Integrating wildlife strike reports into Safety Management Systems for airports

Richard A. Dolbeer, PhD, Sandusky, Ohio USA

Michael J. Begier, Washington, D.C. USA

1st AeroFauna – The wildlife strike risk in Brazil,

São Paulo, Brazil

19 - 20 September 2017

Acknowledgements

U.S. Federal Aviation Administration

U.S. Department of Agriculture, Wildlife Services

Findings and recommendations expressed in this presentation do not necessarily represent the position of the U.S. Federal Aviation Administration

Question: How do we evaluate programs to mitigate risk of wildlife strikes at USA airports?

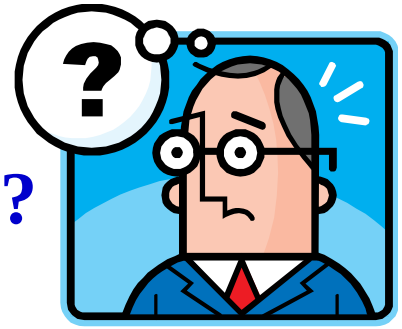
Answer: Current system is regulatory-driven (14 CFR Part 139):

- **If airport has Wildlife Hazard Management Plan (WHMP) approved by the FAA, the airport is in compliance.**
- **WHMP is reviewed annually for completion of targeted projects (e.g., drainage improvement).**

- **However, there are no objective procedures to evaluate effectiveness of the WHMP and to guide improvements.**

The current system is the antithesis of Safety Management System (SMS) approach!

Airport managers naturally want to know:



- How does our program to manage the risk of wildlife strikes compare to other airports?
- How good is our WHMP—are we getting good value (risk mitigation) for money invested?

At present, the U.S. FAA has no objective process in place to provide answers!!

What process does the civil or military aviation authority use in your country??

Is there a solution to this dilemma?

We propose that national Wildlife Strike Databases can play a key role to:

- **provide objective benchmarks of airport's performance in mitigating risk compared to other airports.**
  - **Strikes in airport environment (≤1500 feet)**
  - **Strikes on approach/climb at >1500 feet**

If we do not have objective, comparative data, we must base decisions upon subjective opinion!

No one is held accountable!

Data → Knowledge → Power

Power (Improved WHMP)

