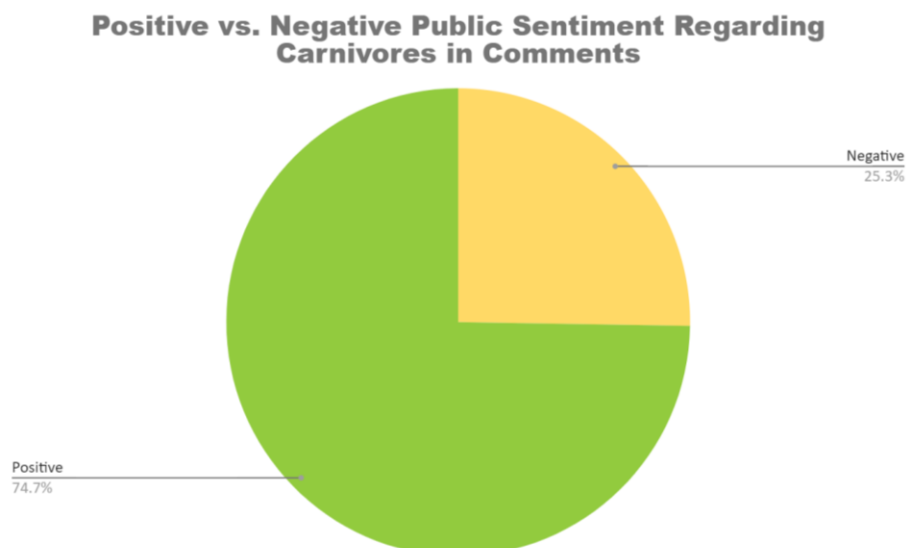
Including a comment when making a report is optional. The comments that expressed positive or negative feelings towards a carnivore were coded into themes so that we could analyze these sentiments (Table 3). Positive themes were assigned to comments that expressed empathy or thankfulness from their encounter and to comments that used words or emoticons with positive connotations. Negative themes were assigned to comments that expressed concern for safety or desire to get rid of the carnivore within urban spaces. Appendix XII depicts the different words seen in comments that demonstrated either a positive or negative sentiment towards carnivore encounters.

Table 3. Themes related to human sentiment towards carnivores.

Categories of CS Reports (Feelings)	Number reported
Positive feelings of reporter towards carnivore	71
Negative feelings of reporter towards carnivore	24
User explicitly expressed empathy for the carnivore	16
User explicitly expresses feeling unsafe about urban carnivore presence	14
User explicitly expressed thankfulness for the application	6
User explicitly expresses they want to get rid of urban carnivore presence	5
User explicitly expressed curiosity and wonder about carnivore	5

Of those that expressed either a negative or positive sentiment within the comments in Carnivore Spotter, almost 75% of reports showed positive sentiments regarding their carnivore encounters (Figure 9). Only about 25% showed a negative response.

Figure 9. Positive vs. Negative Public Sentiment Regarding Carnivores in Comments.





## Discussion

Through all of the reports community members have contributed to Carnivore Spotter, we have gained a better understanding of the interactions people have with carnivores in urban spaces, and how people feel about sharing space with urban carnivores such as: coyotes, bobcats, black bears, raccoons, cougars/mountain lions, red foxes, river otters, and opossums in Washington State. We have learned that the majority of reports that indicated an interaction with a carnivore were of carnivores interacting with human-related objects. While reports have shown that carnivores interact with varying objects, human-related objects that were commonly interacted with were yards, fences, decks, trash, and pet food bowls. Specifically, many reports of black bears interacting with a human-related object were of them interacting with trash bins. Reports have also shown bobcats, cougars, opossum, and raccoons walking along the tops of fences. Some reports have indicated that raccoons live in people's decks or trees near their yards, and some reports have indicated carnivores such as opossums eating pet food left outside. These observations tell us that as we share space with these carnivores, it is important to consider ways we can encourage people to take extra care with securing trash bins and preventing access to human or pet food, as carnivores can be especially attracted to these sources.

The second most common interaction carnivores had with others were with domestic animals. While this interaction was the most common to occur, out of all 4,217 reports, only about 1% included interactions in which a carnivore was eating or attempting to eat a pet or livestock animal. It is worth discussing the challenge of accurately identifying whether a carnivore was attempting to eat another animal. Although behaviors such as hunting, stalking, and aggression could have been indications of an attempt to eat another animal, we are not able to know whether those behaviors led to an act of predation unless the actual consumption of the animal was observed. When observers described in their comments a carnivore was trying to eat another animal, observers may have been describing their inferences instead of observations when indicating a carnivore was hunting or stalking another animal. Aggression displayed by a carnivore towards another animal could also have been for other factors not related to the intent to predate as well. This had led to our decision to consider reports as predation on other animals as such, only when observers indicated in their comments that they truly felt a domestic or livestock animal was being targeted by a carnivore or that the carnivore had the animal in their mouths and/or was carrying them away. In reports that indicated interactions between carnivores and domestic animals, ~19% of these interactions occurred with the presence of a pet dog, with mostly raccoons as the carnivore in these interactions. While carnivore interactions with domestic animals are the second most common interaction carnivores had with others, these types of interactions make up only 2% of all total reports. It may still be beneficial however to take precaution in leaving pets or livestock outside unattended. Direct interaction between a human and carnivore was rare making up only ~0.04% of all reports. In interactions between humans and carnivores, the majority of people stayed quiet, while others shouted/made noise or walked away. In reports where people shouted or made noise, various reports indicated the carnivore ran or walked away in response. This may suggest that when encountering a carnivore, yelling or making noise may benefit the

person if they were seeking to inhibit further interaction with the carnivore. For more information on best practices for coexisting with carnivores, please see the links located at the bottom of this report.

