Integrating Bird Strike Risk and Avian Survey Data to Prioritize Management Goals

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"No management decision is possible until we know what it is we want."

Graeme Caughley. Analysis of Vertebrate Populations

Purpose

- Enter into a dialogue on following question:

  How can we best utilize avian survey data to *inform* our estimates of strike risk?

Approach

- Strike risk
- Airport wildlife surveys
- Developing airport-specific strike risk estimates
- Prioritizing management
- Evaluation

Strike Risk

Requirements to estimate strike risk?

- Annex 14, Volume 1, *Aerodrome Design and Operations*, ICAO (2004) introduced the requirement of Safety Management Systems (SMS) for airports in member states, a program in which risk assessment is emphasized.

- Wildlife Hazard Management Plan...to proactively monitor wildlife hazards, analyze trends, and to understand and anticipate fluctuations in risk.

Dolbeer, R. A., S. E. Wright, J. Weller, A. L. Anderson, and M. J. Begier. 2016. Wildlife strikes to civil aircraft in the United States 1990-2015. U.S. Department of Transportation, Federal Aviation Administration, Office of Airport Safety and Standards, Serial Report 22, Washington, D.C., USA.

- What is risk?
  - Likelihood.
    - sources of a problem,
    - potential endpoints (e.g., hull loss)
    - how sources contribute to those endpoints.

- Application to managing wildlife populations on airports?
  - Seasonality, habitats, diurnal patterns of use, numbers, strike frequency, & direct/indirect damage

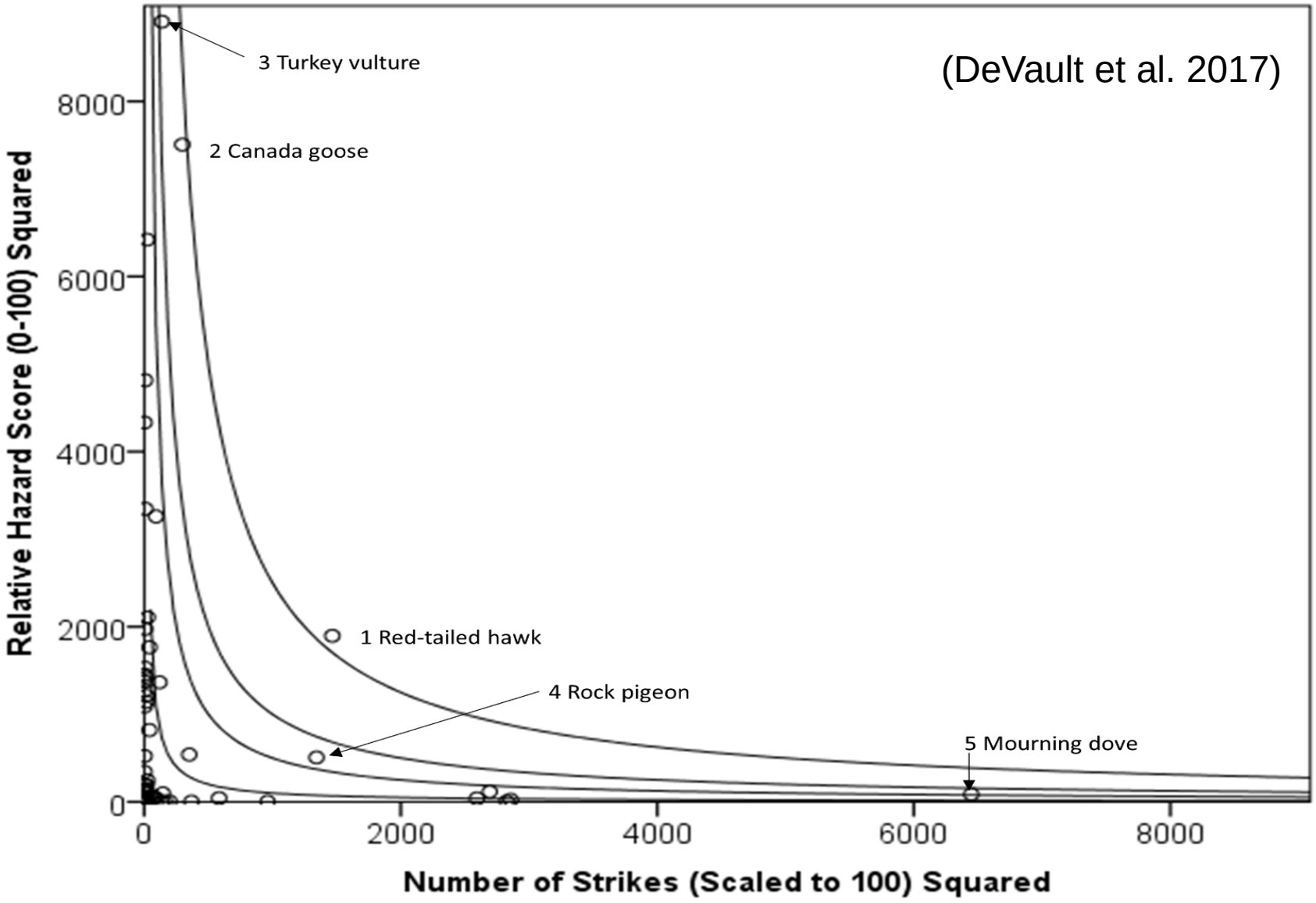
- What is a strike hazard score?
  - Likelihood of aircraft damage or effect on flight when strikes occur.
  - Informs us of the likelihood of damage if a certain species is struck.
  - Does not inform us of the likelihood of the strike and subsequent damage.

