DataVisualisation_BirdStrike

February 1, 2024

#DATA VISUALISATION OF BIRDS STRIKE

####Reading the Birds_strike_data

```
[ ]: from google.colab import files
     uploaded=files.upload()
```

```
<IPython.core.display.HTML object>

Saving Bird_Strike_Data.csv to Bird_Strike_Data.csv
```

###Importing necessary libraries

```
[ ]: import pandas as pd
     import matplotlib.pyplot as plt
```

```
[ ]: data=pd.read_csv('Bird_Strike_Data.csv')
     data
```

```
[ ]:        Record ID Aircraft: Type                    Airport: Name Altitude bin  \
     0         202152       Airplane                     LAGUARDIA NY    > 1000 ft
     1         208159       Airplane      DALLAS/FORT WORTH INTL ARPT    < 1000 ft
     2         207601       Airplane                 LAKEFRONT AIRPORT    < 1000 ft
     3         215953       Airplane               SEATTLE-TACOMA INTL    < 1000 ft
     4         219878       Airplane                      NORFOLK INTL    < 1000 ft
     …            …            …                                 …          …
     25553     321151       Airplane                 REDDING MUNICIPAL    > 1000 ft
     25554     319677       Airplane                      ORLANDO INTL    < 1000 ft
     25555     319680            NaN                               NaN          NaN
     25556     319679       Airplane  DETROIT METRO WAYNE COUNTY ARPT    < 1000 ft
     25557     319593       Airplane      ABRAHAM LINCOLN CAPITAL ARPT    < 1000 ft

           Aircraft: Make/Model Wildlife: Number struck  \
     0                B-737-400                Over 100
     1                    MD-80                Over 100
     2                    C-500                Over 100
     3                B-737-400                Over 100
     4             CL-RJ100/200                Over 100
     …                      …                      …
     25553              EMB-120                       1
```

```
25554                A-321                       1
25555               EC-135                     NaN
25556            B-757-200                       1
25557            B-737-400                       1

       Wildlife: Number Struck Actual Effect: Impact to flight     FlightDate  \
0                                 859         Engine Shut Down  11/23/00 0:00
1                                 424                     None   7/25/01 0:00
2                                 261                     None   9/14/01 0:00
3                                 806    Precautionary Landing    9/5/02 0:00
4                                 942                     None   6/23/03 0:00
…                               …                      …            …
25553                               1                     None  12/30/11 0:00
25554                               1                     None  12/30/11 0:00
25555                               1                      NaN            NaN
25556                               1                     None  12/31/11 0:00
25557                               1                     None  12/31/11 0:00

      Effect: Indicated Damage  … Remains of wildlife sent to Smithsonian  \
0                Caused damage  …                                   False
1                Caused damage  …                                   False
2                    No damage  …                                   False
3                    No damage  …                                   False
4                    No damage  …                                   False
…                        …  …                                   …
25553                No damage  …                                   False
25554                No damage  …                                   False
25555                No damage  …                                   False
25556                No damage  …                                   False
25557            Caused damage  …                                   False

                                                 Remarks Wildlife: Size  \
0      FLT 753. PILOT REPTD A HUNDRED BIRDS ON UNKN T…        Medium
1      102 CARCASSES FOUND. 1 LDG LIGHT ON NOSE GEAR …         Small
2      FLEW UNDER A VERY LARGE FLOCK OF BIRDS OVER AP…         Small
3      NOTAM WARNING. 26 BIRDS HIT THE A/C, FORCING A…         Small
4                                          NO DMG REPTD.          Small
…                                                   …            …
25553                                DUCK? NO DMG REPTD.          Large
25554                                              NaN          Small
25555  STRUCK BIRD ON RT FRONT DURING T/O. BIRD REPTD…           NaN
25556  PILOTS REPORT STRIKING UNKNOWN BIRD ON RWY 21L…        Medium
25557  HIT CENTER OF RADOME, CAVING IN ABOUT 12". RAD…        Medium

      Conditions: Sky      Wildlife: Species  \
0            No Cloud  Unknown bird - medium
1          Some Cloud            Rock pigeon
```

```
2            No Cloud      European starling
3          Some Cloud      European starling
4            No Cloud      European starling
…               …                    …
25553        Overcast   Unknown bird - large
25554      Some Cloud           Tree swallow
25555        No Cloud   Unknown bird - small
25556      Some Cloud  Unknown bird - medium
25557        No Cloud        Red-tailed hawk

       Pilot warned of birds or wildlife?  Cost: Total $ Feet above ground  \
0                                       N         30,736             1,500
1                                       Y              0                 0
2                                       N              0                50
3                                       Y              0                50
4                                       N              0                50
…                                   …            …              …
25553                                   N              0             1,500
25554                                   Y              0                 0
25555                                 NaN              0               NaN
25556                                   Y              0                 0
25557                                   N              0                 0

      Number of people injured Is Aircraft Large?
0                             0                Yes
1                             0                 No
2                             0                 No
3                             0                Yes
4                             0                 No
…                        …                …
25553                         0                 No
25554                         0                 No
25555                         0                NaN
25556                         0                Yes
25557                         0                Yes

[25558 rows x 26 columns]
```

```
[ ]: print(data.info())
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 25558 entries, 0 to 25557
Data columns (total 26 columns):
 #   Column                                   Non-Null Count  Dtype
---  ------                                   --------------  -----
 0   Record ID                                25558 non-null  int64
 1   Aircraft: Type                           25429 non-null  object
 2   Airport: Name                            25429 non-null  object
 3   Altitude bin                             25429 non-null  object
 4   Aircraft: Make/Model                     25558 non-null  object
 5   Wildlife: Number struck                  25429 non-null  object
 6   Wildlife: Number Struck Actual           25558 non-null  int64
 7   Effect: Impact to flight                 25429 non-null  object
 8   FlightDate                               25429 non-null  object
 9   Effect: Indicated Damage                 25558 non-null  object
 10  Aircraft: Number of engines?             25291 non-null  object
 11  Aircraft: Airline/Operator               25429 non-null  object
 12  Origin State                             25109 non-null  object
 13  When: Phase of flight                    25429 non-null  object
 14  Conditions: Precipitation                25558 non-null  object
 15  Remains of wildlife collected?           25558 non-null  bool
 16  Remains of wildlife sent to Smithsonian  25558 non-null  bool
 17  Remarks                                  20787 non-null  object
 18  Wildlife: Size                           25429 non-null  object
 19  Conditions: Sky                          25558 non-null  object
 20  Wildlife: Species                        25558 non-null  object
 21  Pilot warned of birds or wildlife?       25429 non-null  object
 22  Cost: Total $                            25558 non-null  object
 23  Feet above ground                        25429 non-null  object
 24  Number of people injured                 25558 non-null  int64
 25  Is Aircraft Large?                       25429 non-null  object
dtypes: bool(2), int64(3), object(21)
memory usage: 4.7+ MB
None
```

###Splitting the month and year

[ ]:

```
data['FlightDate']=pd.to_datetime(data['FlightDate'])

data['month']=data['FlightDate'].dt.month
data['year']=data['FlightDate'].dt.year
```

[ ]:

```
missing_values=data.isnull().sum()
print(missing_values)
```

```
Record ID                                       0
Aircraft: Type                                129
Airport: Name                                 129
Altitude bin                                  129
Aircraft: Make/Model                            0
Wildlife: Number struck                       129
Wildlife: Number Struck Actual                  0
Effect: Impact to flight                      129
FlightDate                                    129
Effect: Indicated Damage                        0
```

```
Aircraft: Number of engines?               267
Aircraft: Airline/Operator                 129
Origin State                               449
When: Phase of flight                      129
Conditions: Precipitation                    0
Remains of wildlife collected?               0
Remains of wildlife sent to Smithsonian      0
Remarks                                   4771
Wildlife: Size                             129
Conditions: Sky                              0
Wildlife: Species                            0
Pilot warned of birds or wildlife?         129
Cost: Total $                                0
Feet above ground                          129
Number of people injured                     0
Is Aircraft Large?                         129
month                                      129
year                                       129
dtype: int64
```

[ ]:

```
data['Aircraft: Type']=data['Aircraft: Type'].str.upper()
```

[ ]:

```
print(data.columns)
```

```
Index(['Record ID', 'Aircraft: Type', 'Airport: Name', 'Altitude bin',
       'Aircraft: Make/Model', 'Wildlife: Number struck',
       'Wildlife: Number Struck Actual', 'Effect: Impact to flight',
       'FlightDate', 'Effect: Indicated Damage',
       'Aircraft: Number of engines?', 'Aircraft: Airline/Operator',
       'Origin State', 'When: Phase of flight', 'Conditions: Precipitation',
       'Remains of wildlife collected?',
       'Remains of wildlife sent to Smithsonian', 'Remarks', 'Wildlife: Size',
       'Conditions: Sky', 'Wildlife: Species',
       'Pilot warned of birds or wildlife?', 'Cost: Total $',
       'Feet above ground', 'Number of people injured', 'Is Aircraft Large?',
       'month', 'year'],
      dtype='object')
```

