

# Final Project: BIO 539

Jessica Zeramby

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## An Exploratory Data Analysis of Wildlife Rehabilitation Records

### Introduction

In recent decades, there has been a surge in interest in studies of human-wildlife conflicts as scientists have become more aware of their importance. According to new research in this field, there may be an underutilized and often overlooked data source that has the potential to provide critical information for understanding human-wildlife interactions that lead to conflicts. Admission records from wildlife rehabilitation facilities, according to modern scholars, could be the tool they've been looking for to characterize human impacts on wildlife and better understand human-wildlife conflicts. The following analysis was performed to provide evidence in support of this theory.

The Wildlife Rehabilitators Association of Rhode Island, or WRARI, is a non-profit organization based in Rhode Island that promotes understanding, education, and respect for all Rhode Island wildlife. The WRARI headquarters, located in southern Rhode Island, also serves as the state's only fully operational wildlife veterinary clinic. The wildlife clinic has taken in thousands of injured, orphaned, and displaced wildlife in need of veterinary care over the last twenty-five years and worked to rehabilitate them for successful release back into the wild. The WRARI and RI wildlife clinic staff gave permission for the following analysis to be performed using their annual wildlife intake records from 2014, 2016, 2018, and 2019. They provided annual wildlife admission records for each of the four years of data used in this analysis, with each file containing spreadsheet data logging every animal admitted to the facility that year.

### Research Objectives

The following analysis was centered on four key questions:

1. What are the most common sources of wildlife injury in Rhode Island?
2. Which species in Rhode Island are the most threatened or vulnerable?
3. How many wild animals are admitted to this facility on a regular basis, or what is the average number of wildlife intakes to this facility?
4. Which Rhode Island locations, if any, serve as hotspots for wildlife injury or displacement?

*At the request of the data source, some information was omitted from the following data files prior to inclusion in this analysis. Any personal or private information, as well as any information that is not publicly available, has been excluded from the following data sets.*

## Data Analysis

To begin, each set of annual wildlife admission records was evaluated individually, beginning with the first year of available data, 2014, and ending with the most recent year of available data, 2019.

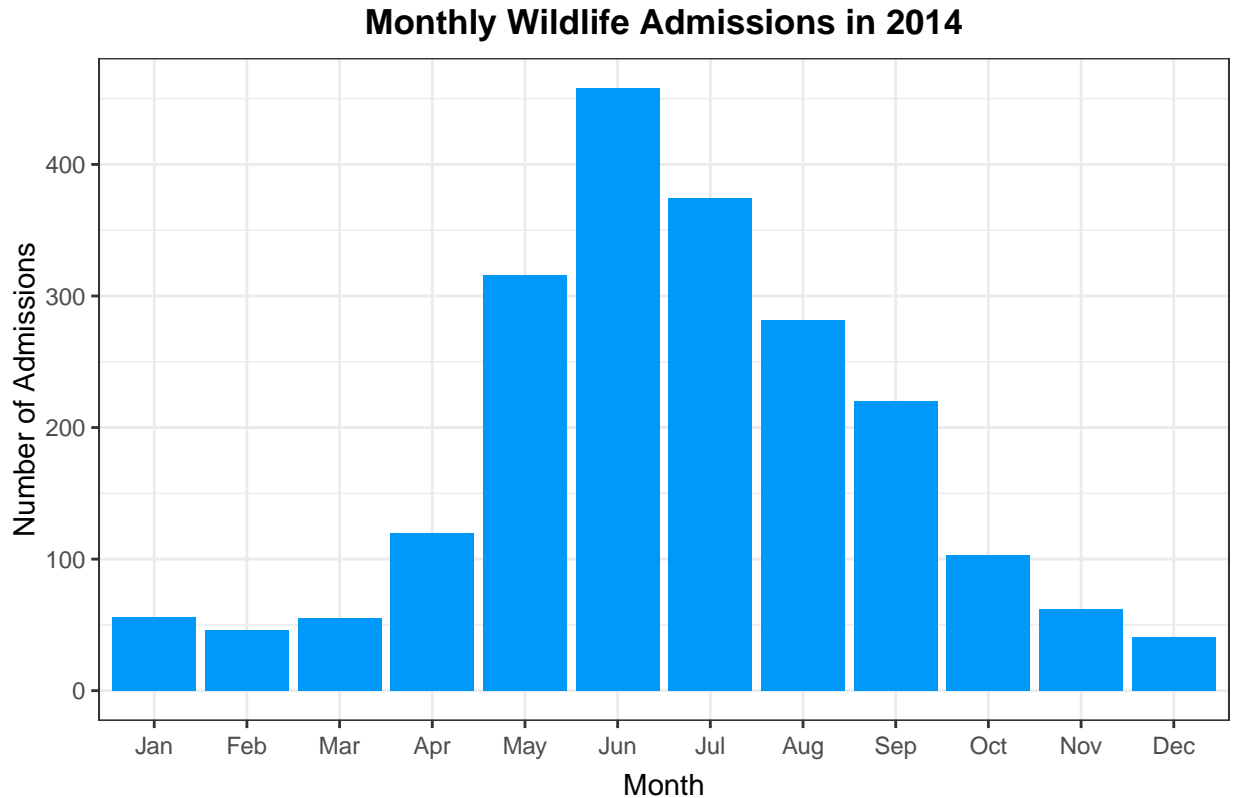
### 2014 Wildlife Admission Records

The 2014 wildlife admission records were first analyzed to calculate the number of clinic admissions for each month of the year.

#### 2014 Monthly Admissions:

Table 1: The number of monthly admissions to the wildlife clinic in 2014.

Month	Admissions
Jan	56
Feb	46
Mar	55
Apr	120
May	316
Jun	458
Jul	374
Aug	282
Sep	220
Oct	103
Nov	62
Dec	41



**Figure 1: The number of monthly admissions to the wildlife clinic in 2014.**

#### Results:

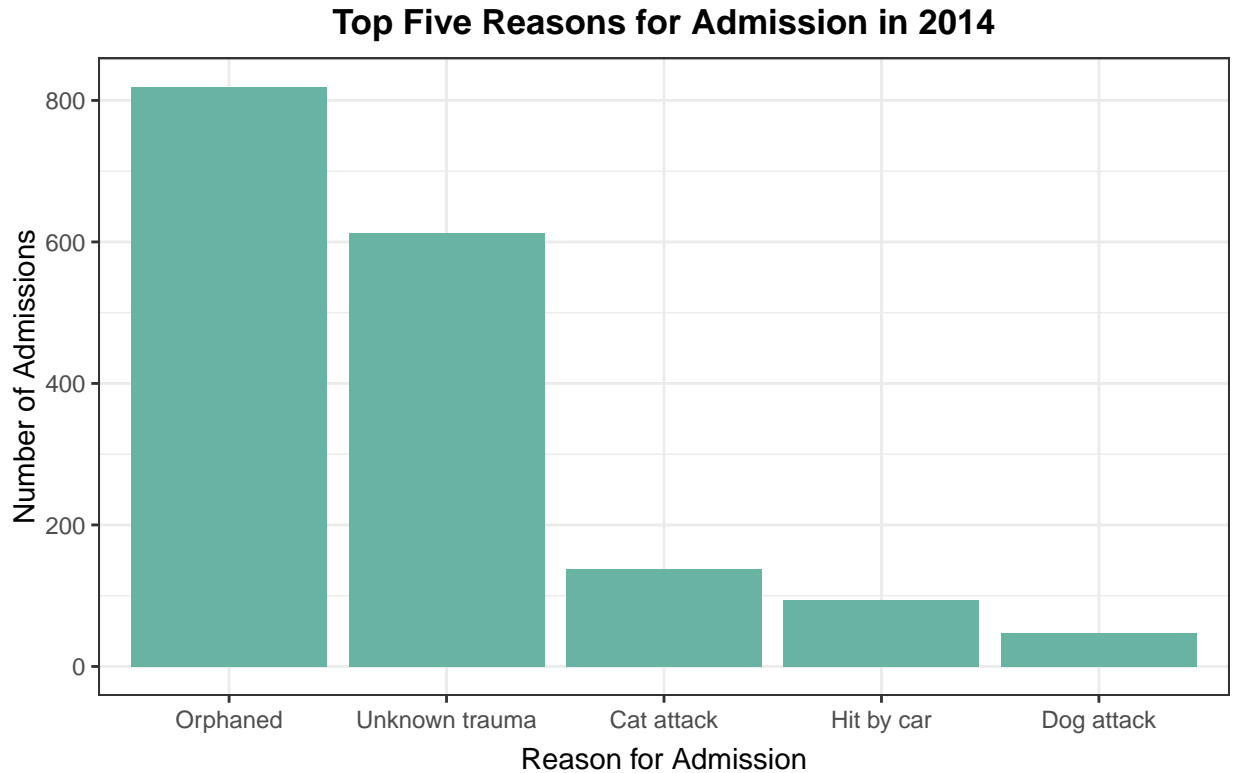
According to these results, the average number of monthly intakes in 2014 was 177 total intakes per month. The month of June had the highest number of intakes in a single month, with 458 total intakes, followed by July, which had the second highest number of intakes per month for the year, with 374 total intakes. After peaking in the summer, the number of monthly intakes began to decline. Admissions fell steadily throughout October and November, reaching a winter low of 41 intakes in December, 56 in January, and 46 in February. According to these patterns, the number of wildlife admissions to this facility appears to follow seasonal trends.

Following this, the 2014 intake records were analyzed to determine the top five reasons for wildlife clinic admissions this year.

#### 2014 Top Five Reasons for Admission:

Table 2: The total number of admissions and percentage of total admissions for each of the top five reasons for admission in 2014.