- What is strike risk?
  - Likelihood, which can be applied to proactively direct management to mitigate immediate and future wildlife threats to aviation safety.
  - (frequency component) x (severity component)

(frequency component) x (severity component)

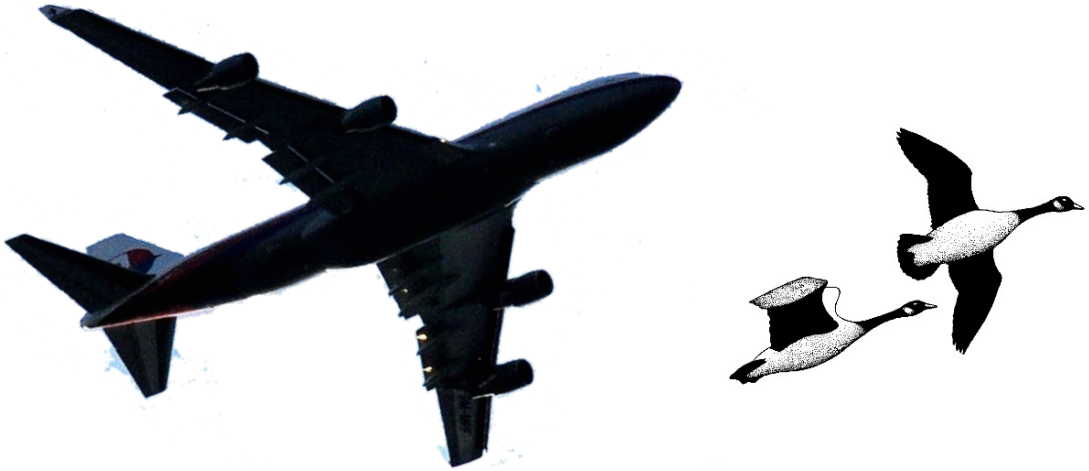
(species-specific strikes) x (species hazard score)

Species	Risk rank	Damaging strikes	Total strikes	RHS	Risk	Total reported cost ($US)
Red-tailed hawk	1	118	515	44	2,780,325	17,660,362
Canada goose	2	121	232	87	2,233,249	10,872,559
Turkey vulture	3	89	158	94	1,229,499	4,444,706
Rock pigeon	4	40	493	23	680,923	3,982,209
Mourning dove	5	36	1,080	9	560,248	569,698
European starling	6	28	698	11	315,575	697,385
Mallard	7	34	129	57	299,799	5,617,599
Ring-billed gull	8	28	252	23	189,512	537,910
Herring gull	9	26	147	37	163,056	2,011,880
Bald eagle	10	28	64	80	145,365	8,693,343



(DeVault et al. 2017)

Factors contributing to strike risk:



1. Aircraft type
2. Phase of flight
3. Aircraft movements
4. Relative position of birds in space and time
5. Relative frequency of species strikes
6. Species & associated hazard

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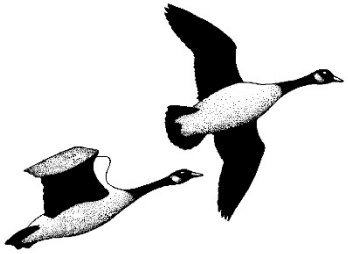

