Team B
28 February 2024

Early Insights Report on 311 Animal Complaint Trends

This report provides a preliminary analysis of animal complaint trends over the past decade, focusing on the past 2-3 years and the previous 5-10 years. By examining the frequency of reports and identifying the types of animals most commonly involved in complaints, we aim to offer early insights that can assist in understanding broader trends and inform future investigations.

The analysis is structured around the following key questions:
1. How many reports were filed in the previous 2-3 years and 5-10 years, and are there any discernible trends in these reports, such as increases or decreases in total numbers?
2. What types of animals are most commonly reported in complaints?

We hypothesized that:
- There has been an **overall increase** in reports over the past decade, possibly due to increased urbanization, awareness, or reporting mechanisms.
- Certain animals, such as **rats** and **domestic pets**, will be more commonly reported due to their proximity to human habitats.

Our research began with a detailed extraction of data from the Analyze Boston 311 service request logs, focusing exclusively on animal-related complaints. We refined the data for precision, addressing misclassifications and removing duplicate entries. The data was then organized to showcase the reports received each year and sorted by the type of animal involved in the complaints. To provide a clear visual understanding of the data, we created time-series graphs to display the progression of report volumes over time and bar charts to represent the frequency of complaints for each animal category. These visual tools were fundamental to our initial statistical examination, effectively bringing the trends and notable shifts throughout the examined periods to light.

To visualize the trend of animal-related complaints in Boston over the past decade and to answer our first question, we created two graphs: a scatter plot and a bar graph. Figure 1 offers a visual timeline, with individual data points for each year from 2013 to 2023, allowing us to observe the trajectory of report volumes. Figure 2 provides a clear, year-by-year comparison of the number of reports, making the annual increases or decreases immediately apparent. Both graphs draw on the same yearly data, beginning with 5,530 reports in 2013 and showing a steady escalation to 17,070 reports by 2023.

From these visualizations, we can observe a discernible upward trend in animal-related complaints over the eleven years. This is particularly evident in Figure 1, where the ascending line of best fit underscores the overall increase. Figure 2 reinforces this insight.
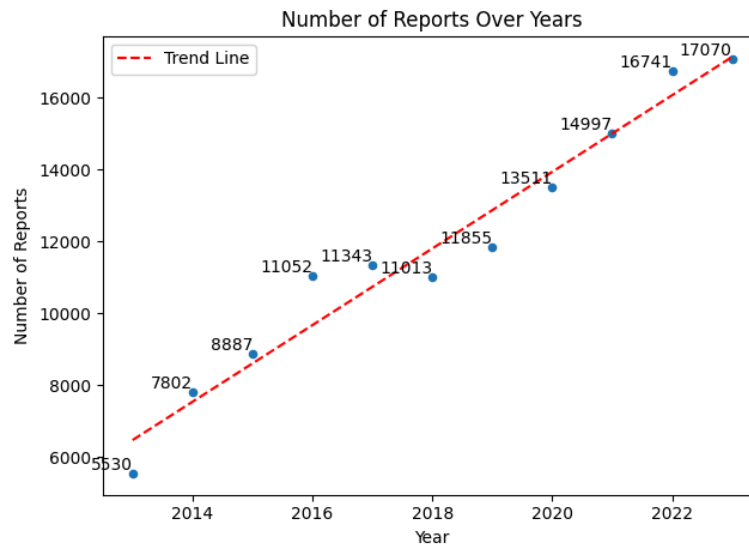

Figure 1. This scatter plot shows a clear ascending trend in animal-related complaints in Boston from 2013 to 2023, with a trend line highlighting the steady increase in reports over time.
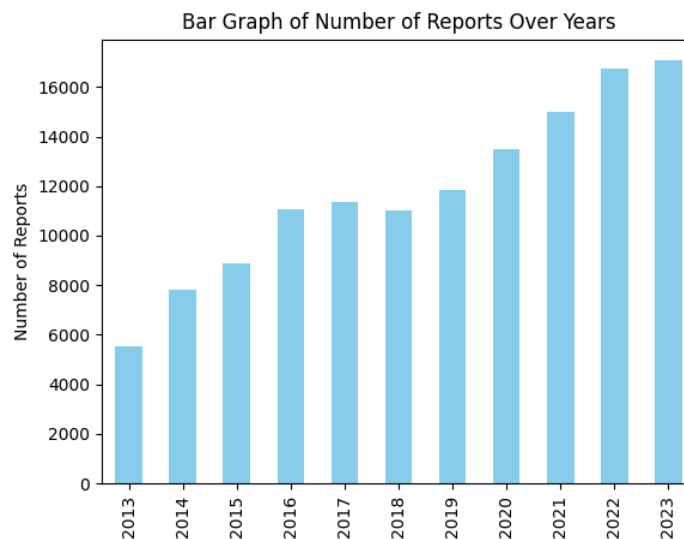