Reason Admitted	Number of Admissions	Percent of Total Admissions
Orphaned	819	38
Unknown trauma	613	29
Cat attack	138	6
Hit by car	94	4
Dog attack	47	2



**Figure 2: The total number of admissions for each of the top five reasons for admission to the wildlife clinic in 2014.**

#### **Results:**

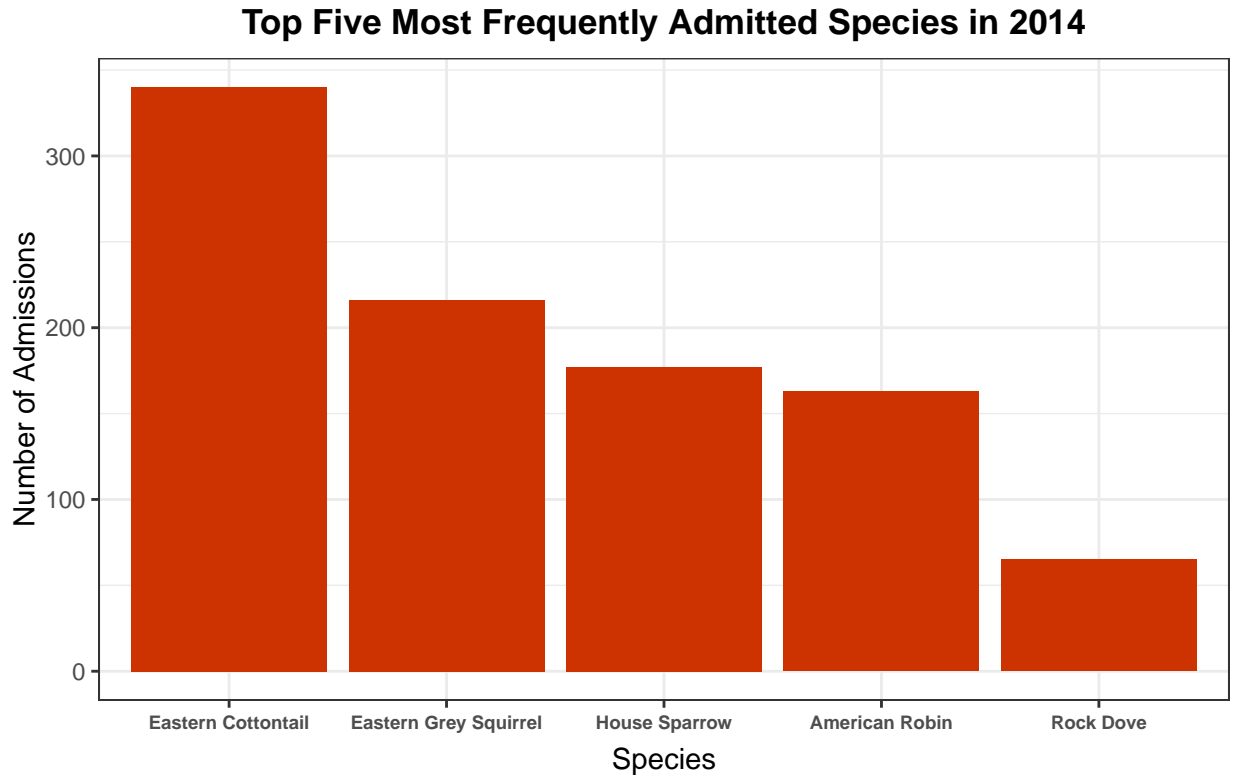
According to these findings, In 2014, the top five reasons for admission to the wildlife clinic accounted for 1,711 of the 2,133 total intakes, or 80 percent of all intakes. Therefore, the top five reasons for admission accounted for more than three-quarters of all clinic admissions in 2014. The most common reason for admission in this year was orphaned wildlife (38%), followed by cases of unknown injuries or trauma (29%), attacks on wildlife by domestic cats (6%), incidents involving animal-vehicle collisions (4%), and attacks on wildlife by domestic dogs (2%).

In the following and final segment of the 2014 individual year data analysis, the top five species that were the most severely impacted and thus frequently admitted to the clinic in 2014 were evaluated.

#### **2014 Top Five Most Frequently Admitted Species:**

Table 3: The number of admissions and percent of total admissions for the top five most frequently admitted species in 2014.

Species	Number of Admissions	Percent of Total Admissions
Eastern Cottontail	340	16
Eastern Grey Squirrel	216	10
House Sparrow	177	8
American Robin	163	8
Rock Dove	65	3



**Figure 3: The top five most frequently admitted species in 2014 and the total number of clinic admissions for each.**

**Results:**

According to these results, the top five most commonly admitted species accounted for 961 of the 2,133 total intakes in 2014, or 45 percent of all intakes in 2014. The Eastern Cotton Tail was the most frequently admitted species, accounting for 16% of all admissions, followed by the Eastern Grey Squirrel (10%), the House Sparrow (8%), the American Robin (8%), and the Rock Dove (3%). According to these findings, of the 168 different species admitted to the clinic in 2014, the top five most frequently admitted species accounted for nearly half of all admissions.

After calculating the number of monthly wildlife admissions, identifying the top five reasons for admission to the clinic, and determining the top five most frequently admitted species over the course of the year, the portion of this analysis specific to the 2014 yearly intake records was completed. The second stage of this investigation involved a similar examination of 2016 wildlife admission records.

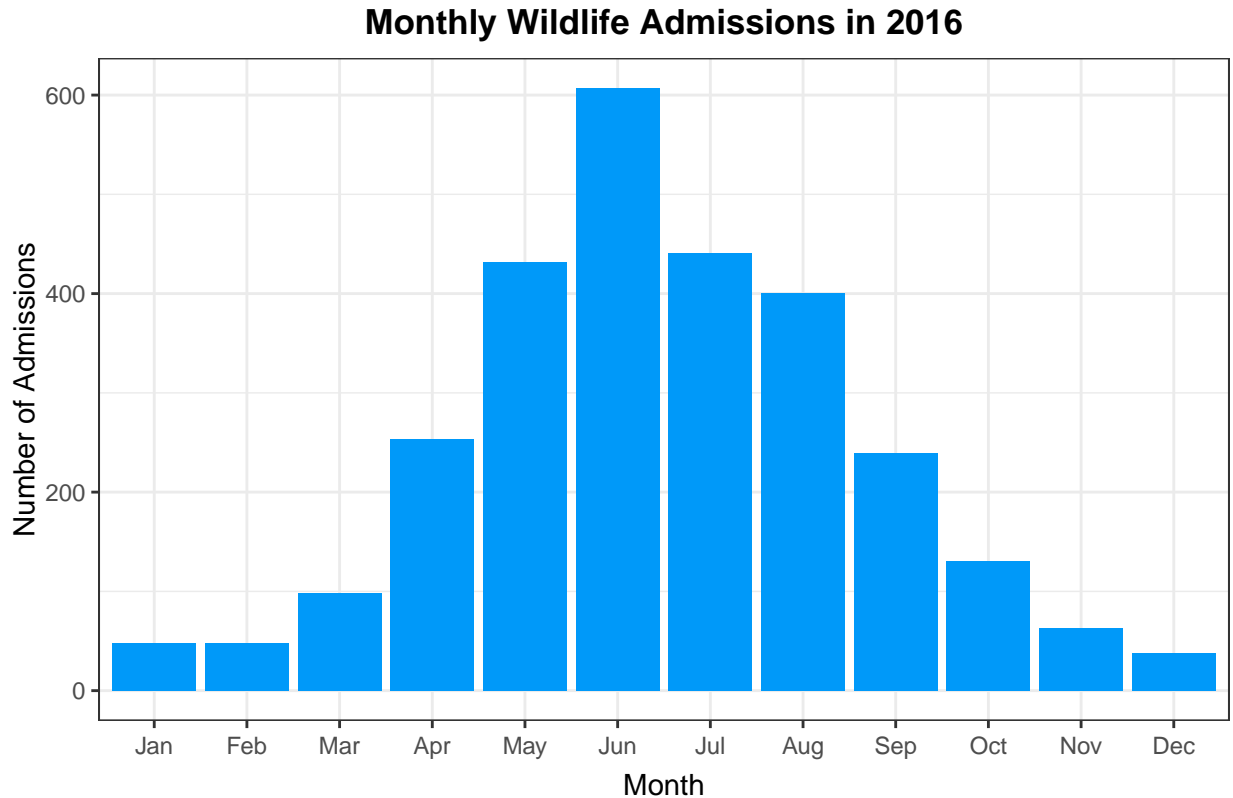
## 2016 Wildlife Admission Records

To begin the analysis of the 2016 wildlife admissions data, the number of intakes to the clinic in each month of the year was determined.

### 2016 Monthly Admissions:

Table 4: The number of monthly admissions to the wildlife clinic in 2016.

Month	Admissions
Jan	48
Feb	48
Mar	98
Apr	253
May	432
Jun	607
Jul	441
Aug	400
Sep	239
Oct	130
Nov	63
Dec	38



