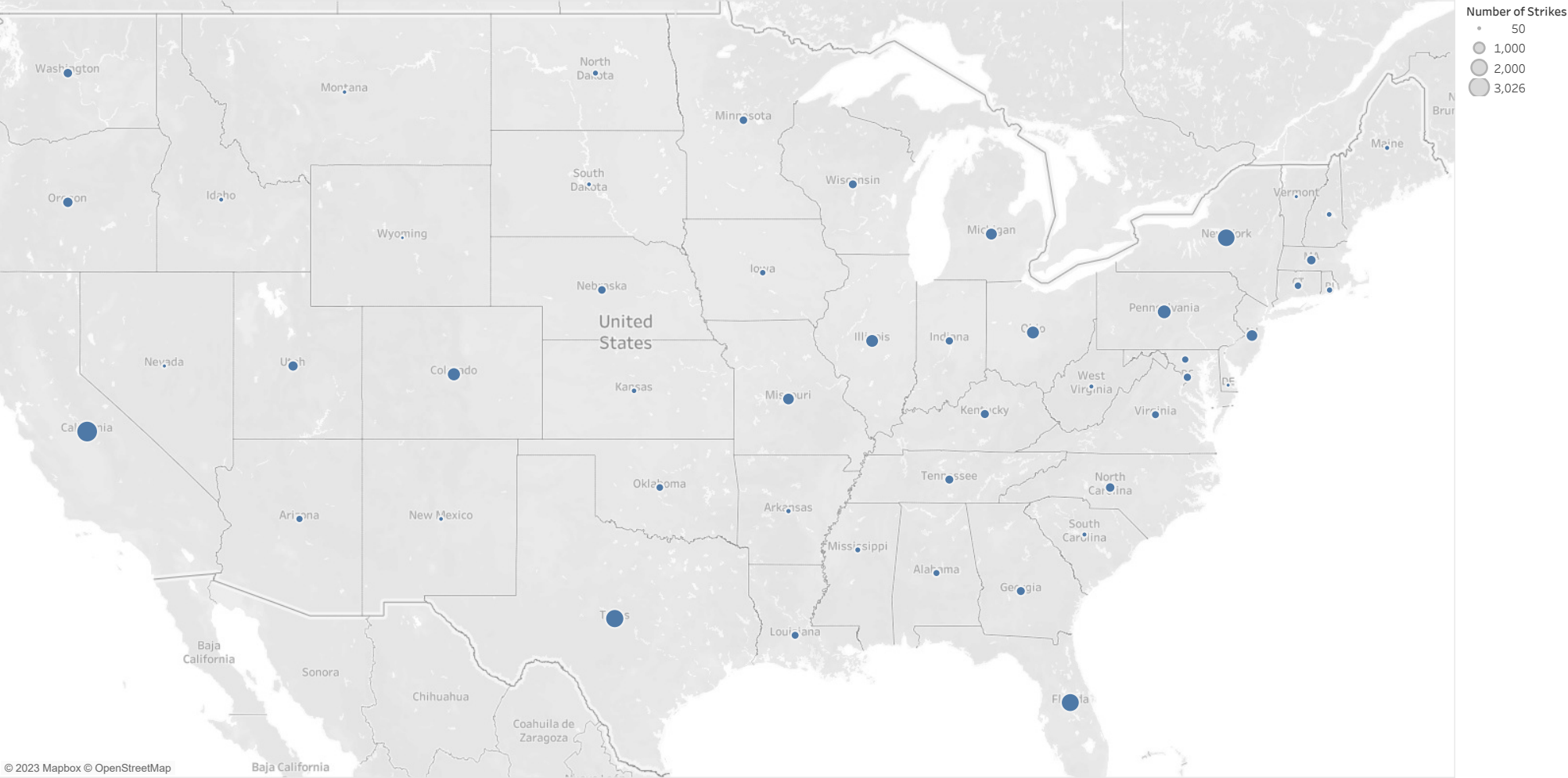


Location/Count



Map based on Longitude (generated) and Latitude (generated). Size shows sum of Number of Strikes. Details are shown for Country and Origin State. The data is filtered on Collision Date and Time Year, which keeps 16 of 16 members.

Wildlife Strike Location and Sizes in the US over time (Currently showing 2000)



Map based on Longitude (generated) and Latitude (generated). Size shows Running Sum of Count of FAA Wildlife Strikes. Details are shown for Country and Origin State.

Collision Time vs. Categorized Time of Day
(Time vs. When TOD)

When: Time..	Collision Date and Time														
	0	1	2	3	4	5	6	7	8	9	10	11	13	14	15
Null	0	1	2	3	4	5	6	7	8	9	10	11	13	14	15
Dawn					4	5	6	7	8	9	10			14	15
Day	0	1	2	3	4	5	6	7	8	9	10	11	13	14	15
Dusk			2			5	6		8						15
Night	0	1	2	3	4	5	6	7	8	9	10	11	13	14	15

Collision Date and Time Hour broken down by Collision Date and Time Hour vs. When: Time of day.

Collision Time vs. Categorized Time of Day
(Time vs. When TOD)

When: Time..	Collision Date and Time							
	16	17	18	19	20	21	22	23
Null	16	17	18	19	20	21	22	23
Dawn		17						
Day	16	17	18	19	20	21	22	23
Dusk	16	17	18	19	20	21	22	23
Night	16	17	18	19	20	21	22	23

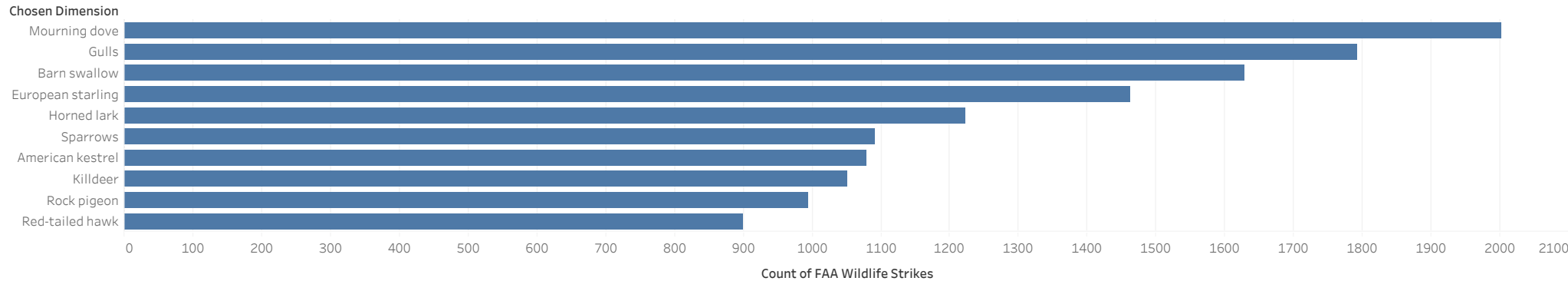
Collision Date and Time Hour broken down by Collision Date and Time Hour vs. When: Time of day.

Count Strikes

Wildlife: Species	Rank of Number of Strikes along ..	Count of FAA Wildlife Strikes
Mourning dove	1	2,002
Gulls	2	1,792
Barn swallow	3	1,629
European starling	4	1,462
Horned lark	5	1,223
Sparrows	6	1,091
American kestrel	7	1,079
Killdeer	8	1,052
Rock pigeon	9	995
Red-tailed hawk	10	899

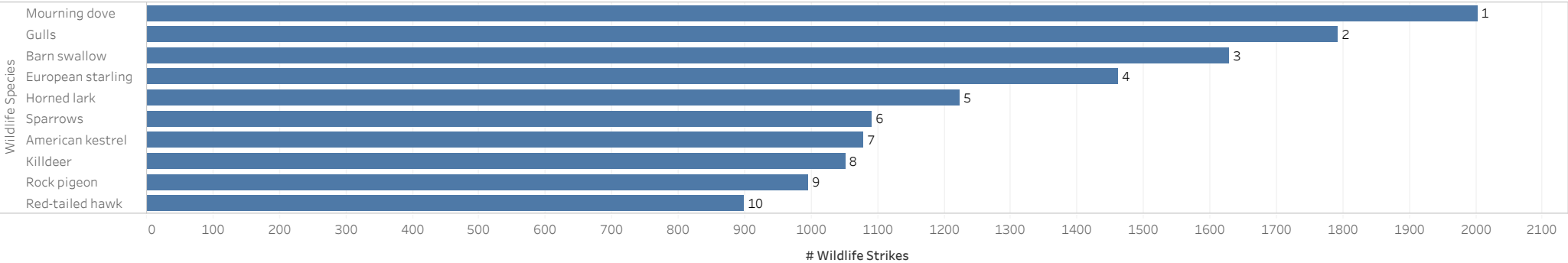
Rank of Number of Strikes along Wildlife: Species and count of FAA Wildlife Strikes broken down by Wildlife: Species. The view is filtered on Wildlife: Species, which keeps 10 of 469 members.

Interactive Top N Count Strikes



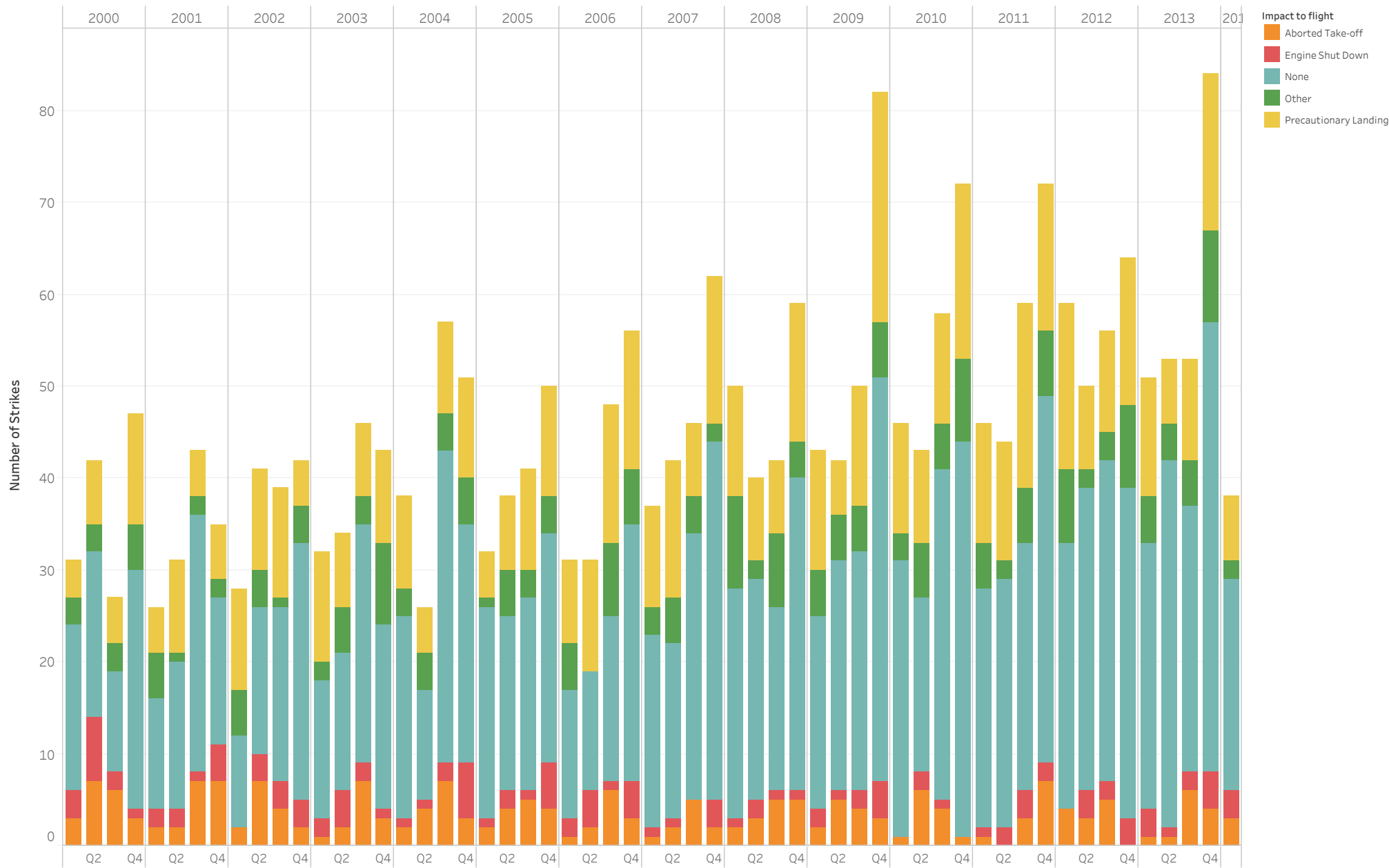
Count of FAA Wildlife Strikes for each Chosen Dimension. The view is filtered on Chosen Dimension, which has multiple members selected.