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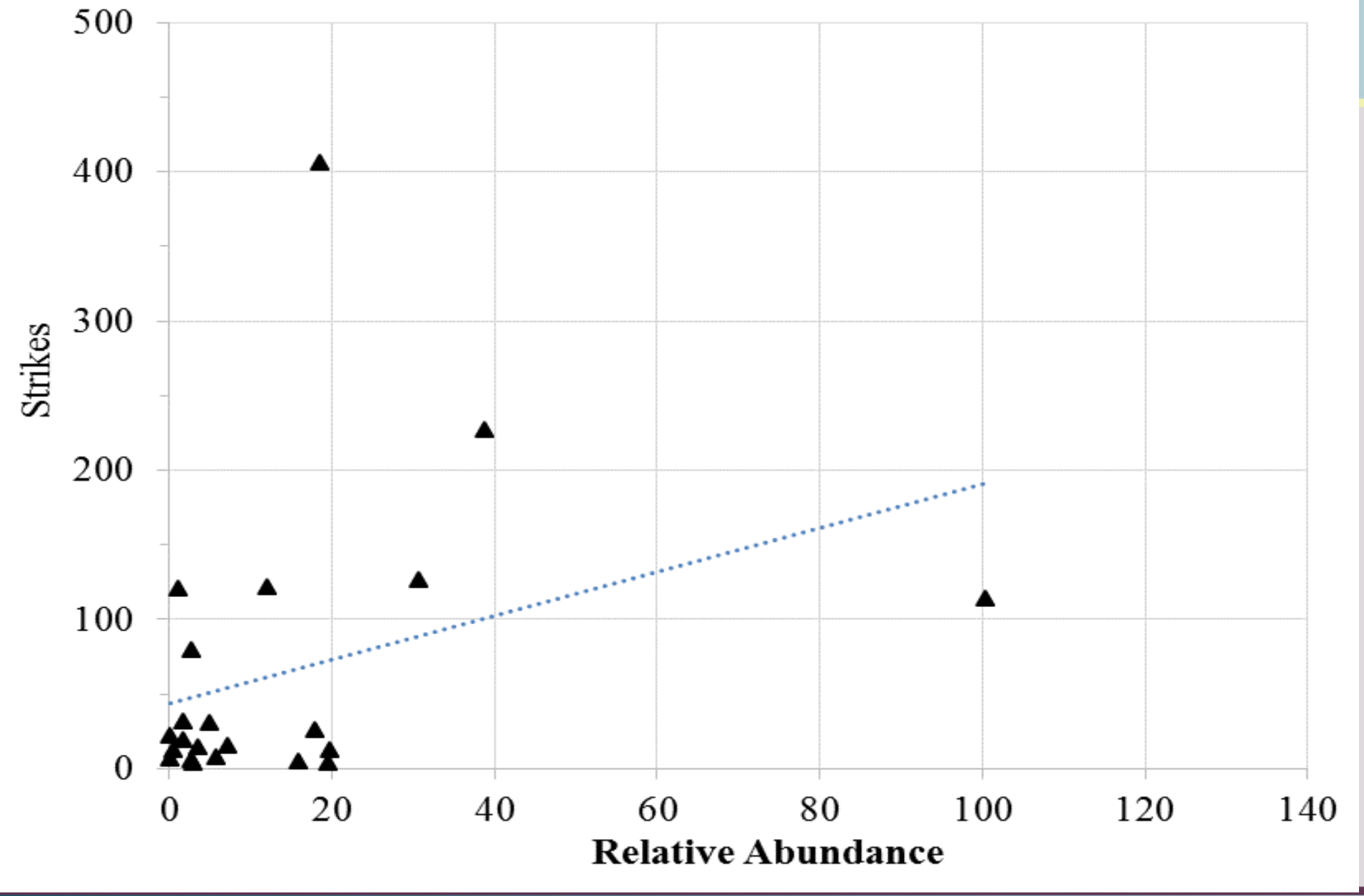
500
400
300
200
100
0
Strikes
0
20
40
60
80
100
120
140
Relative Abundance