**Figure 4: The number of monthly admissions to the wildlife clinic in 2016.**

#### **Results:**

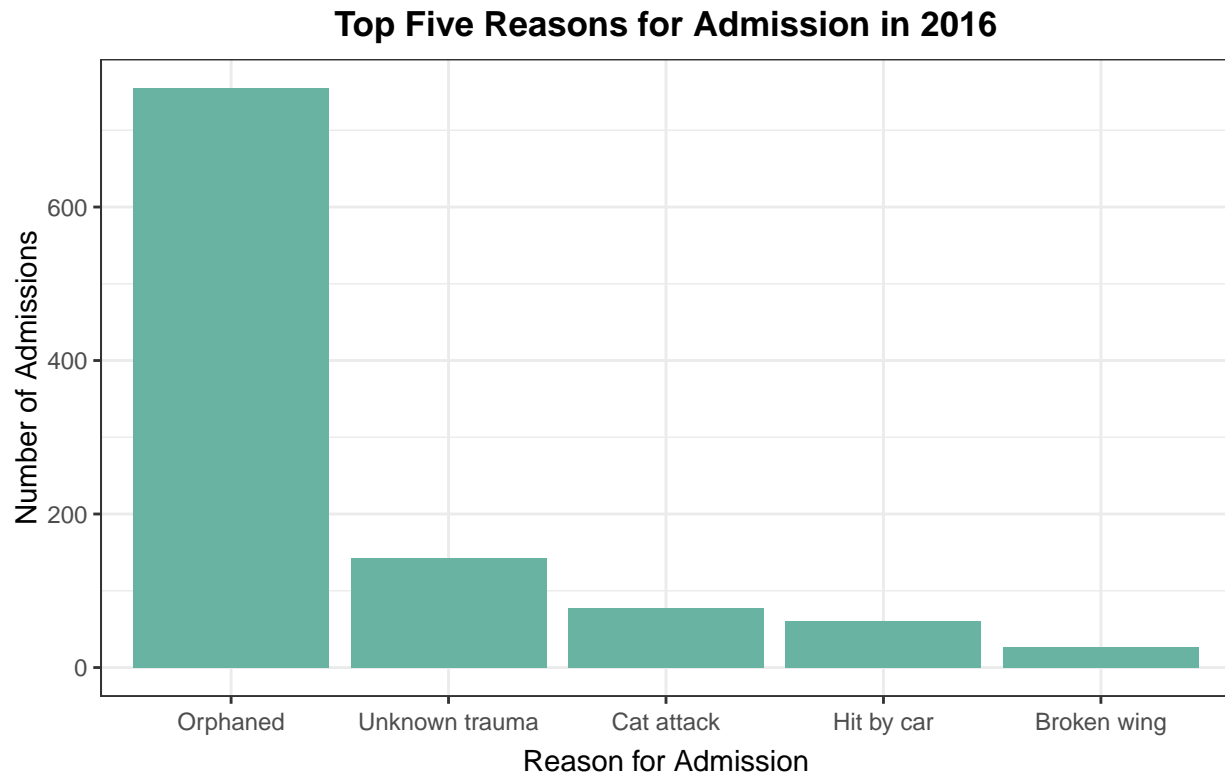
Monthly admissions trends in 2016 appeared to follow seasonal patterns similar to those observed in 2014. Clinic admissions peaked once again between May and August, with June and July continuing to be the busiest months for wildlife admissions, with 607 and 441 admissions per month, respectively. The highest number of admissions in a single month was 607, and the lowest number of admissions in a single month was 38. The total number of admissions per month in 2016 was 233 on average across all months. As shown in Figure 4, the number of monthly admissions decreased steadily from late summer to early fall. Admissions then fell to their lowest point of the year in the winter months of December and January, with only 38 and 48 intakes, respectively, and remained at a steady, relatively low admissions rate throughout the winter.

Following these findings, the 2016 intake records were assessed to determine the top five most common reasons for clinic admission this year.

### 2016 Top Five Reasons for Admission:

Table 5: The total number of admissions and percentage of total admissions for each of the top five reasons for admission in 2016.

Reason Admitted	Number of Admissions	Percent of Total Admissions
Orphaned	755	27
Unknown trauma	143	5
Cat attack	78	3
Hit by car	61	2
Broken wing	27	1



**Figure 5: The total number of admissions for each of the top five reasons for admission to the wildlife clinic in 2016**

### Results:

The five primary reasons for admission to the wildlife clinic accounted for 1,064 of the 2,797 total intakes in 2016, or 38% of all intakes. According to these calculations, the most common reason for admission to the clinic in 2016 was wildlife orphanage (27%), followed by cases of unknown injuries or trauma (5%), attacks on wildlife by domestic cats (3%), incidents involving animal-vehicle collisions (2%), and injuries to wildlife resulting in broken wings (1%).

The next and final step in the 2016 intake record data analysis was to identify the top five species admitted to the clinic this year.

### 2016 Top Five Most Frequently Admitted Species:



Table 6: The number of admissions and percent of total admissions for the top five most frequently admitted species in 2016.

Species	Number of Admissions	Percent of Total Admissions
Eastern Cottontail	351	13
Eastern Grey Squirrel	250	9
House Sparrow	205	7
American Robin	170	6
Mourning Dove	93	3

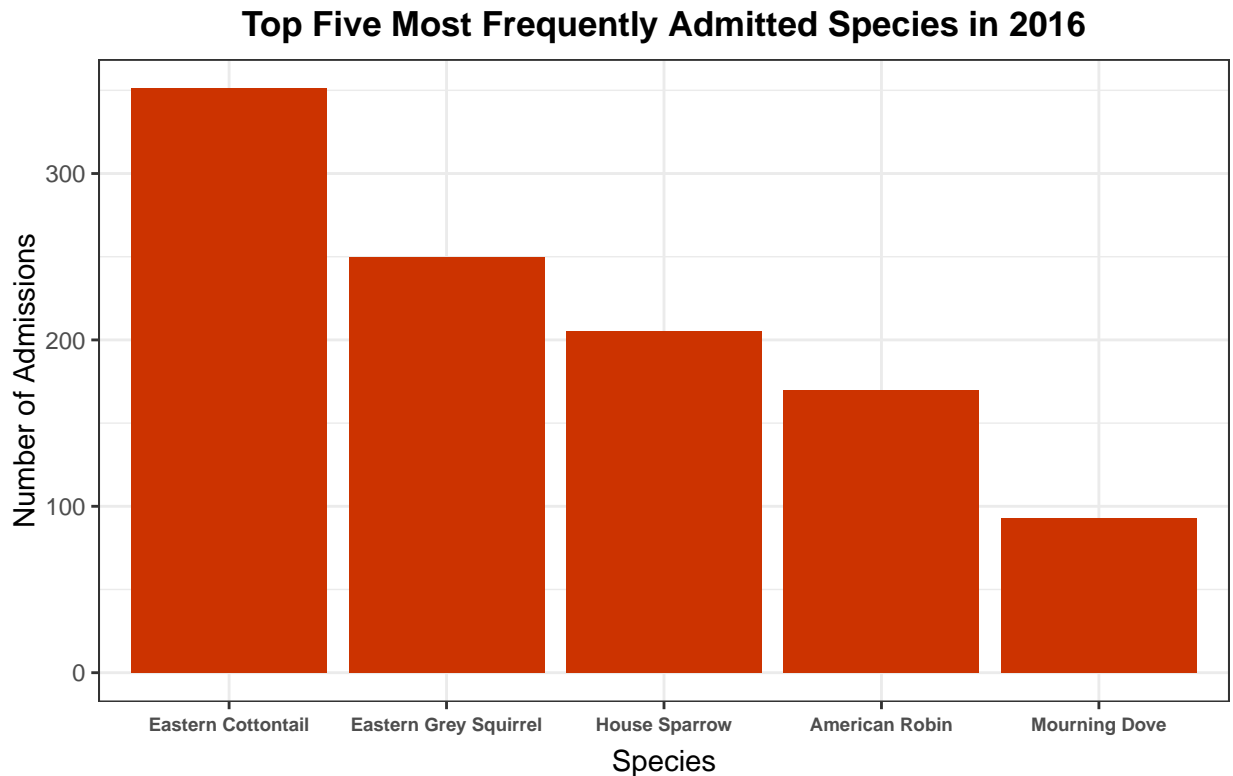


Figure 6: The top five most frequently admitted species in 2016 and the total number of clinic admissions for each.

#### Results:

According to these findings, the top five most commonly admitted species accounted for 1,069 of the 2,797 total intakes, or nearly 40% of all intakes in 2016. The Eastern Cotton Tail was once again the most commonly encountered species at the clinic, accounting for 13% of all admissions, followed by the Eastern Grey Squirrel (9%), the House Sparrow (7%), the American Robin (6%), and the Mourning Dove (3%). Out of the 272 different species admitted to the clinic in 2016, these top five species accounted for nearly 40% of all admissions in this year.

After calculating the number of monthly admissions and identifying the top five reasons for admission to the clinic as well as the five most frequently admitted species in the 2016 admissions analysis, the 2018 admission records were examined.

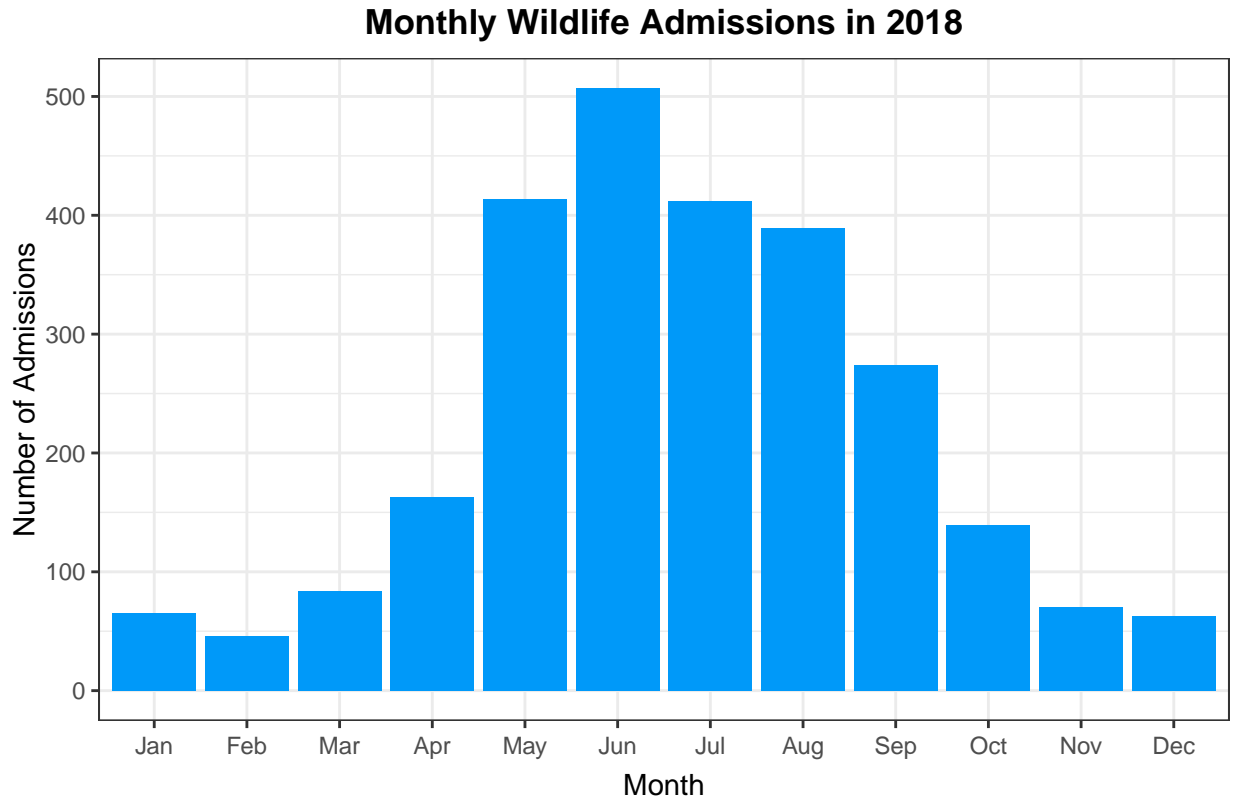
## 2018 Wildlife Admission Records

The first step in analyzing the 2018 wildlife admission records was to determine the number of monthly admissions over the course of the year.