↑ Application of knowledge

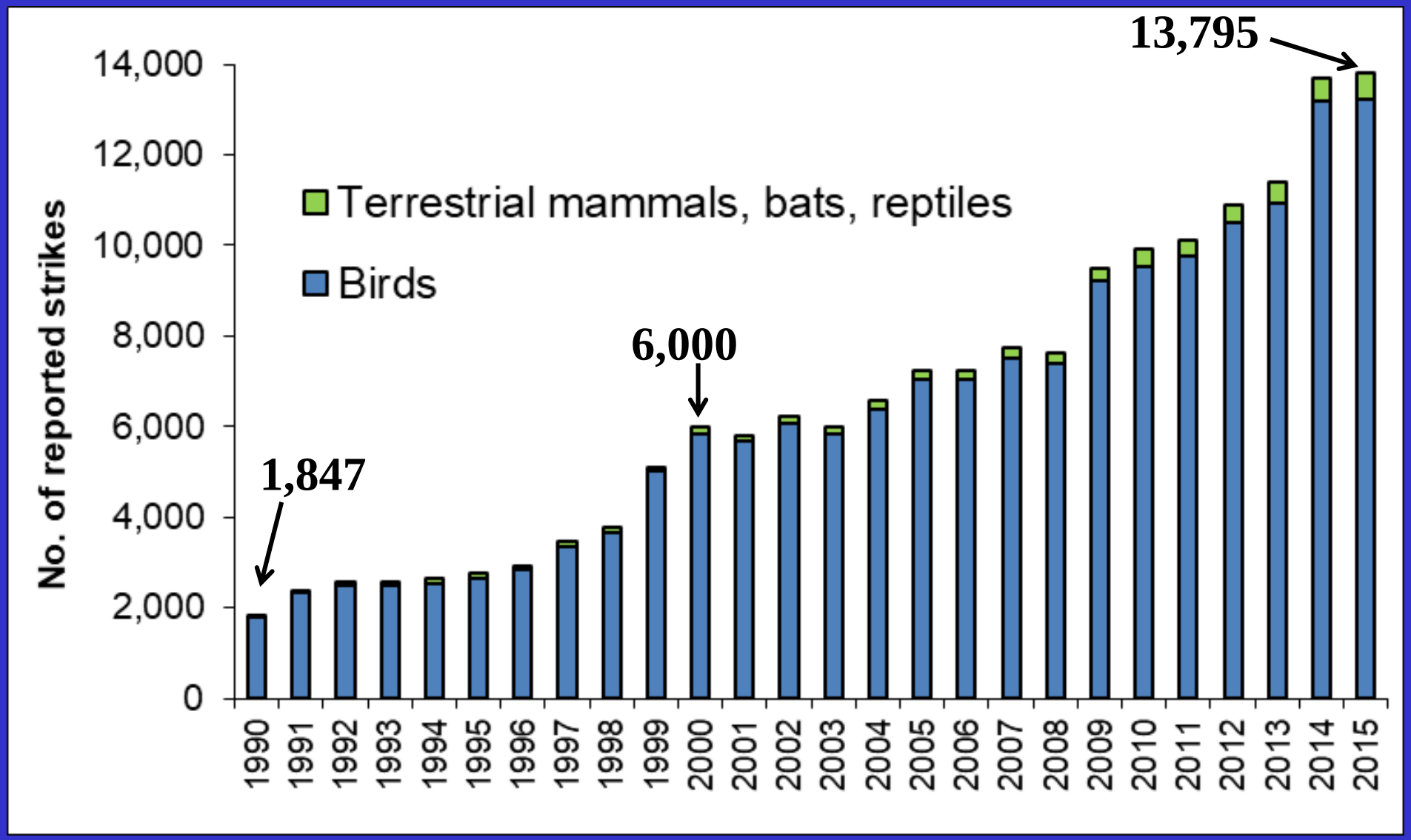
Objective (quantitative) knowledge

↑ Data analysis

Strike database provides scientific foundation

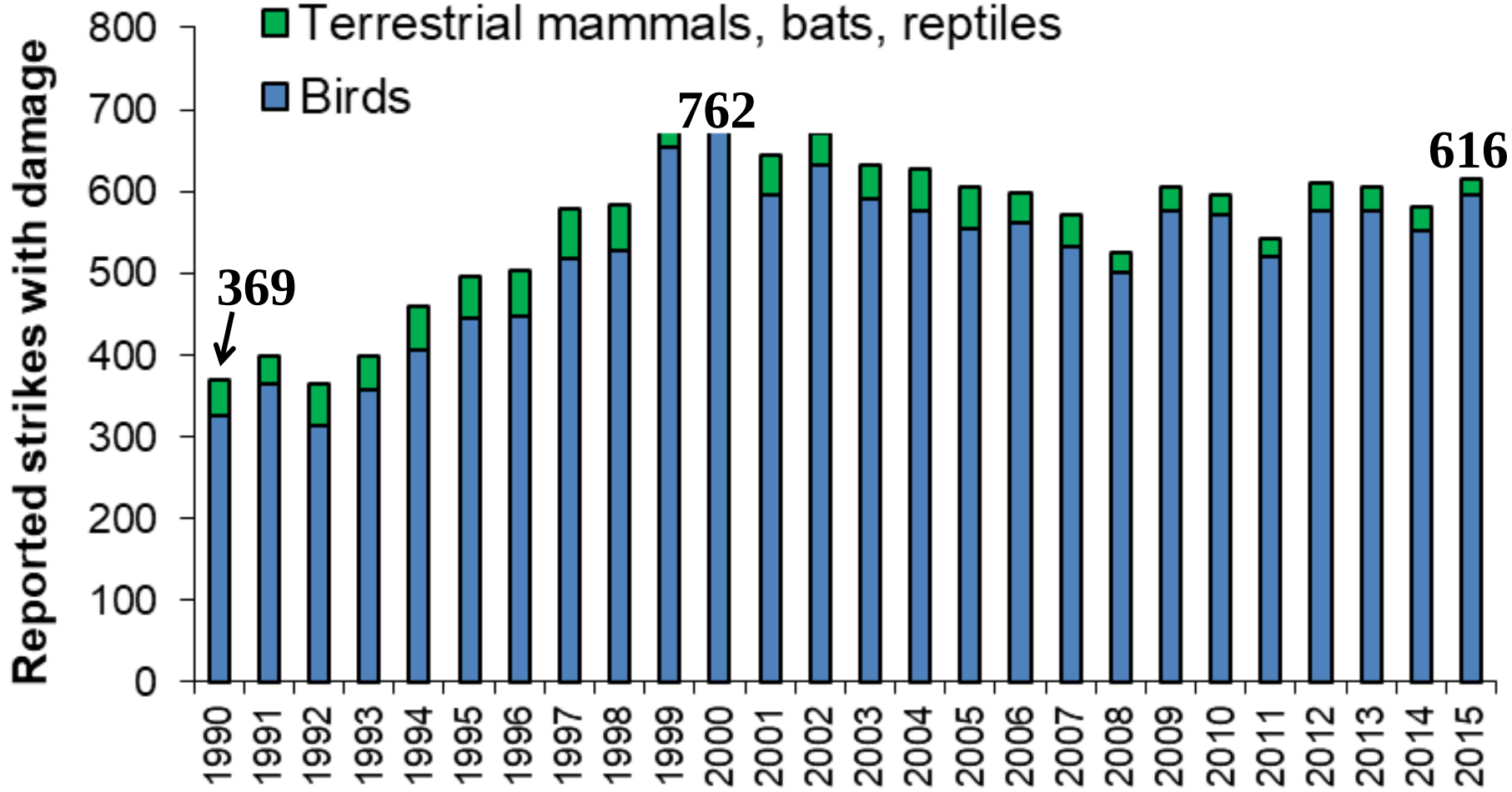
FAA National Wildlife Strike Database

Total strikes reported by year, 1990-2015

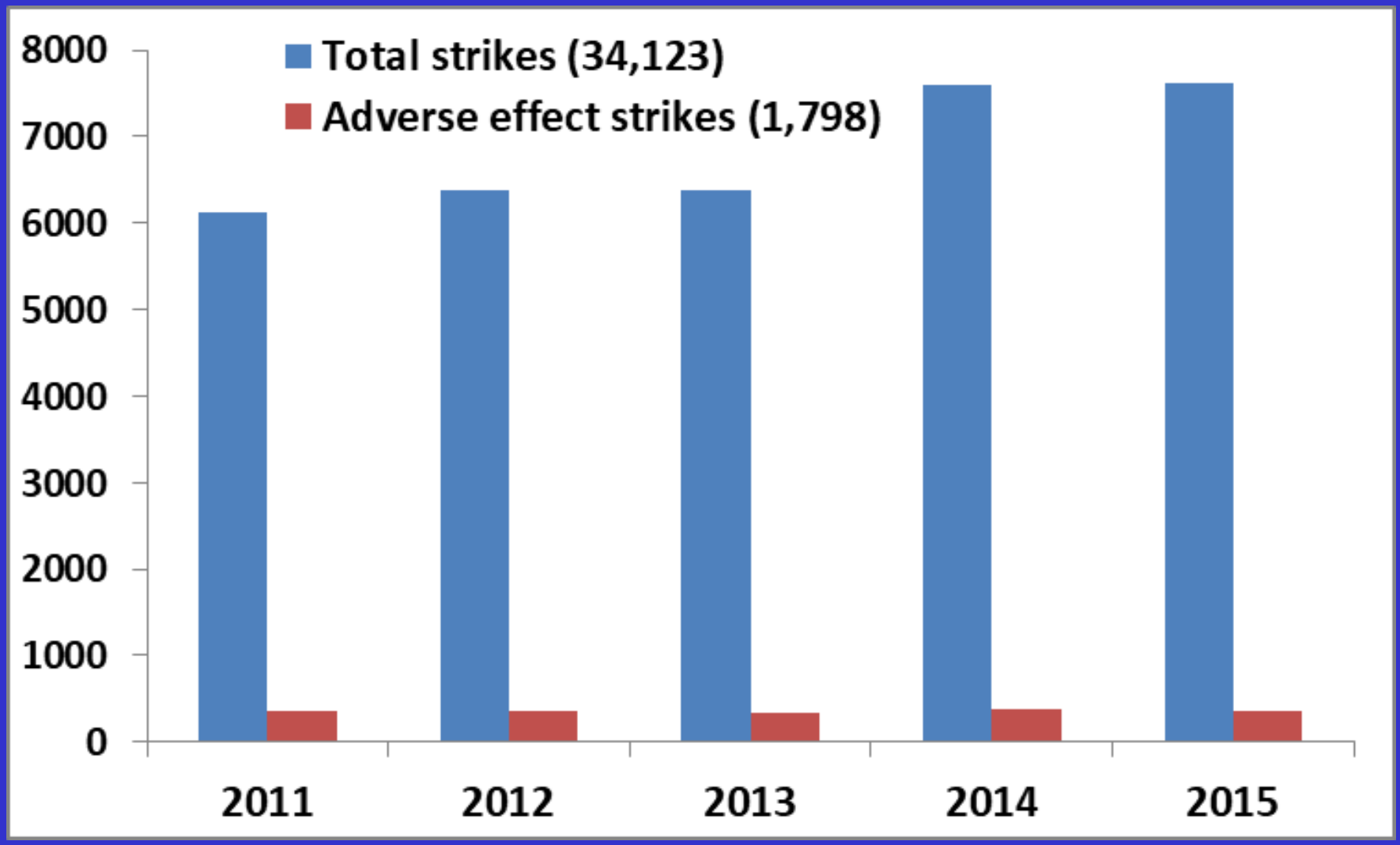


FAA National Wildlife Strike Database

Damage strikes reported by year, 1990-2015



FAA National Wildlife Strike Database
Total strikes and "Adverse Effect" strikes
(100 busiest airports in USA)



Filtering the records in database for analysis:

Years = 2011 - 2015
Airports = 100 busiest airports, USA
(median of 172,000 movements/year)

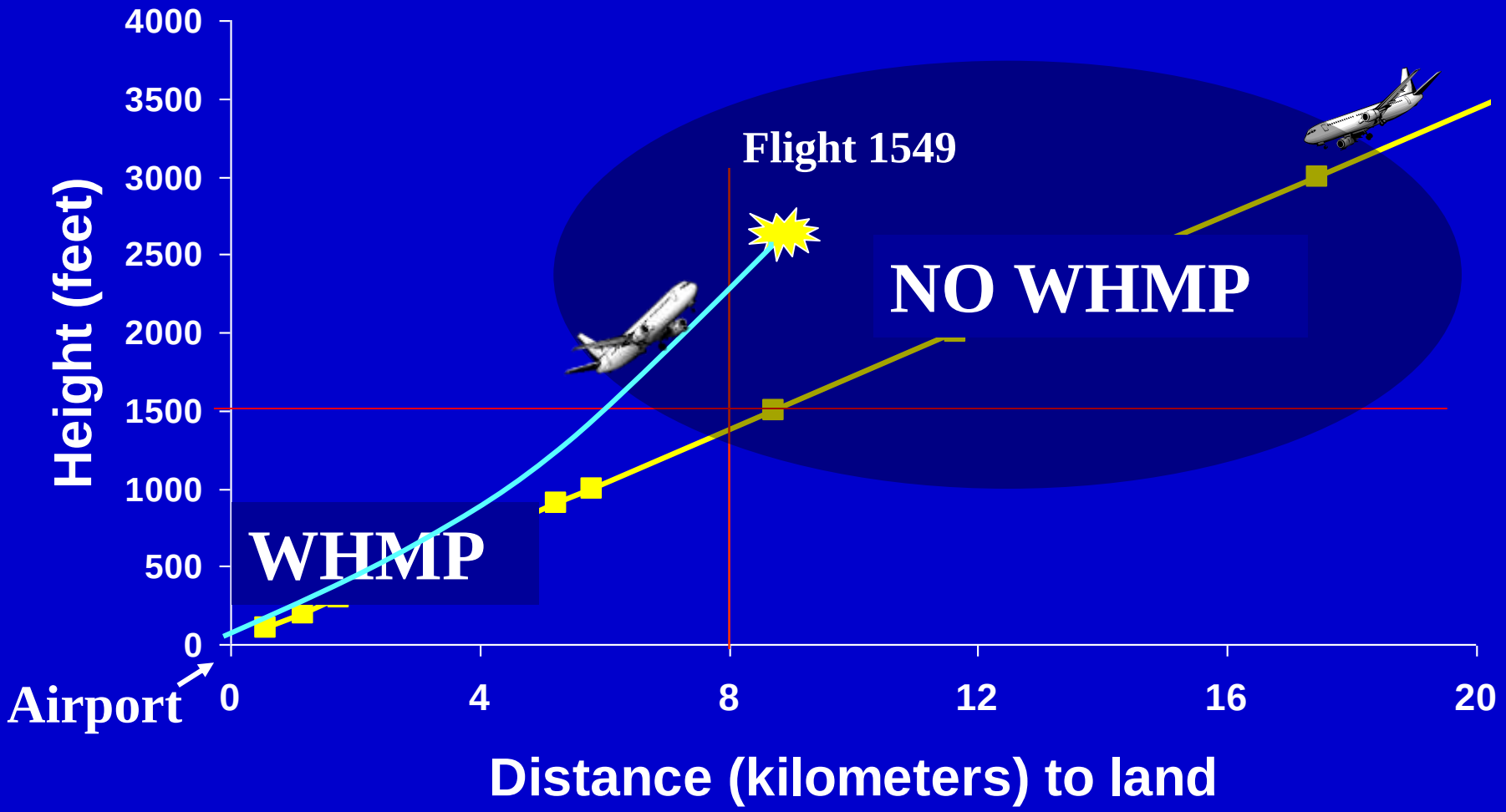
Height (AGL) where strike occurred	Number of strikes:	
	Total	With adverse effect (AE)*
≤1,500 feet	30,758	1,434 (4.7%)
>1,500 feet	3,365	364 (10.8%)
Total	34,123	1,798 (5.3%)