###Cleaning the dataset

[ ]:

```
data.drop(['Record ID','Remarks'],axis=1,inplace=True)
```

[ ]:

```
clean_data=data
clean_data
```

[ ]:

```
      Aircraft: Type                    Airport: Name Altitude bin  \
0           AIRPLANE                     LAGUARDIA NY    > 1000 ft
1           AIRPLANE      DALLAS/FORT WORTH INTL ARPT    < 1000 ft
```

```
2           AIRPLANE                LAKEFRONT AIRPORT    < 1000 ft
3           AIRPLANE              SEATTLE-TACOMA INTL    < 1000 ft
4           AIRPLANE                     NORFOLK INTL    < 1000 ft
…              …                              …          …
25553       AIRPLANE                REDDING MUNICIPAL    > 1000 ft
25554       AIRPLANE                     ORLANDO INTL    < 1000 ft
25555            NaN                              NaN          NaN
25556       AIRPLANE  DETROIT METRO WAYNE COUNTY ARPT    < 1000 ft
25557       AIRPLANE     ABRAHAM LINCOLN CAPITAL ARPT    < 1000 ft

      Aircraft: Make/Model Wildlife: Number struck  \
0                B-737-400                Over 100
1                    MD-80                Over 100
2                    C-500                Over 100
3                B-737-400                Over 100
4             CL-RJ100/200                Over 100
…                    …                     …
25553              EMB-120                       1
25554                A-321                       1
25555               EC-135                     NaN
25556            B-757-200                       1
25557            B-737-400                       1

       Wildlife: Number Struck Actual Effect: Impact to flight FlightDate  \
0                                 859         Engine Shut Down 2000-11-23
1                                 424                     None 2001-07-25
2                                 261                     None 2001-09-14
3                                 806    Precautionary Landing 2002-09-05
4                                 942                     None 2003-06-23
…                               …                      …        …
25553                               1                     None 2011-12-30
25554                               1                     None 2011-12-30
25555                               1                      NaN        NaT
25556                               1                     None 2011-12-31
25557                               1                     None 2011-12-31

      Effect: Indicated Damage Aircraft: Number of engines?  …  \
0                Caused damage                            2  …
1                Caused damage                            2  …
2                    No damage                            2  …
3                    No damage                            2  …
4                    No damage                            2  …
…                        …                           …  …
25553                No damage                            2  …
25554                No damage                            2  …
25555                No damage                          NaN  …
25556                No damage                            2  …
```

```
25557            Caused damage                            2  …

      Wildlife: Size Conditions: Sky      Wildlife: Species  \
0             Medium        No Cloud  Unknown bird - medium
1              Small      Some Cloud            Rock pigeon
2              Small        No Cloud      European starling
3              Small      Some Cloud      European starling
4              Small        No Cloud      European starling
…              …             …                    …
25553          Large        Overcast   Unknown bird - large
25554          Small      Some Cloud           Tree swallow
25555            NaN        No Cloud   Unknown bird - small
25556         Medium      Some Cloud  Unknown bird - medium
25557         Medium        No Cloud        Red-tailed hawk

      Pilot warned of birds or wildlife?  Cost: Total $  Feet above ground  \
0                                      N         30,736              1,500
1                                      Y              0                  0
2                                      N              0                 50
3                                      Y              0                 50
4                                      N              0                 50
…                                  …            …                …
25553                                  N              0              1,500
25554                                  Y              0                  0
25555                                NaN              0                NaN
25556                                  Y              0                  0
25557                                  N              0                  0

      Number of people injured Is Aircraft Large? month    year
0                            0                Yes  11.0  2000.0
1                            0                 No   7.0  2001.0
2                            0                 No   9.0  2001.0
3                            0                Yes   9.0  2002.0
4                            0                 No   6.0  2003.0
…                        …                …   …     …
25553                        0                 No  12.0  2011.0
25554                        0                 No  12.0  2011.0
25555                        0                NaN   NaN     NaN
25556                        0                Yes  12.0  2011.0
25557                        0                Yes  12.0  2011.0

[25558 rows x 26 columns]
```

###Unique phase of flight

[ ]:

```
print(data['When: Phase of flight'].unique())
```

```
['Climb' 'Landing Roll' 'Approach' 'Take-off run' 'Descent' nan 'Taxi'
```

```
 'Parked']
```

0.0.1 First and Last 10 species names

[ ]:

```
print("First 10 species name")
print(data['Wildlife: Species'].value_counts().head(10))
print("\n")
print("Last 10 species name")
print(data['Wildlife: Species'].value_counts().tail(10))
```

```
First 10 species name
Unknown bird - small     10505
Unknown bird - medium     4318
Mourning dove              898
European starling          885
Unknown bird - large       797
Rock pigeon                596
Barn swallow               579
Killdeer                   470
American kestrel           444
Red-tailed hawk            412
Name: Wildlife: Species, dtype: int64



Last 10 species name
Red-naped sapsucker     1
Ptarmigans              1
Fairy tern              1
Common merganser        1
Prairie dog             1
Cape May warbler        1
Western bluebird        1
Common ground-dove      1
Yellow-billed magpie    1
Pine grosbeak           1
Name: Wildlife: Species, dtype: int64
```

[ ]:

```
print(clean_data.columns)
```

```
Index(['Aircraft: Type', 'Airport: Name', 'Altitude bin',
       'Aircraft: Make/Model', 'Wildlife: Number struck',
       'Wildlife: Number Struck Actual', 'Effect: Impact to flight',
       'FlightDate', 'Effect: Indicated Damage',
       'Aircraft: Number of engines?', 'Aircraft: Airline/Operator',
       'Origin State', 'When: Phase of flight', 'Conditions: Precipitation',
       'Remains of wildlife collected?',
       'Remains of wildlife sent to Smithsonian', 'Wildlife: Size',
       'Conditions: Sky', 'Wildlife: Species',
       'Pilot warned of birds or wildlife?', 'Cost: Total $',
       'Feet above ground', 'Number of people injured', 'Is Aircraft Large?',
       'month', 'year'],
      dtype='object')
```

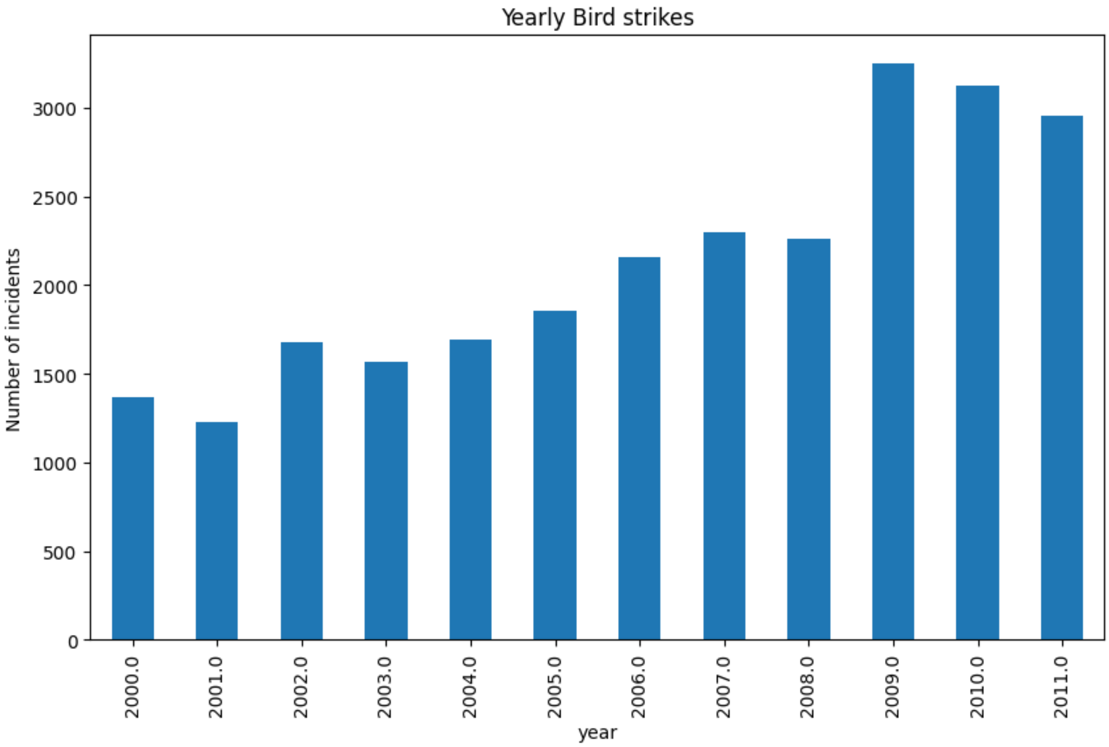
###Year Analysis

```
[ ]: clean_data['year'].value_counts().sort_index()
```

```
[ ]: 2000.0    1367
     2001.0    1230
     2002.0    1681
     2003.0    1568
     2004.0    1692
     2005.0    1853
     2006.0    2159
     2007.0    2301
     2008.0    2258
     2009.0    3247
     2010.0    3121
     2011.0    2952
     Name: year, dtype: int64
```