Top 10 Wildlife Species Causing Strikes



Count of FAA Wildlife Strikes for each Choose Dimension (Parameters) broken down by Chosen Dimension. The marks are labeled by Rank of Number of Strikes. The view is filtered on Chosen Dimension, which has multiple members selected.

Strikes Over Time: **Caused damage** Reported



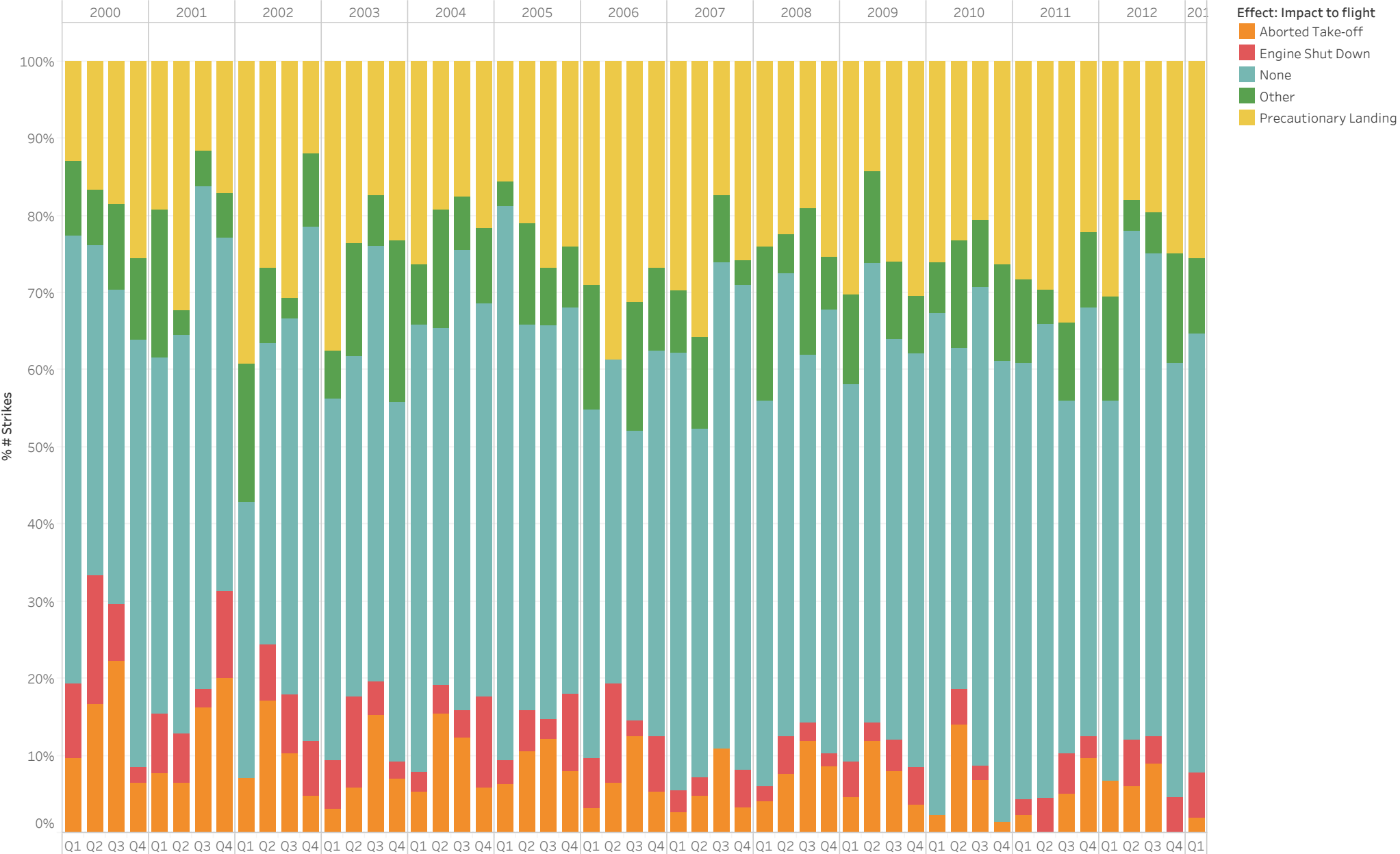
Number of Strikes for each Quarter of Collision Date and Time broken down by Year of Collision Date and Time. Color shows details about Effect: Impact to flight. The marks are labeled by Number of Strikes. The data is filtered on Effect: Impact to flight and Effect: Indicated Damage. The Effect: Impact to flight filter excludes Null. The Effect: Indicated Damage filter keeps Caused damage. The view is filtered on Year of Collision Date and Time, which excludes 2015.

Strikes Over Time: **Caused damage** Reported



Number of Strikes for each Quarter of Collision Date and Time broken down by Year of Collision Date and Time. Color shows details about Effect: Impact to flight. The marks are labeled by Number of Strikes. The data is filtered on Effect: Impact to flight and Effect: Indicated Damage. The Effect: Impact to flight filter excludes Null. The Effect: Indicated Damage filter keeps Caused damage. The view is filtered on Year of Collision Date and Time, which excludes 2015.

Strikes Over Time: **Caused damage** Reported



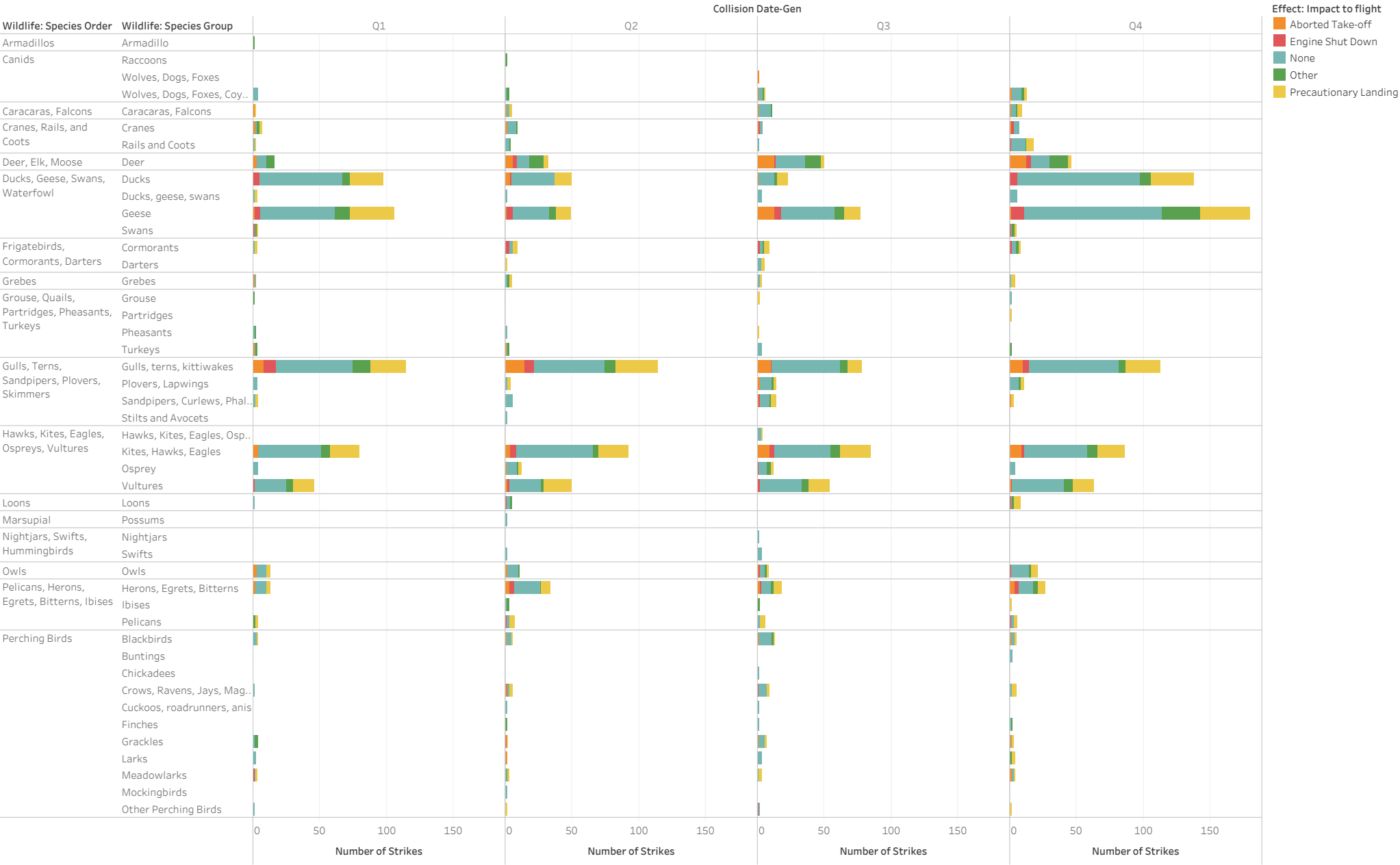
% of Total Number of Strikes for each Quarter of Collision Date and Time broken down by Year of Collision Date and Time. Color shows details about Effect: Impact to flight. The data is filtered on Effect: Impact to flight and Effect: Indicated Damage. The Effect: Impact to flight filter excludes Null. The Effect: Indicated Damage filter keeps Caused damage. Percents are based on each column of each pane of the table.

Strikes Over Time: **Caused damage** Reported



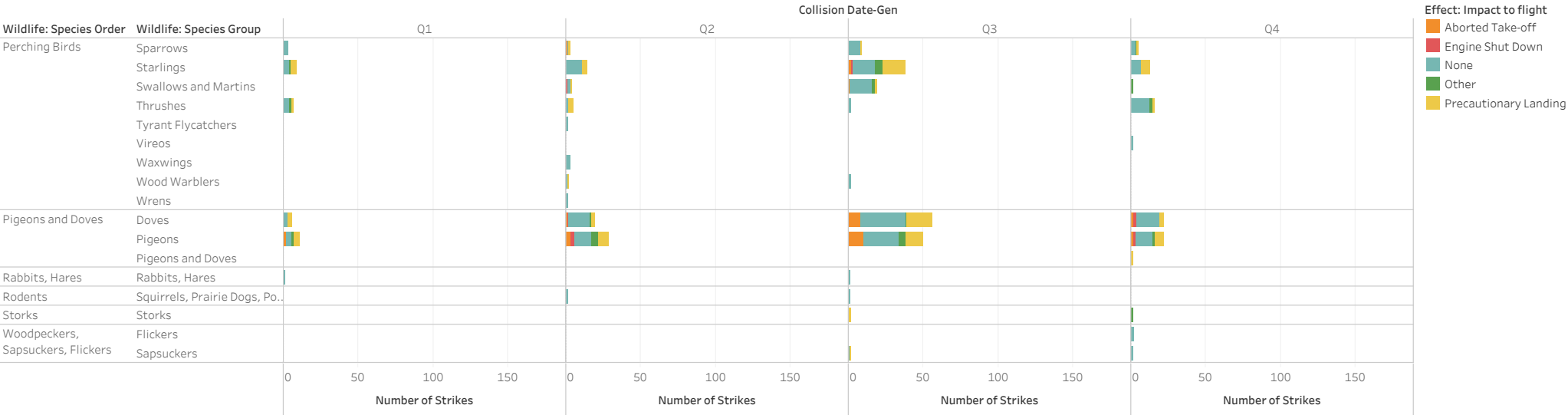
% of Total Number of Strikes for each Quarter of Collision Date and Time broken down by Year of Collision Date and Time. Color shows details about Effect: Impact to flight. The data is filtered on Effect: Impact to flight and Effect: Indicated Damage. The Effect: Impact to flight filter excludes Null. The Effect: Indicated Damage filter keeps Caused damage. Percents are based on each column of each pane of the table.