*AE strikes cause damage or negative effect on flight (aborted take-off, precautionary/emergency landing, engine shutdown)

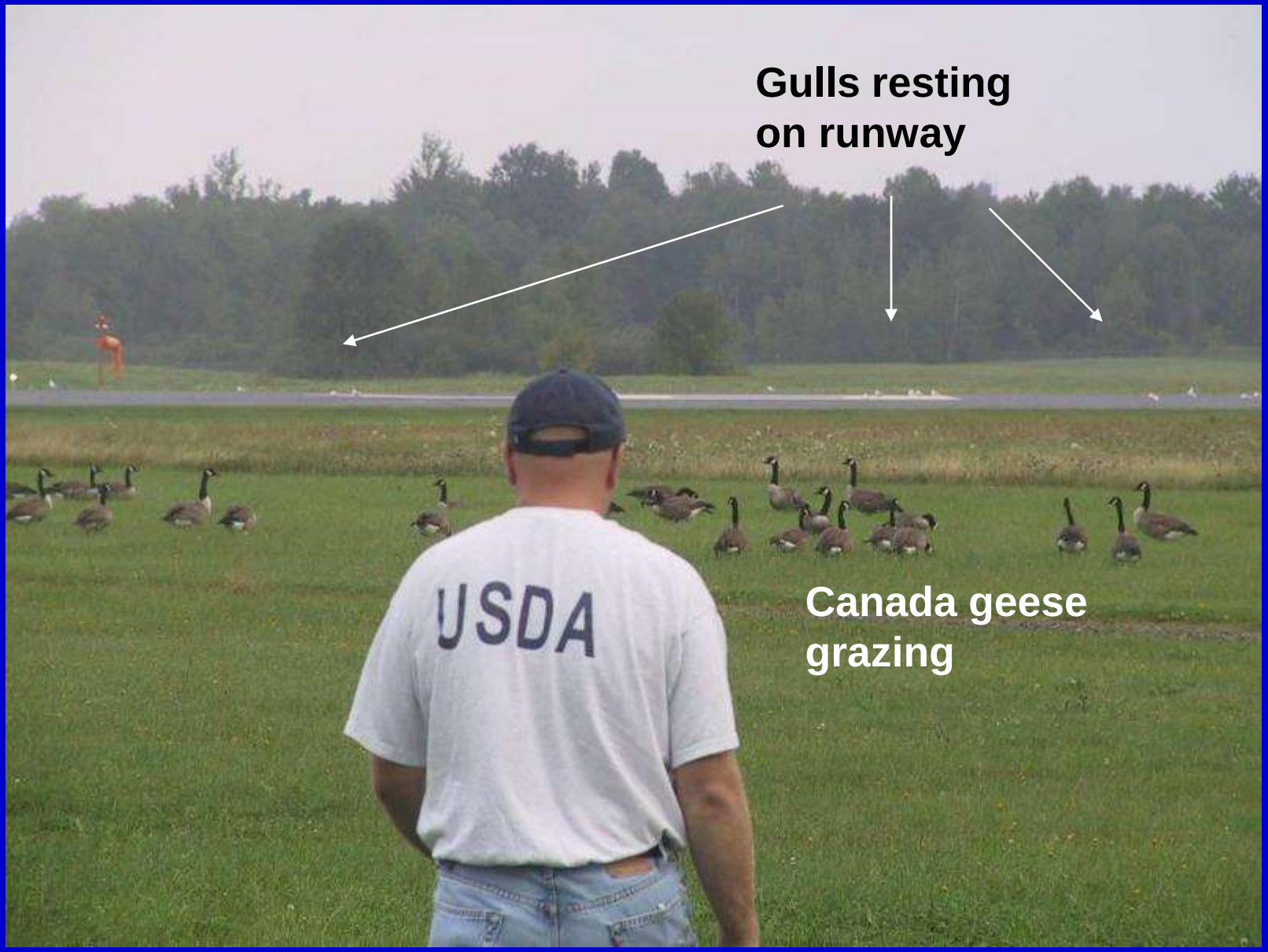
Why should there be a separate benchmark for strikes on approach/ departure at >1500 feet AGL?

Answer:

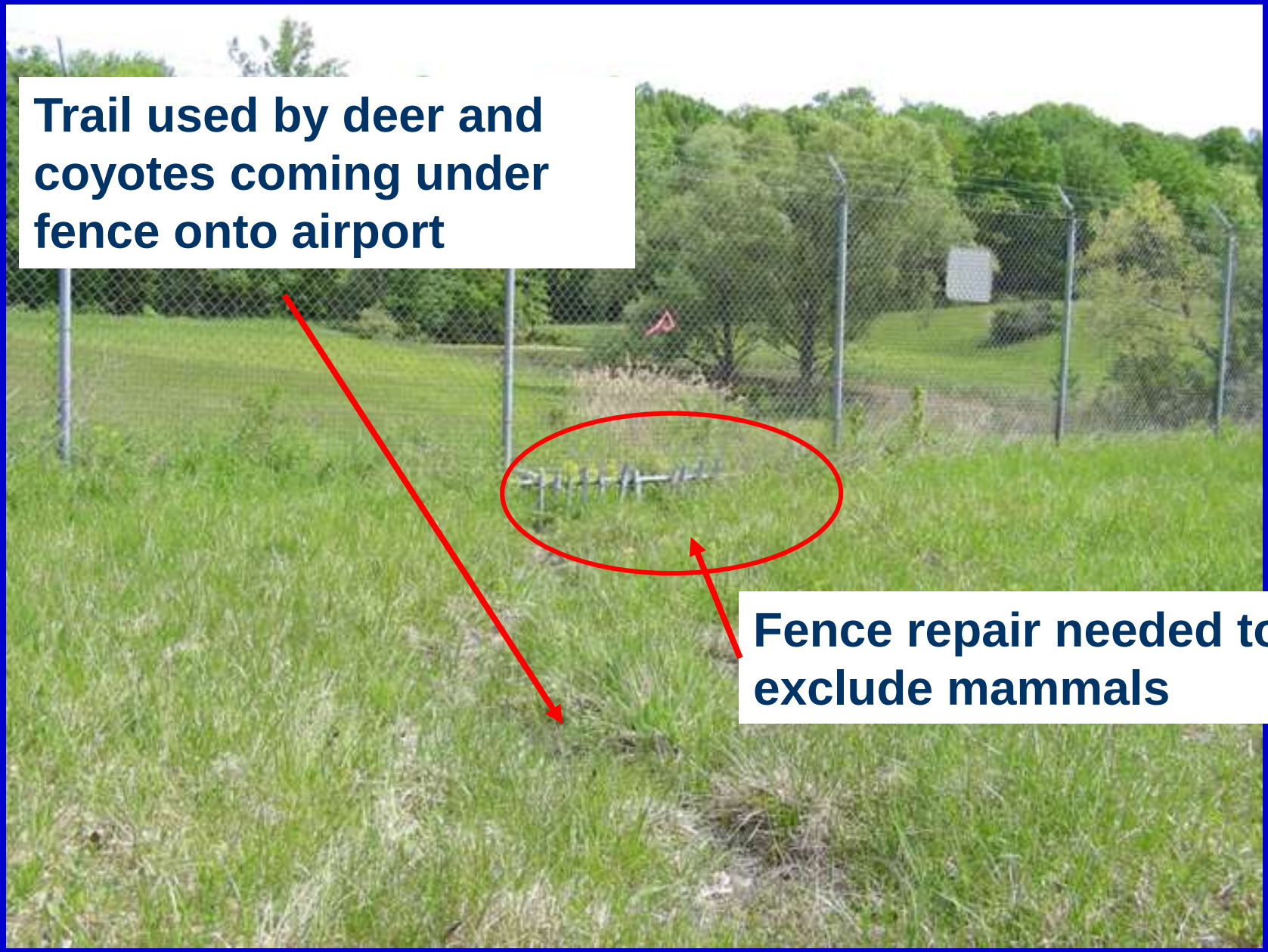
- These strikes are usually >8 km from AOA on airport.
- These strikes are important for risk analysis and mitigation… But these strikes typically are not addressed in an airport's WHMP.
- By creating a separate benchmark, it permits an airport to assess the risk for these "off airport" strikes.
- Provides objective basis to incorporate mitigation strategies for these "off airport" strikes into the WHMP.


