Safety Management of Wildlife Hazards to Aviation: An Analysis of Wildlife Strikes in Part 139 Airports in Florida (2011-2020)

Tiago D. de Tella
dikertst@erau.edu
Undergraduate Student—Researcher

Flavio A. C. Mendonca, Ph.D., MBA
coimbraf@erau.edu
Faculty Advisor

Abstract

A vital step toward mitigating the risk of aircraft accidents due to wildlife strikes is the collection, analyses, and understanding of wildlife strike data (see figure 1). Previous studies have focused on gathering and analyzing wildlife encounters over the entire United States (DeVault et al., 2018; Dolbeer et al., 2021), this way not considering regional and other factors such as bird migration patterns, local wildlife populations, and seasons of the year as they may have a different impact on the risk of strikes in individual regions (Dolbeer, 2020). Dolbeer et al. (2021) and Mendonca et al. (2020) have advocated for the analyses of wildlife strike data in a regional level for accident prevention efforts. The purpose of this study was twofold: 1) To develop empirical information obtained from the analysis of wildlife-strike and aircraft operations data at Part 139 airports in Florida (2011-2020); and 2) To investigate which season of the year yields the most wildlife-strike data at the investigated airports. The researcher in this study answered the research questions through the analysis, revision, and evaluation of the existing data. There were 8,962 wildlife strikes to aviation at and around the Part139 airports in Florida (2011-2020). Five percent (n= 457) of the total strikes caused damage to aircraft. One aircraft was damaged beyond repair after a strike. Almost 66% (n=5,962) of the total incidents involved commercial operators. A post hoc analysis revealed a higher frequency of wildlife strikes per 100,000 aircraft operations (wildlife strike index) during the Summer, Winter, and Spring seasons of the year. Findings of this study can provide further insight to aviation safety stakeholders by offering a regional approach to the difference in the wildlife strike index through the seasons of the year.

Figure 1. Damage resulting from wildlife strike

Methodology

Researchers used the US National Wildlife Strike Database (NWSD) (FAA, 2021a) and the Air Traffic Activity System (ATADS) (FAA, 2021b) to collect data regarding reported wildlife strikes and aircraft movements, respectively. The seasons of the year were assumed to start at the same day during the 10 years within the scope of this study. This study included all Part 139 airports (Figure 2) in the state of Florida (FAA, 2021c) except Florida Keys Marathon International Airport (MTH) and Eglin Air Force Base/Destin-Fort Walton Beach Airport (VPS) since the number of aircraft movements in these airports were not included in the ATADS. Relevant data obtained from ATADS and NWSD were filtered and sorted using Microsoft Excel. A Kruskal-Wallis test was conducted using IBM SPSS to determine the existence of a difference between the wildlife strike index per season of the year.

Figure 2. Airports analyzed

Findings and Discussion

There were 8.962 wildlife strikes to aircraft in the Part 139 airports in Florida (2011-2020). Findings suggested that approximately 66% of the reported strikes involved commercial operators. Ninety two and 63 strikes involved general aviation (GA) and military aircraft, respectively. More than 5% (n=457) of the wildlife strikes within the scope of this study caused damage to aircraft. Approximately 62% (n= 3,834) of strikes occurred during the arrival phases of flight. The majority of strikes (n=4,318) occurred during the day, representing 48.2% of all reported wildlife strikes. Meanwhile, only 17% (n= 1,527) of wildlife strikes occurred during the night time. Thirty-eight and 125 strikes occurred during dawn and dusk, respectively. Interestingly, most strikes (n=1,673) of the total strikes occurred during the day of the summer seasons being followed by the day of the fall seasons (n=1,157) see Figure 3.

Time of Day	Dawn	Day	Dusk	Night	Unknown
Winter	3	717	22	181	463
Spring	12	771	22	359	584
Summer	12	1673	53	524	1071
Fall	11	1157	28	516	783
Total	38	4318	125	1580	2901

Figure 3. Wildlife Strikes per time of day and season of the year

The summer season had the most wildlife strikes (n=3,333), but the fall season had the highest number of damaging wildlife strikes (n= 141) (see Figure 4). Approximately 62% (n=3,834) of the total strikes occurred during the arrival phases of flight (descent, arrival, approach, and landing roll), while 36% (n=36.3%) occurred during the departure phases of flight (take-off run, climb, and departure).

Variables	Winter	Spring	Summer	Fall
Strikes	1,386	1,748	3,333	2,495
Damaging Strikes	113	97	106	134
Aircraft Movements	9,047,313	9,026,284	8,302,145	8,676,357
Wildlife Strike Index	15.32	19.37	40.15	28.76
Damaging Strike Index	1.25	1.07	1.28	1.54

Figure 4. Wildlife Strikes

A Kruskal-Wallis test was conducted to determine if there were differences in reported wildlife strikes per 100,000 movements between the four seasons of the year: Fall (n = 10), Winter (n = 10), Spring (n = 10), and Summer (n = 10). The Kruskal-Wallis test was selected over an ANOVA because there was an outlier in the Spring season and three outliers in the Summer season. Distributions of reported wildlife strikes per 100,000 movements were not similar for all groups, as assessed by visual inspection of a boxplot.