Airport Wildlife Surveys

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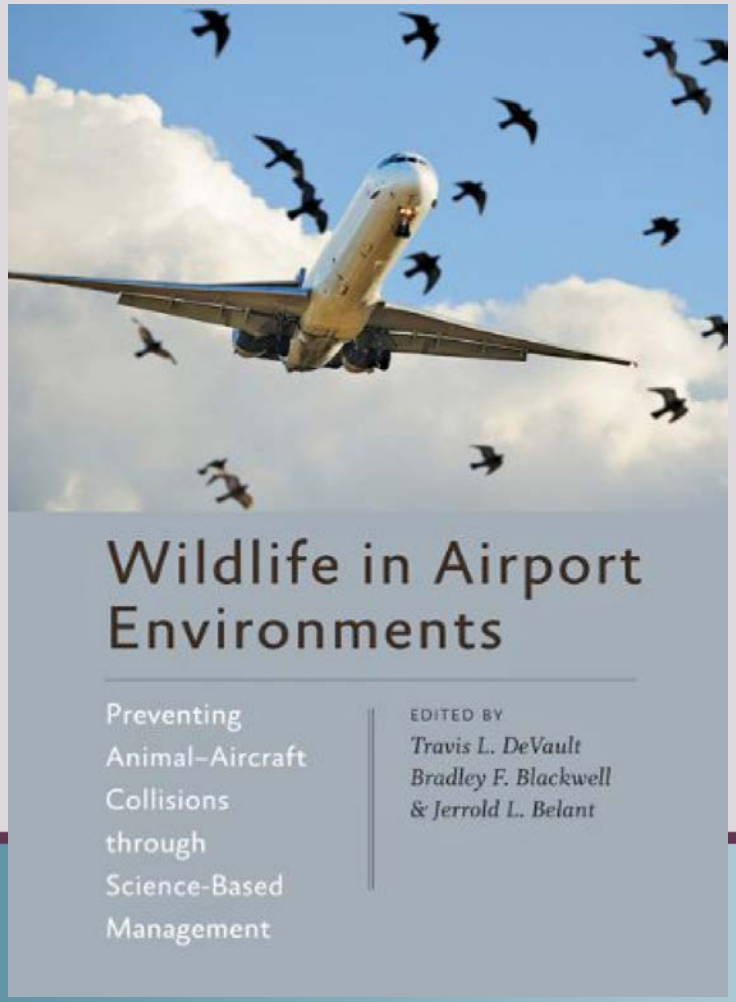

– Requirement

In conducting a Wildlife Hazard Assessment 14 CFR Part 139.337 (c)(2) requires the *“identification of the wildlife species observed and their numbers, locations, local movements, and daily and seasonal occurrences.”*

Wildlife Hazard Management Plan: 14 CFR 139.337 (f)

- rationale:

  Accurate survey data support and guide management actions.

- objective:

  To identify and quantify wildlife hazards on and near airport properties.

How do we adapt the strike risk concept to a specific airport?

- Is species strike risk equal across airports where a particular species is observed?
- What is the strike risk for a species that uses an airport habitat(s), but has never been struck?

- If management priorities will be based on risk, does strike risk that is estimated based on broad data from the FAA strike database apply to your airport?

- If not, how is strike risk estimated for a species observed, but not struck?

- Developing airport-specific strike risk estimates
  - Example airport

Strike Risk:

$$(\text{strikes scaled to } 100)^2 \times (\text{RHS scaled to } 100)^2$$

Species observed on the airport	Overall Strike Risk (FAA & DeVault et al. 2017)	Rank
Red-tailed hawk	2780325	1
Canada goose	2233249	2
Turkey vulture	1229499	3
Rock pigeon	680923	4
Mourning dove	560248	5
European starling	315575	6
Mallard	299799	7