Count Strikes/Impact/Damage over Time - Animals



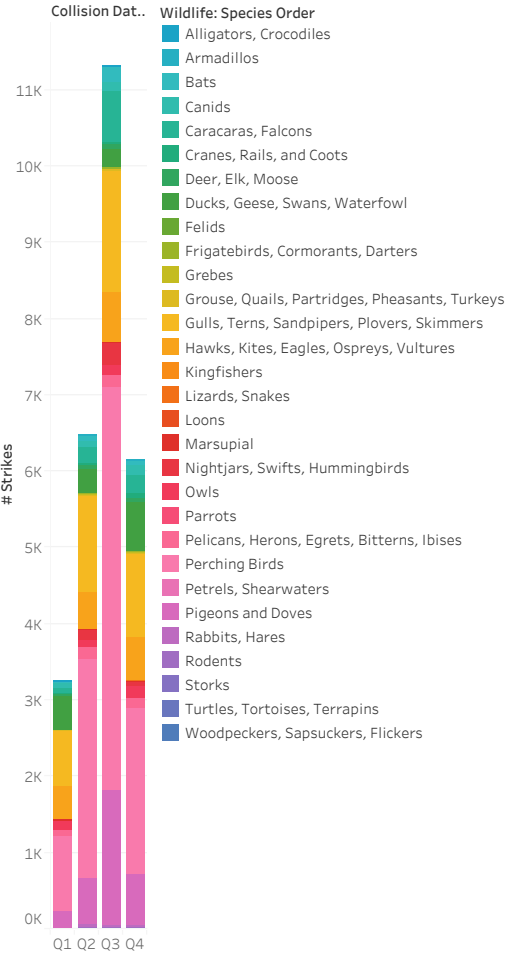
Number of Strikes for each Wildlife: Species Group broken down by Quarter of Collision Date-Gen vs. Wildlife: Species Order. Color shows details about Effect: Impact to flight. The data is filtered on Effect: Impact to flight, Effect: Indicated Damage and Year of Collision Date-Gen. The Effect: Impact to Flight filter excludes Null. The Effect: Indicated Damage filter keeps Caused damage. The Year of Collision Date-Gen filter excludes 2015.

Count Strikes/Impact/Damage over Time - Animals



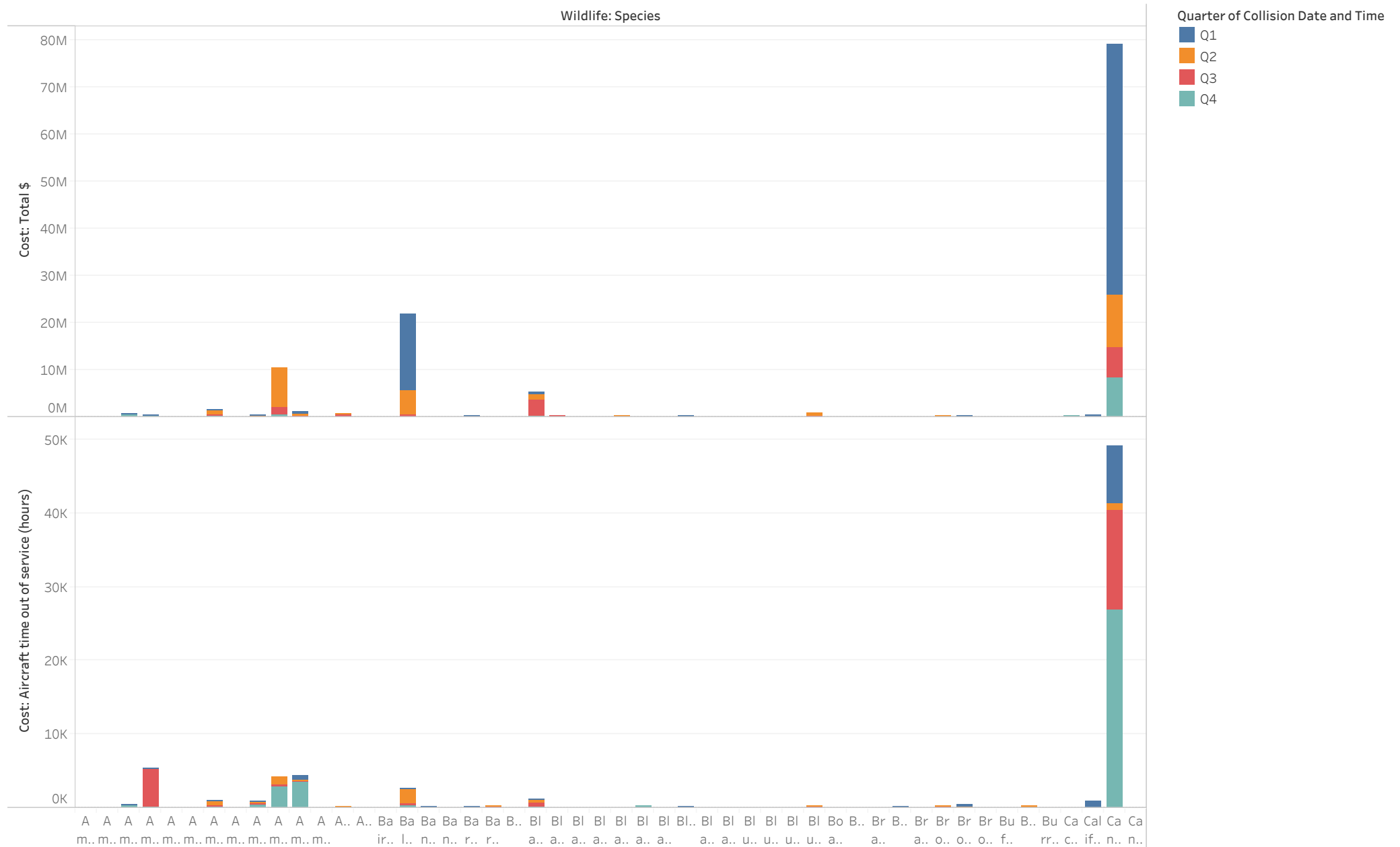
Number of Strikes for each Wildlife: Species Group broken down by Quarter of Collision Date-Gen vs. Wildlife: Species Order. Color shows details about Effect: Impact to flight. The data is filtered on Effect: Impact to flight, Effect: Indicated Damage and Year of Collision Date-Gen. The Effect: Impact to flight filter excludes Null. The Effect: Indicated Damage filter keeps Caused damage. The Year of Collision Date-Gen filter excludes 2015.

Strikes by Quarter
by Animal (Order)



Number of Strikes for
each Quarter of
Collision Date and
Time. Color shows
details about Wildlife:
Species Order.
Details are shown for
Wildlife: Species
Group. The data is
filtered on Effect:
Impact to flight and
Year of Collision
Date-Gen. The Effect:
Impact to flight filter
excludes Null. The
Year of Collision
Date-Gen filter
excludes 2015.

\$/Hours Impact by Species-Static



Sum of Cost: Total \$ and sum of Cost: Aircraft time out of service (hours) for each Wildlife: Species. Color shows details about Collision Date and Time Quarter. The view is filtered on sum of Cost: Aircraft time out of service (hours), which keeps non-Null values only.

\$/Hours Impact by Species-Static



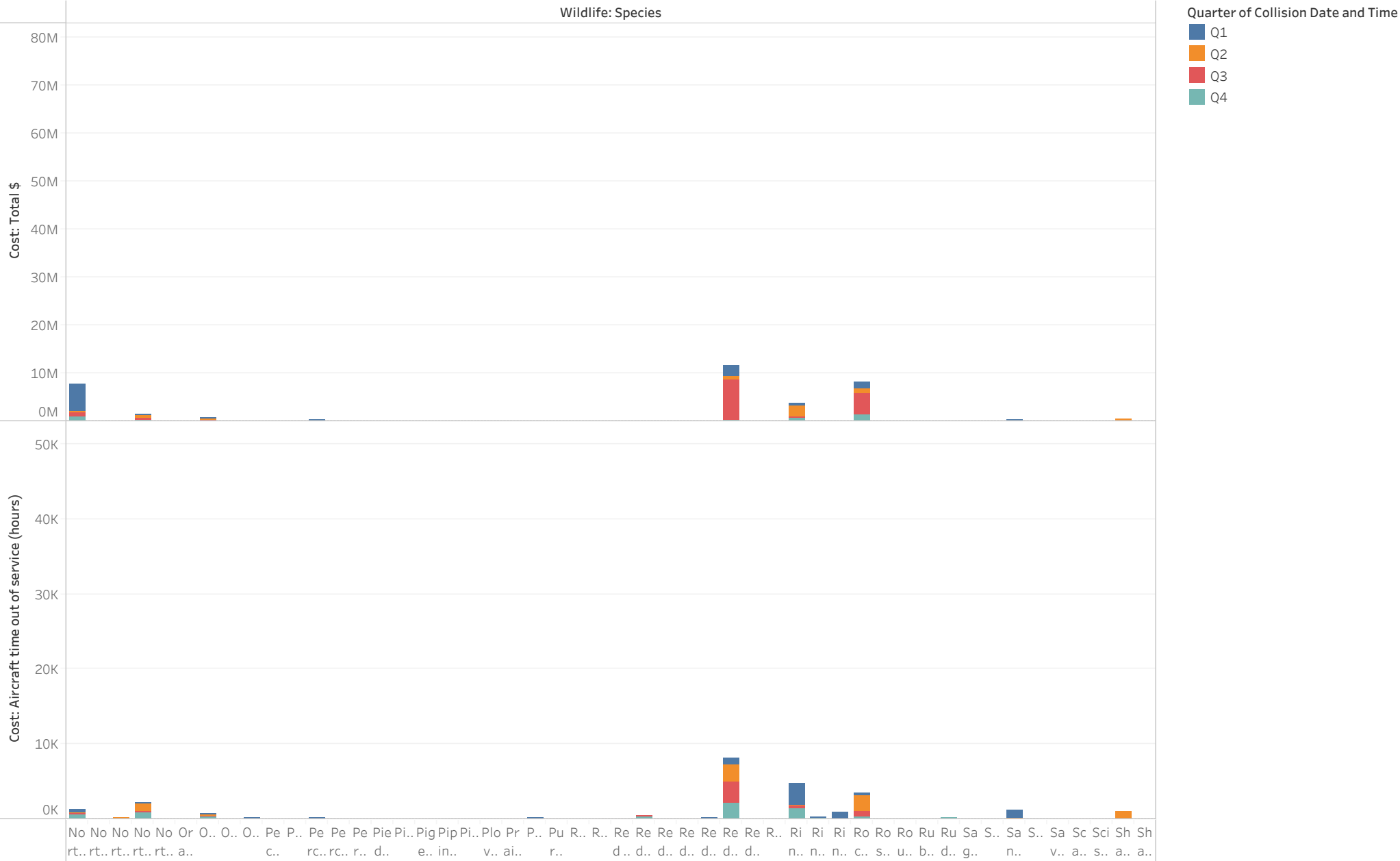
Sum of Cost: Total \$ and sum of Cost: Aircraft time out of service (hours) for each Wildlife: Species. Color shows details about Collision Date and Time Quarter. The view is filtered on sum of Cost: Aircraft time out of service (hours), which keeps non-Null values only.

\$/Hours Impact by Species-Static



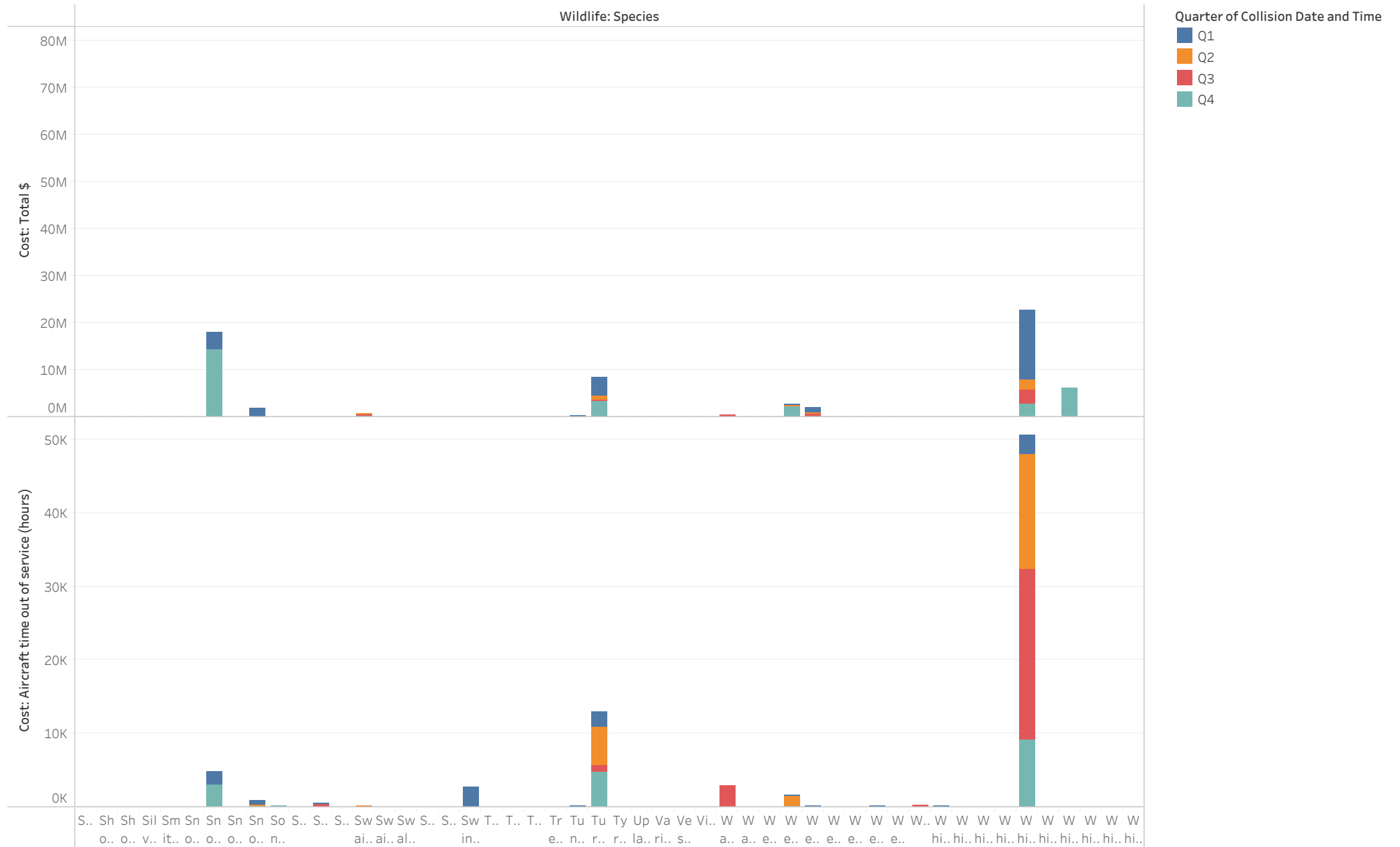
Sum of Cost: Total \$ and sum of Cost: Aircraft time out of service (hours) for each Wildlife: Species. Color shows details about Collision Date and Time Quarter. The view is filtered on sum of Cost: Aircraft time out of service (hours), which keeps non-Null values only.