### 2018 Monthly Admissions:

Table 7: The number of monthly admissions to the wildlife clinic in 2018.

Month	Admissions
Jan	65
Feb	46
Mar	84
Apr	163
May	414
Jun	507
Jul	412
Aug	389
Sep	274
Oct	139
Nov	70
Dec	63



**Figure 7: The number of monthly admissions to the wildlife clinic in 2018.**

#### **Results:**

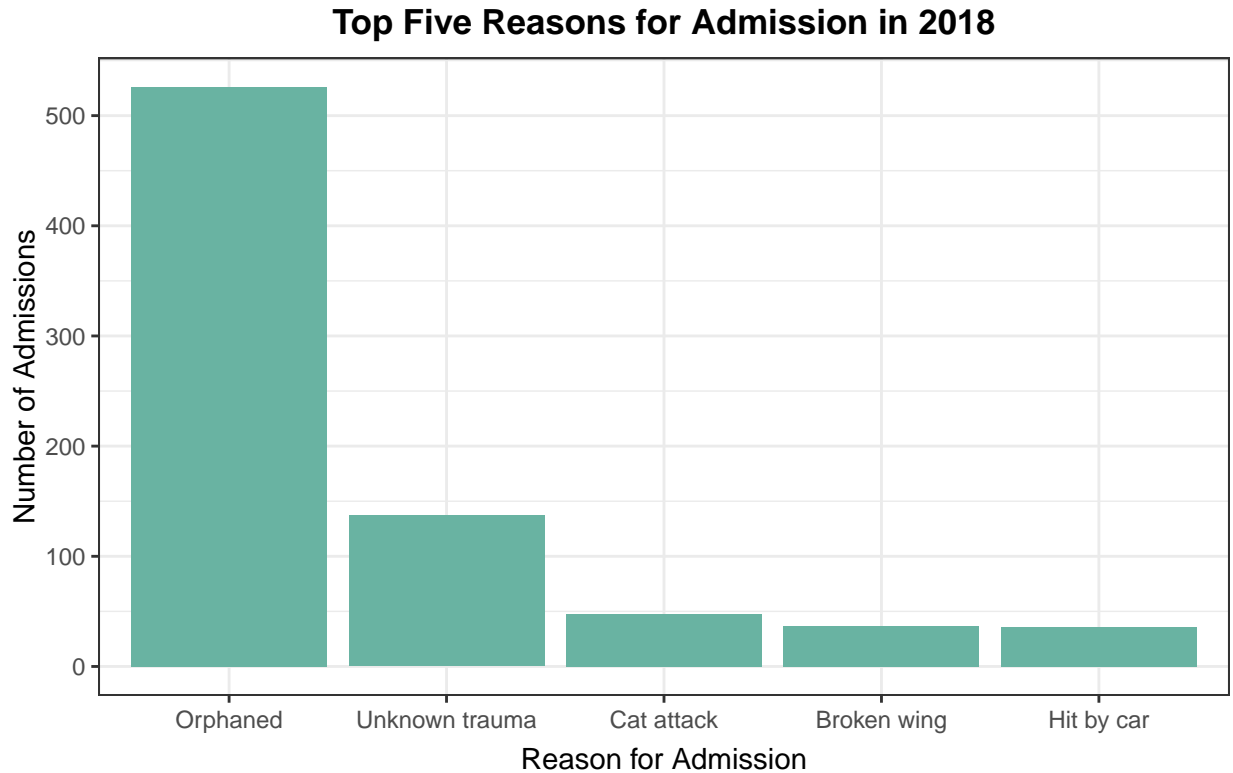
According to these findings, monthly admissions trends in 2018 followed seasonal patterns, as seen in previous years. Admission numbers peaked again between May and August, with June having the most total admissions, with 507 total admissions, and May and July coming in second, with 414 and 412 monthly admissions, respectively. While June had the most monthly admissions, February had the fewest, with only 46 admissions in the entire month. Monthly admission numbers averaged 218 total admissions per month.

Following this section of the analysis, the top five most common reasons for clinic admission in 2018 were next examined.

#### **2018 Top Five Reasons for Admission:**

Table 8: The total number of admissions and percentage of total admissions for each of the top five reasons for admission in 2018.

Reason Admitted	Number of Admissions	Percent of Total Admissions
Orphaned	526	20
Unknown trauma	137	5
Cat attack	48	2
Broken wing	37	1
Hit by car	36	1



**Figure 8: The total number of admissions for each of the top five reasons for admission to the wildlife clinic in 2018**

#### **Results:**

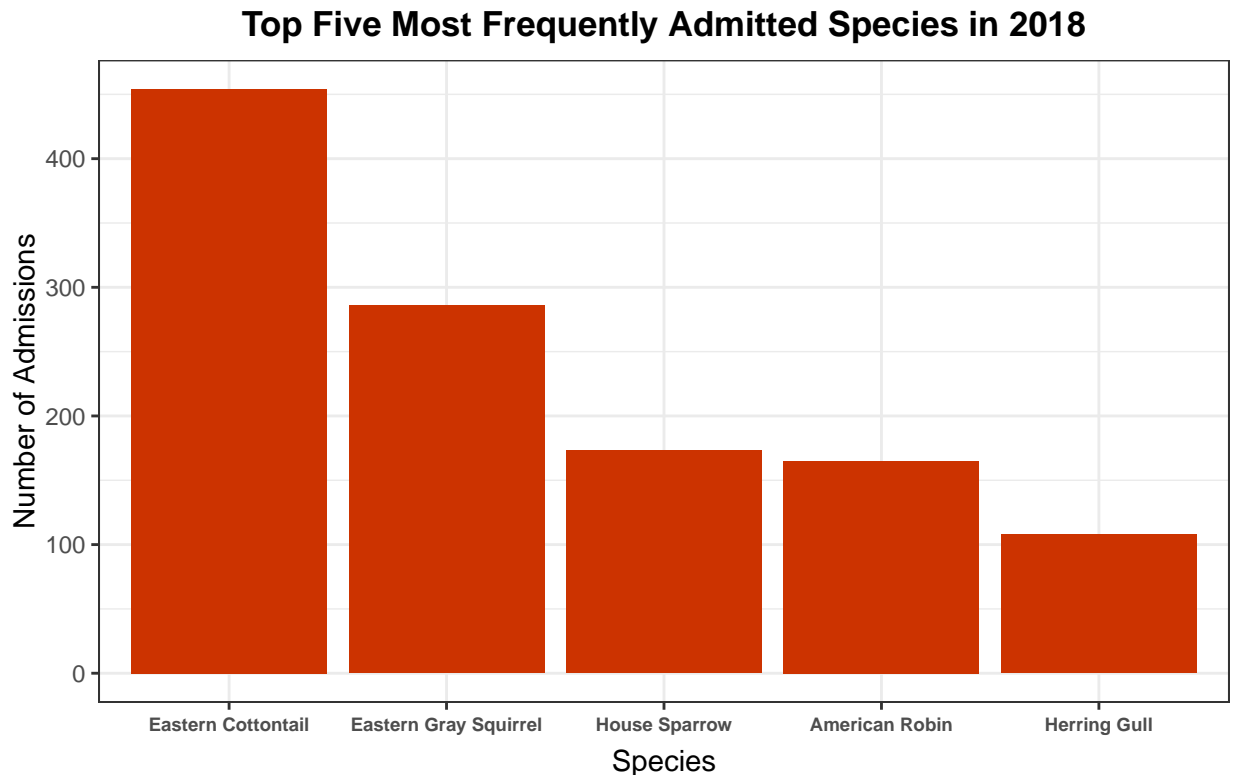
According to these calculations, the five most common reasons for admission to the wildlife clinic accounted for 784 of the 2,626 total intakes in 2018, or 29 percent of all intakes. In 2018, the most common reason for admission was wildlife orphanage (20%), followed by cases of unknown injuries or trauma (5%), attacks on wildlife by domestic cats (2%), injuries to wildlife resulting in broken wings (1%), and incidents involving animal-vehicle collisions (1%).

Finally, the final step in the 2018 admissions analysis was to identify the five most severely impacted species this year, as indicated by the five species most frequently admitted to the clinic this year.

#### **2018 Top Five Most Frequently Admitted Species:**

Table 9: The number of admissions and percent of total admissions for the top five most frequently admitted species in 2018.

Species	Number of Admissions	Percent of Total Admissions
Eastern Cottontail	454	17
Eastern Gray Squirrel	286	11
House Sparrow	173	7
American Robin	165	6
Herring Gull	108	4



**Figure 9: The top five most frequently admitted species in 2018 and the total number of clinic admissions for each.**

**Results:**

According to these findings, the top five most frequently admitted species accounted for 1,186 of the total 2,626 admissions in 2018, or 45 percent of all admissions. This year, the Eastern Cotton Tail was the most frequently admitted species, accounting for 17% of all admissions, followed by the Eastern Grey Squirrel (11%), the House Sparrow (7%), the American Robin (6%), and the Herring Gull (4%). As a result, of the 199 species admitted to the clinic in 2018, admission from the top five most frequently admitted species accounted for 45 percent of all admissions.

The 2018 individual admissions record analysis concluded with these findings. The intake records for 2019 were the following set to be examined in this analysis, as well as the final individual set of yearly records to be evaluated.