Flight 1549
NO WHMP
WHMP
Height (feet)
4000
3500
3000
2500
2000
1500
1000
500
0
Airport
0
4
8
12
16
20
Distance (kilometers) to land

Embraer 190 hit Canada geese at 100 feet AGL on departure from KHPN (New York), April 2012


Gulls resting
on runway
USDA
Canada geese
grazing

Nov 2012, Greenville, SC (Dept. of Homeland Security aircraft)


Trail used by deer and coyotes coming under fence onto airport
Fence repair needed to exclude mammals

B-757 hit a coyote at 0 feet AGL on departure from KPOP (North Carolina), December 2015

Vegetation removal from fence to prevent mammals from climbing over

Fence repair needed to exclude large mammals

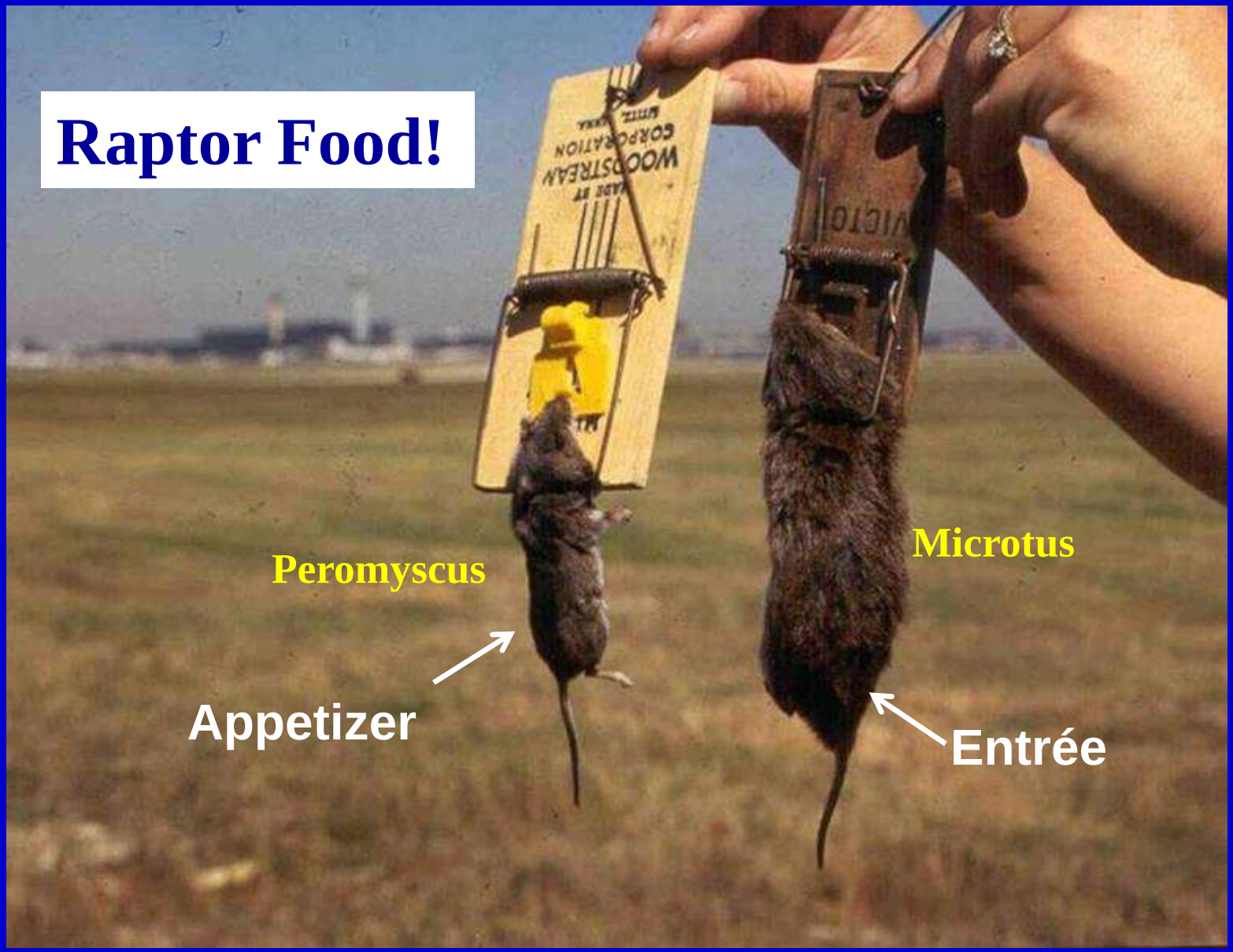
Example ≤1500 feet AGL

Cessna 220 hit an osprey at 100 feet AGL on final approach to KPOP (Florida), September 2013

Example ≤1500 feet AGL

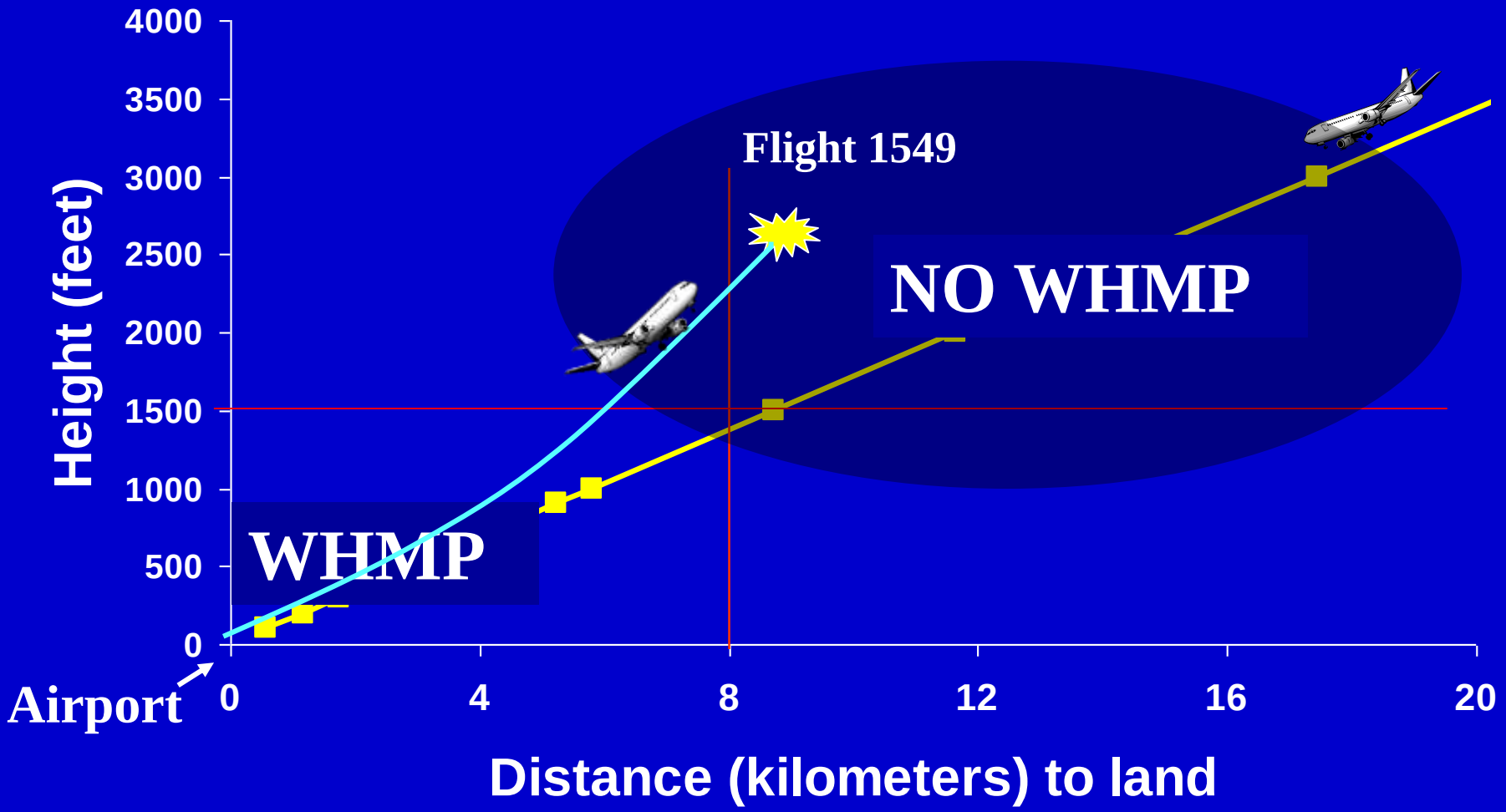
MD-80 hit a Swainson's hawk at 500 feet AGL on departure from KDFW (Texas) August 2013

Adaptation of wildlife to urban settings. Why are raptors on the airport?