\$/Hours Impact by Species-Static



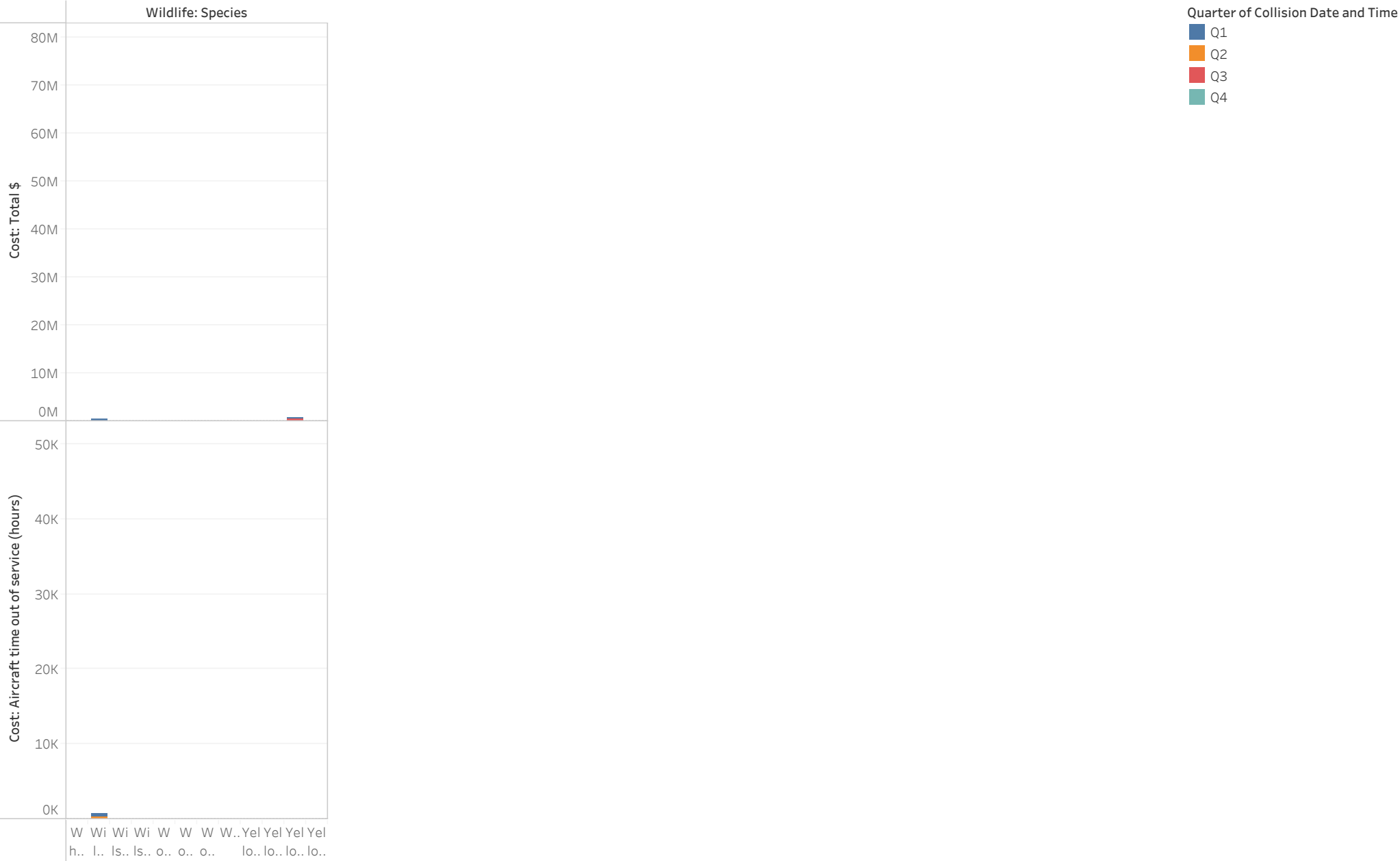
Sum of Cost: Total \$ and sum of Cost: Aircraft time out of service (hours) for each Wildlife: Species. Color shows details about Collision Date and Time Quarter. The view is filtered on sum of Cost: Aircraft time out of service (hours), which keeps non-Null values only.

\$/Hours Impact by Species-Static



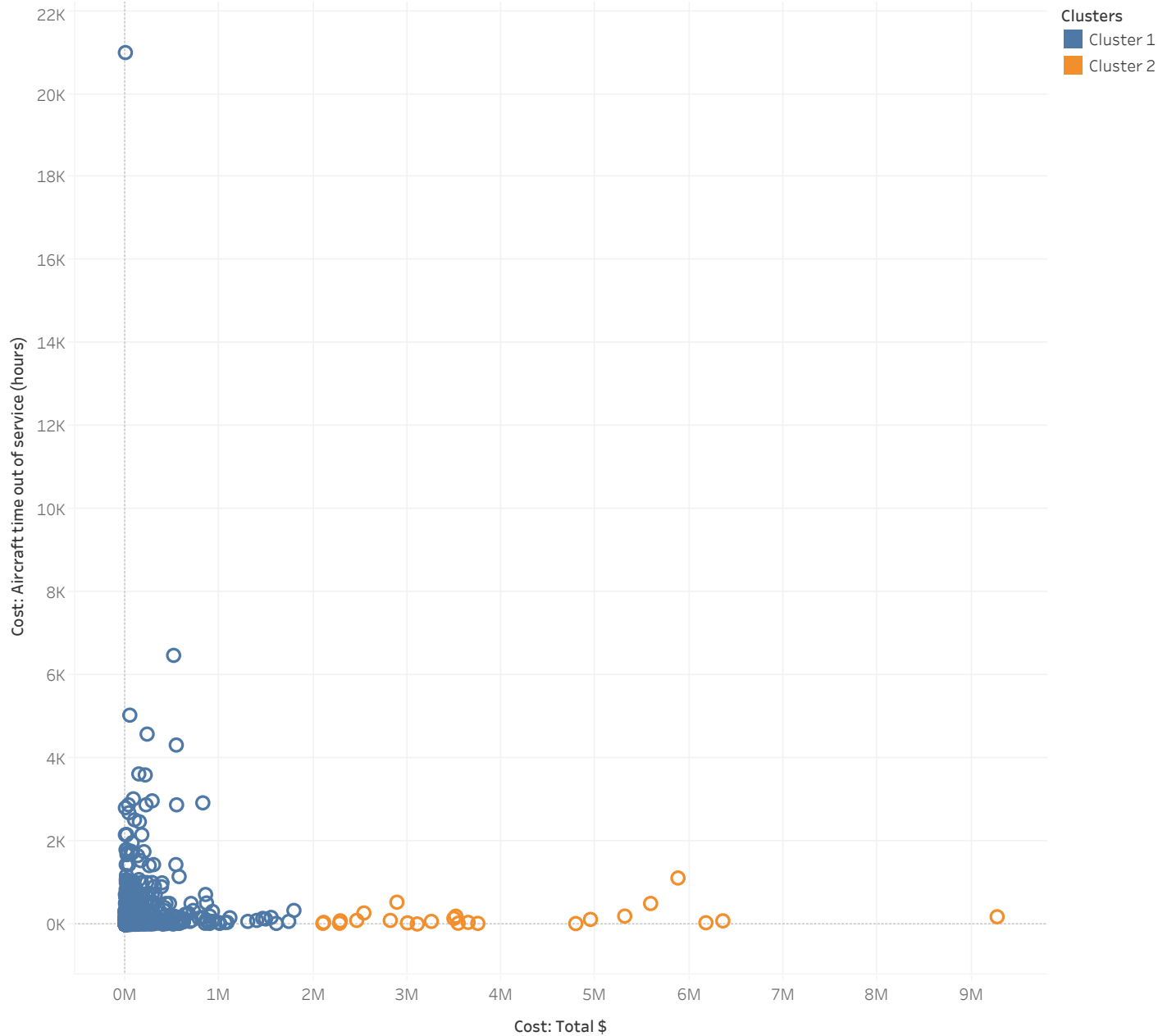
Sum of Cost: Total \$ and sum of Cost: Aircraft time out of service (hours) for each Wildlife: Species. Color shows details about Collision Date and Time Quarter. The view is filtered on sum of Cost: Aircraft time out of service (hours), which keeps non-Null values only.

\$/Hours Impact by Species-Static



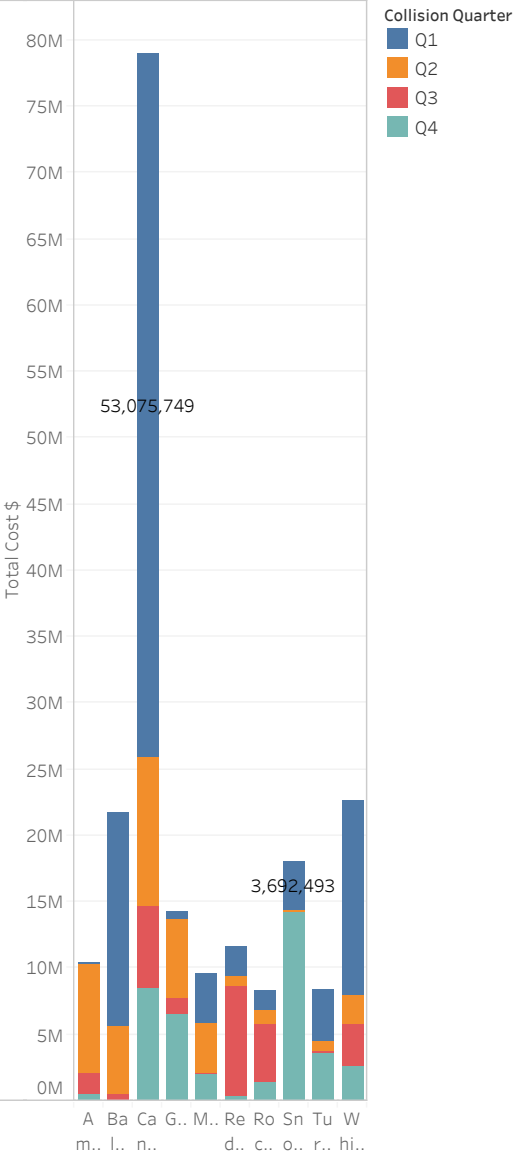
Sum of Cost: Total \$ and sum of Cost: Aircraft time out of service (hours) for each Wildlife: Species. Color shows details about Collision Date and Time Quarter. The view is filtered on sum of Cost: Aircraft time out of service (hours), which keeps non-Null values only.