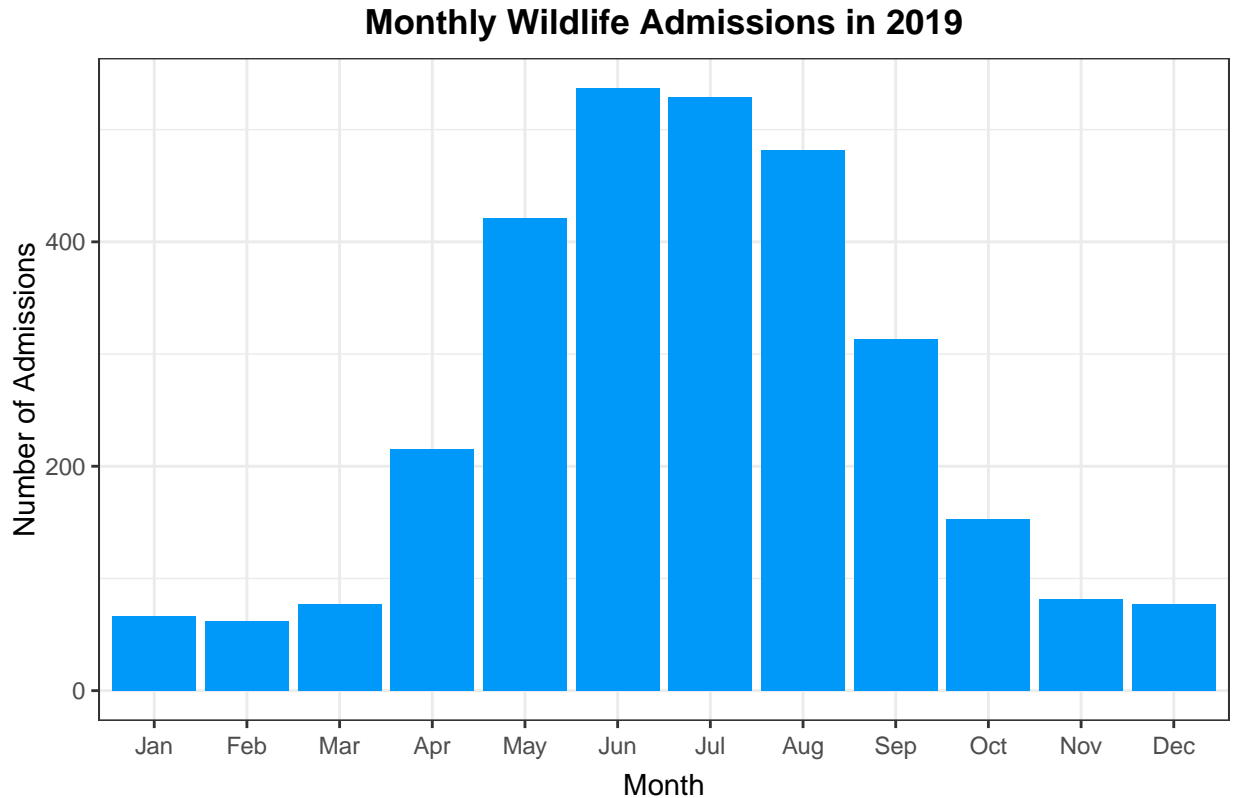
## 2019 Wildlife Admission Records

In this analysis, the final individual set of annual intake records to be evaluated were those from 2019. The first step in analyzing the 2019 intake data, once again, was to determine the number of monthly admissions throughout the year.

### 2019 Monthly Admissions:

Table 10: The number of monthly admissions to the wildlife clinic in 2019.

Month	Admissions
Jan	66
Feb	62
Mar	77
Apr	215
May	421
Jun	537
Jul	529
Aug	482
Sep	313
Oct	153
Nov	82
Dec	77



**Figure 10: The number of monthly admissions to the wildlife clinic in 2019.**

#### **Results:**

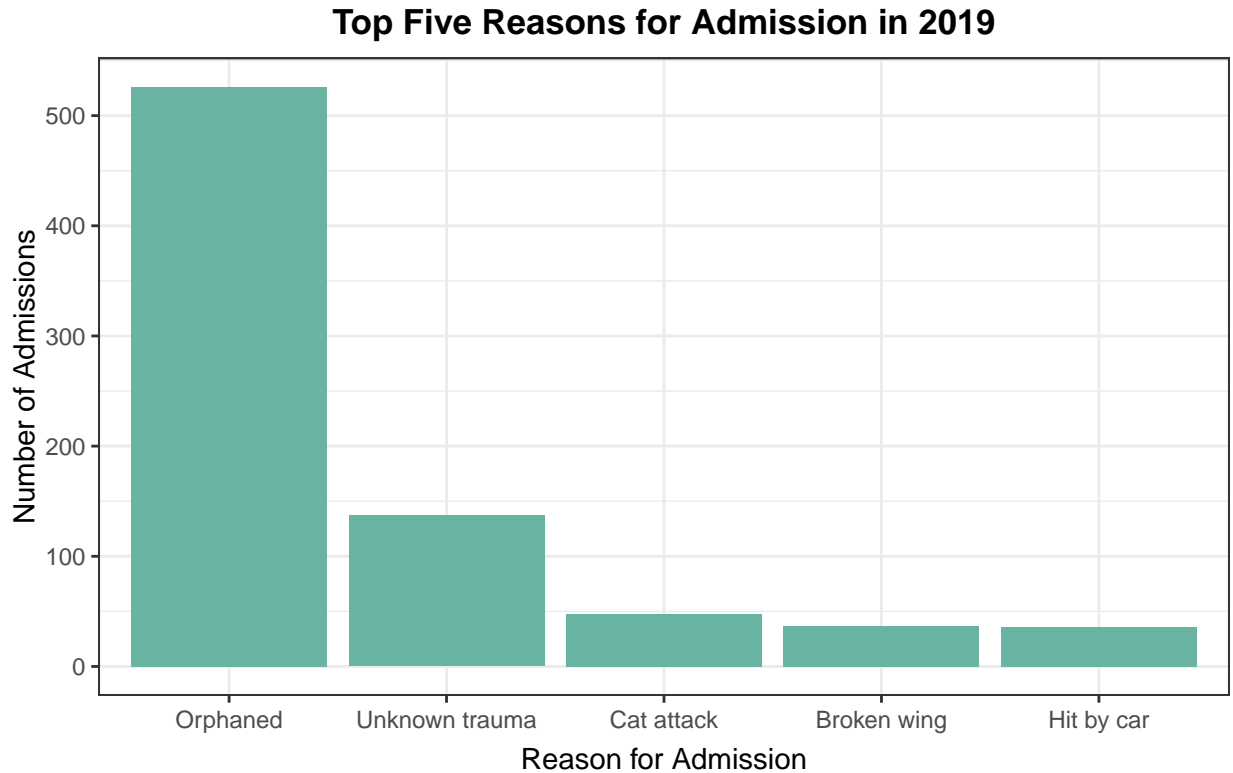
According to these findings, monthly admissions in 2019 followed seasonal patterns, as they had in previous years. Admission numbers peaked between May and August once more, with June being the busiest month for wildlife admissions, followed by July, which had the year's second highest admission count. The month with the highest total number of admissions was June, with 537, and the month with the lowest total number of admissions was February, with 62. Monthly admissions averaged 251 total admissions per month. Throughout the summer, the number of intakes remained close to its peak, with intakes falling just below 500 in August.

The next step, as seen in previous years' analyses, was to identify the top five reasons for clinic admission in 2019.

#### **2019 Top Five Reasons for Admission:**

Table 11: The total number of admissions and percentage of total admissions for each of the top five reasons for admission in 2019.

Reason Admitted	Number of Admissions	Percent of Total Admissions
Orphaned	526	17
Unknown trauma	137	5
Cat attack	48	2
Broken wing	37	1
Hit by car	36	1



**Figure 11: The total number of admissions for each of the top five reasons for admission to the wildlife clinic in 2019.**

#### **Results:**

The top five primary reasons for admission to the wildlife clinic accounted for 784 of the 3014 total intakes in 2019, or 26 percent of all intakes, according to these findings. In 2019, the most common reason for admission was wildlife orphanage (17%), followed by cases of unknown injuries or trauma (5%), domestic cat attacks on wildlife (2%), wildlife injuries resulting in broken wings (1%), and incidents involving animal-vehicle collisions (1%).

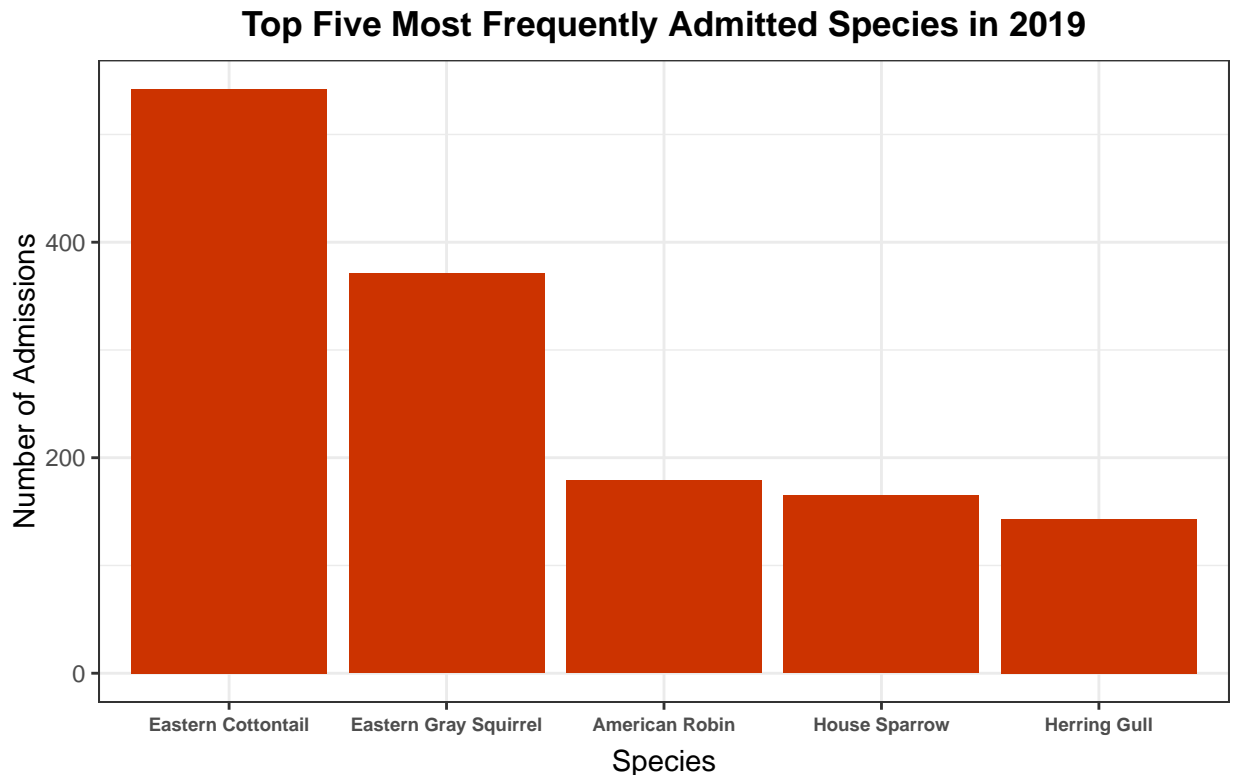
Finally, the top five species that were frequently admitted to the clinic in 2019 were identified in the final segment of the 2019 annual admissions data analysis.