Raptor Food!
Peromyscus
Microtus
Appetizer
Entrée

Example >1500 feet AGL

A-320 hit flock of Canada geese at 2900 feet AGL and >8 km from KLGA on departure (New York), January 2009


Flight 1549
NO WHMP
WHMP
Height (feet)
4000
3500
3000
2500
2000
1500
1000
500
0
Airport
0
4
8
12
16
20
Distance (kilometers) to land

Example >1500 feet AGL

CRJ 200 hit white pelicans at 5000 feet AGL on descent into KLIT (Arkansas), April 2011

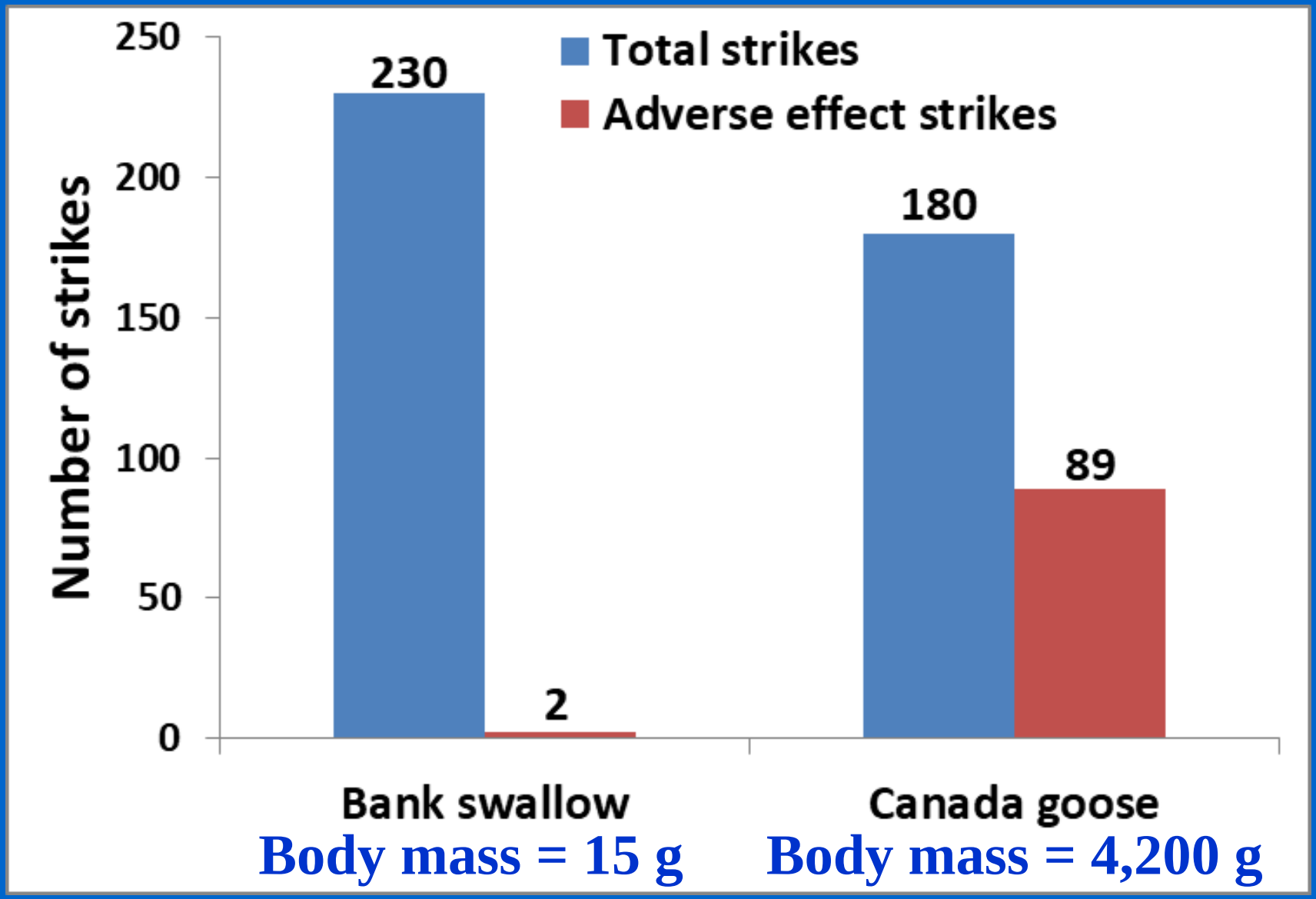
What is an objective benchmark of an airport's performance in mitigating risk?

Should benchmark be the overall strike rate (all reported strikes/100K movements)?

Answer: No!! Comparison of the reported strike rate at an airport in relation to rates at other airports is not a valid metric because airports often vary in:

- **hazard level of species struck (e.g., swallow vs. goose).**
- **completeness of reporting all strikes (e.g., carcasses found on runway).**

Example: Hazard level of Bank Swallows versus Geese, Civil Aircraft, USA, 2011-2015



Should benchmark be the Adverse Effect strike rate?[1, 2]

Answer: Yes. Comparison of AE strike rate at airport in relation to rates at other airports is valid metric:

- **AE strike rate incorporates hazard level of species struck (e.g., swallow vs. goose).**
- **There is much less bias among airports in reporting AE strikes compared to all strikes.**
- **Bottom line of airport's WHMP is to reduce AE strikes.**

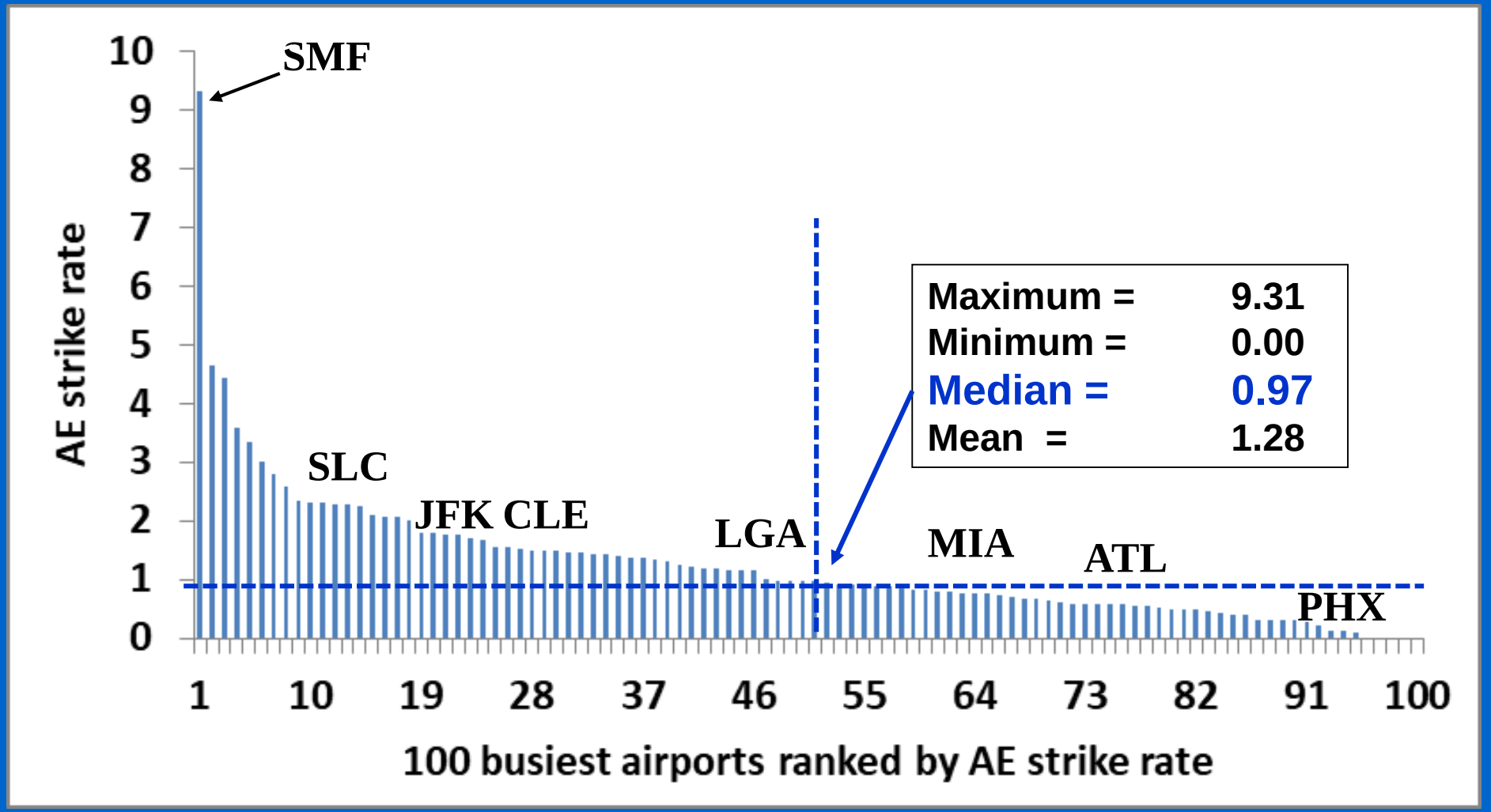
(1) Strikes at ≤1500 feet AGL that cause damage or negative effect on flight/100K movements