##Number of bird strikes

```
[ ]: plt.figure(figsize=(10,6))
     clean_data['year'].value_counts().sort_index().plot(kind='bar')
     plt.title('Yearly Bird strikes')
     plt.xlabel('year')
     plt.ylabel('Number of incidents')
     plt.show()
```



```
[ ]: US_states=print(clean_data['Origin State'].unique())
```

```
['New York' 'Texas' 'Louisiana' 'Washington' 'Virginia' nan 'Delaware'
 'DC' 'Georgia' 'Florida' 'California' 'Illinois' 'Connecticut' 'Missouri'
 'Rhode Island' 'Hawaii' 'Arizona' 'Tennessee' 'South Carolina'
 'South Dakota' 'New Jersey' 'Colorado' 'Minnesota' 'Alabama' 'Ohio'
 'Wisconsin' 'Michigan' 'Massachusetts' 'Alaska' 'North Carolina'
 'Kentucky' 'Indiana' 'Oregon' 'Pennsylvania' 'New Hampshire' 'Arkansas'
 'Nevada' 'Mississippi' 'Maryland' 'Maine' 'Quebec' 'Idaho'
 'British Columbia' 'Utah' 'Nebraska' 'Iowa' 'New Mexico' 'West Virginia'
 'Oklahoma' 'North Dakota' 'Vermont' 'Wyoming' 'Kansas'
 'Prince Edward Island' 'Montana' 'Puerto Rico' 'Ontario' 'Virgin Islands'
 'Newfoundland and Labrador' 'Alberta' 'Saskatchewan']
```

```
[ ]: valid_us_states = ['New York', 'Texas', 'Louisiana', 'Washington', 'Virginia',␣
      ↪'Delaware', 'DC', 'Georgia', 'Florida', 'California', 'Illinois',␣
      ↪'Connecticut', 'Missouri', 'Rhode Island', 'Hawaii', 'Arizona', 'Tennessee',␣
      ↪'South Carolina', 'South Dakota', 'New Jersey', 'Colorado', 'Minnesota',␣
      ↪'Alabama', 'Ohio', 'Wisconsin', 'Michigan', 'Massachusetts', 'Alaska',␣
      ↪'North Carolina', 'Kentucky', 'Indiana', 'Oregon', 'Pennsylvania', 'New␣
      ↪Hampshire', 'Arkansas', 'Nevada', 'Mississippi', 'Maryland', 'Maine',␣
      ↪'Utah', 'Nebraska', 'Iowa', 'New Mexico', 'West Virginia', 'Oklahoma',␣
      ↪'North Dakota', 'Vermont', 'Wyoming', 'Kansas', 'Montana']
```

```
bird_strikes_us_states = clean_data[clean_data['Origin State'].
 ↪isin(valid_us_states)]
bird_strikes_by_state=bird_strikes_us_states['Origin State'].value_counts()
bird_strikes_by_state
```

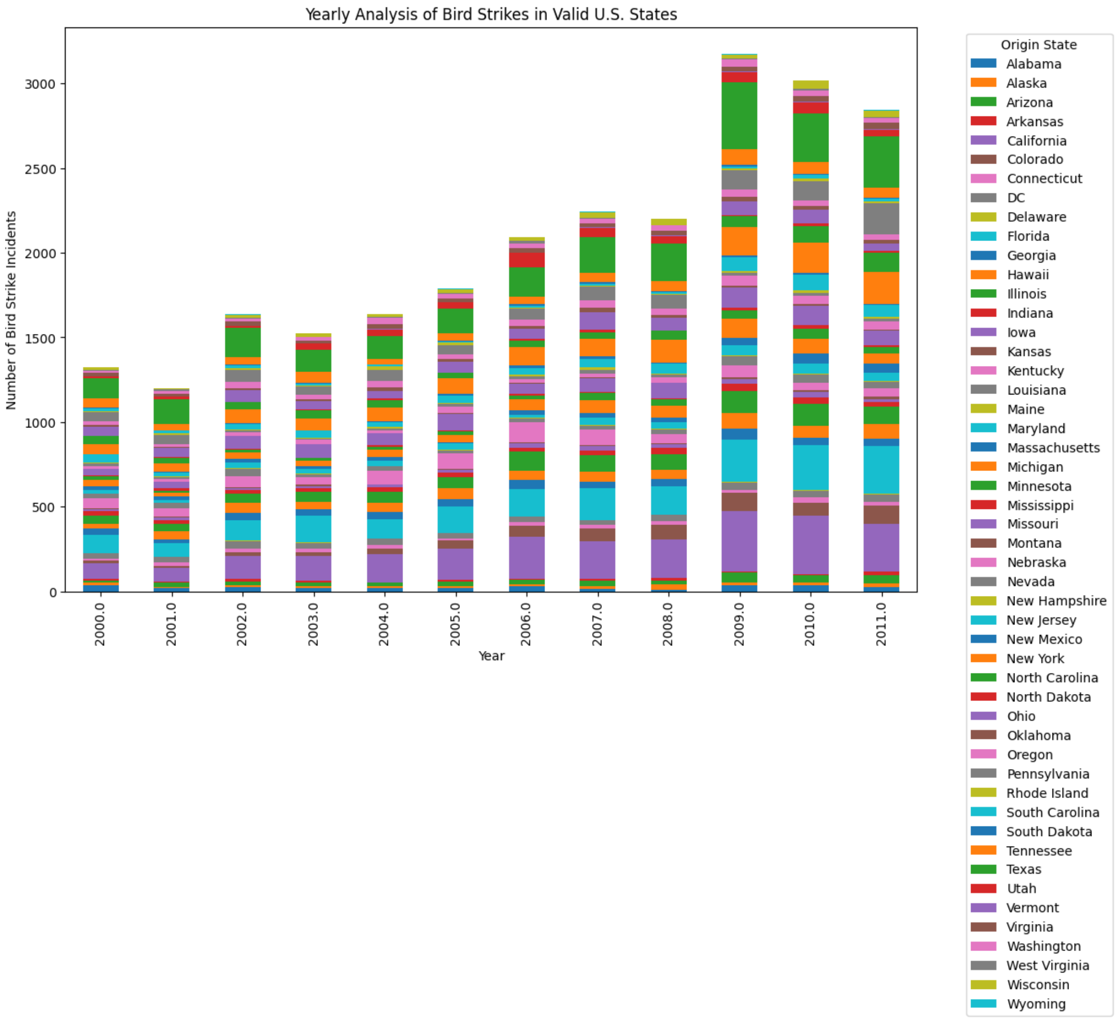
```
[ ]: California        2520
     Texas             2453
     Florida           2055
     New York          1319
     Illinois          1008
     Pennsylvania       986
     Missouri           960
     Kentucky           812
     Ohio               778
     Hawaii             729
     Michigan           678
     Colorado           664
     Tennessee          655
     North Carolina     652
     New Jersey         600
     Georgia            510
     Utah               496
     Maryland           433
     DC                 432
     Louisiana          397
     Oregon             391
     Nebraska           368
     Arizona            360
     Massachusetts      355
     Minnesota          352
     Indiana            346
     Washington         330
     Alabama            301
     Virginia           300
     Wisconsin          286
     Connecticut        246
     Iowa               228
     Oklahoma           212
     Alaska             186
     Nevada             167
     South Carolina     166
     Rhode Island       125
     New Hampshire      120
     Arkansas           118
     Mississippi        117
     Kansas             100
     New Mexico          94
```

```
North Dakota        87
West Virginia       83
South Dakota        60
Montana             43
Maine               41
Vermont             36
Wyoming             34
Delaware            27
Name: Origin State, dtype: int64
```