#### **2019 Top Five Most Frequently Admitted Species:**

Table 12: The number of admissions and percent of total admissions for the top five most frequently admitted species in 2019.

Species	Number of Admissions	Percent of Total Admissions
Eastern Cottontail	542	18
Eastern Gray Squirrel	371	12
American Robin	179	6
House Sparrow	165	5
Herring Gull	143	5





**Figure 12: The top five most frequently admitted species in 2019 and the total number of clinic admissions for each.**

**Results:**

In 2019, the top five most commonly admitted species accounted for 1,400 of the total 3,014 admissions, or 46 percent of all admissions. The Eastern Cotton Tail was the most frequently admitted species this year, accounting for 18% of all admissions, followed by the Eastern Grey Squirrel (12%), American Robin (6%), House Sparrow (5%), and Herring Gull (5%). According to these findings, of the 169 different species admitted to the clinic in 2019, the top five most frequently admitted species accounted for 46 percent of all admissions overall.

**These findings brought the section of this analysis specific to each set of individual yearly intake records to a close, completing the yearly intake analyses for 2014, 2016, 2018, and 2019.**

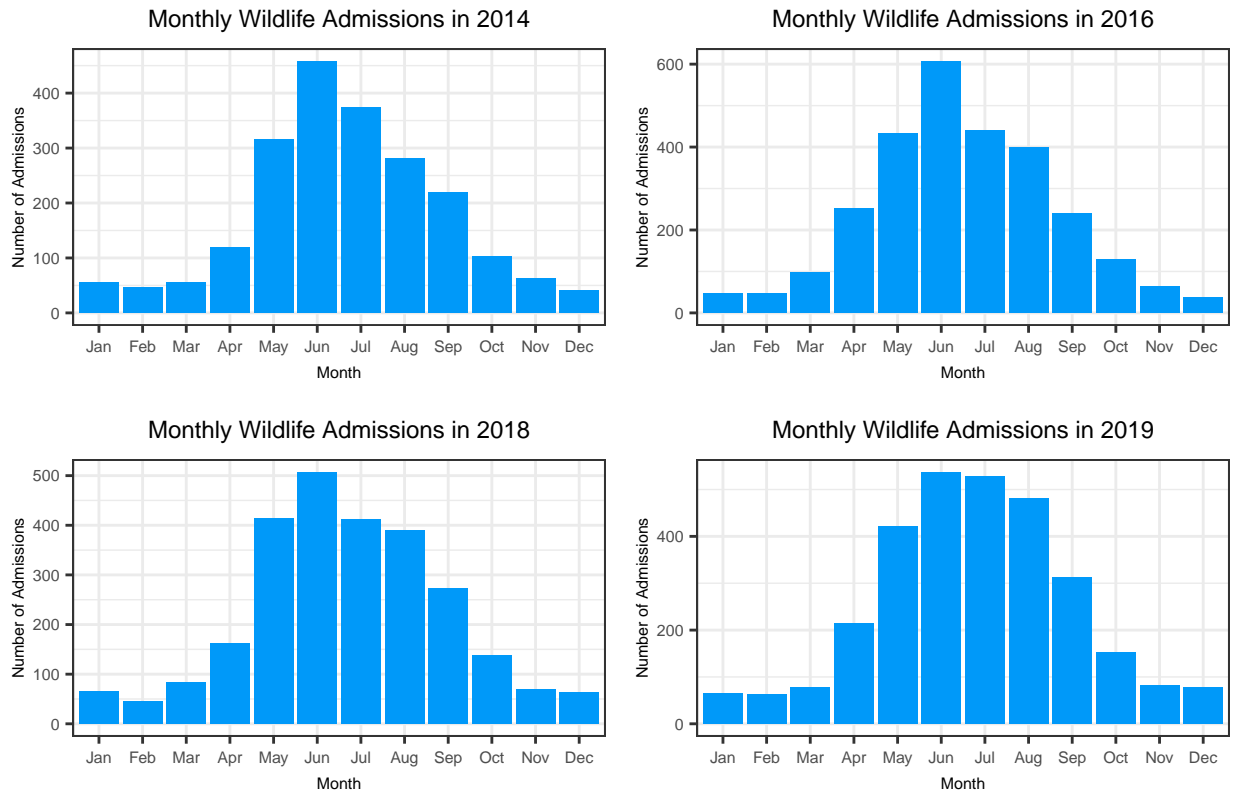
Following this, for each of the figures generated from the individual yearly intake records analyses, correlating figures for all four years of data were placed side by side in order to gain perspective on how trends in clinic admissions may or may not change with time.

## Side-by-Side Wildlife Admission Records

The first figures to be compared from the yearly record analyses were those generated by the number of monthly intakes for each month within each year of intake data.

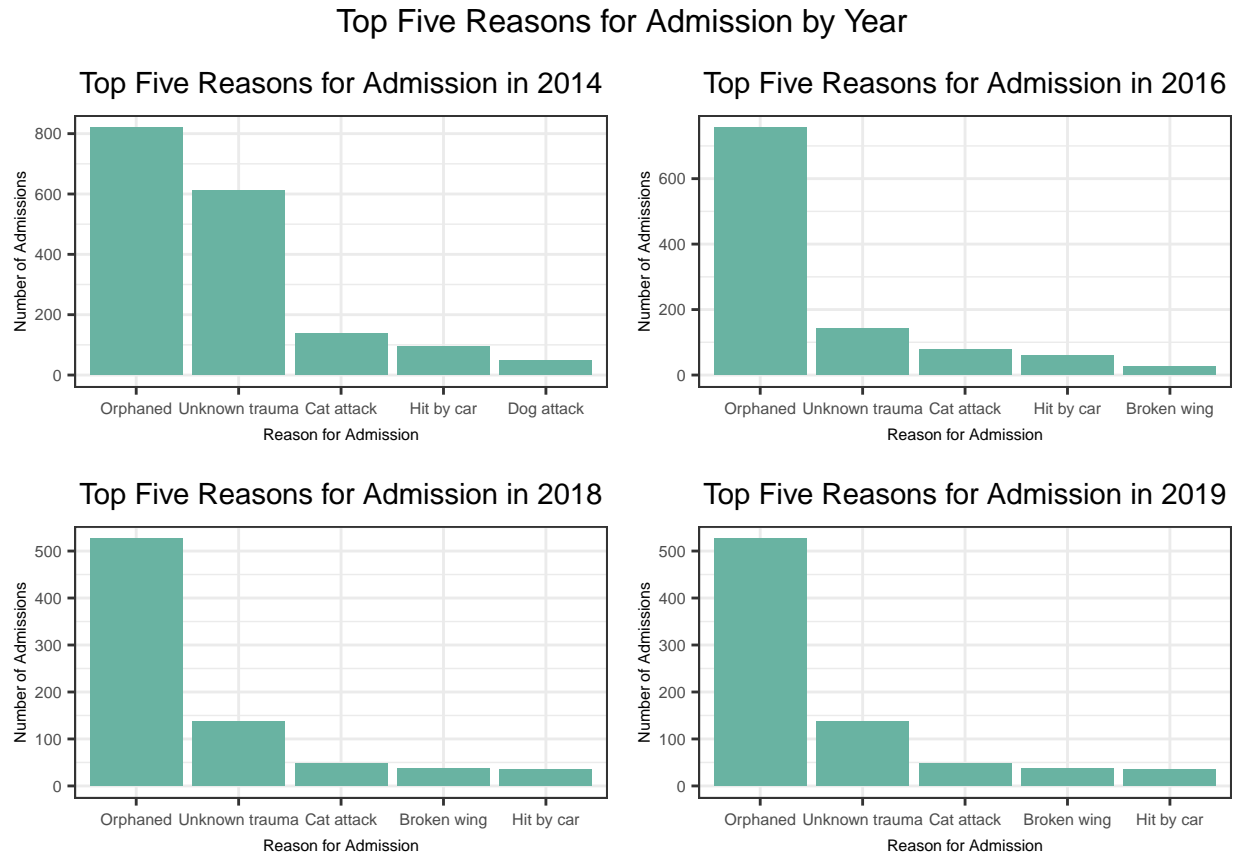
### Side-by-Side Monthly Admissions, 2014-2019, (Figure 13):

#### Monthly Admissions by Year



Following this, the top five reasons for admission plots from each yearly analysis were formatted side by side in order to graphically display trends in the top five most common reasons for clinic admission from 2014 to 2019.