Clusters by Impact: **Total Cost \$**



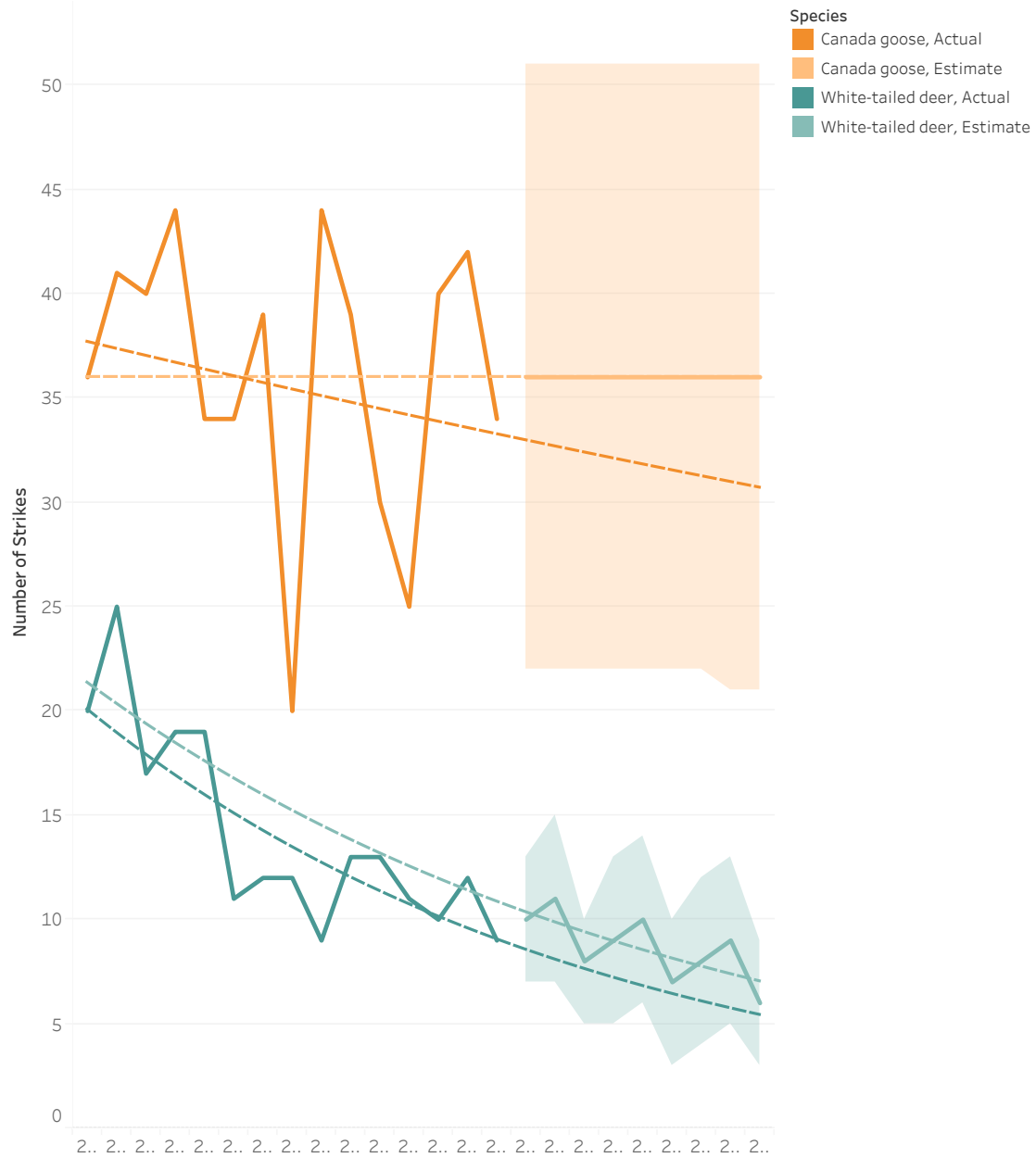
Cost: Total \$ vs. Cost: Aircraft time out of service (hours). Color shows details about Clusters (5). Details are shown for Wildlife: Species. The data is filtered on Cost: Aircraft time out of service (hours), which keeps non-Null values only.

Total Cost \$ by Wildlife Species



Choose Impact Field (Parameters) and Chosen Impact Field for each Wildlife: Species. Color shows details about Collision Date and Time Quarter. The marks are labeled by Chosen Impact Field. The view is filtered on Wildlife: Species, which keeps 10 of 469 members.

High Risk Wildlife Strike Forecast



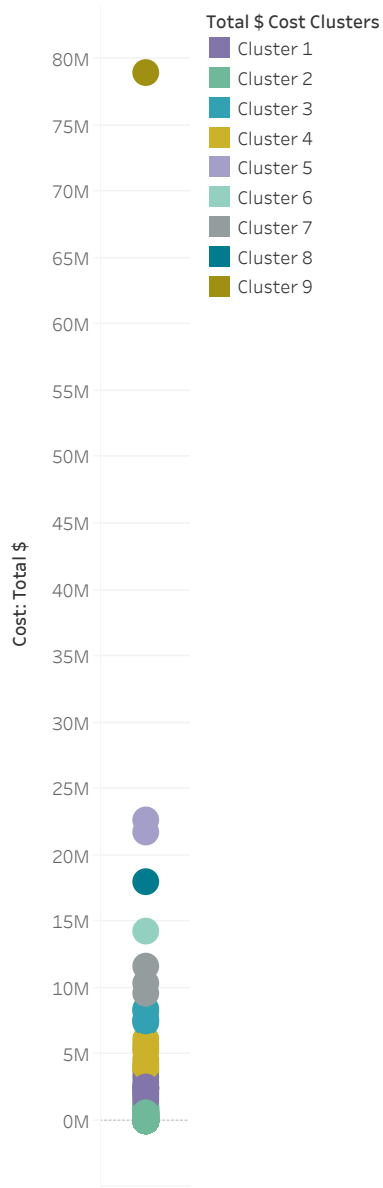
The trend of sum of Number of Strikes (actual & forecast) for Collision Date and Time Year. Color shows details about Wildlife: Species and Forecast indicator. The view is filtered on Wildlife: Species, which keeps Canada goose and White-tailed deer.

Clusters by #
Strikes



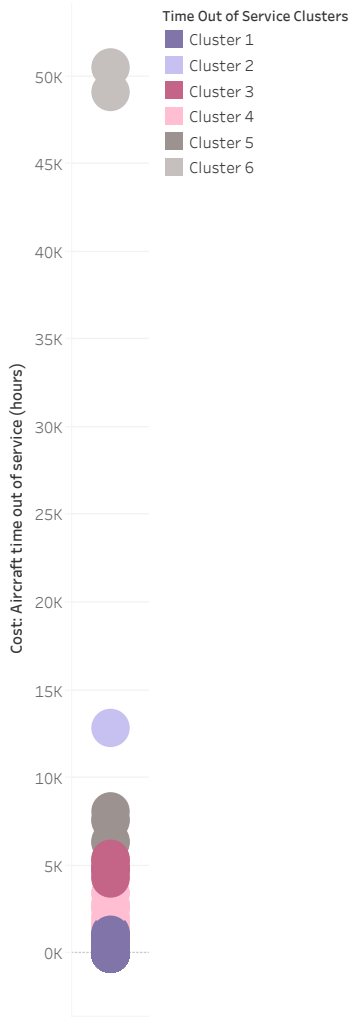
Sum of Number of
Strikes for each
Clusters. Color
shows details
about Wildlife:
Species Order.
Details are shown
for Wildlife:
Species ID.

Clusters by Total \$
Cost Impact



Sum of Cost: Total \$.
Color shows details
about Clusters (10).
Details are shown for
Wildlife: Species.

Clusters by
Aircraft Time out
of Service Impact



Sum of Cost: Aircraft
time out of service
(hours). Color shows
details about
Clusters (14).
Details are shown
for Wildlife: Species.
The view is filtered
on sum of Cost:
Aircraft time out of
service (hours),
which keeps non-Null
values only.

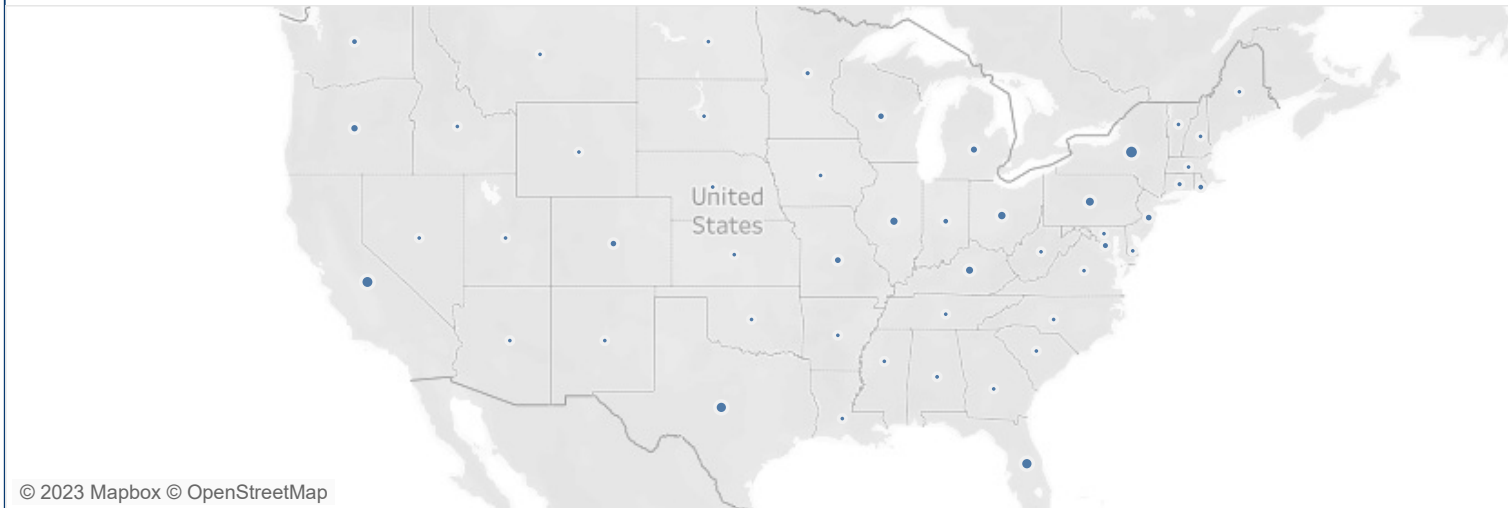
(c) 2023
Julie
Leung,
Data
Source:
FAA
Wildlife
Strikes (f
aa_data_
subset),
Last
Updated:
2023-10-
31
5:25:29
p.m.
More info
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about
project: [https://git
hub.com/j
twleung/
Final-Proj
ect-Table
au/blob/
main/RE
ADME.m
d](https://github.com/jtwleung/Final-Project-Tableau/blob/main/README.md)

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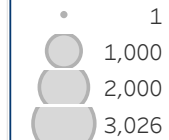


Trends in Wildlife Strikes (FAA) 2002-2015

Wildlife Strike Location and Sizes in the US over time (Currently showing 2000)



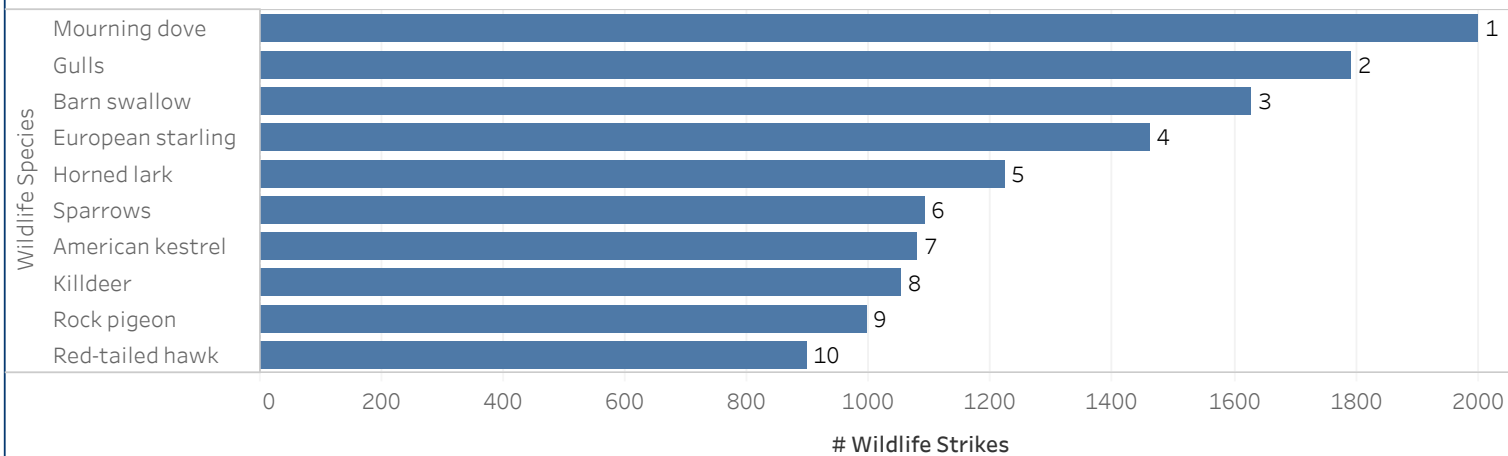
Strikes
(Running Sum)



