# Be Proactive:
# The Abundance-based Strike Risk Index

**Maxime Allard**

M. Sc. Biology

Falcon Environmental Services Inc.

Collaborators:

Pierre Molina, Marilou G. Skelling and Marie-Line Fiola

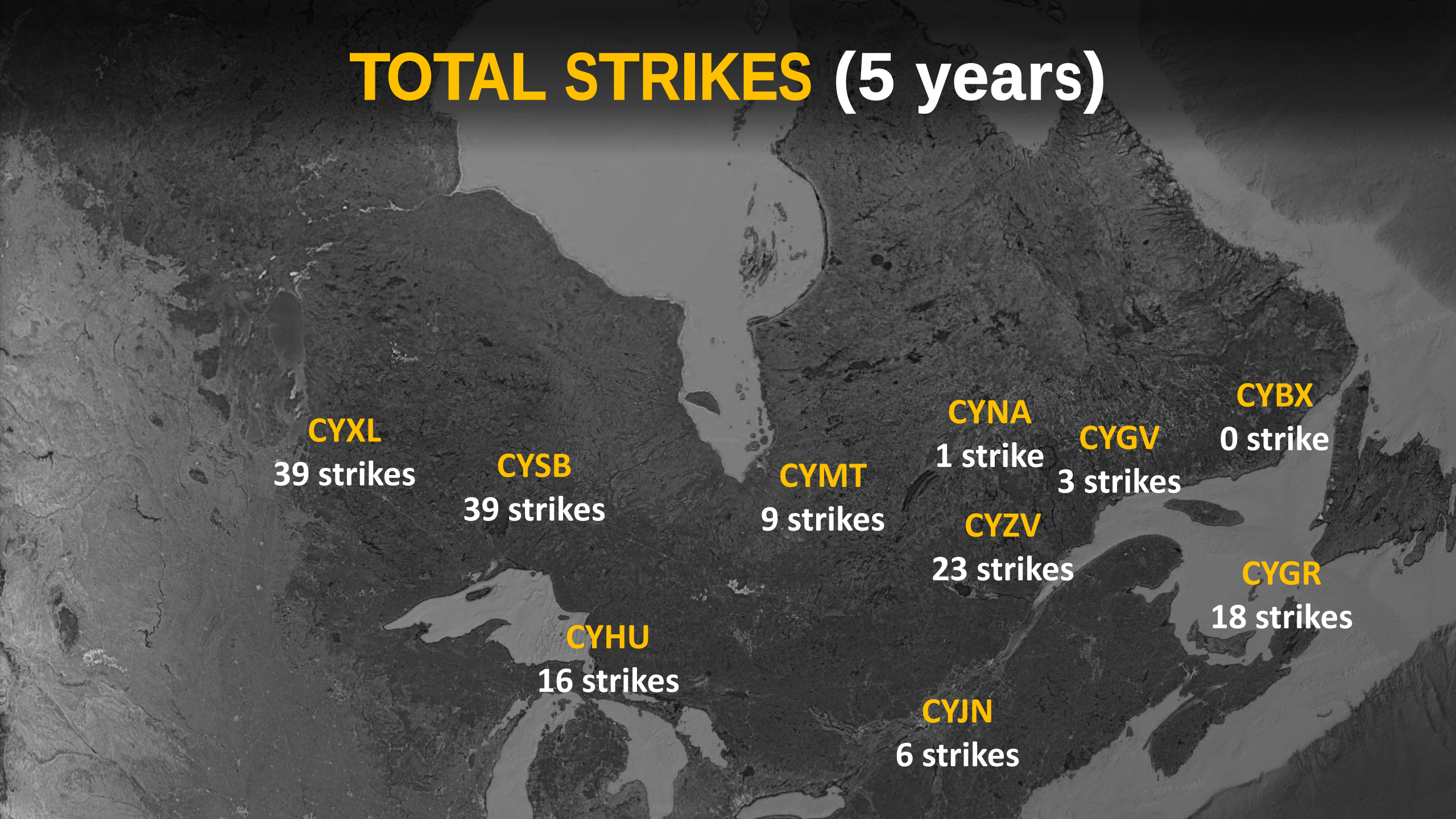

# HOW MANY AIRCRAFT CRASHES DO YOU NEED BEFORE TAKING ACTION?


HOW MANY BIRD STRIKES DO YOU NEED BEFORE TAKING ACTION?