Figure 2. The bar graph illustrates a consistent year-over-year rise in animal-related complaints, with a notable surge in reports starting from 2020.

To ascertain the significance of our findings from the visual data analysis, we conducted a linear regression with our results shown in Figure 3. The regression, with an R-squared value of 0.957, suggests that approximately 95.70% of the variance in the annual report counts can be explained by the year alone, which indicates a solid fit of the model to the data. The positive coefficient for the year (1065.60) confirms that each passing year is associated with an average increase of approximately 1066 reports. The F-statistic is highly significant ($p < 0.001$), reinforcing the reliability of the trend observed. This regression model underscores the consistent growth in animal-related complaints over the years, which could indicate underlying factors such as increasing urban wildlife populations or heightened public awareness and reporting.

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                        OLS Regression Results
==============================================================================
Dep. Variable:                 Reports   R-squared:                       0.957
Model:                             OLS   Adj. R-squared:                  0.952
Method:                  Least Squares   F-statistic:                     200.6
Date:                 Tue, 27 Feb 2024   Prob (F-statistic):           1.85e-07
Time:                         13:03:17   Log-Likelihood:                -87.883
No. Observations:                   11   AIC:                             179.8
Df Residuals:                        9   BIC:                             180.6
Df Model:                            1
Covariance Type:             nonrobust
==============================================================================
                 coef    std err          t      P>|t|      [0.025      0.975]
------------------------------------------------------------------------------
const        -2.139e+06   1.52e+05    -14.087      0.000   -2.48e+06    -1.8e+06
Year          1065.6000     75.227     14.165      0.000     895.424    1235.776
==============================================================================
Omnibus:                         0.199   Durbin-Watson:                   1.212
Prob(Omnibus):                   0.905   Jarque-Bera (JB):                0.369
Skew:                            0.199   Prob(JB):                        0.832
Kurtosis:                        2.196   Cond. No.                     1.29e+06
==============================================================================
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Table 1. This linear regression output table validates the significant yearly increase in animal complaint reports, with a high R-squared value indicating the model's explanatory solid power for the trend observed from 2013 to 2023.

We also created graphs to clearly depict the types of animals most frequently reported in complaints. Figure 3 renders a comparative perspective on the frequency of each animal category, providing a straightforward ranking by count. Complementing this, Figure 4 offers a proportional breakdown, showcasing the relative contribution of each animal category to the overall complaint tally.

We can discern valuable insights from the provided data regarding the prevalence of specific animal complaints. The most reported animal is the rat, with 4,964 instances, closely followed by dogs at 4,793 and mice at 4,529, indicating a significant concern with rodents in the city. The