With lower numbers of reports submitted in central and south Seattle, and the majority of reports of carnivores coming from northern Seattle, we will consider doing outreach in these areas based on the high number of reports in north Seattle. Woodland Park Zoo is located in north Seattle and we have communicated about Carnivore Spotter to our WPZ audience of members, staff, volunteers and others, so people in north Seattle who are already connected with WPZ may be more likely to be aware of Carnivore Spotter. Promoting Carnivore Spotter in other regions of Seattle may help us more clearly understand the distribution of reports we see across Seattle. Current users of Carnivore Spotter can aid with promoting awareness of Carnivore Spotter by sharing about it with their family, friends, colleagues, neighbors and other contacts.

The data collected over the course of this past year has provided us with deeper insight on urban carnivores within Seattle, and will help us increase our understanding of these species to contribute to cultivating coexistence between wildlife and human communities. We hope to continue to learn more about the carnivores within these urban spaces by comparing the data from Carnivore Spotter with our trail camera data for the Seattle Urban Carnivore Project. The data collected has also provided us with insight on things that we can improve upon in the future. Some suggestions for improving Carnivore Spotter include updating Carnivore Spotter to give users the ability to edit their submitted reports if needed, and fixing the issue in which locations are sometimes listed in as “Unknown” neighborhood within the app. We are very grateful to those who submitted comments in their reports. Reading your comments is vital in understanding how we can more efficiently provide recommendations and resources to our community members as they encounter carnivores. Thank you for using Carnivore Spotter and sharing your carnivore encounters! We could not have had such a successful year without your support. We look forward to hearing about your further sightings of urban carnivores!

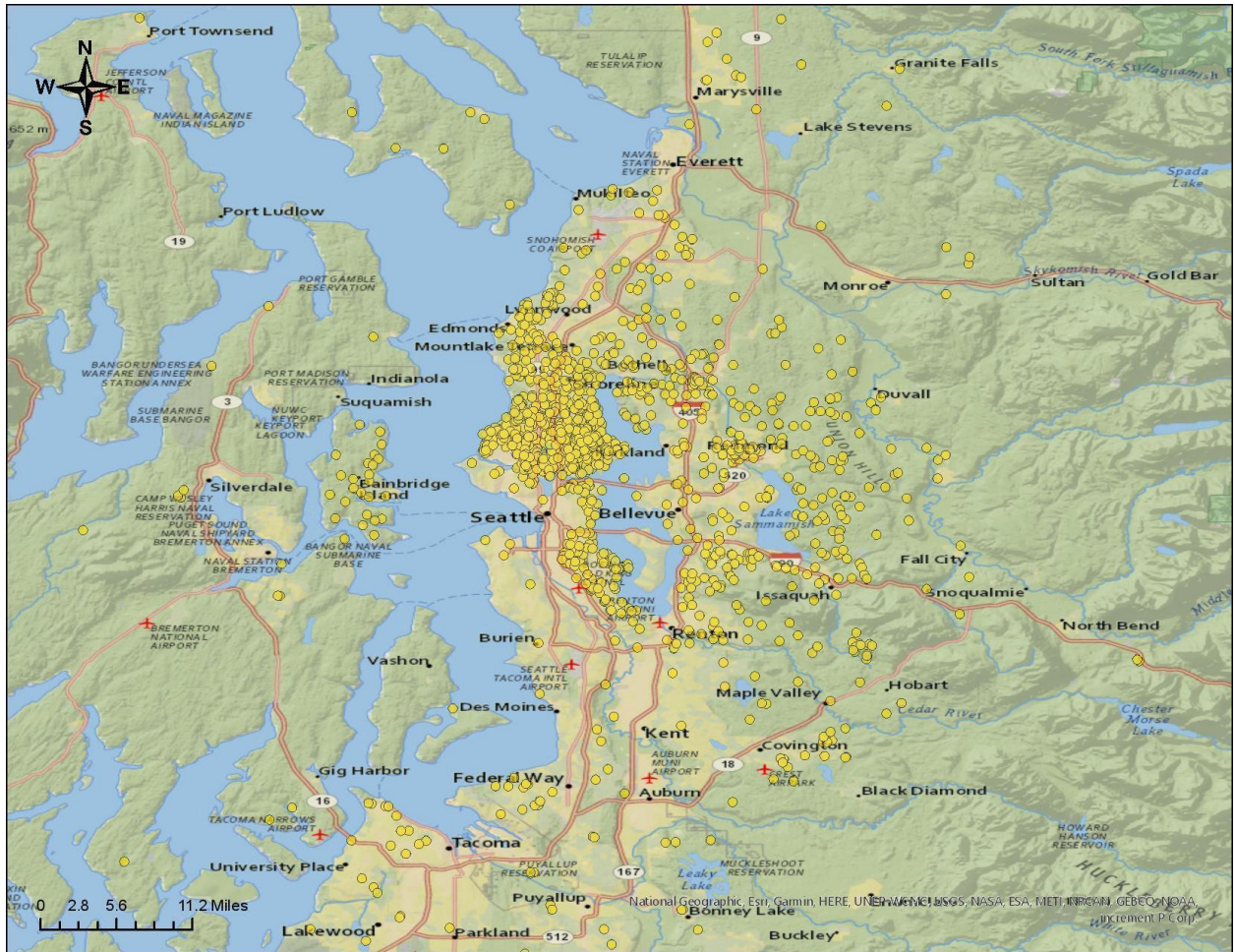
## Relevant Links:

- Carnivore Spotter Tool: <https://carnivorespotter.org/urban-carnivore-spotter/>
- Carnivore Spotter and Seattle Urban Carnivore Project Description Webpage: <https://www.zoo.org/carnivorespotter>
- Frequently Asked Questions About Coyotes: <https://www.zoo.org/seattlecarnivores/faq>
- PAWS Wildlife Center for helping sick, injured and orphaned wildlife: <https://www.paws.org/wildlife/>
- Washington Department of Fish and Wildlife’s Article on Living with Wildlife: <https://wdfw.wa.gov/species-habitats/living>
- Seattle Urban Carnivore Project : <https://www.zoo.org/seattlecarnivores>
- Coexisting with Carnivores project focused in Issaquah: <https://www.zoo.org/coexisting>

Appendix I: Table showing the different themes coded for within the data.

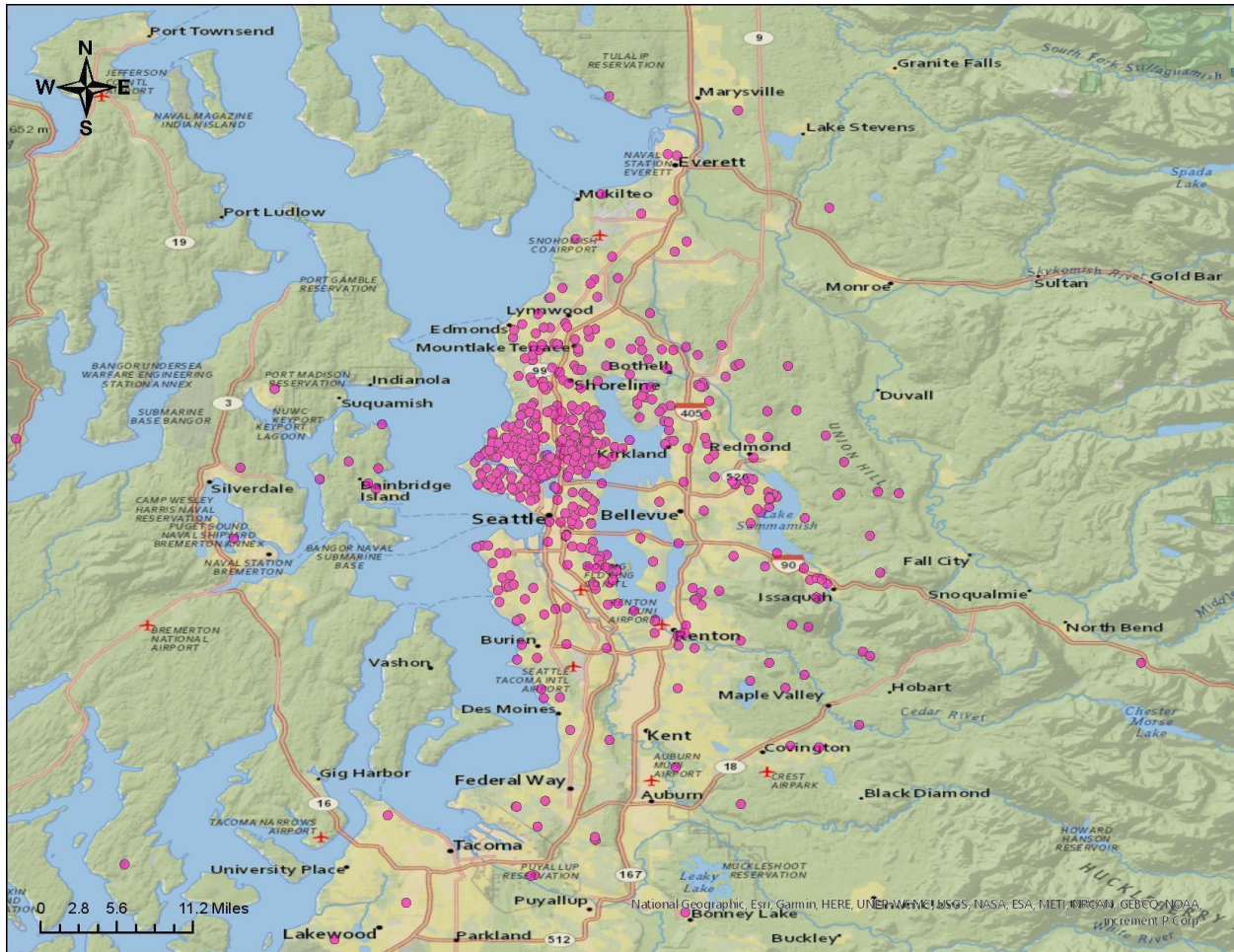
Categories of CS Reports	Code
Feelings of reporter towards carnivore (Neutral)	F
Interactions with human-made objects (Negative)	O
Interaction with a domestic animal (Neutral)	D
Feelings of reporter towards carnivore (Positive)	FP
Interaction with other wild animal (Neutral)	W
Predation / feeding (Neutral)	P
Carnivore was playful (Neutral)	PL
Interactions with human-made objects (Neutral)	ON
Feelings of reporter towards carnivore (Negative)	FN
User explicitly expressed empathy for the carnivore (Neutral)	E
User explicitly expresses feeling unsafe about urban carnivore presence (Negative)	Unsafe
Carnivore physically attacks domestic animal (Neutral)	A
Interactions with humans (Negative)	HN
Interactions with humans (Neutral)	H
User explicitly expressed thankfulness for the application (Positive)	T
User explicitly expresses they want to get rid of urban carnivore presence (Negative)	Problem
User explicitly expressed curiosity and wonder about carnivore (Neutral)	C