0.1 Yearly Analysis & Bird strikes in US

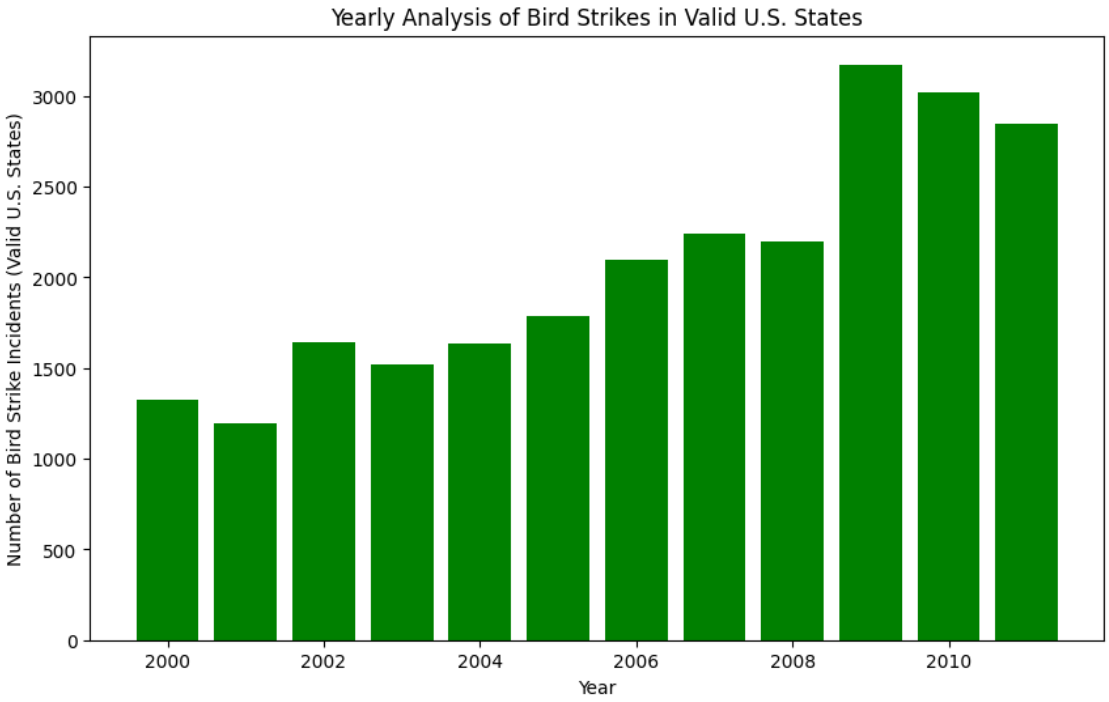
[ ]:

```
valid_us_states = ['New York', 'Texas', 'Louisiana', 'Washington', 'Virginia',␣
 ↪'Delaware', 'DC', 'Georgia', 'Florida', 'California', 'Illinois',␣
 ↪'Connecticut', 'Missouri', 'Rhode Island', 'Hawaii', 'Arizona', 'Tennessee',␣
 ↪'South Carolina', 'South Dakota', 'New Jersey', 'Colorado', 'Minnesota',␣
 ↪'Alabama', 'Ohio', 'Wisconsin', 'Michigan', 'Massachusetts', 'Alaska',␣
 ↪'North Carolina', 'Kentucky', 'Indiana', 'Oregon', 'Pennsylvania', 'New␣
 ↪Hampshire', 'Arkansas', 'Nevada', 'Mississippi', 'Maryland', 'Maine',␣
 ↪'Utah', 'Nebraska', 'Iowa', 'New Mexico', 'West Virginia', 'Oklahoma',␣
 ↪'North Dakota', 'Vermont', 'Wyoming', 'Kansas', 'Montana']
bird_strikes_us_states = clean_data[clean_data['Origin State'].
 ↪isin(valid_us_states)]
bird_strikes_us_states
# Count of bird strike incidents for valid U.S. states each year
bird_strikes_by_state_yearly = bird_strikes_us_states.groupby(['year', 'Origin␣
 ↪State']).size().unstack()

# Plotting a stacked bar chart
bird_strikes_by_state_yearly.plot(kind='bar', stacked=True, figsize=(12, 8))
plt.xlabel('Year')
plt.ylabel('Number of Bird Strike Incidents')
plt.title('Yearly Analysis of Bird Strikes in Valid U.S. States')
plt.legend(title='Origin State', bbox_to_anchor=(1.05, 1), loc='upper left')  #␣
 ↪Place legend outside the plot
plt.show()
```



[ ]:

```
bird_strikes_us_states_yearly = bird_strikes_us_states.groupby('year').size()

# Plotting a bar chart for Yearly Analysis of Bird Strikes in valid U.S. states
plt.figure(figsize=(10, 6))
plt.bar(bird_strikes_us_states_yearly.index, bird_strikes_us_states_yearly.
  ↪values, color='green')
plt.xlabel('Year')
plt.ylabel('Number of Bird Strike Incidents (Valid U.S. States)')
plt.title('Yearly Analysis of Bird Strikes in Valid U.S. States')
plt.show()
```

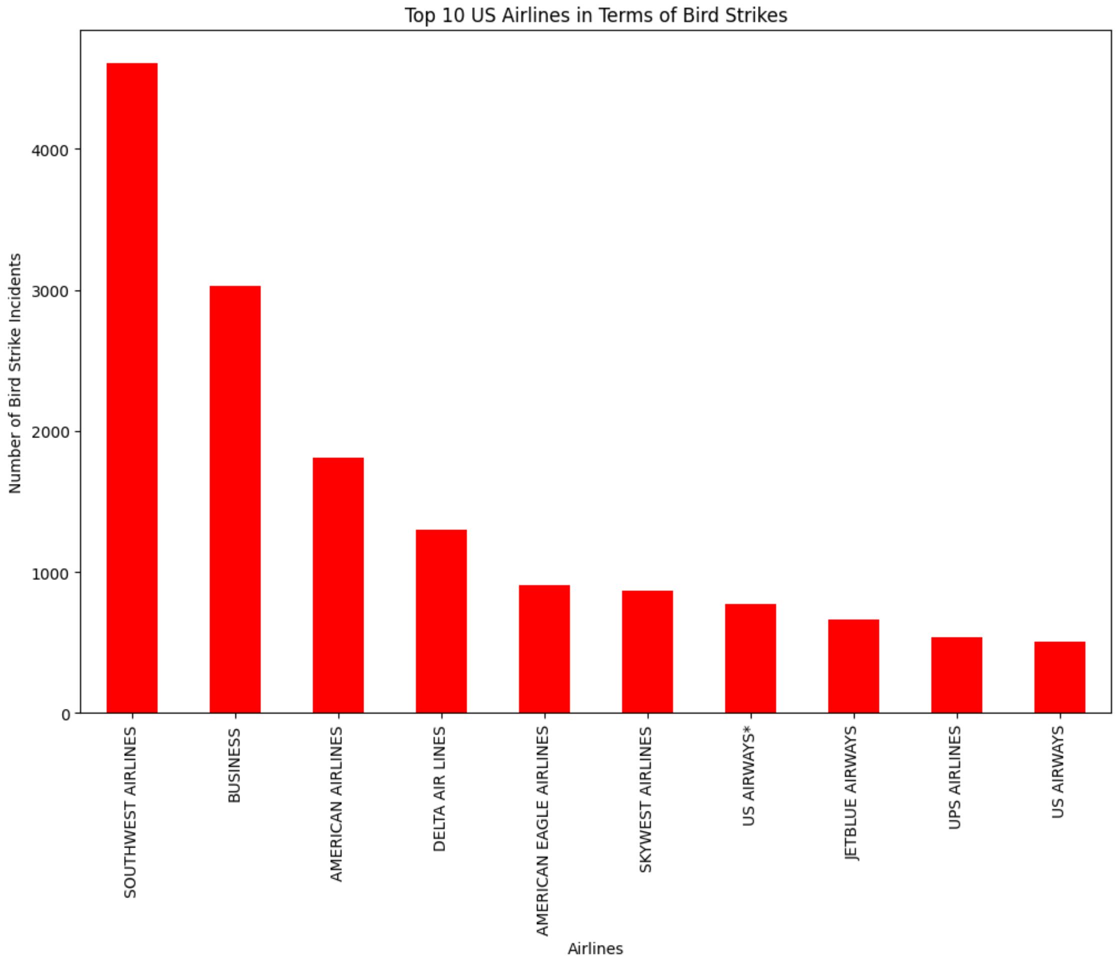


[ ]:
```
bird_strikes_by_airline = bird_strikes_us_states['Aircraft: Airline/Operator'].
 ↪value_counts()
bird_strikes_by_airline
```

[ ]:
```
SOUTHWEST AIRLINES           4610
BUSINESS                     3032
AMERICAN AIRLINES            1809
DELTA AIR LINES              1302
AMERICAN EAGLE AIRLINES       905
                             …
JETCORP                         1
ISLAND EXPRESS                  1
AIR AMERICA/TOTAL AIR           1
AIR JAPAN                       1
MIDWEST AVIATION DIVISION       1
Name: Aircraft: Airline/Operator, Length: 284, dtype: int64
```

0.2 Top 10 US Airlines for encountering bird strikes

[ ]:
```
top_10_airlines = bird_strikes_by_airline.head(10)

# Plotting a bar chart for Top 10 US Airlines in terms of bird strikes
top_10_airlines.plot(kind='bar', figsize=(12, 8),color='red')
plt.xlabel('Airlines')
plt.ylabel('Number of Bird Strike Incidents')
plt.title('Top 10 US Airlines in Terms of Bird Strikes')
plt.show()
```