# HOW MANY BIRD STRIKES DO YOU NEED BEFORE TAKING ACTION?

# Blanc-Sablon Airport (CYBX)

| Year | Strike Number | Aircraft Movements | Strike Rate / 10,000 Movements |
|---|---|---|---|
| 2010 | 0 | 5 890 | 0 |
| 2011 | 0 | 5 678 | 0 |
| 2012 | 0 | 5 403 | 0 |
| 2013 | 0 | 5 287 | 0 |
| 2014 | 0 | 5 197 | 0 |


TOTAL STRIKES (5 years)
CYXL
39 strikes
CYSB
39 strikes
CYMT
9 strikes
CYNA
1 strike
CYGV
3 strikes
CYBX
0 strike
CYZV
23 strikes
CYGR
18 strikes
CYHU
16 strikes
CYJN
6 strikes

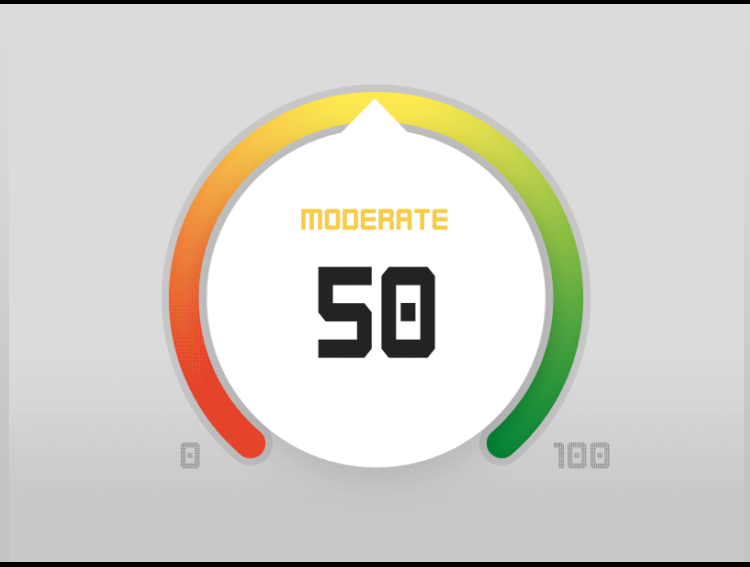
# Northern Airports

CARIBOU STRIKES NEVER HAPPENED IN CANADA

**YET…**

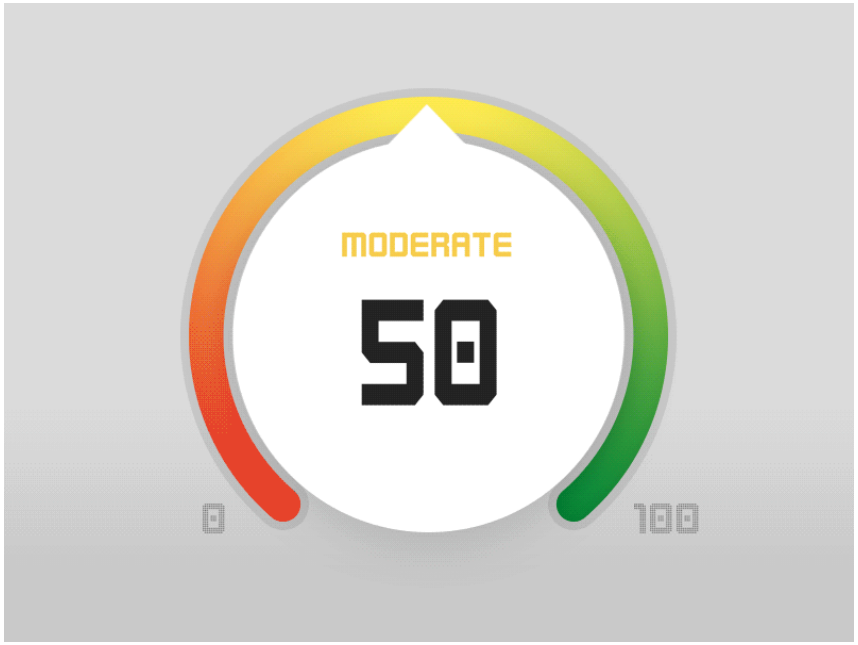
CARIBOU STRIKES NEVER HAPPENED IN CANADA

# YET...




WHAT WOULD BE THE RISK IF WE ONLY TAKE INTO ACCOUNT THE STRIKES

LOW




# MAYBE STRIKES ARE NOT THE RIGHT "TOOL" TO ASSESS THE RISK


# What about BIGGER AIRPORTS?

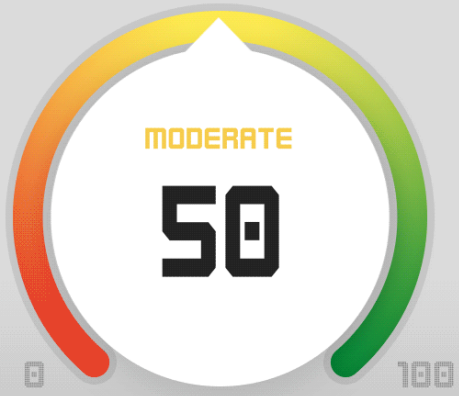
# Montreal-Trudeau Airport (CYUL)


Canada Geese are seen on the airfield 1 day out of three.