## Appendix II: Geographic distribution of reports indicating sightings of coyotes.

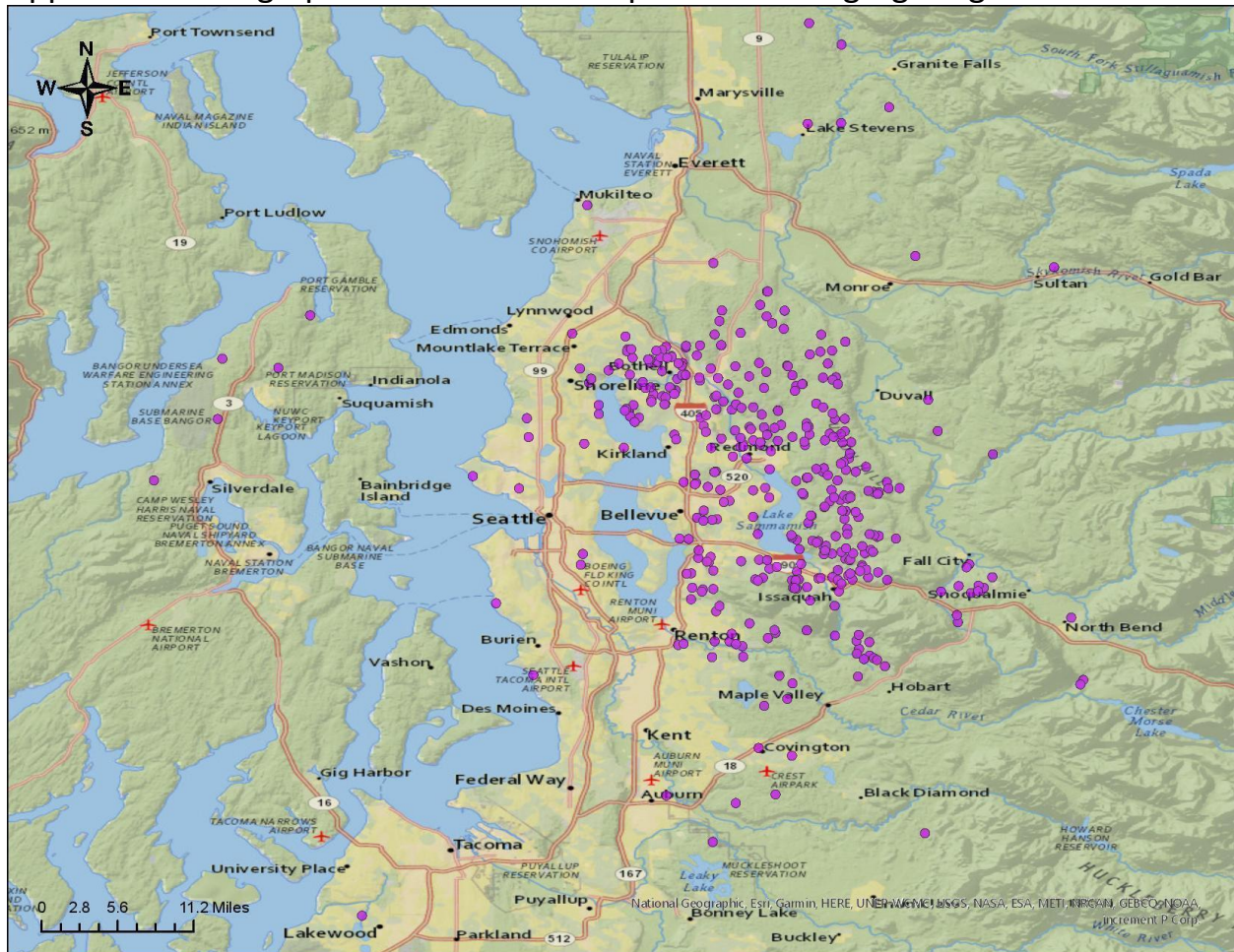




Appendix III: Geographic distribution of reports indicating sightings of raccoons.