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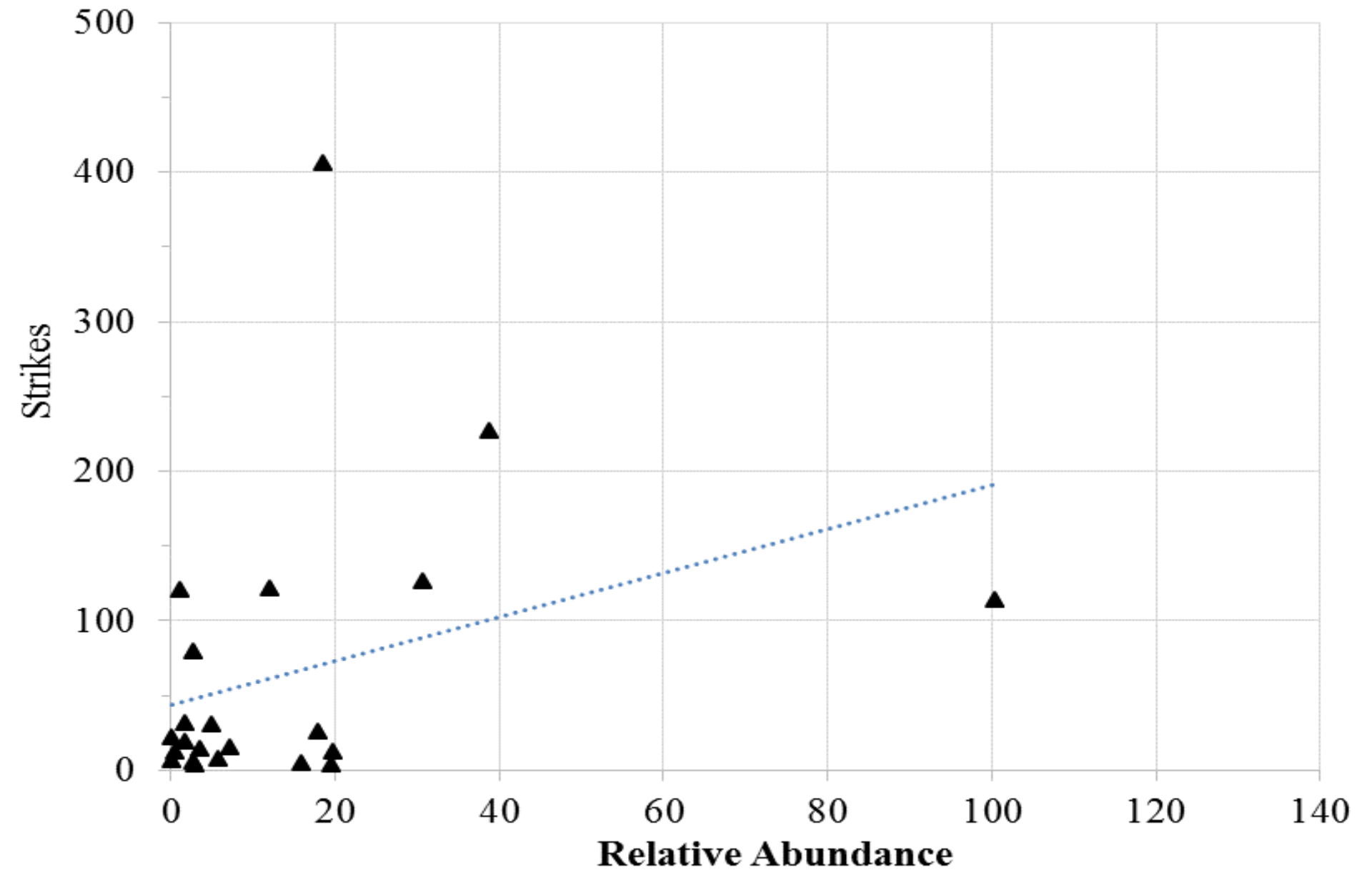
- Risk for species not struck?

- Is risk based on across-airport reports (FAA strike database) applicable to your airport?

Airport Strike Risk:

$$(\text{strikes scaled to } 100)^2 \times (\text{RHS scaled to } 100)^2$$

For species not struck, the frequency component must be replaced. We have the RHS.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140
Relative Abundance

Species	Airport Strike Risk	Survey RA (individuals)	Prop. RA	Prop. time in critical airspace (RPZ, runway/taxi)
Turkey vulture	45081632.7	0.66	0.007	0.900
Red-tailed hawk	1011461.2	0.66	0.007	0.900
European starling	888979.6	65.70	0.666	0.500
Mourning dove	5290000.0	3.94	0.040	0.100
Canada goose	0.0	6.60	0.067	0.100
Mallard	0.0	13.14	0.133	0.100
Rock pigeon	0.0	7.88	0.080	0.900

Species Relative Frequency, SRF

SRF = (Prop. RA) x (Prop. Time critical airspace)

SRF is then scale to 100

Species	Airport Strike Risk	Species Relative Frequency
Turkey vulture	45081632.7	2
Red-tailed hawk	1011461.2	2
European starling	888979.6	100
Mourning dove	5290000.0	1
Canada goose	0.0	2
Mallard	0.0	4
Rock pigeon	0.0	22

Airport Strike Risk:

$$(\text{strikes scaled to } 100)^2 \times (\text{RHS scaled to } 100)^2$$

Species	Species Relative Frequency (Prop. RA x Prop. Time)	RHS	Airport Strike Risk
Canada goose	2	87	30276.0
Mallard	4	57	5198.4
Rock pigeon	22	23	256036.0

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Red-tailed hawk	1011461.2	3
European starling	888979.6	4
Mourning dove	5290000.0	2
Canada goose	30276.0	6
Mallard	5198.4	7
Rock pigeon	256036.0	5

- Prioritizing management

Turkey vulture	1
Mourning dove	2
Red-tailed hawk	3
European starling	4
Rock pigeon	5
Canada goose	6
Mallard	7

- Evaluation
  - Do this annually
    - Species struck
    - Calculate strike risk, then rank
    - Compare to previous strike risk ranks
    - Assess your management
    - New priorities

Questions?