ONLY ONE STRIKE HAPPENED

# Montreal-Trudeau Airport (CYUL)

**>200,000 movements per year**
**~80 strikes per year**

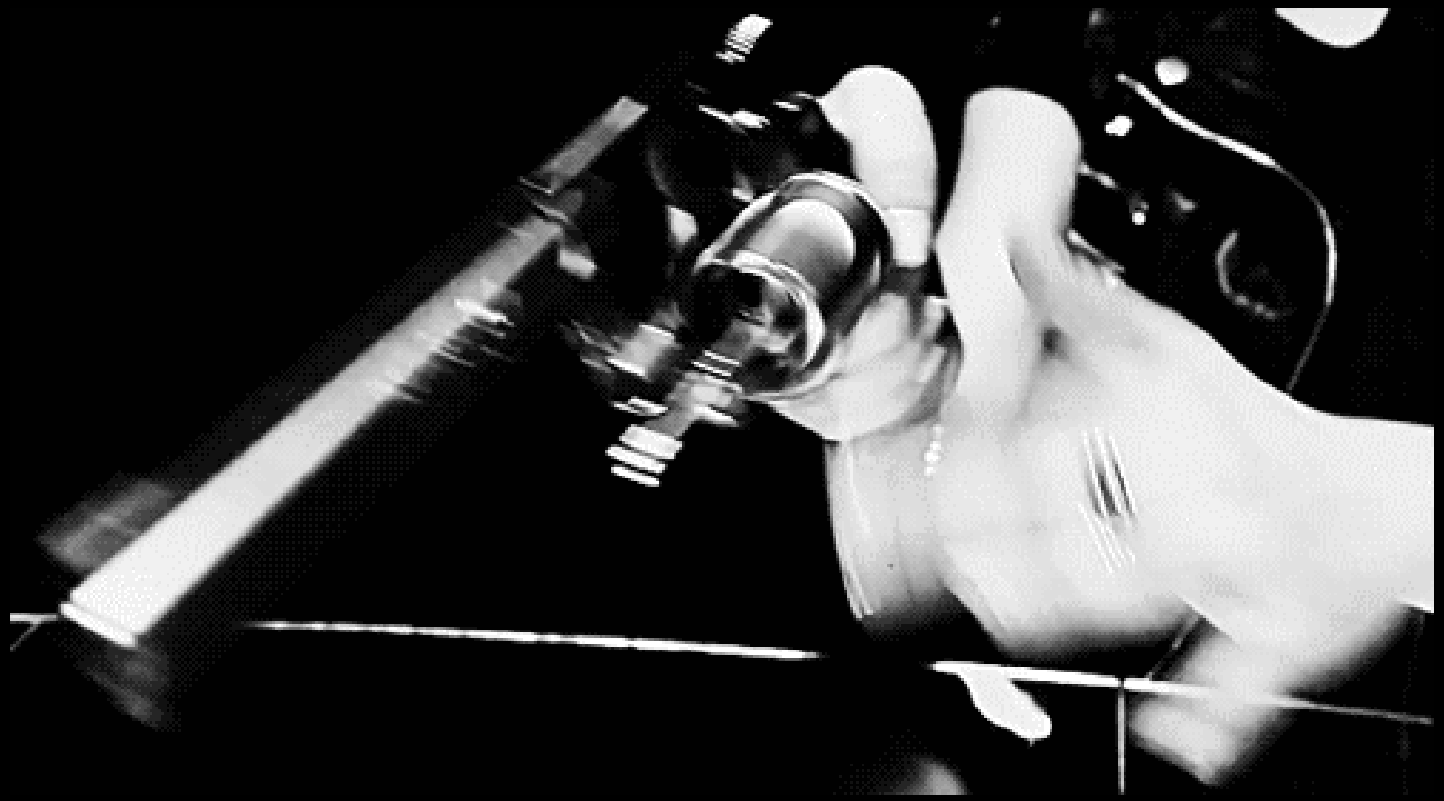



**LOW**

Canada Geese are seen on the airfield 1 day out of three.

ONLY ONE STRIKE HAPPENED