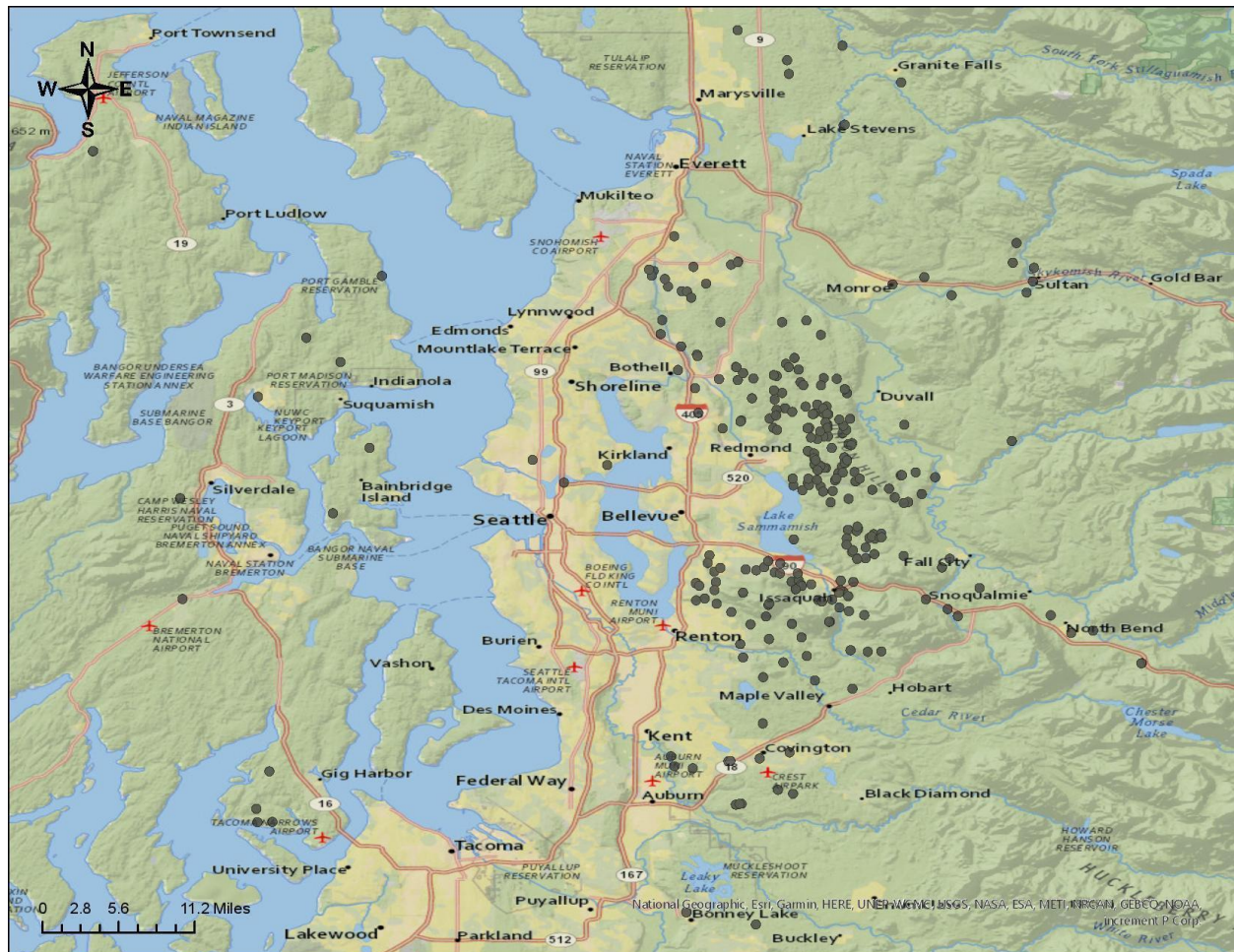


## Appendix IV: Geographic distribution of reports indicating sightings of bobcats.