considerably high count for bed bugs at 2,682 and birds at 2,340 also highlights the diversity of animal-related issues faced by the community. These figures reflect public health and nuisance concerns and may also suggest patterns in urban wildlife populations or the effectiveness of local animal control measures.
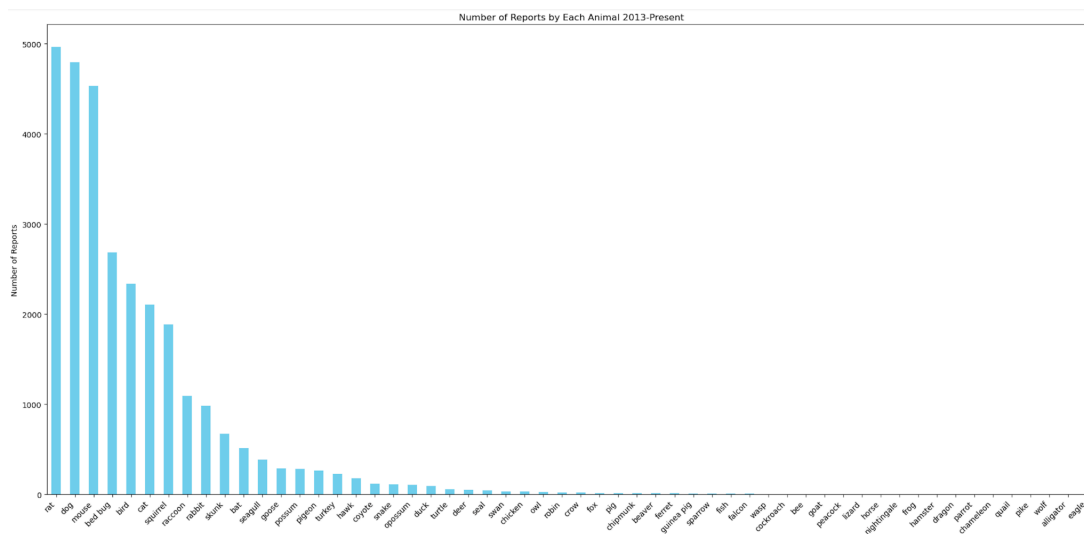

Figure 3. This bar graph illustrates the frequency of animal-related complaints, highlighting rats, dogs, and mice as the most commonly reported issues over the selected time frame.

Figure 4. The pie chart visually represents the proportion of each animal category in the total number of complaints, with rats, dogs, and mice making up the most significant segments.

The in-depth analysis of animal-related complaints recorded in the Analyze Boston 311 service requests provides a statistical overview of the trends. It significantly impacts the city's public services and urban planning initiatives. The upward trajectory in complaints, particularly with rats leading the reports, signals a pressing need for more targeted rodent control and public health strategies. These insights could potentially aid the city of Boston in several ways:

1. **Resource Allocation:** The consistent increase in animal-related complaints calls for a reevaluation of resource allocation for city services. Departments could use this data to justify budget adjustments and push for more effective pest control, animal control, and public health interventions.
2. **Public Health Initiatives:** The significant number of rodent-related complaints underscores the potential risks to public health. This data could inform the design and implementation of comprehensive public health campaigns to educate the public on preventive measures and to mitigate the risks associated with urban wildlife.
3. **Urban Planning:** Insight into the types of animals commonly reported in complaints could influence urban planning decisions. Understanding the specific challenges posed by different animal populations can lead to integrating wildlife management considerations into the planning of green spaces, waste management systems, and housing developments.

Our current analysis provides a quantitative measure of the rise in animal-related complaints. Yet, it does not address the qualitative aspects of these encounters, such as the severity of incidents or the satisfaction with the city's response. It remains unclear how changes in urban landscapes, climate patterns, or community behaviors may influence these trends.

Moving forward, our study could benefit from integrating geographic information system (GIS) data to spatially analyze the distribution of complaints, which could reveal hotspots and inform targeted interventions. Additionally, engaging in species-specific behavior studies could show why certain animals are more frequently reported and how urban adaptation influences animal behavior. Understanding public perception and the social factors in reporting animal encounters can also provide a deeper context for the raw data.

A significant methodological challenge we faced was that many complaints had no closure reason we could parse through to identify the animal involved. Our data is primarily collected by parsing for animal names in the "closure reasons", as this field usually contains the animal name. However, for some reports, the closure reason was blank, preventing us from identifying an animal name. This limitation could have skewed our data toward the animals whose names were explicitly mentioned in the closure reason or description, potentially underrepresenting the true

diversity or frequency of animal complaints. Addressing this data collection and analysis gap will be crucial for refining our understanding of animal complaint trends and enhancing the accuracy of our findings.

In conclusion, the data-driven insights provided by our analysis have the potential to significantly influence the operational and strategic decisions made by the city of Boston. By utilizing this information, the city can take a proactive stance in addressing the challenges presented by urban wildlife, ultimately improving the quality of life for its residents and ensuring a healthier coexistence between urban environments and the animals that inhabit them.