# STRIKE-BASED Risk Assessment



If you play enough you will loose.

# MOST AIRPORTS HAVEN'T PLAYED ENOUGH YET

STRIKES are the result of an accident

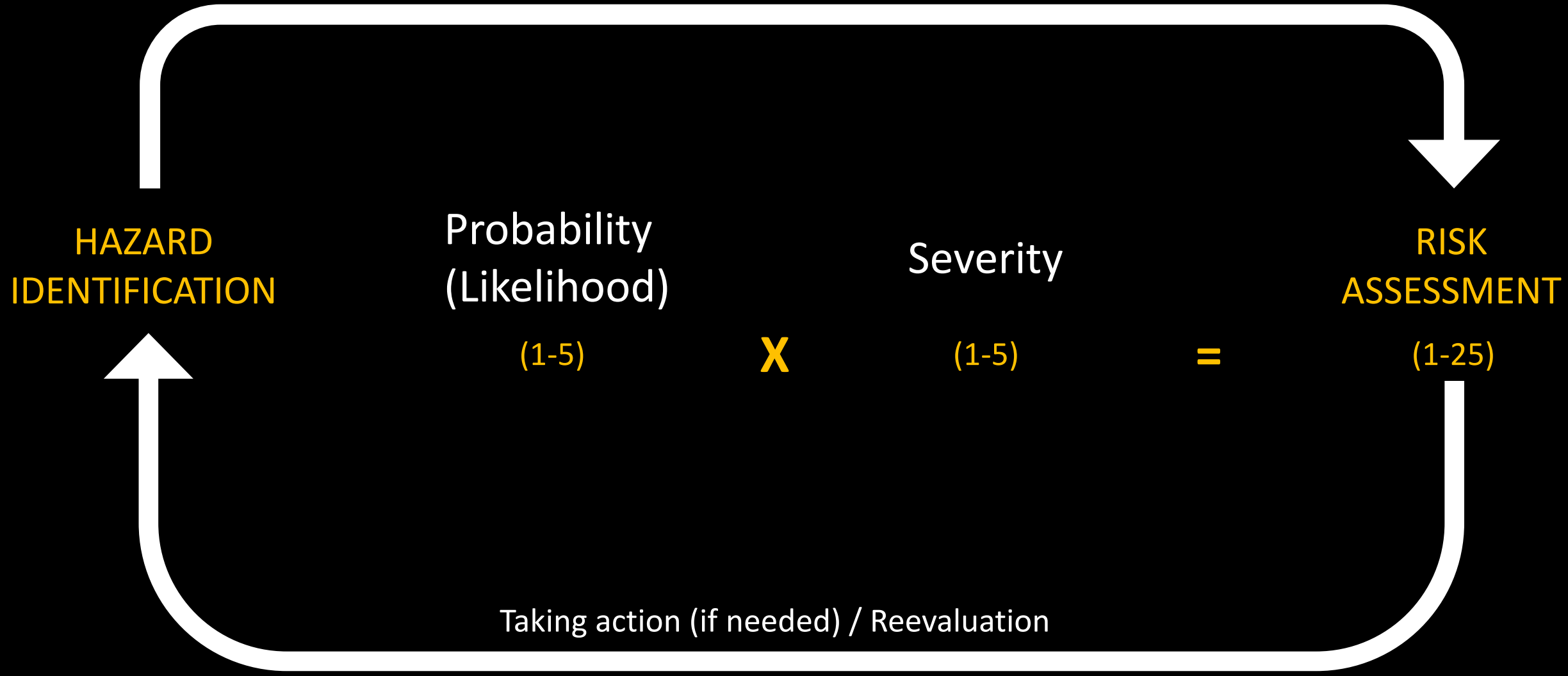
If you have strikes it is because you have wildlife