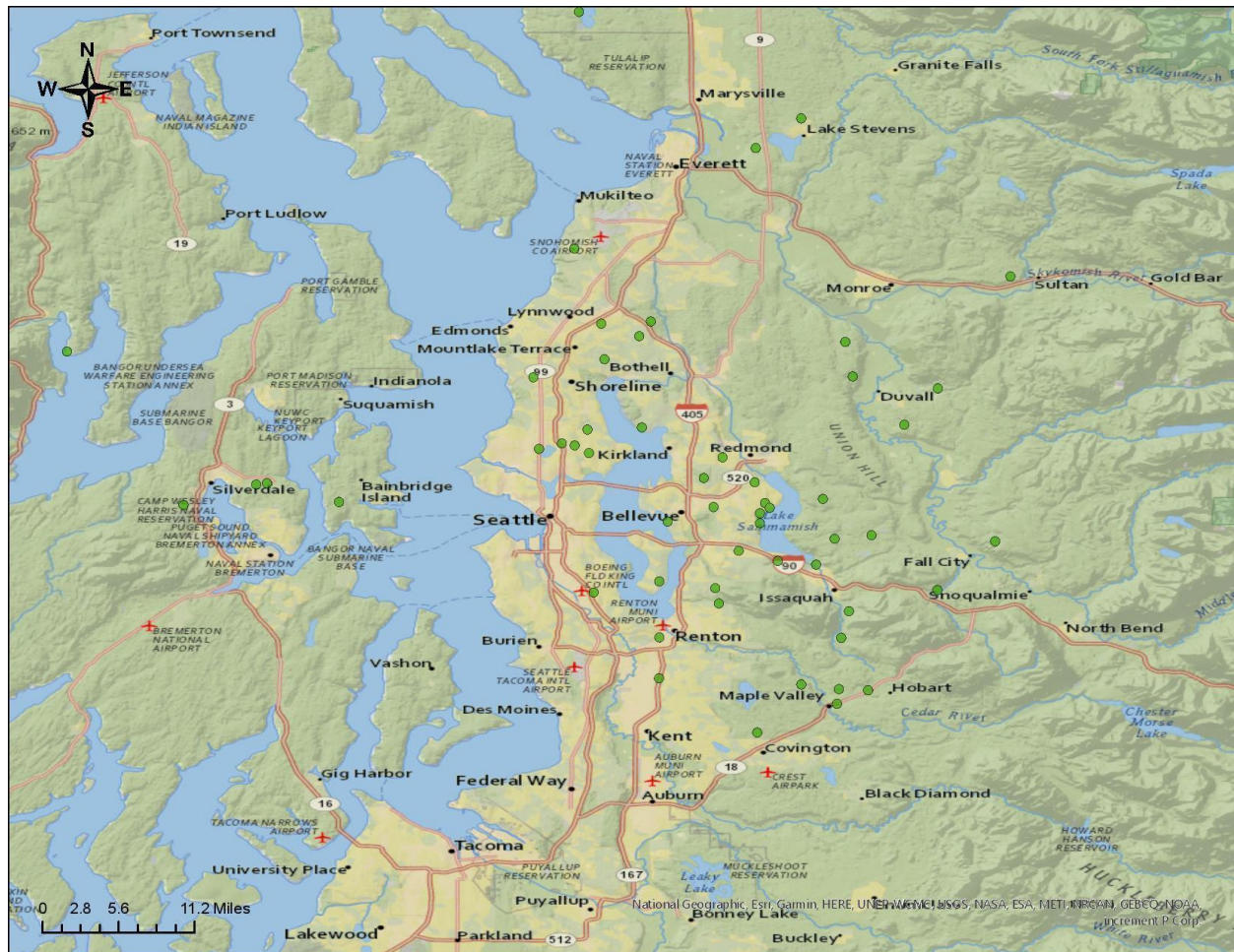




Appendix V:Geographic distribution of reports indicating sightings of black bear.