0.3 Top 50 Airports with most incidents of bird strikes

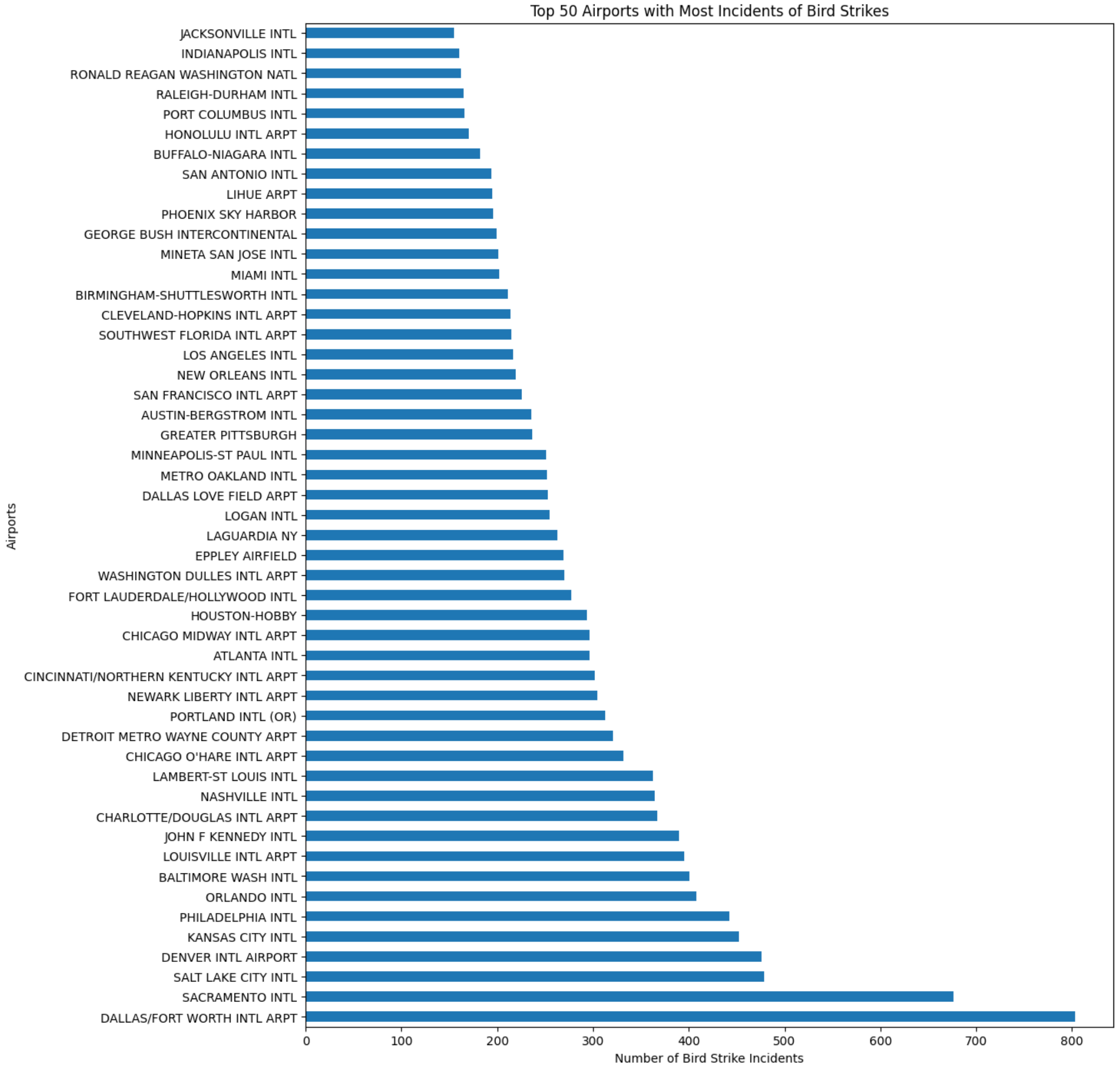
```
[ ]: bird_strikes_by_airport = clean_data['Airport: Name'].value_counts()
     top_50_airports = bird_strikes_by_airport.head(50)
     top_50_airports
```

```
[ ]: DALLAS/FORT WORTH INTL ARPT                803
     SACRAMENTO INTL                            676
     SALT LAKE CITY INTL                        479
     DENVER INTL AIRPORT                        476
     KANSAS CITY INTL                           452
     PHILADELPHIA INTL                          442
     ORLANDO INTL                               408
```

```
BALTIMORE WASH INTL                       401
LOUISVILLE INTL ARPT                      395
JOHN F KENNEDY INTL                       390
CHARLOTTE/DOUGLAS INTL ARPT               367
NASHVILLE INTL                            364
LAMBERT-ST LOUIS INTL                     363
CHICAGO O'HARE INTL ARPT                  332
DETROIT METRO WAYNE COUNTY ARPT           321
PORTLAND INTL (OR)                        313
NEWARK LIBERTY INTL ARPT                  305
CINCINNATI/NORTHERN KENTUCKY INTL ARPT    302
ATLANTA INTL                              296
CHICAGO MIDWAY INTL ARPT                  296
HOUSTON-HOBBY                             294
FORT LAUDERDALE/HOLLYWOOD INTL            277
WASHINGTON DULLES INTL ARPT               270
EPPLEY AIRFIELD                           269
LAGUARDIA NY                              263
LOGAN INTL                                255
DALLAS LOVE FIELD ARPT                    253
METRO OAKLAND INTL                        252
MINNEAPOLIS-ST PAUL INTL                  251
GREATER PITTSBURGH                        237
AUSTIN-BERGSTROM INTL                     236
SAN FRANCISCO INTL ARPT                   226
NEW ORLEANS INTL                          219
LOS ANGELES INTL                          217
SOUTHWEST FLORIDA INTL ARPT               215
CLEVELAND-HOPKINS INTL ARPT               214
BIRMINGHAM-SHUTTLESWORTH INTL             211
MIAMI INTL                                202
MINETA SAN JOSE INTL                      201
GEORGE BUSH INTERCONTINENTAL              199
PHOENIX SKY HARBOR                        196
LIHUE ARPT                                195
SAN ANTONIO INTL                          194
BUFFALO-NIAGARA INTL                      182
HONOLULU INTL ARPT                        170
PORT COLUMBUS INTL                        166
RALEIGH-DURHAM INTL                       165
RONALD REAGAN WASHINGTON NATL             162
INDIANAPOLIS INTL                         160
JACKSONVILLE INTL                         155
Name: Airport: Name, dtype: int64
```

[ ]:

```
top_50_airports.plot(kind='barh', figsize=(12, 15))
plt.xlabel('Number of Bird Strike Incidents')
plt.ylabel('Airports')
plt.title('Top 50 Airports with Most Incidents of Bird Strikes')
plt.show()
```



0.4 Yearly cost incurred due to bird strikes

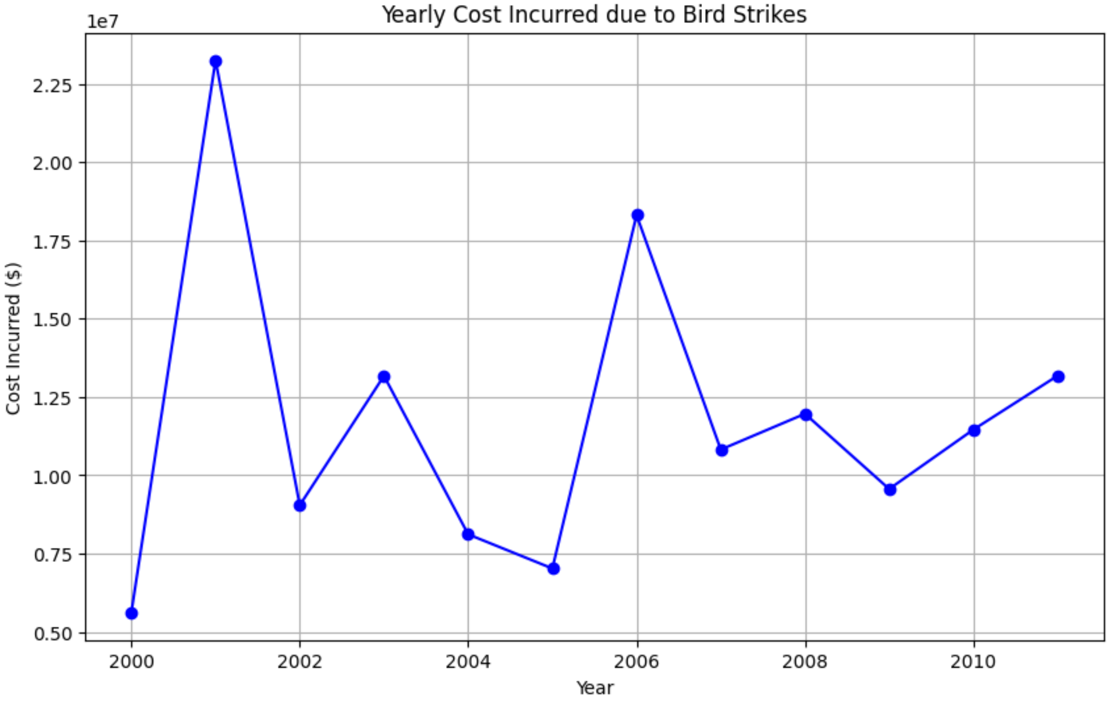
```
[ ]: clean_data['Cost: Total $'] = pd.to_numeric(clean_data['Cost: Total $'].
      ↪replace('[^\d.]', '', regex=True), errors='coerce')
     yearly_cost_due_to_bird_strikes = clean_data.groupby('year')['Cost: Total $'].
      ↪sum()
     yearly_cost_due_to_bird_strikes
```

[ ]:

```
year
2000.0     5625496
2001.0    23252168
2002.0     9046405
2003.0    13176787
2004.0     8116866
2005.0     7026670
2006.0    18309903
2007.0    10822426
2008.0    11966121
2009.0     9564327
2010.0    11459879
2011.0    13180130
Name: Cost: Total $, dtype: int64
```

[ ]:

```
# Plotting a line chart for Yearly Cost Incurred due to Bird Strikes
plt.figure(figsize=(10, 6))
plt.plot(yearly_cost_due_to_bird_strikes.index, yearly_cost_due_to_bird_strikes.
  ↪values, marker='o', linestyle='-', color='blue')
plt.xlabel('Year')
plt.ylabel('Cost Incurred ($)')
plt.title('Yearly Cost Incurred due to Bird Strikes')
plt.grid(True)
plt.show()
```



0.5 When do most bird strikes occur?

[ ]:

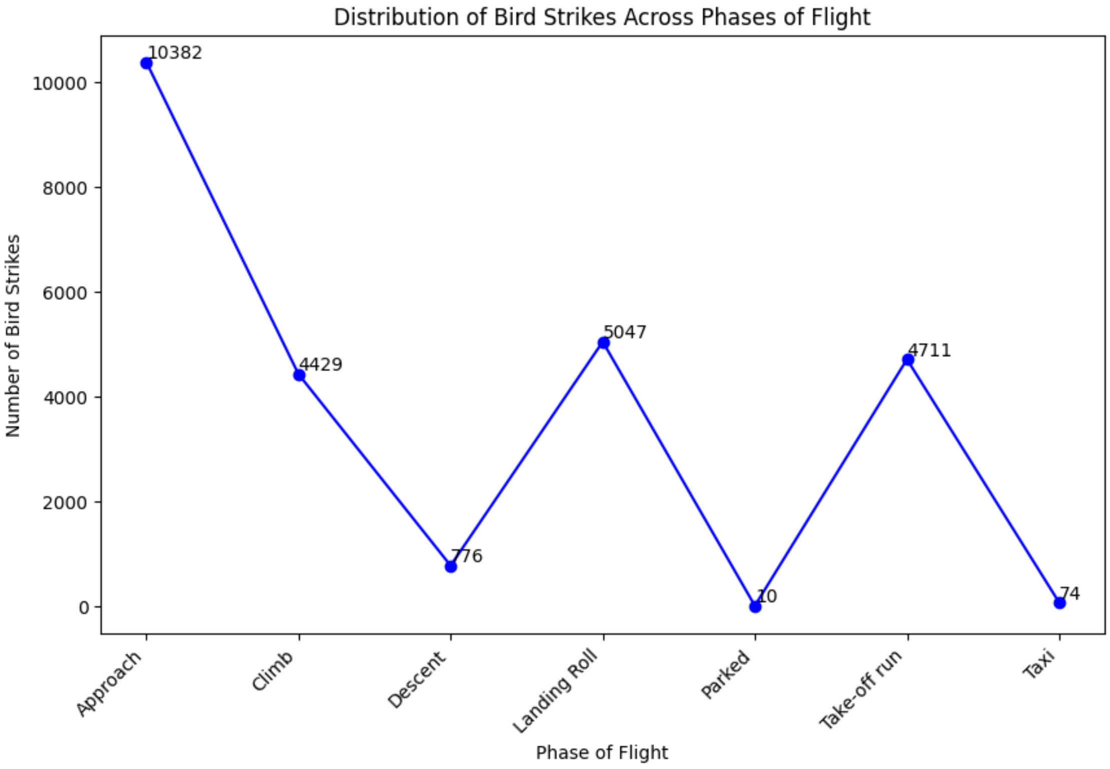
```
bird_strikes_by_phase = clean_data['When: Phase of flight'].value_counts()
bird_strikes_by_phase
```

[ ]:

```
Approach         10382
Landing Roll      5047
Take-off run      4711
Climb             4429
Descent            776
Taxi                74
Parked              10
Name: When: Phase of flight, dtype: int64
```

[ ]:

```
sorted_phases = bird_strikes_by_phase.index.sort_values()

# Plotting a line plot
plt.figure(figsize=(10, 6))
plt.plot(sorted_phases, bird_strikes_by_phase[sorted_phases], marker='o',␣
 ↪linestyle='-', color='b')

plt.xlabel('Phase of Flight')
plt.ylabel('Number of Bird Strikes')
plt.title('Distribution of Bird Strikes Across Phases of Flight')

plt.xticks(rotation=45, ha='right')

# Displaying values on data points
for x, y in zip(sorted_phases, bird_strikes_by_phase[sorted_phases]):
    plt.text(x, y, f'{y}', ha='left', va='bottom')

plt.show()
```



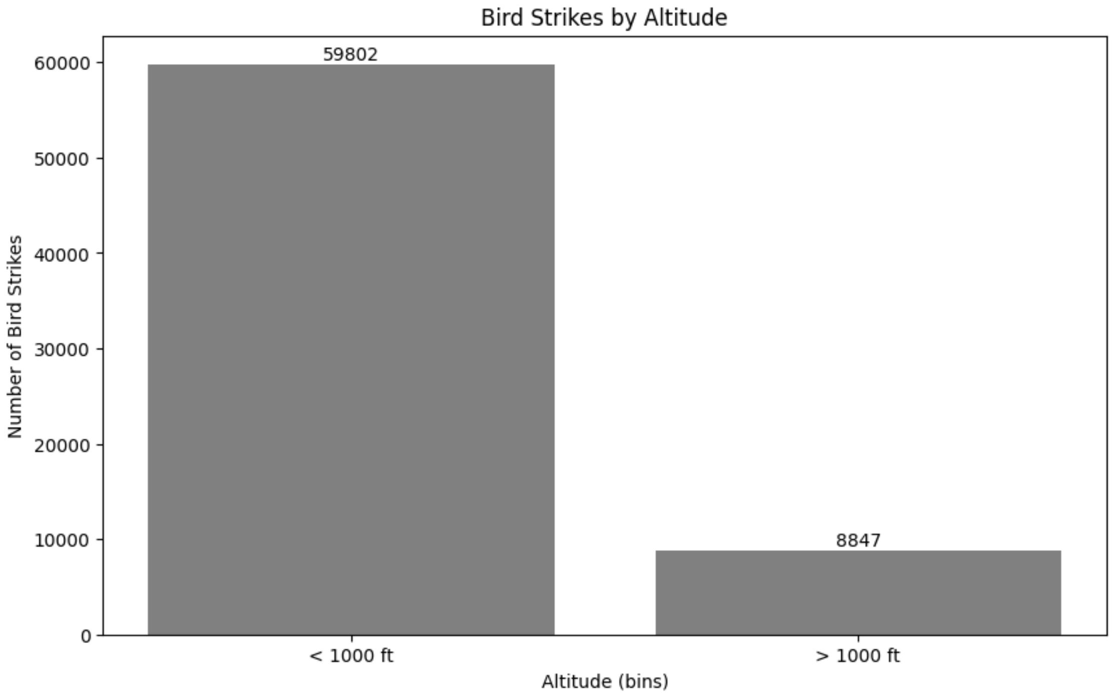
0.6 Altitude of aeroplanes at the time of strike

```
[ ]: altitude_data = clean_data[['Altitude bin','Wildlife: Number Struck Actual']]

     # Grouping by altitude and calculating the total number of bird strikes at each␣
      ↪altitude
     bird_strikes_by_altitude = altitude_data.groupby('Altitude bin')['Wildlife:␣
      ↪Number Struck Actual'].sum()
     bird_strikes_by_altitude
```

```
[ ]: Altitude bin
     < 1000 ft    59802
     > 1000 ft     8847
     Name: Wildlife: Number Struck Actual, dtype: int64
```

```
[ ]: sorted_altitudes = bird_strikes_by_altitude.index.sort_values()

     # Plotting a bar chart
     plt.figure(figsize=(10, 6))
     plt.bar(sorted_altitudes, bird_strikes_by_altitude[sorted_altitudes],␣
      ↪color='grey', label='Bird Strikes')
```

```
plt.xlabel('Altitude (bins)')
plt.ylabel('Number of Bird Strikes')
plt.title('Bird Strikes by Altitude')

for x, y in zip(sorted_altitudes, bird_strikes_by_altitude[sorted_altitudes]):
    plt.text(x, y, f'{y}', ha='center', va='bottom')

plt.show()
```



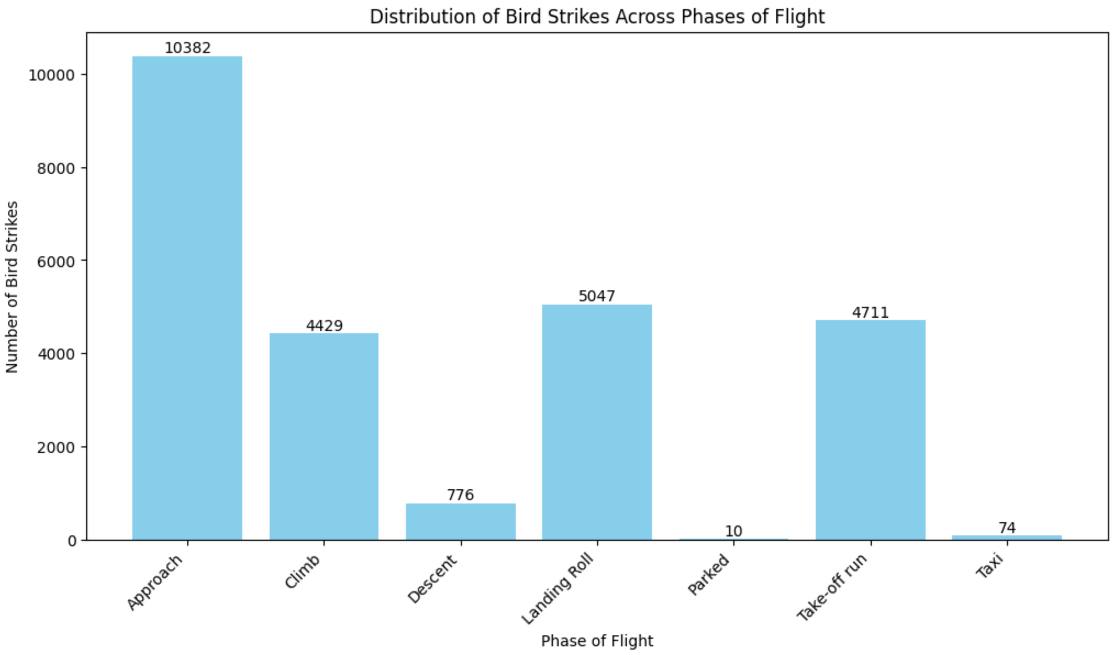
0.7 Phase of flight at the time of strike

```
[ ]: bird_strikes_by_phase = clean_data['When: Phase of flight'].value_counts()
     bird_strikes_by_phase
```

```
[ ]: Approach        10382
     Landing Roll     5047
     Take-off run     4711
     Climb            4429
     Descent           776
     Taxi               74
     Parked             10
     Name: When: Phase of flight, dtype: int64
```