(2) Strikes at >1500 feet AGL on final approach/initial climb that cause damage or negative effect on flight/100K movements

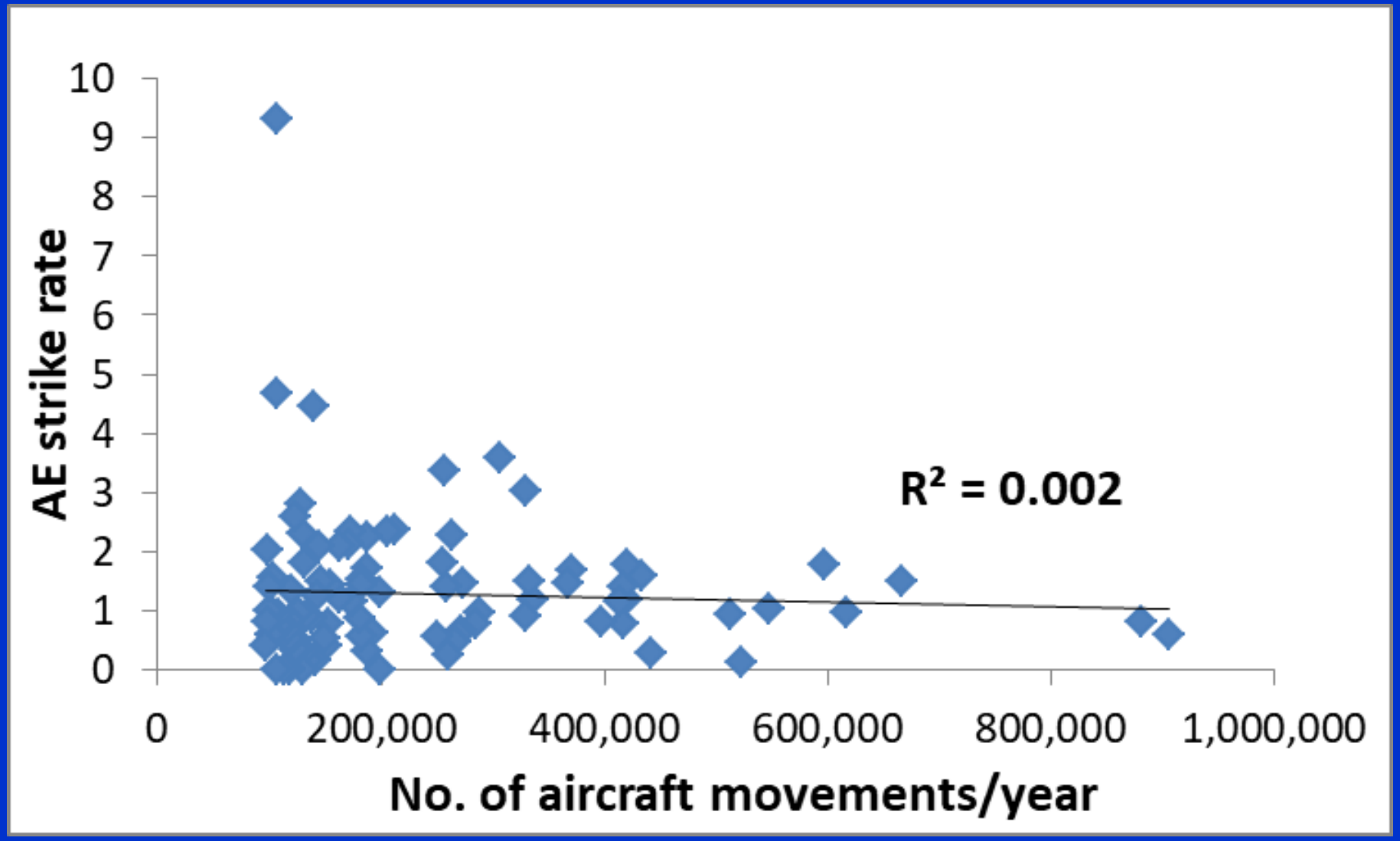
Okay, if we can agree that the AE strike rate is a valid metric, then what are these rates for U.S. Airports?

AE Snow goose strike Minneapolis-St. Paul (MSP), Nov 2010

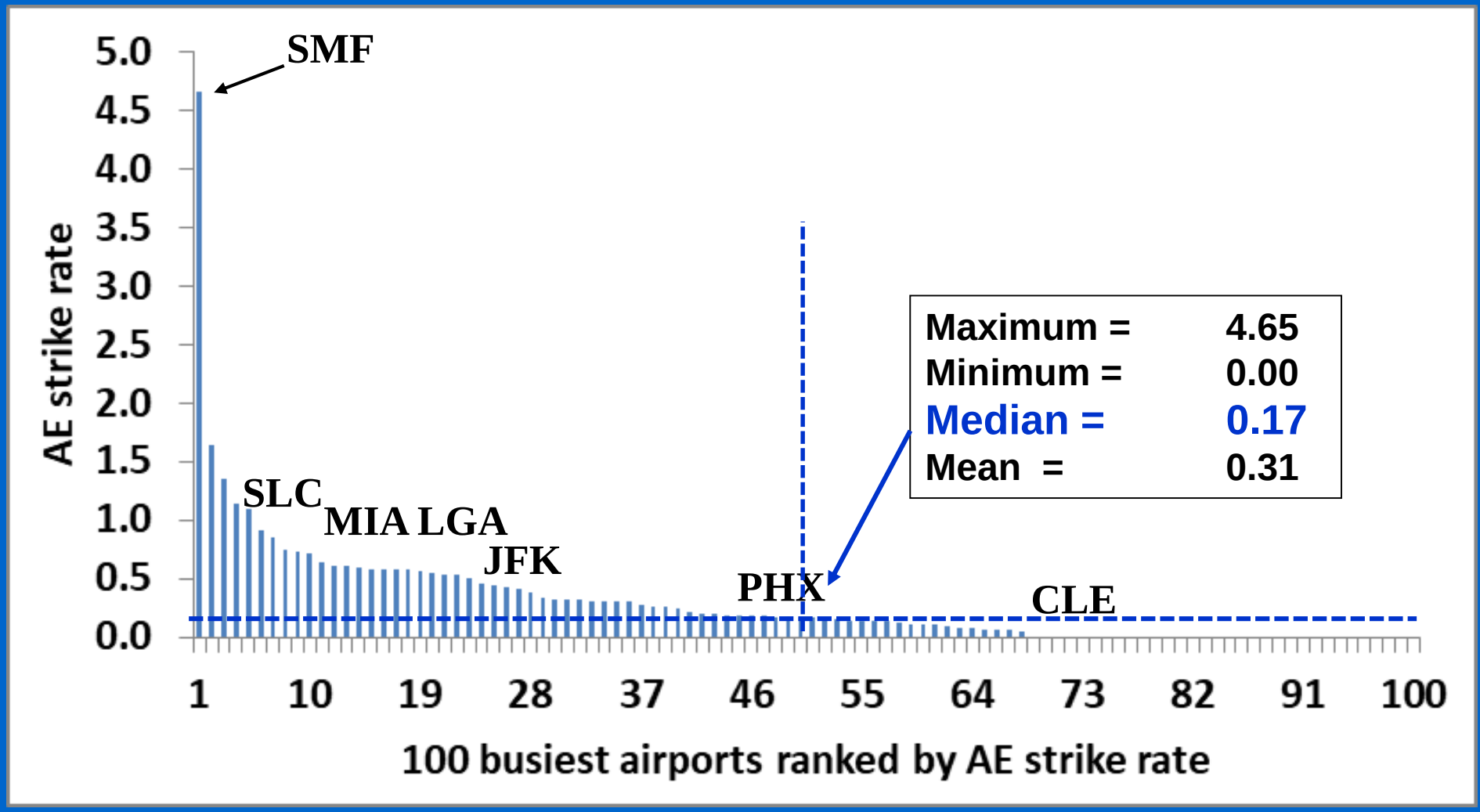
Adverse effect (AE) wildlife strikes/100K movements (<1500 feet AGL), 2011-2015