Collision Year
2000

☐ Show history

Top 10 Wildlife Species Causing Strikes



Choose Dimension

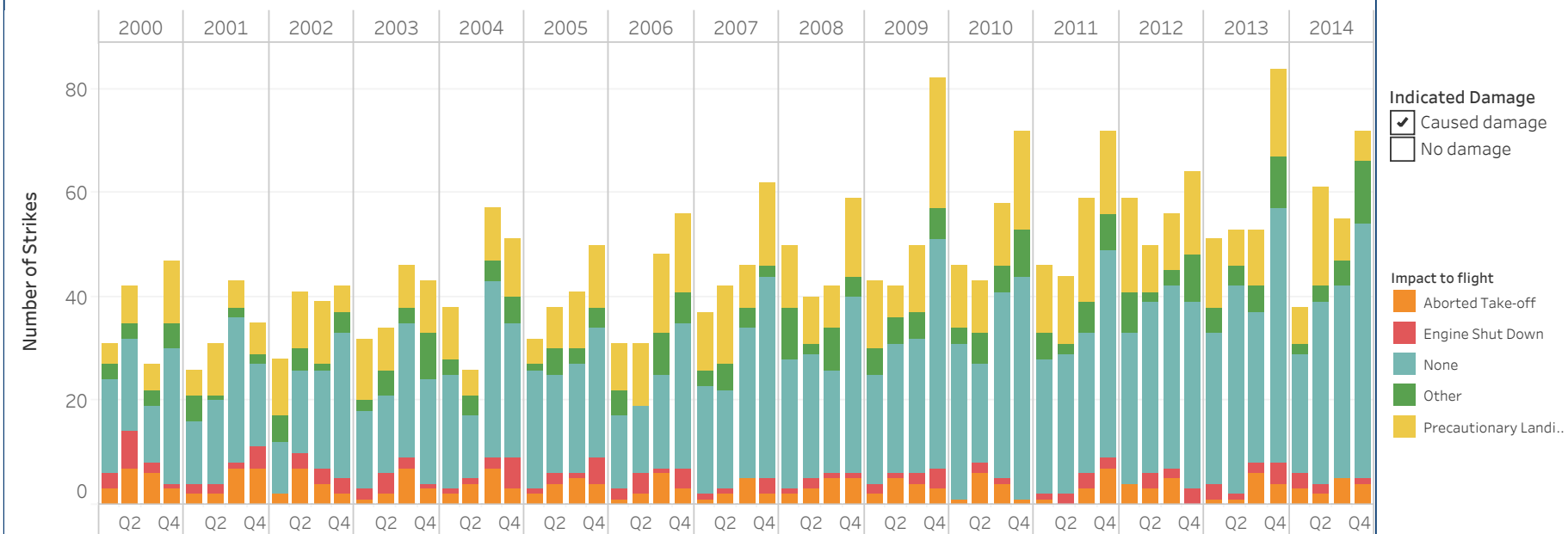
- ☒ Wildlife Species
- ☐ Phase of flight
- ☐ Time of day
- ☐ Amt. damage
- ☐ Airport
- ☐ State

Top N
10

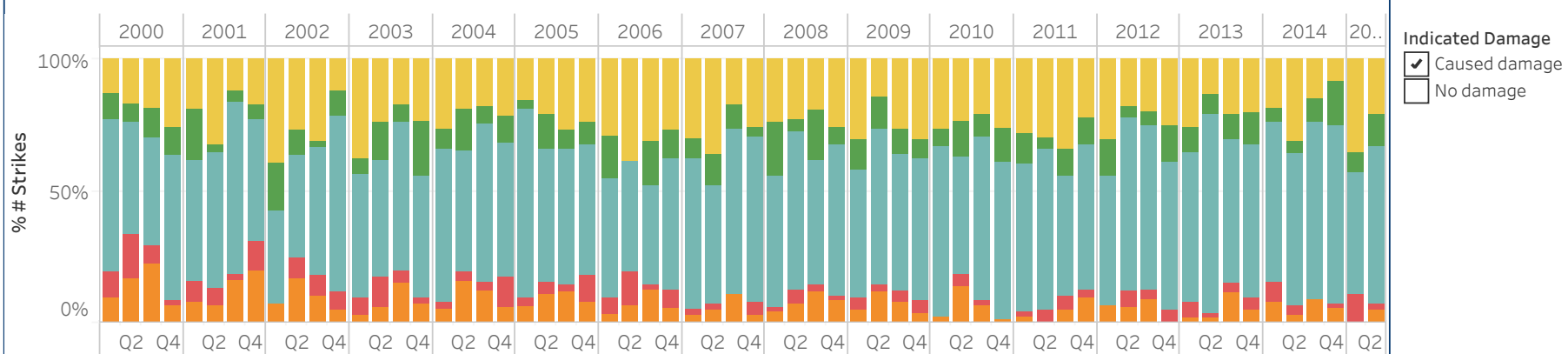


Trends in Wildlife Strikes (FAA) 2002-2015

Strikes Over Time: **Caused damage** Reported



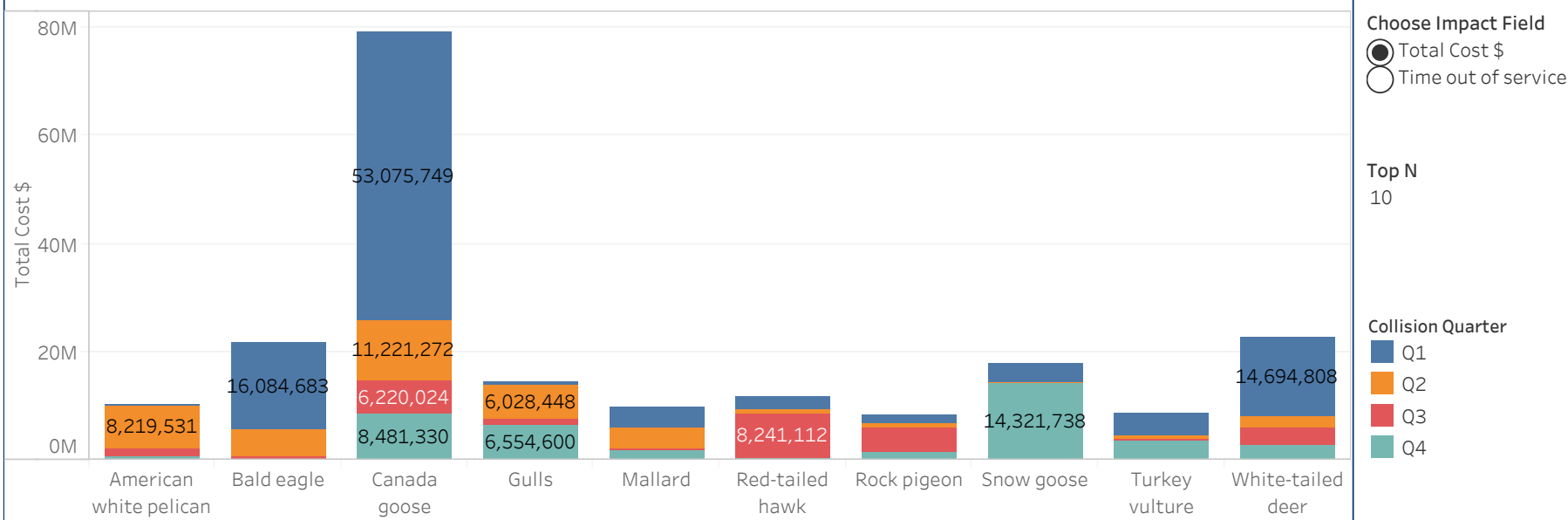
Strikes Over Time: **Caused damage** Reported



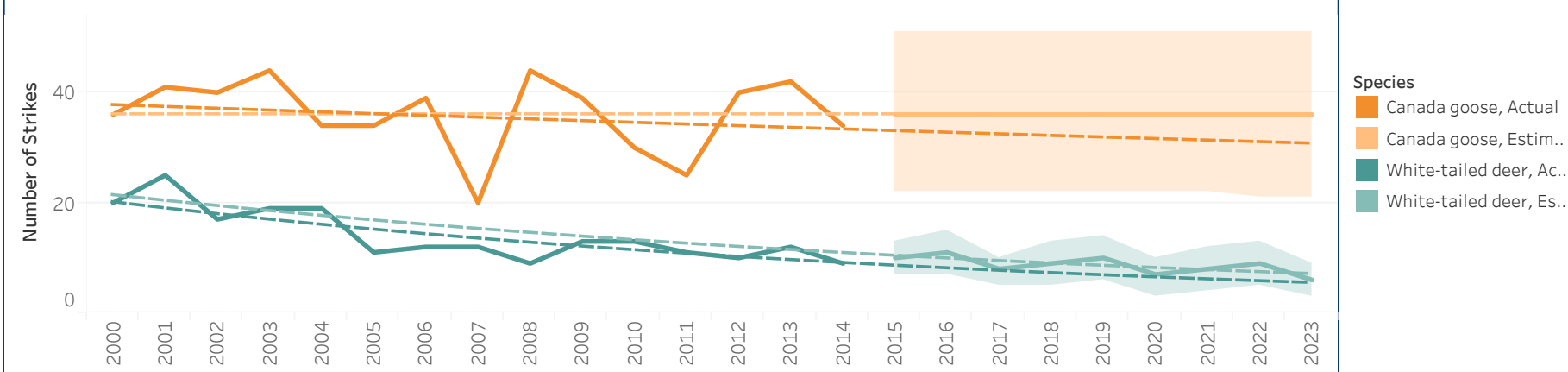


Trends in Wildlife Strikes (FAA) 2002-2015

Total Cost \$ by Wildlife Species



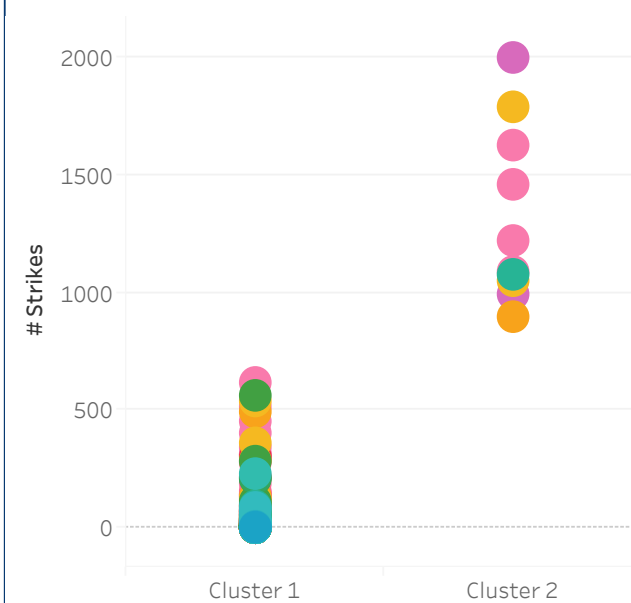
High Risk Wildlife Strike Forecast



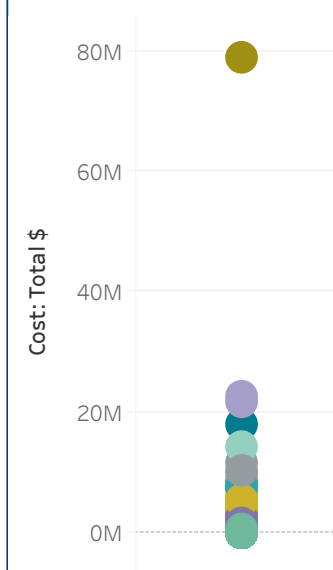


Trends in Wildlife Strikes (FAA) 2002-2015

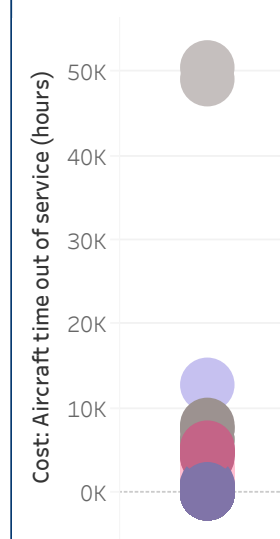
Clusters by # Strikes



Clusters by Total \$ Cost Impact



Clusters by Aircraft Time out of Service Impact



Total \$ Cost Cluste..