[ ]:

```
sorted_phases = bird_strikes_by_phase.index.sort_values()

# Plotting a bar chart
plt.figure(figsize=(12, 6))
plt.bar(sorted_phases, bird_strikes_by_phase[sorted_phases], color='skyblue')

plt.xlabel('Phase of Flight')
plt.ylabel('Number of Bird Strikes')
plt.title('Distribution of Bird Strikes Across Phases of Flight')

plt.xticks(rotation=45, ha='right')

# Displaying values on top of bars
for x, y in zip(sorted_phases, bird_strikes_by_phase[sorted_phases]):
    plt.text(x, y, f'{y}', ha='center', va='bottom')

plt.show()
```



0.8 Average altitude of aeroplanes in different phases at the time of strike.

[ ]:

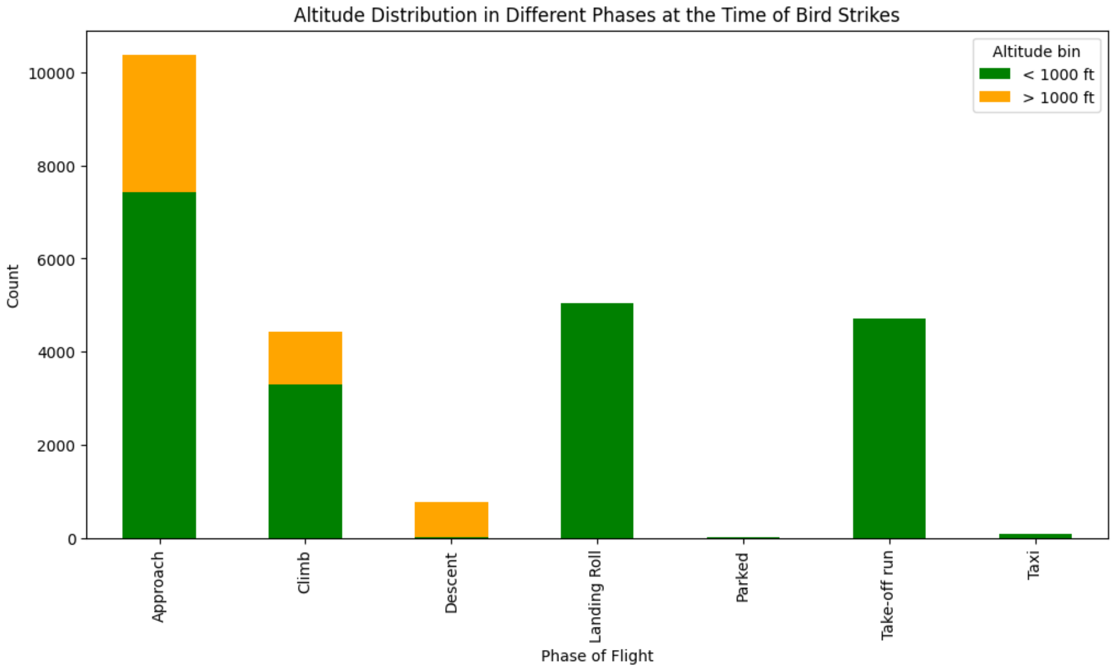
```
altitude_phase_data = clean_data[['When: Phase of flight', 'Altitude bin']]
altitude_phase_data
```

[ ]:

```
      When: Phase of flight Altitude bin
0                     Climb    > 1000 ft
```

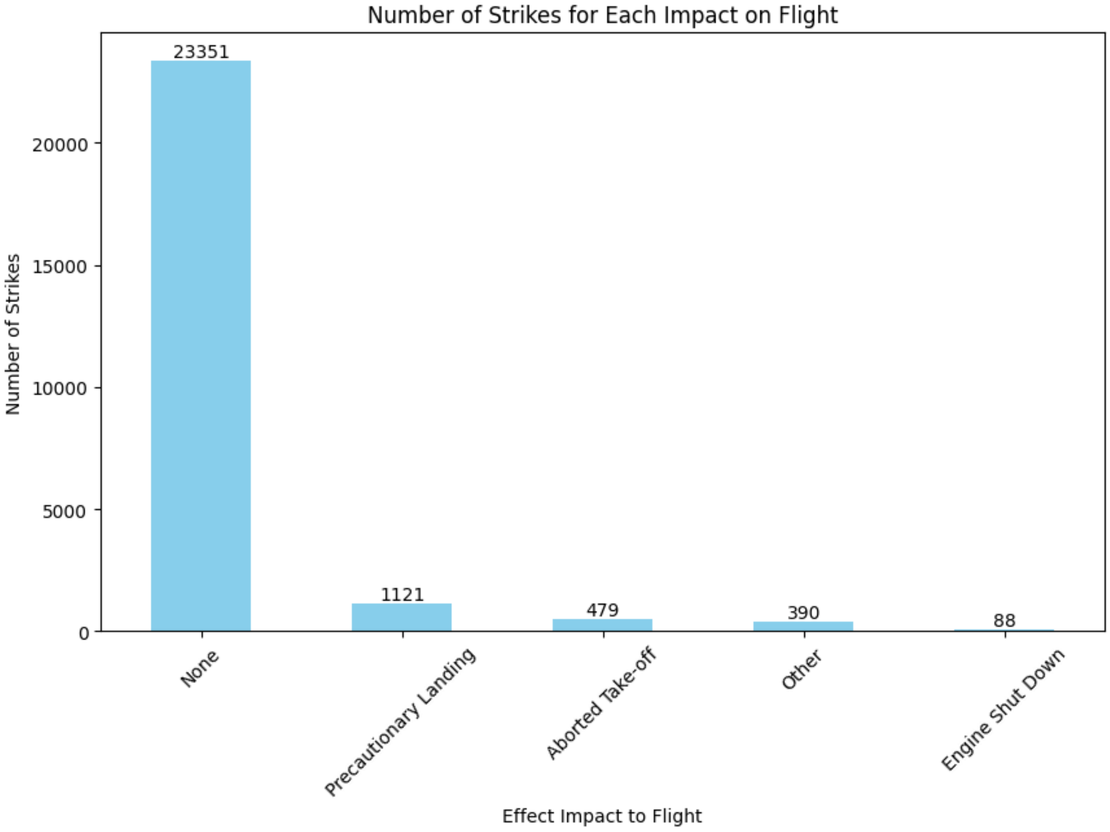
```
1              Landing Roll    < 1000 ft
2                  Approach    < 1000 ft
3                     Climb    < 1000 ft
4                  Approach    < 1000 ft
…                         …          …
25553              Approach    > 1000 ft
25554          Landing Roll    < 1000 ft
25555                   NaN          NaN
25556          Landing Roll    < 1000 ft
25557         Take-off run     < 1000 ft

[25558 rows x 2 columns]
```

```
[ ]: plt.figure(figsize=(12, 6))
     pd.crosstab(altitude_phase_data['When: Phase of flight'],␣
      ↪altitude_phase_data['Altitude bin']).plot(kind='bar', stacked=True,␣
      ↪color=['green', 'orange'], ax=plt.gca())

     plt.xlabel('Phase of Flight')
     plt.ylabel('Count')
     plt.title('Altitude Distribution in Different Phases at the Time of Bird␣
      ↪Strikes')
     plt.legend(title='Altitude bin', loc='upper right')

     plt.show()
```