NOT BECAUSE YOU HAD STRIKES BEFORE

Widlife abundance should be the way to assess strike risk.

Strong statistical relationship between strikes and abundance data (R2>60%)

# SAFETY MANAGEMENT SYSTEM



# SAFETY MANAGEMENT SYSTEM – SMS FACTORS

Probability (Likelihood

Severity

**Probability of an event to occur:**

1- Extremely improbable
2- Extremely remote
3- Remote
4- Reasonably probable
5- Frequent

**How serious the event is:**

1- Negligible
2- Minor
3- Moderate
4- Major
5- Catastrophic

# SAFETY MANAGEMENT SYSTEM

WILDLIFE

HAZARD IDENTIFICATION

Probability (Likelihood)

(1-5)

**More Widlife = More Likely**

RISK ASSESSMENT

(1-25)

AIRCRAFT

**More Aircraft = More Likely**

Taking action (if needed) / Reevaluation

# SAFETY MANAGEMENT SYSTEM

HAZARD IDENTIFICATION

WILDLIFE

Probability (Likelihood)

(1-5)

X

WILDLIFE

Severity

(1-5)

=

RISK ASSESSMENT

(1-25)

AIRCRAFT

AIRCRAFT

Taking action (if needed) / Reevaluation

# SAFETY MANAGEMENT SYSTEM

**More biomass**
**More damages**

WILDLIFE

HAZARD IDENTIFICATION

Severity

RISK ASSESSMENT

(1-5) = (1-25)

**Aircraft susceptibility to strikes**

AIRCRAFT

Taking action (if needed) / Reevaluation

| HAZARD IDENTIFICATION | Probability (Likelihood) | X | Severity | = | RISK ASSESSMENT |
|---|---|---|---|---|---|
|  | 4 | X | 5 | = | 20 |