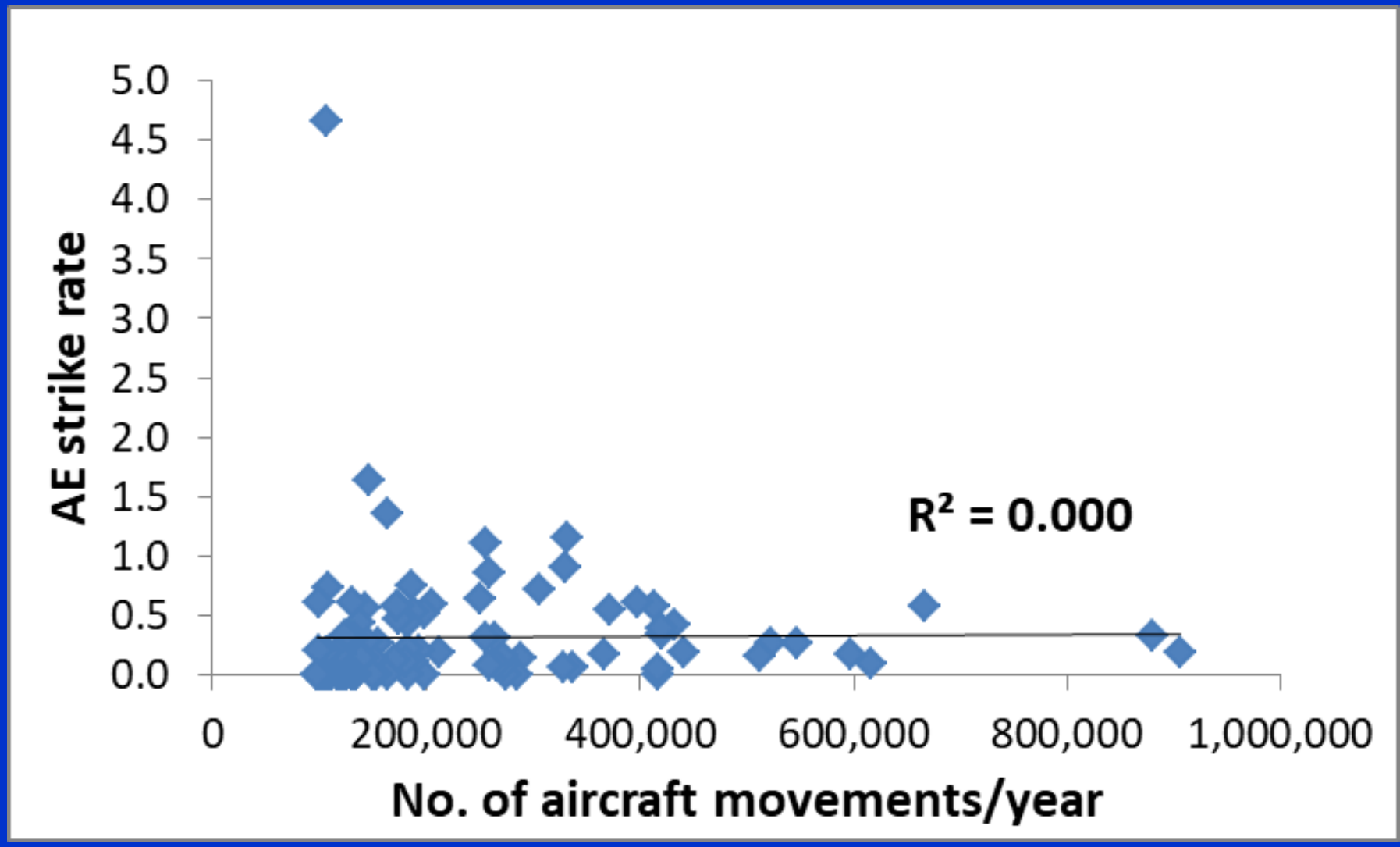
No relationship between movements and Adverse Effect (AE) Strike Rate for 100 busiest airports, USA, 2011-2015 (≤ 1500 feet AGL)



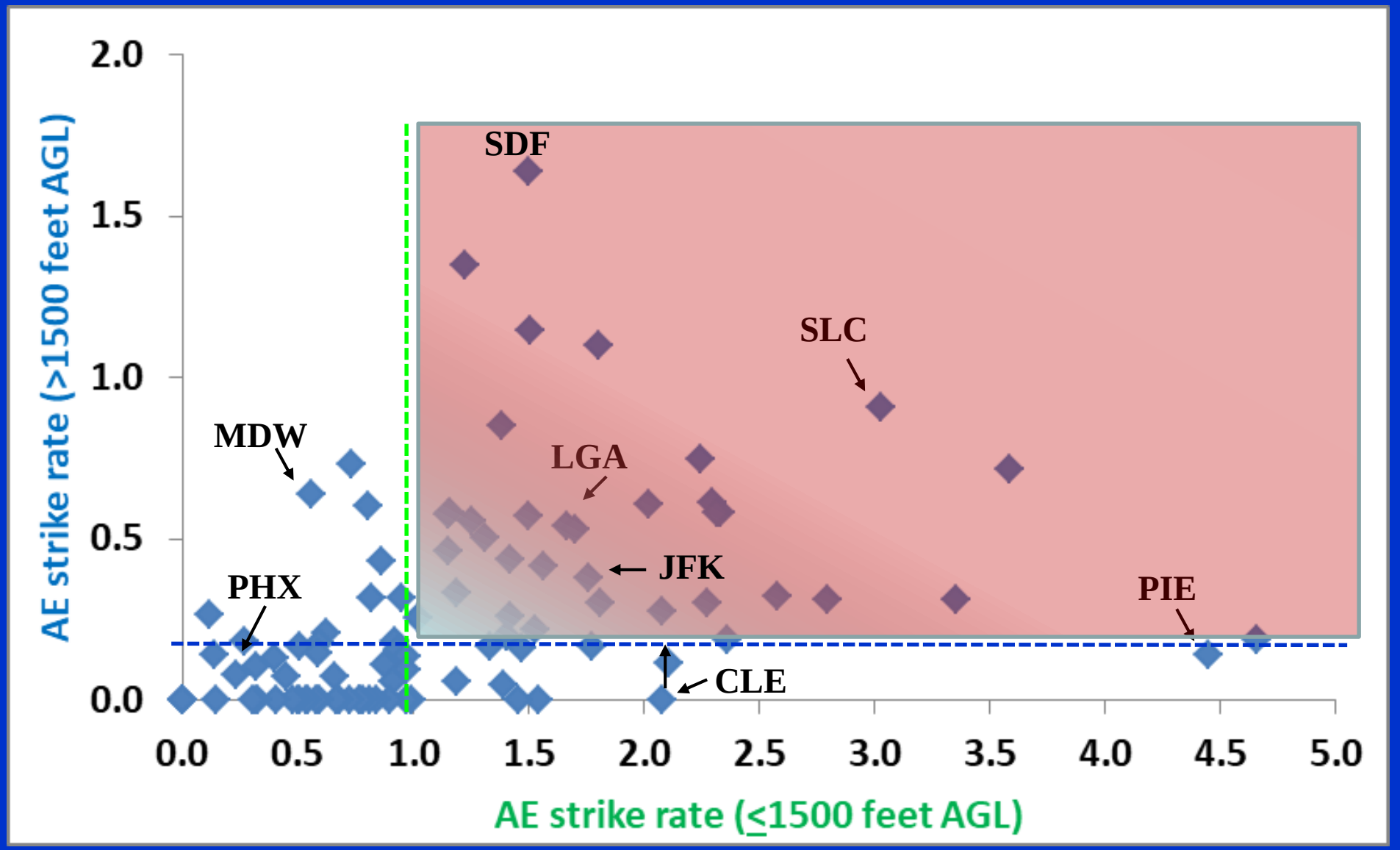
Adverse effect (AE) wildlife strikes/100K movements (>1500 feet AGL), 2011-2015



No relationship between movements and Adverse Effect Strike Rate for 100 busiest airports, USA, 2011-2015 (>1500 feet AGL)



Relationship between Adverse Effect Strike Rates at ≤1500 and >1500 feet AGL for 100 busiest airports, USA, 2011-2015



Does this mean that if my airport is below the median AE strike rates (0.97; 0.17), I don't need to improve anything to mitigate risk?