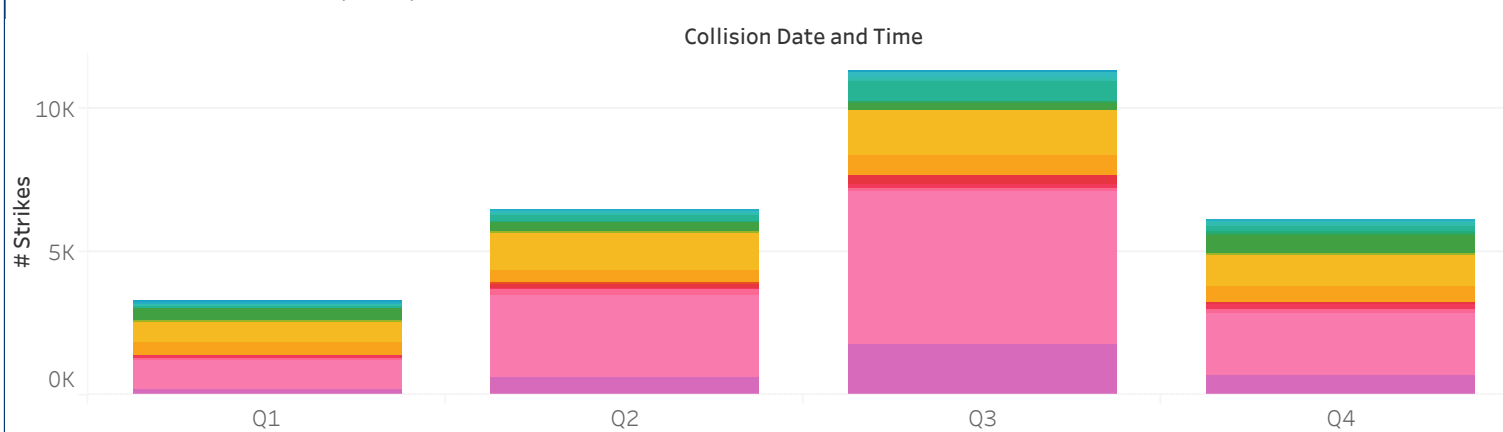
Time Out of Service C..



Species (Order)



Strikes by Quarter by Animal (Order)





Trends in Wildlife Strikes (FAA) 2002-2015

Salient Points and Takeaways For The Reader

(who didn't receive a verbal presentation)

Top 3 Wildlife Species for number of strikes is:

- 1) Mourning dove
- 2) Gulls
- 3) Barn swallow

Top 3 for # Strikes Disproportionate to Top 3 Species for Total \$ Cost damage:

- 1) Canada goose (#12 for # strikes)
- 2) White-tailed deer (#29 for # strikes)
- 3) Bald eagle (#58 for # strikes)

Top 3 for # Strikes Disproportion to Top 3 Species for Aircraft time out of service:

- 1) White-tailed deer
- 2) Canada goose
- 3) Turkey vulture (#24 for # strikes)

Most Strikes Do No Damage and Have No Flight Impact:

- Majority of strikes have "No indicated damage" and Impact to flight of "None"
- When "Damage" is indicated, there are a lot more Impacts of "Precautionary Landing", "Aborted takeoff", "Engine shutdown", "Other", as would be expected.

Heightened Nervousness/Reaction to "No Damage" Strikes Due to 9/11?

- When "No indicated damage", the incident of "Precautionary Landing" (yellow) and "Aborted takeoff" (orange) is relatively higher during the years 2001 Q3-2005 Q1.
 - Possibly heightened reaction and response from airlines, crew, and passenger pressure due to the 9/11 terrorist attacks (September 11, 2001).
 - Perhaps took 4 years for this heightened reaction and nervousness in response to "No damage" strikes to subside.

Overall, most numerous strikes occur in Q3.

- Bird migratory season is in this timeframe (e.g. Canada goose fall migration from late Aug to Nov, peak migration Sept/Oct).
- Canada goose strikes are most numerous in Q2. This may be explained by their northern return timeframe from Feb to early May, peak migration Mar/Apr.

There is an increase in # of strikes overall beginning around 2009.

- Possible reason is increased education or a process change with FAA and airports.
- FAA itself has noted this increase and attributes it to "proactive continuing outreach actions with its aviation industry and government partners [which] have improved the quantity and quality of voluntary wildlife strike reporting"

Source: <https://www.faa.gov/newsroom/wildlife-strike-reporting-continues-increase>.

Wildlife Causing Most Costly Damage or Most Aircraft "out of service" Time Are Not Those Causing Most # Strikes:

- Animals causing most costly monetary damage or aircraft "out of service" impact are Canada goose and White-tailed deer, respectively
- Possible explanation of difference; Canada goose is more likely to strike in the air and possibly shred an engine or cause damage at higher speeds. Engine repair/replacement is much more costly than body damage, and damage at higher speeds would cause greater damage, hence more costly.
- Whereas, White-tailed deer is more likely to cause body damage which is less costly to repair, but requires the aircraft to be grounded for longer to repair.

Strike Forecast for Canada goose and White-tailed deer:

- Given the high cost (\$ and opportunity cost/out of service time) of strikes by Canada geese and White-tailed deer, a forecast for expected # of strikes from 2016-2023 was completed. Expected # of strikes per year as follows:
 - Canada goose: 36 strikes expected each year with flat trend
 - White-tailed deer: 6-11 strikes expected through the years with downward trend

Cluster Analysis:

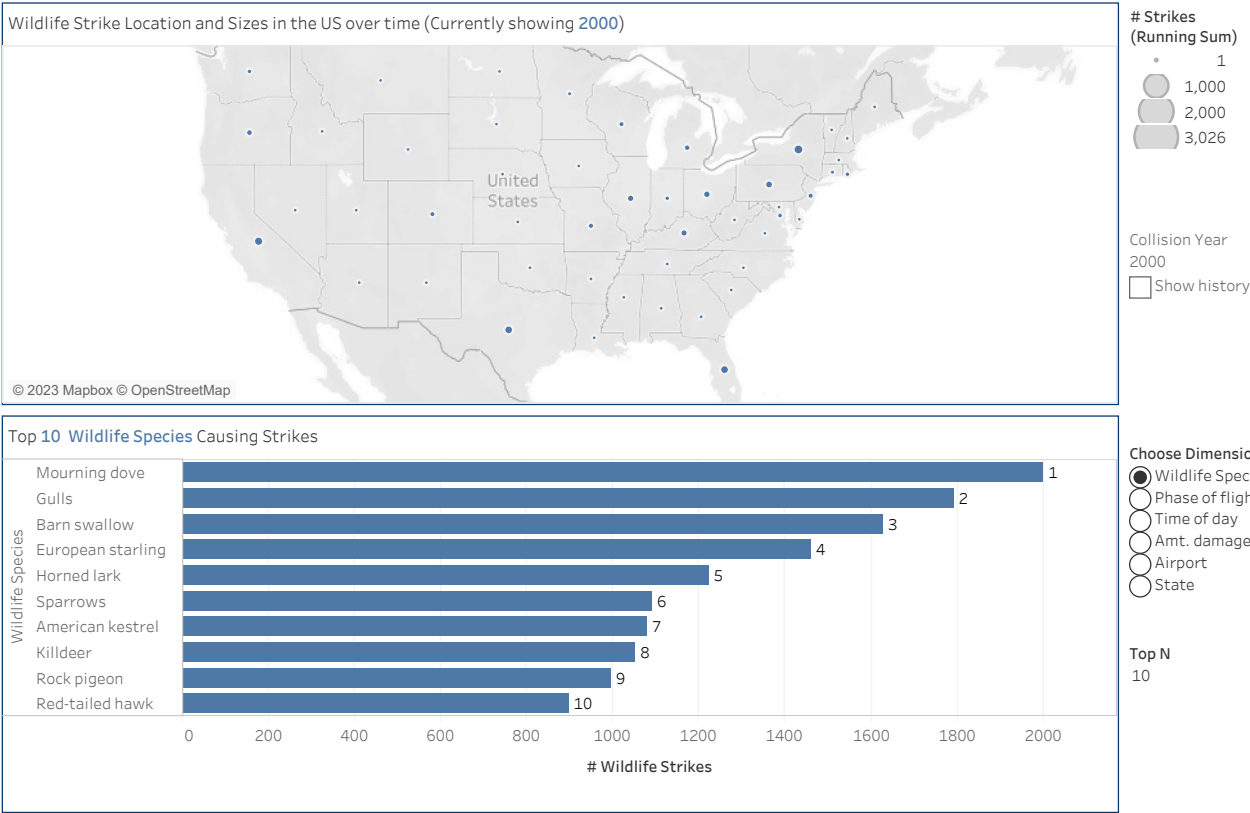
- Clustering on # Strikes reveals 2 clusters, one with mean=33, and the other with mean=1322
- Clustering on Total \$ Cost reveals 9 clusters
- 6 clusters when using Aircraft Time out of Service

FAA Wildlife Strikes Presentation

Wildlife Strike Location & High-Level Data Shape	Strike and Impact Trends Over Time	Top N Cost & Out of Service Impact by Quarter	Backup Viz's - Clusters, # Strikes by Quarter	Salient Points for the Reader (who did not get presentation)
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Trends in Wildlife Strikes (FAA) 2002-2015



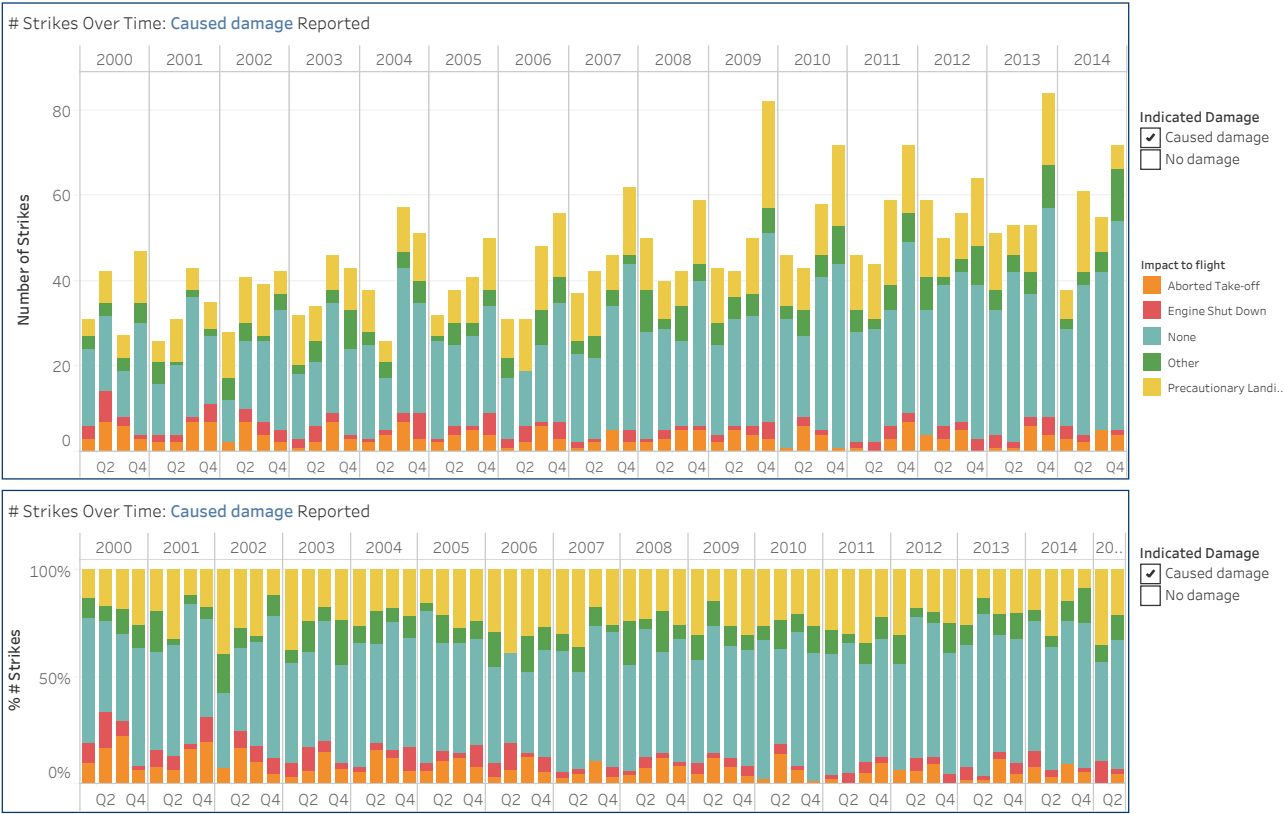
(c) 2023 Julie Leung, Data Source: FAA Wildlife Strikes (faa_data_subset), Last Updated: 2023-10-31 5:25:29 p.m.
More information about this data is available at <https://github.com/JulieLeung/FAA-Wildlife-Strikes/blob/main/README.md>