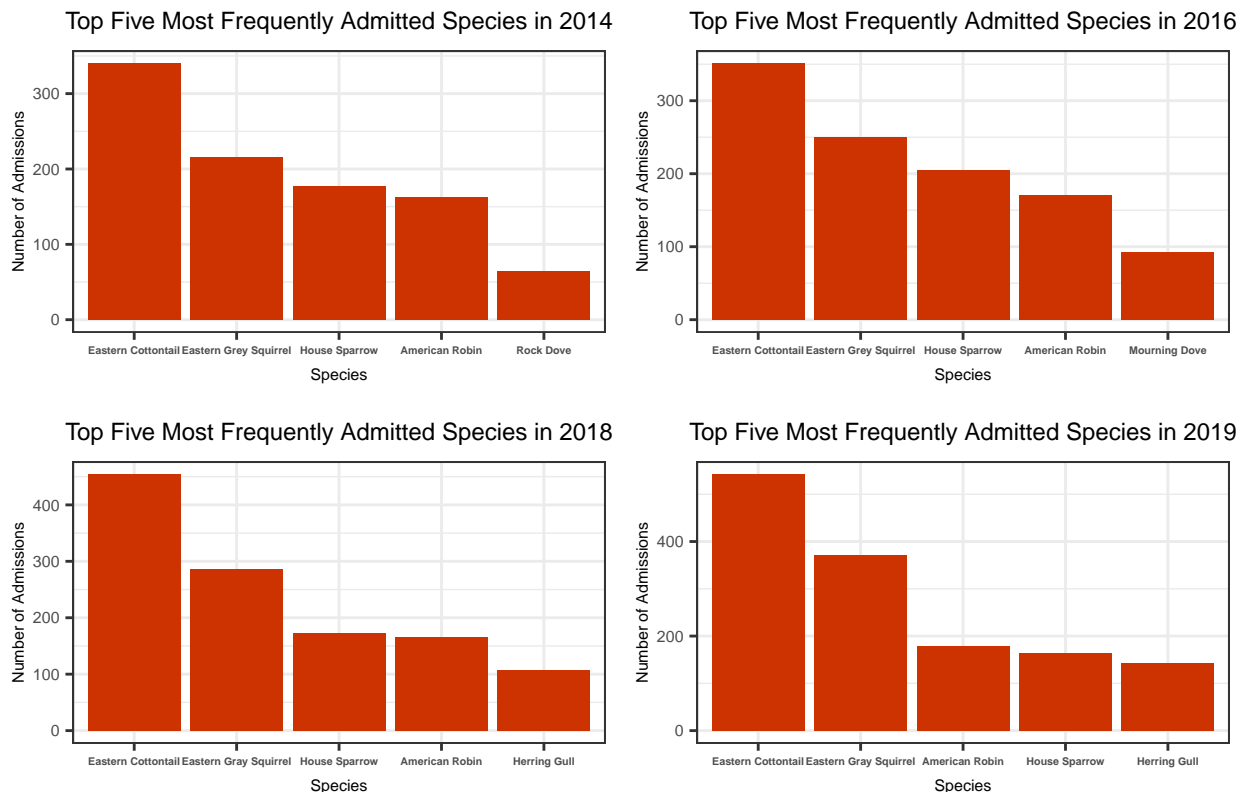
**Side-by-Side Top Five Reasons for Admission, 2014-2019, (Figure 14):**



The final side-by-side comparison in this analysis was for each figure showing the top five most frequently admitted species in each year.

**Side-by-Side Top Five Most Frequently Admitted Species, 2014-2019, (Figure 15):**

**Top Five Common Species by year**



This concluded the side-by-side comparison of the yearly admissions analyses. Following this, all of the intake records from each year were merged into a single data set to analyze admissions trends over time in a different format.

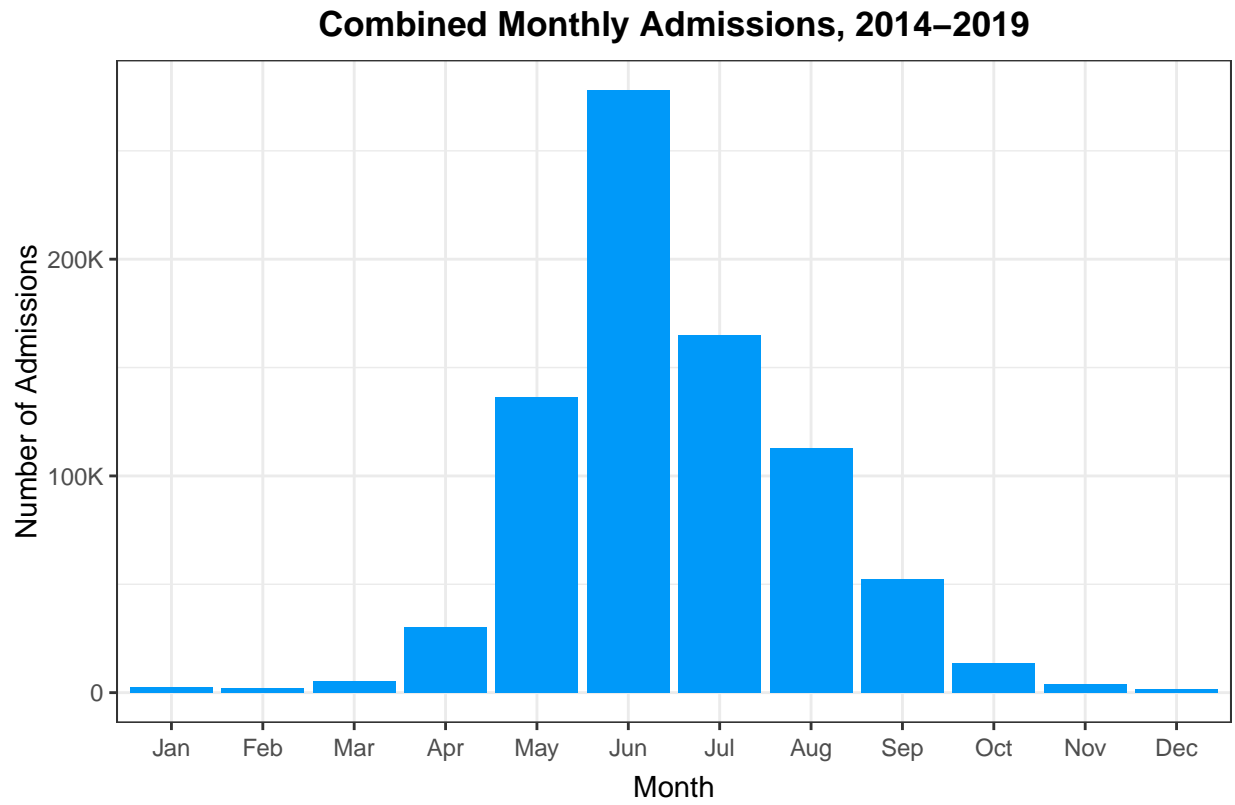
### Merged Wildlife Admission Records

The annual intake records from each year, including 2014, 2016, 2018, and 2019, were combined into a single data file to calculate the total number of admissions across all four years of data in the study period. This merged data set was used to calculate both the number of admissions in each month across all data years and the number of admissions per year across all four years.

#### Combined Total Monthly Admissions, 2014-2019:

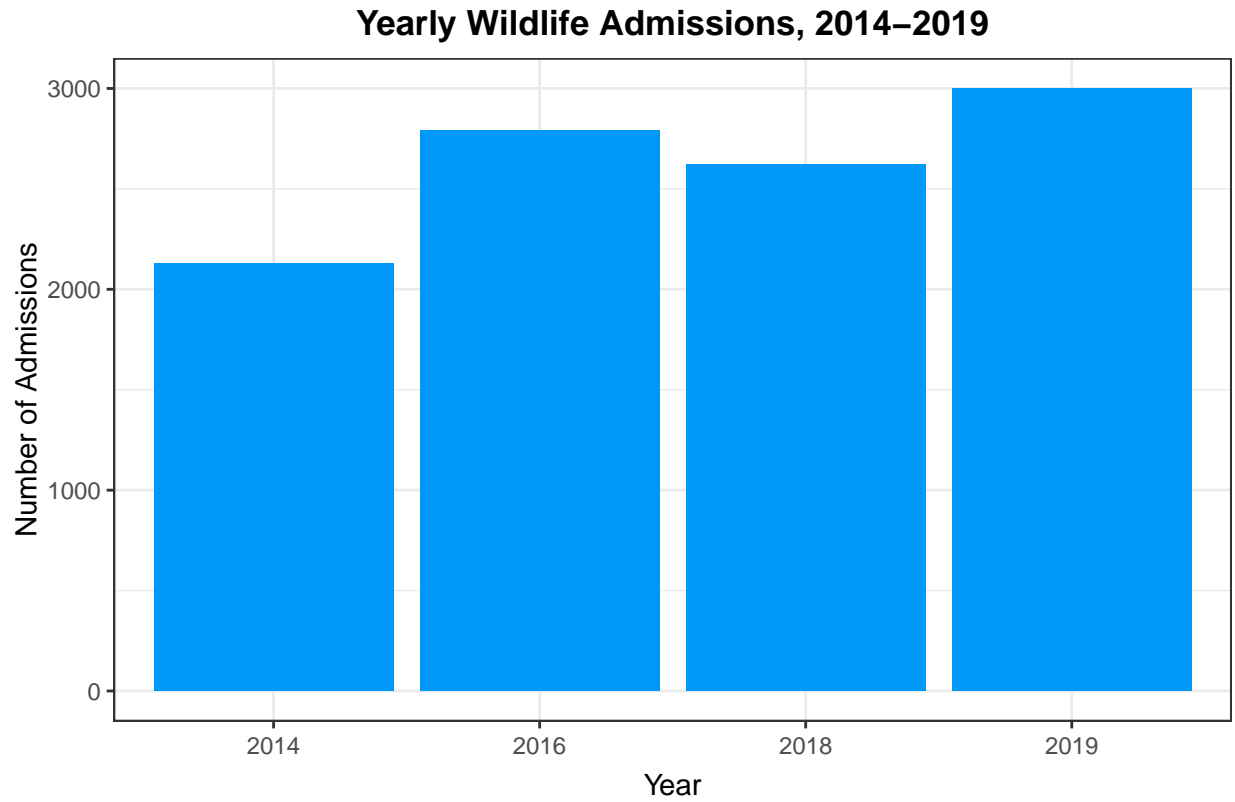
Table 13: Total monthly admissions to the wildlife clinic, 2014-2019.