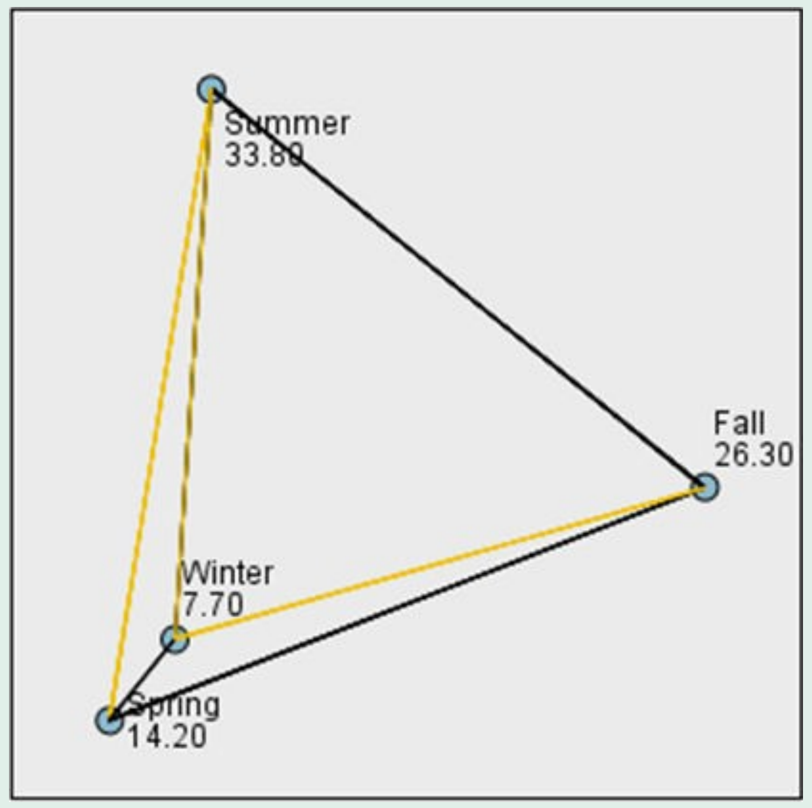

Figure 5. Pairwise comparisons

Median in reported wildlife strikes per 100,000 movements were statistically significantly different between the four seasons of the year, $\chi2(3) = 30.297$, $p < .001$. Subsequently, pairwise comparisons were performed using Dunn's (1964) procedure with a Bonferroni correction for multiple comparisons. This post hoc analysis revealed statistically significant differences in reported wildlife strikes per 100,000 movements between the Winter (7.70) and Fall (26.30) ($p = .002$), between the Winter (7.70) and Summer (33.89) ($p = .000$), and between the Spring (14.20) and Summer (33.89) ($p = .001$) seasons of the year, but not between the Spring and Fall and between Fall and Summer seasons of the year (see Figure 5).

Conclusion

The aviation industry has long recognized the financial and safety threat collisions between wildlife and aircraft pose to aircraft operations. The collection and analysis of data is a vital step towards mitigating the risk that wildlife poses to aviation, since a problem can only be solved when it is well understood (Dolbeer et al., 2021). Findings of this study suggested that there was a statistically significant difference in the likelihood of a wildlife strike through the different seasons of the year. Results indicated a higher likelihood of a wildlife strike during the summer season, but a higher chance of a damaging strike during the fall season at Part 139 airports in Florida. The current project contributes to the safety management of wildlife hazards in Florida by conducting a comprehensive analysis of wildlife strike and aircraft operations data (2011-2020) at the Part 139 airports in Florida. The findings of this study were limited by the information available on the ATADS and the NWSD. Limitations of this study include the fact that it is unknown how many wildlife strikes have truly occurred at the studied airports. According to Dolbeer et al. (2021), recent analyses suggested that less than 50% of general aviation wildlife strikes are reported, while 91% of strikes involving commercial transport aircraft. Additionally, reporters may exclude information within the report making it difficult to ascertain factors associated with the wildlife strike (e.g., level of damage, phase of flight). In the current study, for example, almost 33% (n=2,901) of the reported strikes did not provide information about the time of the day the strike occurred. Most importantly, despite the lack of information available through these sources, the researchers consider the findings of this study still accurate to enhance the wildlife strike prevention efforts by aviation safety Stakeholders

References

Dolbeer, R. A., Begier, M. J., Miller, P. R., Weller, J. R., & Anderson, A. L. (2021, July). *Wildlife Strikes to Civil Aircraft in the United States 1990-2020* (Serial Report Number 27). Retrieved from https://www.faa.gov/airports/airport_safety/wildlife/media/Wildlife-Strike-Report-1990-2020.pdf

Dolbeer, R. A. (2020). Population increases of large birds in North America pose challenges for aviation safety. *Human-Wildlife Interactions, 14* (3), 345-357.

Federal Aviation Administration (FAA) (2021a). *FAA wildlife strike database*. Retrieved from https://wildlife.faa.gov/home

Federal Aviation Administration (FAA). (2021b). *FAA air traffic activity system (ATADS)*. Retrieved from https://aspm.faa.gov/opsnet/sys/main.asp

Federal Aviation Administration (FAA). (2021c). *Part 139 Airport certification*. Federal Aviation Administration. https://www.faa.gov/airports/airport_safety/part139_cert/.

Mendonca, F. A. C., Keller J., & Huang, C. (2020). *Wildlife strikes to aircraft in Brazil: 2011-2018. Journal of Airline and Airport Management, 10*(2), 51-64. https://doi.org/10.3926/jairm.160