FAA Wildlife Strikes Presentation

Wildlife Strike Location & High-Level Data Shape	Strike and Impact Trends Over Time	Top N Cost & Out of Service Impact by Quarter	Backup Viz's - Clusters, # Strikes by Quarter	Salient Points for the Reader (who did not get presentation)
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Trends in Wildlife Strikes (FAA) 2002-2015



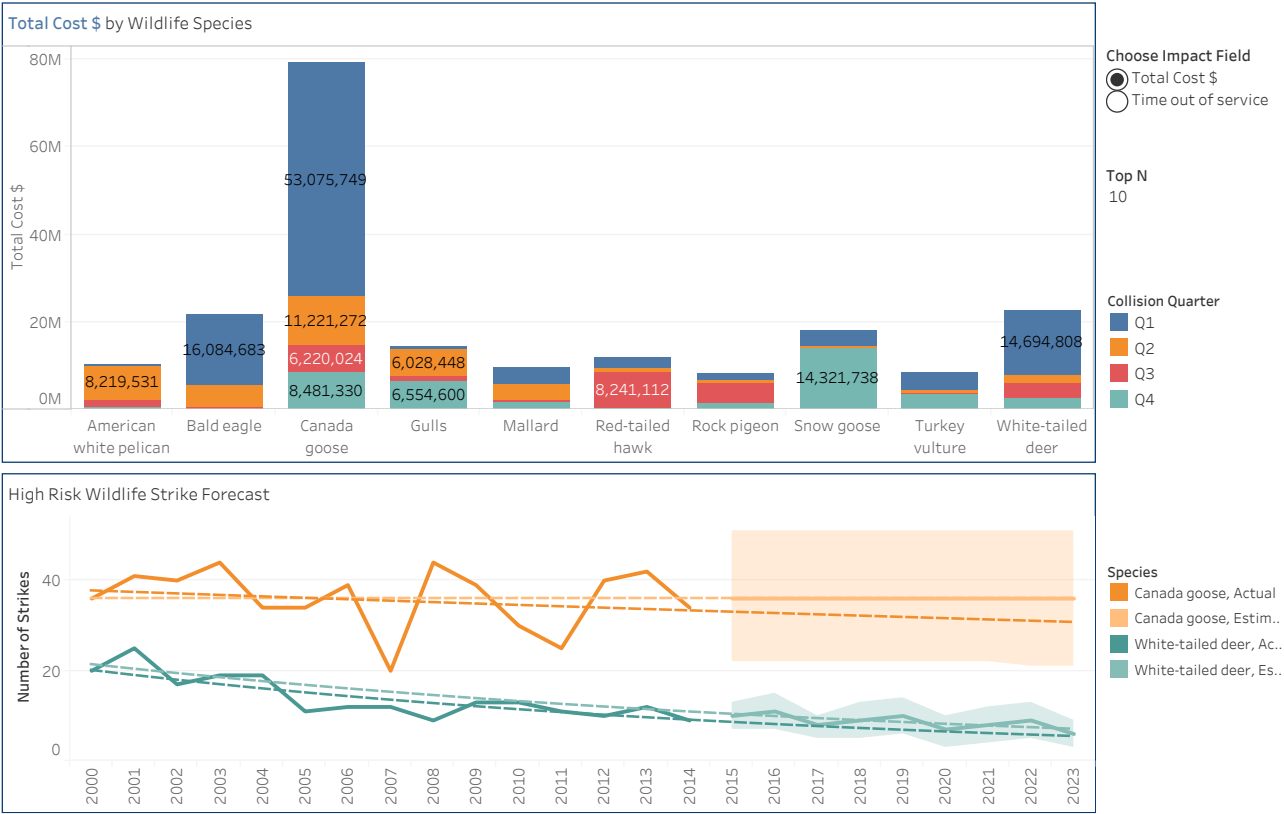
(c) 2023 Julie Leung, Data Source: FAA Wildlife Strikes (faa_data_subset), Last Updated: 2023-10-31 5:25:29 p.m.
More information about this project: <https://github.com/JulieLeung/FAA-Wildlife-Strikes-Data-Analysis>

FAA Wildlife Strikes Presentation

Wildlife Strike Location & High-Level Data Shape	Strike and Impact Trends Over Time	Top N Cost & Out of Service Impact by Quarter	Backup Viz's - Clusters, # Strikes by Quarter	Salient Points for the Reader (who did not get presentation)
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Trends in Wildlife Strikes (FAA) 2002-2015



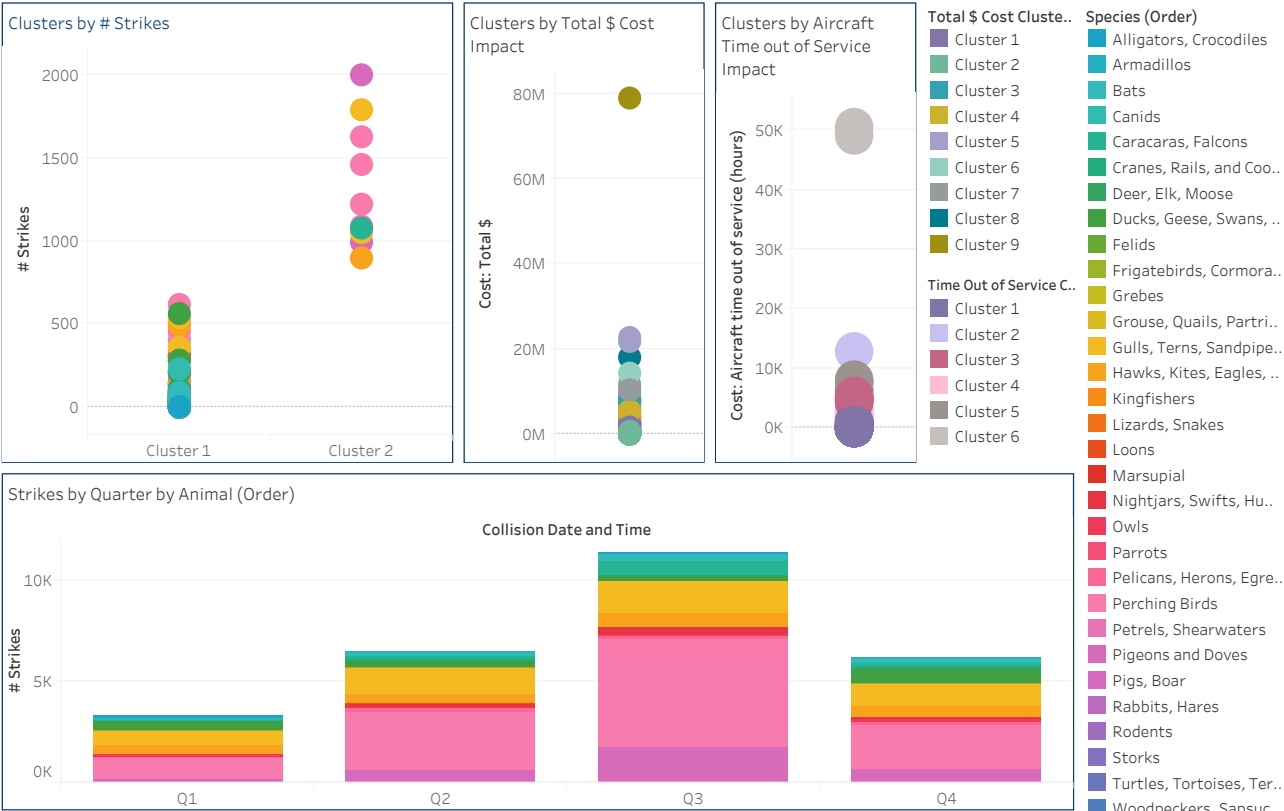
(c) 2023 Julie Leung, Data Source: FAA Wildlife Strikes (faa_data_subset), Last Updated: 2023-10-31 5:25:29 p.m.
More information about this work: <https://github.com/JulieLeung/FAA-Wildlife-Strikes-Data-Analysis>

FAA Wildlife Strikes Presentation

Wildlife Strike Location & High-Level Data Shape	Strike and Impact Trends Over Time	Top N Cost & Out of Service Impact by Quarter	Backup Viz's - Clusters, # Strikes by Quarter	Salient Points for the Reader (who did not get presentation)
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Trends in Wildlife Strikes (FAA) 2002-2015



(c) 2023 Julie Leung, Data Source: FAA Wildlife Strikes (faa_data_subset), Last Updated: 2023-10-31 5:25:29 p.m.
More information about project: <https://github.com/julieleung/FinalProject-Tableau/blob/main/PEADNMF.md>

FAA Wildlife Strikes Presentation

Wildlife Strike Location & High-Level Data Shape	Strike and Impact Trends Over Time	Top N Cost & Out of Service Impact by Quarter	Backup Viz's - Clusters, # Strikes by Quarter	Salient Points for the Reader (who did not get presentation)
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Trends in Wildlife Strikes (FAA) 2002-2015

Salient Points and Takeaways For The Reader (who didn't receive a verbal presentation)

<p>Top 3 Wildlife Species for number of strikes is:</p> <ol style="list-style-type: none">1) Mourning dove2) Gulls3) Barn swallow <p>Top 3 for # Strikes Disproportionate to Top 3 Species for Total \$ Cost damage:</p> <ol style="list-style-type: none">1) Canada goose (#12 for # strikes)2) White-tailed deer (#29 for # strikes)3) Bald eagle (#58 for # strikes) <p>Top 3 for # Strikes Disproportion to Top 3 Species for Aircraft time out of service:</p> <ol style="list-style-type: none">1) White-tailed deer2) Canada goose3) Turkey vulture (#24 for # strikes)	<p>Most Strikes Do No Damage and Have No Flight Impact:</p> <ul style="list-style-type: none">- Majority of strikes have "No indicated damage" and Impact to flight of "None"- When "Damage" is indicated, there are a lot more Impacts of "Precautionary Landing", "Aborted takeoff", "Engine shutdown", "Other", as would be expected. <p>Heightened Nervousness/Reaction to "No Damage" Strikes Due to 9/11?</p> <ul style="list-style-type: none">- When "No indicated damage", the incident of "Precautionary Landing" (yellow) and "Aborted takeoff" (orange) is relatively higher during the years 2001 Q3-2005 Q1.- Possibly heightened vigilance and response from airlines, crew, and from passenger pressure due to the 9/11 terrorist attacks (September 11, 2001)?- Perhaps took 4 years for this heightened vigilance in response to "No damage" strikes to subside. <p>Overall, most numerous strikes occur in Q3.</p> <ul style="list-style-type: none">- Bird migratory season is in this timeframe (e.g. Canada goose fall migration from late Aug to Nov, peak migration Sept/Oct).- Canada goose strikes are most numerous in Q2. This may be explained by their northern return timeframe from Feb to early May, peak migration Mar/Apr.
<p>There is an increase in # of strikes overall beginning around 2009.</p> <ul style="list-style-type: none">- Possible reason is increased education or a process change with FAA and airports.- FAA itself has noted this increase and attributes it to "proactive continuing outreach actions with its aviation industry and government partners [which] have improved the quantity and quality of voluntary wildlife strike reporting" <p>Source: https://www.faa.gov/newsroom/wildlife-strike-reporting-continues-increase.</p>	
<p>Wildlife Causing Most Costly Damage or Most Aircraft "out of service" Time Are Not Those Causing Most # Strikes:</p> <ul style="list-style-type: none">- Animals causing most costly monetary damage or aircraft "out of service" impact are Canada goose and White-tailed deer, respectively- Possible explanation of difference; Canada goose is more likely to strike in the air and possibly shred an engine or cause damage at higher speeds. Engine repair/replacement is much more costly than body damage, and damage at higher speeds would cause greater damage, hence more costly.- Whereas, White-tailed deer is more likely to cause body damage which is less costly to repair, but requires the aircraft to be grounded for longer to repair.	
<p>Strike Forecast for Canada goose and White-tailed deer:</p> <ul style="list-style-type: none">- Given the high cost (\$ and opportunity cost/out of service time) of strikes by Canada geese and White-tailed deer, a forecast for expected # of strikes from 2016-2023 was completed. Expected # of strikes per year as follows:- Canada goose: 36 strikes expected each year with flat trend- White-tailed deer: 6-11 strikes expected through the years with downward trend	<p>Cluster Analysis:</p> <ul style="list-style-type: none">- Clustering on # Strikes reveals 2 clusters, one with mean=33, and the other with mean=1322- Clustering on Total \$ Cost reveals 9 clusters- 6 clusters when using Aircraft Time out of Service