Month	Admissions
Jan	2,688
Feb	2,208
Mar	5,390
Apr	30,360
May	136,512
Jun	278,006
Jul	164,934
Aug	112,800
Sep	52,580
Oct	13,390
Nov	3,906
Dec	1,558



**Figure 16: Total monthly admissions to the wildlife clinic, 2014 to 2019.**

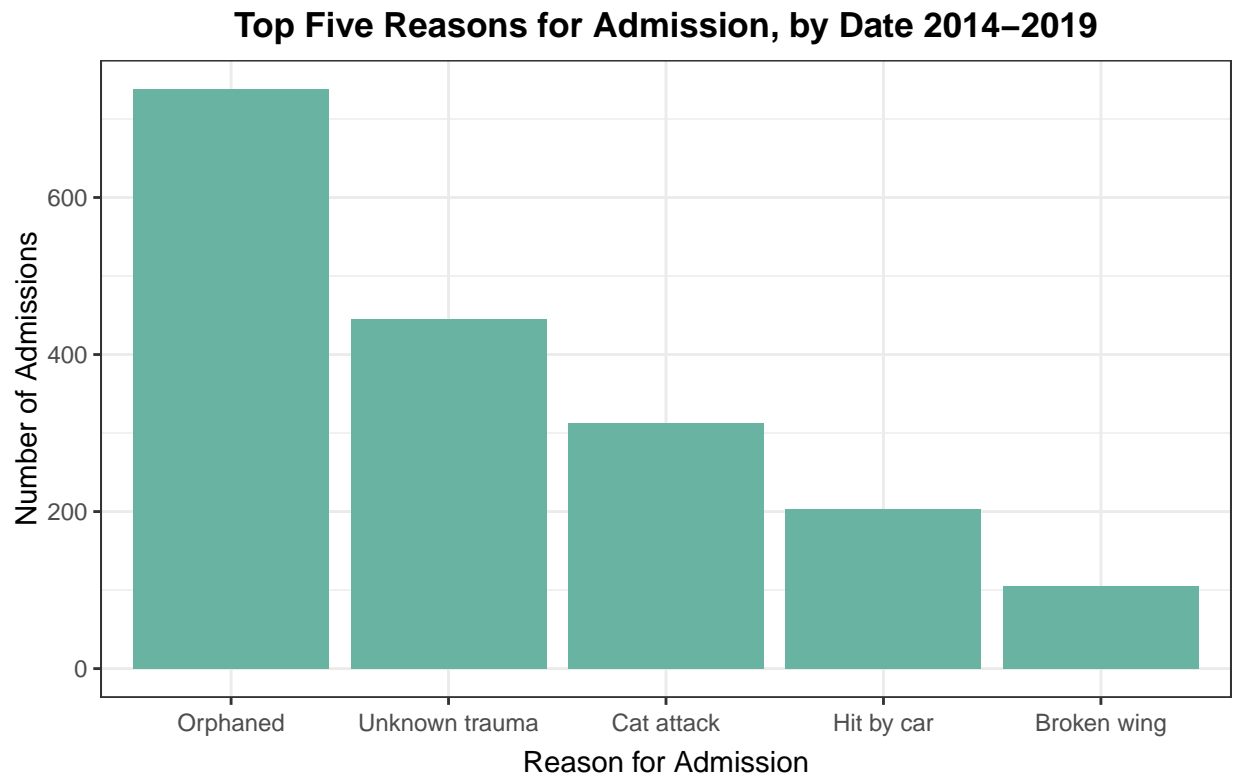
Total Yearly Admissions, 2014-2019:



**Figure 17: Total yearly admissions to the wildlife clinic, 2014 to 2019.**

Following this, the top five reasons for clinic admissions from all years of data were examined.

**Top Five Reasons for Admission, 2014-2019:**

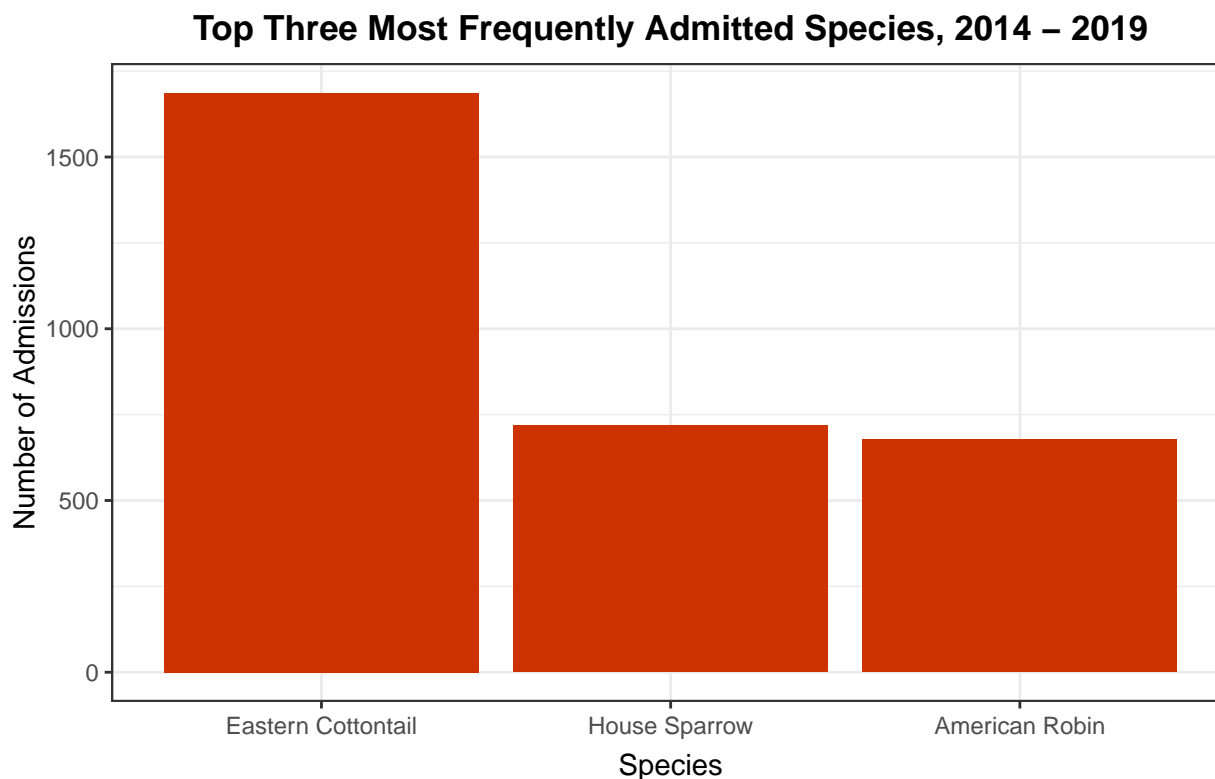


**Figure 18: The total number of admissions for each of the top five reasons for admission to the wildlife clinic, by date from 2014–2019.**



The final stage of the merged data analysis involved determining the top five species most frequently admitted across all years of data in the study. *(Due to the increased sample size in this section of the data analysis, the number of most frequently admitted species was reduced from five to three in this section of the analysis, allowing for a better representation of the species truly at greatest risk- as these results indicate.)*

**Top Three Most Frequently Admitted Species, 2014-2019:**

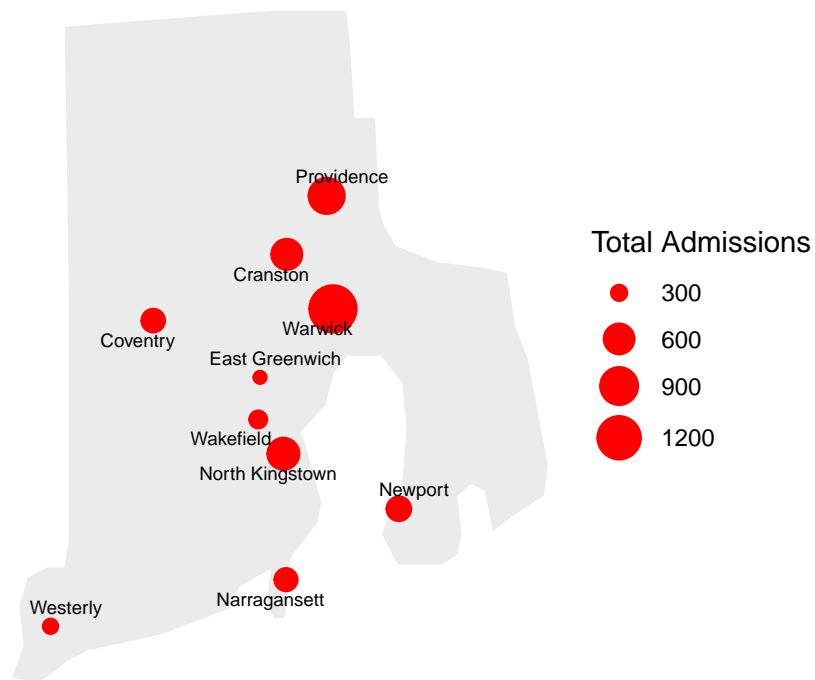


**Figure 19: The top three most frequently admitted species and the total number of clinic admissions for each, 2014–2019.**

The final section of this analysis sought to determine which, if any, locations in Rhode Island serve as hotspots for wildlife injury and displacement. This was investigated by using the mapping function to create a Rhode Island state map that displayed the most frequent locations from which animals were transported to the clinic over the course of all years of data.

Mapping Rhode Island Hot-Spot Locations, All Data Combined, 2014-2019:

### Rhode Island Towns with Leading Admission Rates, 2014–2019



**Figure 20: The number of admissions from each of the top ten towns in Rhode Island with the highest admission rates.**