0.9 Effect of bird strikes & impact on flight

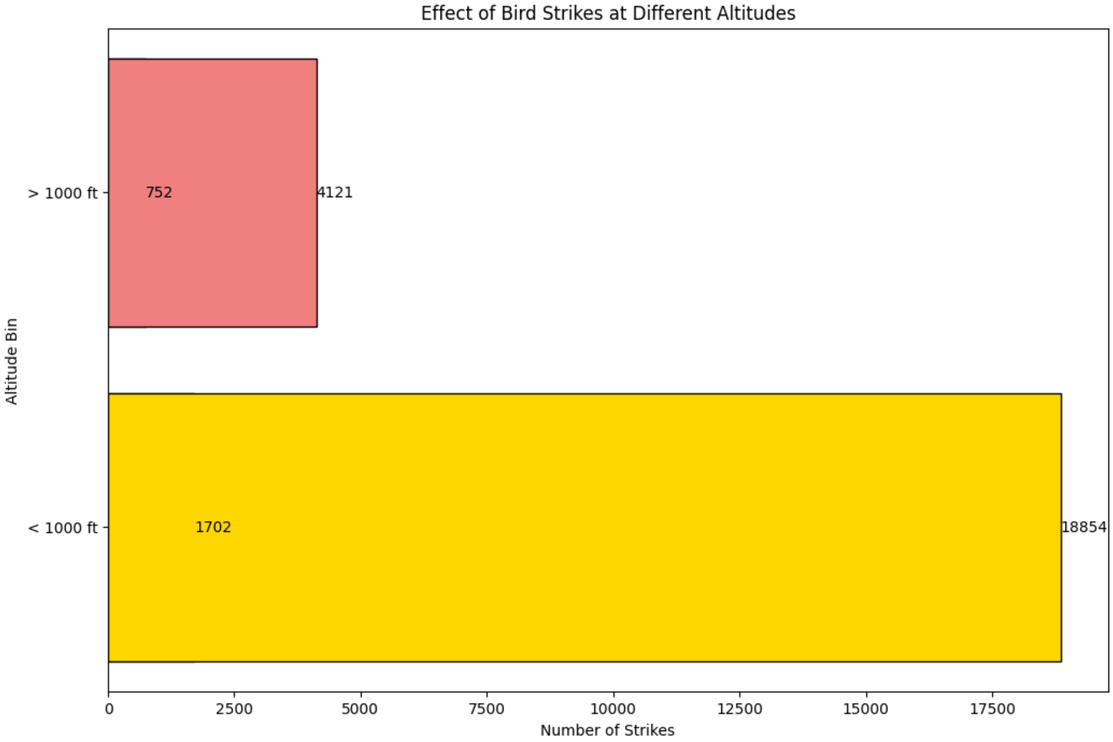
[ ]:
```
plt.figure(figsize=(10, 6))
impact_counts = clean_data['Effect: Impact to flight'].value_counts()
ax=impact_counts.plot(kind='bar', color='skyblue')
for i, v in enumerate(impact_counts):
    ax.text(i, v + 0.1, str(v), ha='center', va='bottom')
plt.title('Number of Strikes for Each Impact on Flight')
plt.xlabel('Effect Impact to Flight')
plt.ylabel('Number of Strikes')
plt.xticks(rotation=45)
plt.show()
```



0.10 Effect of strike at different altitude

[ ]:
```
plt.figure(figsize=(12, 8))

altitude_effect_counts = clean_data.groupby(['Altitude bin', 'Effect: Indicated␣
 ↪Damage']).size().reset_index(name='Number of Strikes')

colors = ['lightcoral', 'gold', 'lightblue']
```

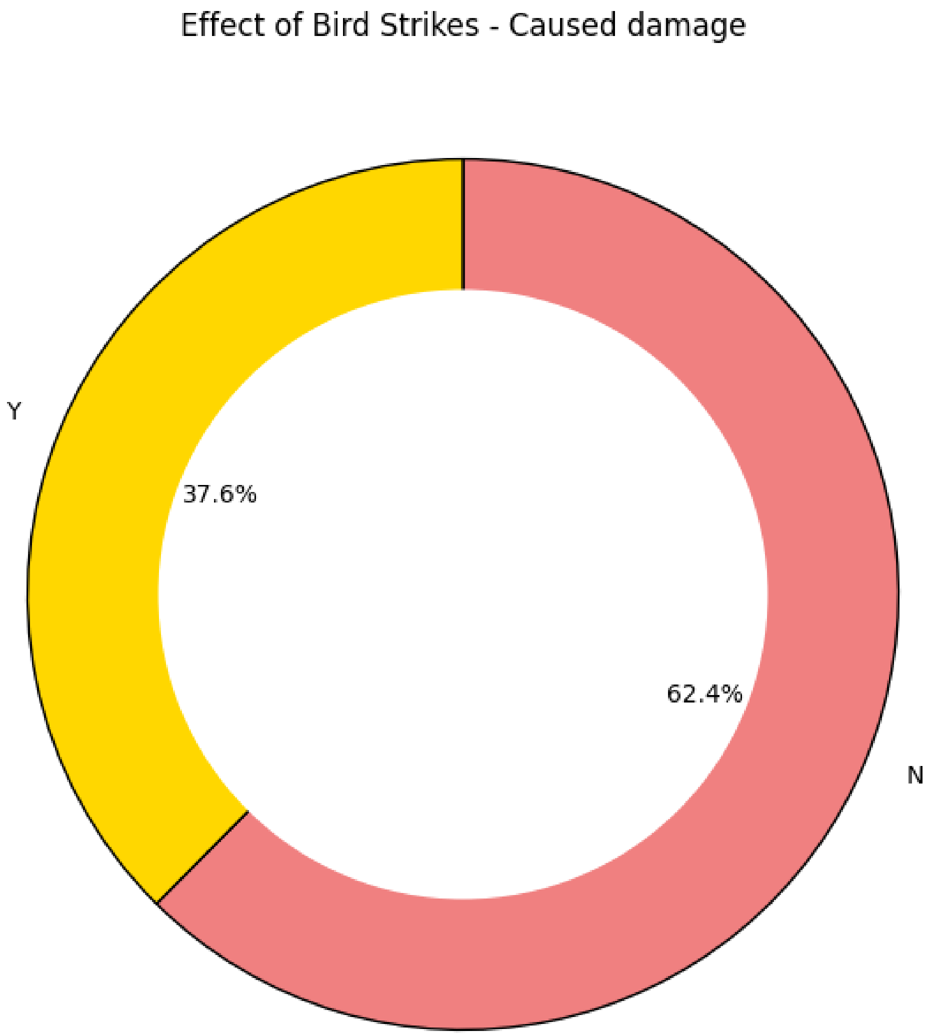
```
# Plot using Matplotlib barh
for index, row in altitude_effect_counts.iterrows():
    current_color = colors[index % len(colors)]
    plt.barh(row['Altitude bin'], row['Number of Strikes'],␣
 ↪color=current_color, edgecolor='black', label=row['Effect: Indicated␣
 ↪Damage'])

    plt.text(row['Number of Strikes'] + 0.1, row['Altitude bin'],␣
 ↪str(row['Number of Strikes']), ha='left', va='center', fontsize=10,␣
 ↪color='black')

plt.title('Effect of Bird Strikes at Different Altitudes')
plt.ylabel('Altitude Bin')
plt.xlabel('Number of Strikes')

plt.show()
```

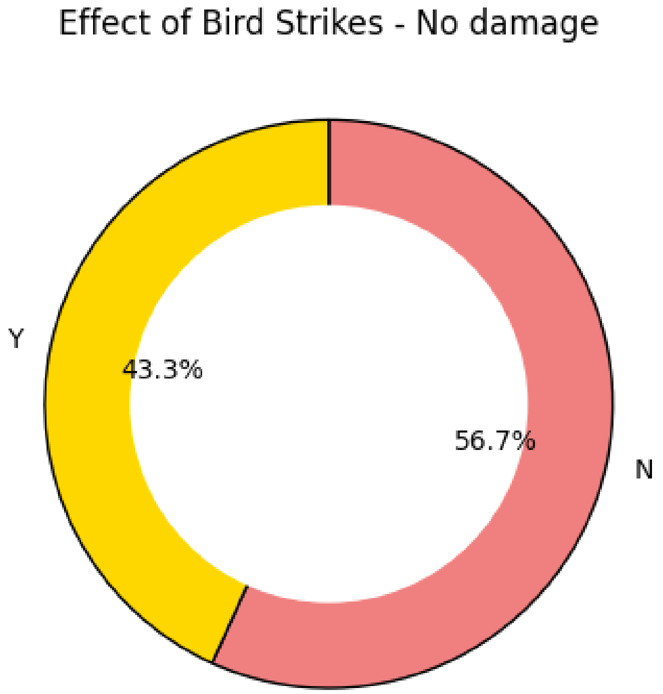


0.11 Prior Waring given to Pilots?

[ ]:

```
import matplotlib.pyplot as plt

plt.figure(figsize=(8, 8))

pilot_warning_effect_counts = clean_data.groupby(['Pilot warned of birds or␣
 ↪wildlife?', 'Effect: Indicated Damage']).size().reset_index(name='Number of␣
 ↪Strikes')

pivot_table = pilot_warning_effect_counts.pivot_table(index='Effect: Indicated␣
 ↪Damage', columns='Pilot warned of birds or wildlife?', values='Number of␣
 ↪Strikes', fill_value=0)

# Plot using Matplotlib pie chart
colors = ['lightcoral', 'gold']
labels = pilot_warning_effect_counts['Pilot warned of birds or wildlife?'].
 ↪unique()

for i, category in enumerate(pivot_table.index):
    plt.pie(pivot_table.loc[category], labels=labels, colors=colors,␣
 ↪autopct='%1.1f%%', startangle=90, counterclock=False,␣
 ↪wedgeprops=dict(edgecolor='black'))

    # Draw a circle at the center to make it look like a donut chart
    centre_circle = plt.Circle((0, 0), 0.70, fc='white')
    fig = plt.gcf()
    fig.gca().add_artist(centre_circle)

    plt.title(f'Effect of Bird Strikes - {category}')

    plt.show()
```


Effect of Bird Strikes - Caused damage
Y
37.6%
62.4%
N


Effect of Bird Strikes - No damage
Y
43.3%
56.7%
N