Answer: No. <u>Every airport should strive for an AE strike rate of 0 at both <1500 and >1500 feet.</u>

Your airport may have a lower risk than many other airports because of:

a) Inherent geographic or site-specific location.

b) Superior WHMP and personnel.

Knowing your airport's AE strike rate provides a "benchmark" or goal to measure future progress or setbacks.

Calculation of cost savings by reducing Adverse Effect (AE) strike rate at an airport (JFK using 2015 data)

	AE strike rate (per 100K movements)	No. of aircraft movements/ year	No. AE strikes/ year	Mean cost (US$) for AE strike	Total annual cost of strikes
JFK airport (actual)	1.75	420,000	7.4	$158,000	$1,161,300
JFK airport (goal)	0.90	420,000	3.8	$158,000	$597,240
Net savings	-0.85	0	-3.6	0	-$564,060

If my airport is above the median AE strike rates (0.90; 0.17), should I be criticized/penalized?

Answer: Not necessarily. Your airport may have a higher risk because of:

a) Inherent "bird-rich" geographic location.

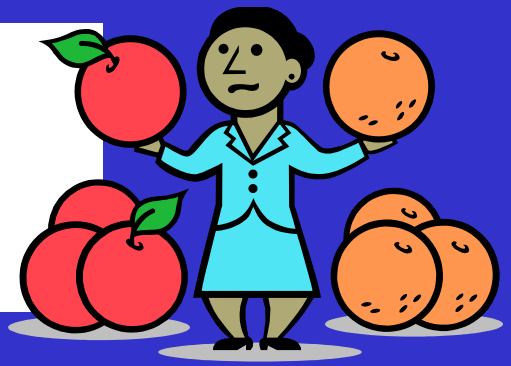
b) An inferior Wildlife Hazard Management Plan.

c) Good WHMP but poorly trained or motivated staff.

<u>However</u>, a high AE strike rate is a red flag; the WHMP needs to be evaluated to lower the rate.

The AE strike rates simply show where your airport stands in relation to other airports and provide "benchmarks" or goals to measure future progress.

Is it really fair to compare airports when one airport has more wildlife inherently present than another airport?



Answer: Yes. The FAA compares airports for other safety-related issues (e.g., runway incursions) and then:

a) Identifies high-risk airports and pin-points problems.

b) Prioritizes ($) mitigation efforts to reduce risk.

Why should we not do this for wildlife risks?

If we refuse to measure and compare risk, how can we wisely manage to mitigate the risk?

PHX, Arizona

AE strike rate

≤1500 feet AGL = 0.27

>1500 feet AGL = 0.18

National median

AE strike rate

≤1500 feet AGL = 0.90

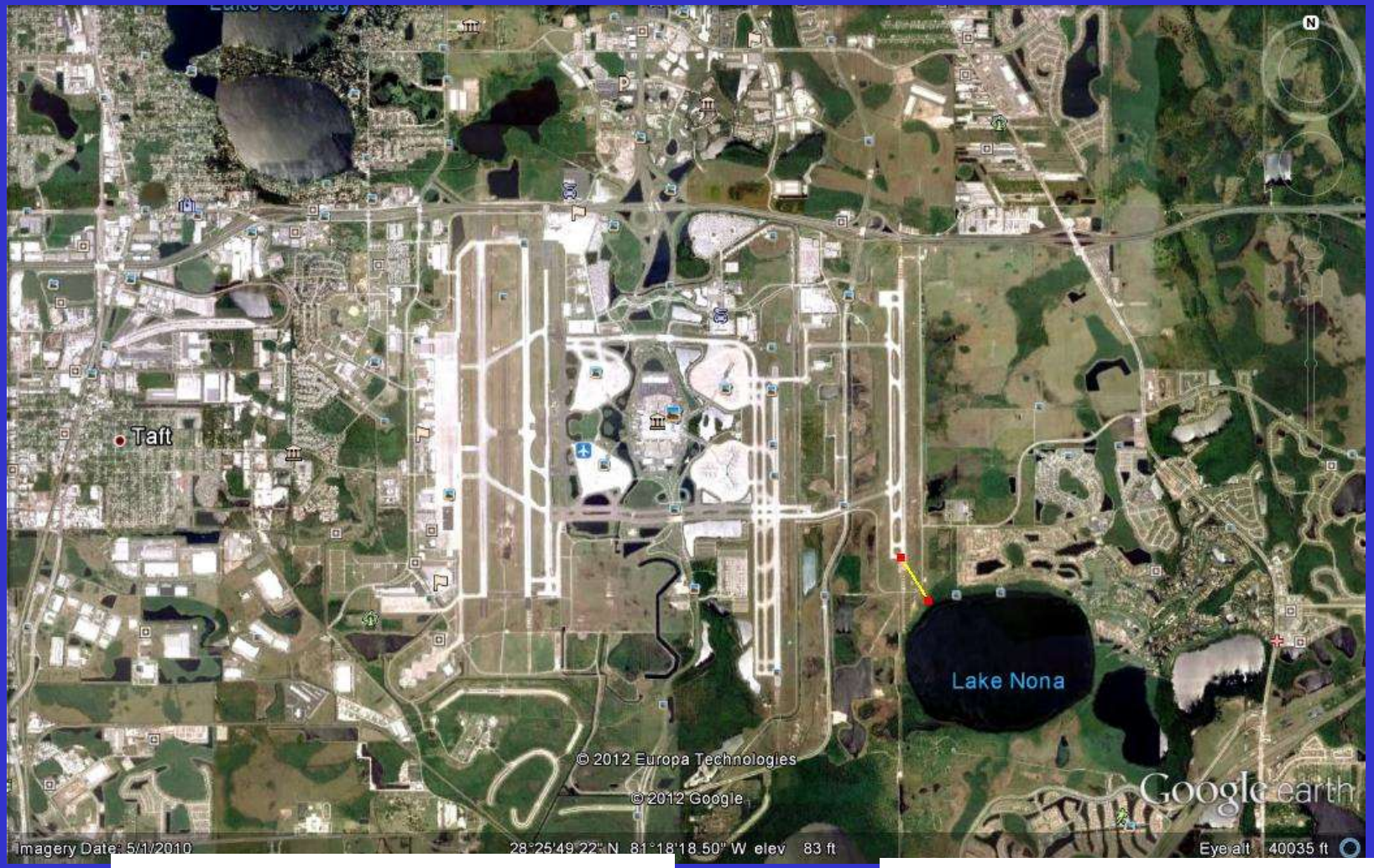
>1500 feet AGL = 0.17

JFK, New York

AE strike rate

≤1500 feet AGL = 1.76

>1500 feet AGL = 0.38



National median

AE strike rate

≤1500 feet AGL = 0.90

>1500 feet AGL = 0.17

MCO, Florida

AE strike rate

≤1500 feet AGL = 3.59

>1500 feet AGL = 0.72

Conclusions:

- **If you cannot measure or quantify a problem, you cannot manage the problem.**
- **Data are critical to measure & quantify problems!**

2011-2015		AE strike rate	
Airport ID	Airport	<1500 ft	>1500 ft
KMCO	ORLANDO	3.59	0.72
KJFK	JOHN F KENNEDY	1.76	0.38
KLGA	LA GUARDIA	1.67	0.54
KIAD	WASHINGTON DULLES	1.51	0.10
KLAX	LOS ANGELES	0.97	0.32
KORD	CHICAGO O'HARE	0.82	0.00
KDTW	DETROIT METRO	0.77	0.18
KATL	ATLANTA	0.60	0.18
KPHX	PHOENIX SKY HARBOR	0.27	0.61
KLAS	LAS VEGAS	0.12	0.12

National median

AE strike rate

≤1500 feet AGL = 0.90

>1500 feet AGL = 0.17

Conclusions:

The U.S. National Wildlife Strike Database (NWSD):

a. **has always provided overview of problem from a national perspective.**

b. **with 14,000 reports now submitted each year, the NWSD enables objective evaluation & guidance at individual airports using AE strike rates.**

c. **These AE strike rates provide guidance for integrating mitigation efforts for strikes at ≤ and >1500 feet AGL into each airport's WHMP.**


If you cannot measure it,
you cannot manage it!
Safer skies for all who fly!
Thank you.