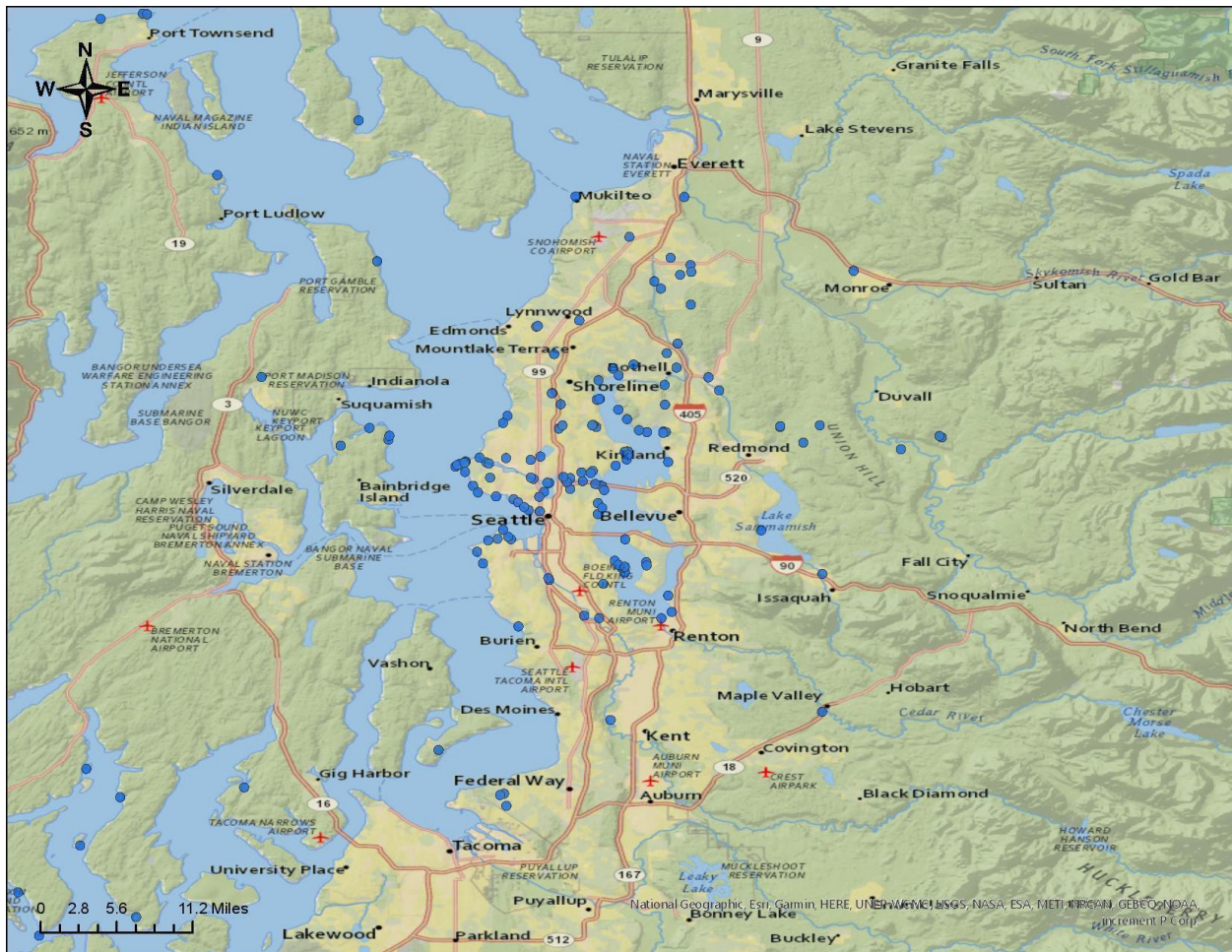


## Appendix VI: Geographic distribution of reports indicating sightings of cougars.





## Appendix VII: Geographic distribution of reports indicating sightings of river otters.

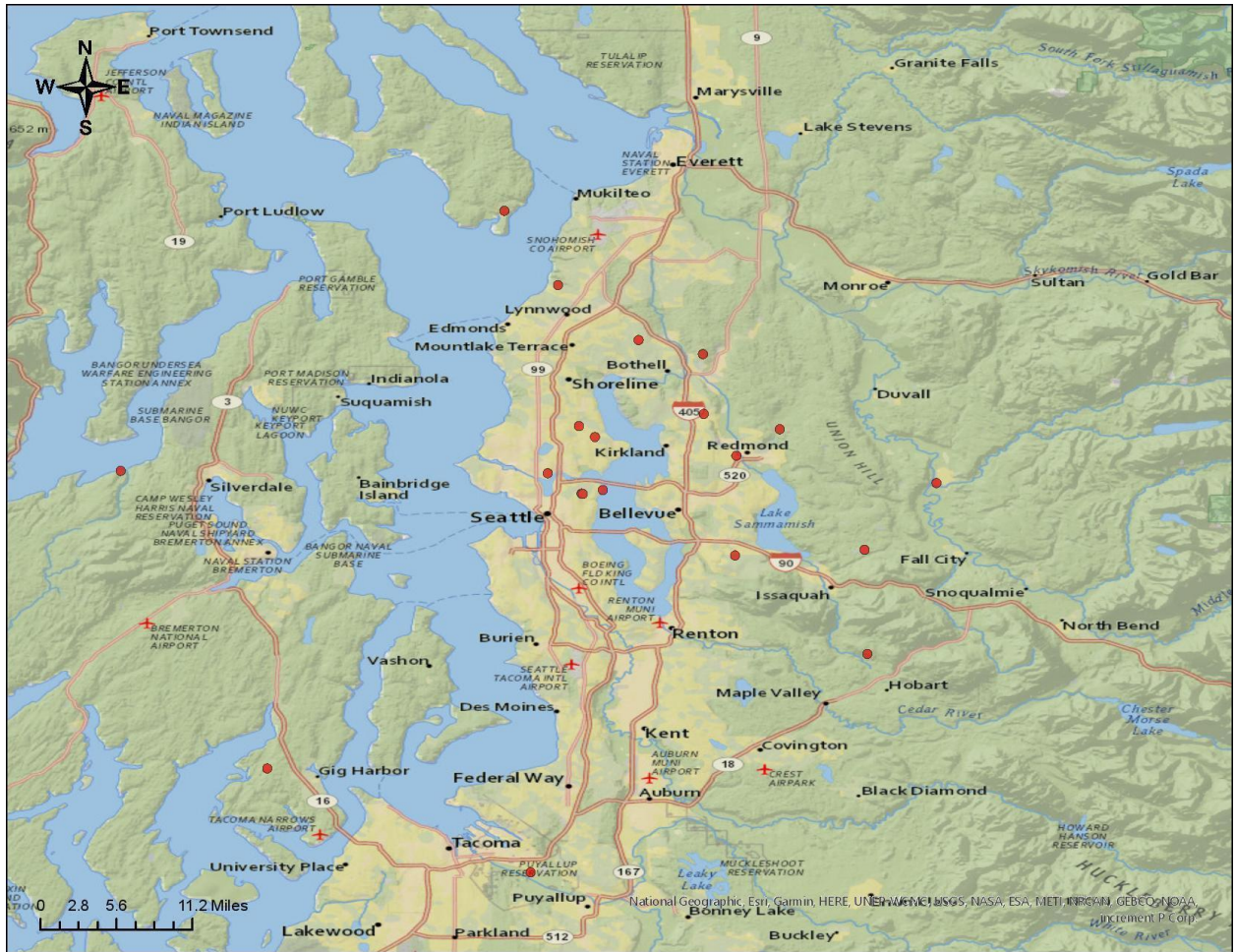


Appendix VIII: Geographic distribution of reports indicating sightings of opossum.

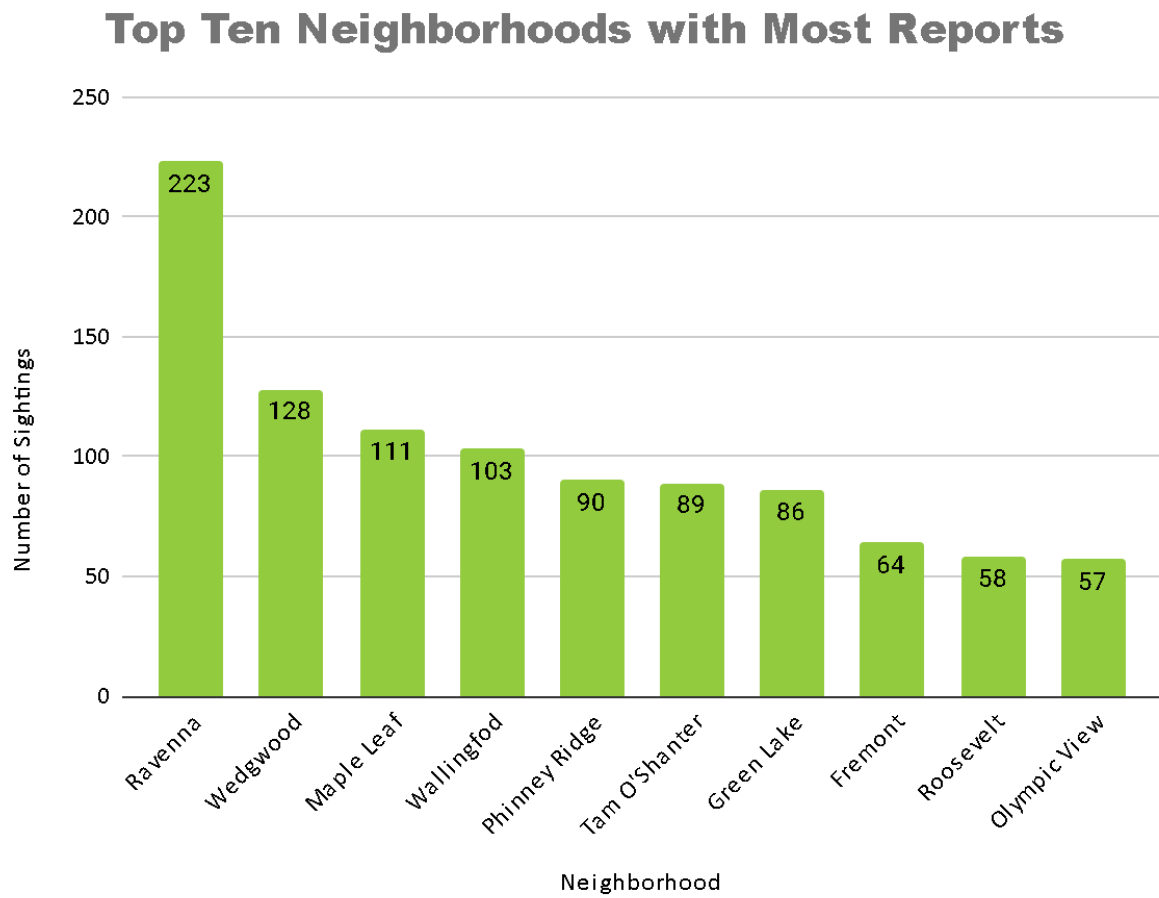




## Appendix IX: Geographic distribution of reports indicating sightings of red fox.



Appendix X: Bar chart of the top 10 Seattle neighborhoods with the most reports.



Appendix XI: Examples of language used in comments that expressed either a positive or negative sentiment toward the carnivore.

Negative	Positive
fear	coexist
afraid	hope
worried	cool
nervous	beautiful
concerned	good
aggressive	excited
animal control	great
danger	enjoy
hate	adorable
uncomfortable	cute
deter	okay
get rid	:)
pest	magical
issue	wonderful
:(	
unsafe	
911	