---

**Probability of an event to occur:**

4- Reasonably probable

**How serious the event is:**

5- Catastrophic

| HAZARD IDENTIFICATION | Probability (Likelihood) | X | Severity | = | RISK ASSESSMENT |
|---|---|---|---|---|---|
|  | 4 | X | 5 | = | 20 |

| Risk Index Value* | Actions |
|---|---|
| 1 – 6] | Low risk. Proceed after considering all elements of risk. |
| ]6 – 10.5[ | Moderate risk. Continue after taking action to manage overall level of risk |
| [10.5 – 15[ | High risk. Continue after taking action to manage overall level of risk. |
| ≥ 15<br>[15 – 25] | Very high risk. **STOP**: Do not proceed until sufficient control measures have been implemented to reduce risk to an acceptable level. |

| HAZARD IDENTIFICATION | Probability (Likelihood) | X | Severity | = | RISK ASSESSMENT |
|---|---|---|---|---|---|
|  | 4 | X | 5 | = | 20 |

Similar to the risk analysis done by most airport

But, SMS tries to separate the risk into factors
More reliable

HAZARD IDENTIFICATION

Probability (Likelihood) **X** Severity **=** RISK ASSESSMENT

4 **X** 5 **=** 20

---

**Ordered Qualitative Score** **X** **Ordered Qualitative Score** **=** **Ordered Qualitative Score**

Defined by a human according to a definition

| HAZARD IDENTIFICATION | Probability (Likelihood) | X | Severity | = | RISK ASSESSMENT |
|---|---|---|---|---|---|
|  | 4 | X | 5 | = | 20 |

| Quantitative Score | X | Quantitative Score | = | Quantitative Score |
|---|---|---|---|---|

Result of a mathematical operation

# DATA-based RISK ANALYSIS PROCESS

# DATA-based RISK ANALYSIS PROCESS

Probability
(Likelihood)

```
00252d0 32 d1 af 60 81 65 0d 58 3f a0 c0 c0 74 08 03 1a
00252e0 3c 60 e8 05 80 07 84 06 05 2f af d8 2b 2a cc 61
00252f0 de 07 01 ad 78 89 62 4a d7 1e 37 18 bf 6a 5a 20
0025300 5f 77 19 df 69 a7 c5 06 29 c4 2c 5e ea 8a 28 26
0025310 ab a3 90 89 2f 73 12 f7 a9 4b 72 d2 41 8b e5 b1
0025320 53 d3 f2 1c b0 be ec ac 51 2c 3b c0 aa 74 24 39
0025330 54 dd 92 3c d0 06 35 a1 26 32 8e 92 b1 11 21 5f
0025340 43 01 bb 8b cb 77 f2 85 5e dc 71 9d 15 ae bf 28
0025350 e7 8a db ca f7 15 fb 08 99 df dd df 7d c2 57 77
0025360 96 8f 75 55 66 5f 52 7c 64 70 64 f3 06 02 73 ab
0025370 9d 0b c7 5a 81 01 33 65 8c 6c e2 e0 2a a7 38 06
0025380 e0 41 c9 29 72 b0 c7 84 0b ef 64 e2 4d 59 39 96
0025390 72 4b 1d 56 2c ba 37 ad 1e d9 6f 7f 82 5b 97 bb
00253a0 7d dc e6 3d 97 d5 2b c4 08 1f 87 1f d2 aa 1e c9
00253b0 7d 89 29 8b ec b6 fd 08 96 54 26 b5 49 87 d8 24
00253c0 dd 0d ad 42 0e 5c 21 b7 6e 5c 95 20 3e 60 ac 40
00253d0 e0 b7 1e 40 84 7d e4 bf eb 81 09 ae f5 3f 7b e4
00253e0 46 3e 7e be 3c bb bb bf bb f6 23 9a 8e 7a 1c 8f
00253f0 b2 62 1c 06 bf 4d 71 75 50 89 23 3f f5 ad 34 d3
0025400 a4 4a 04 57 89 54 3b a1 06 64 62 04 c9 47 0a 3e
0025410 3c a3 97 b5 2b 34 f0 d3 bb a1 fb ac 7a af dd df
0025420 71 37 2f 7b bb bc be 25 54 57 da 42 7b ca 42 29
0025430 73 bf 04 56 df 82 27 8a a0 23 aa 62 70 6a 0c b1
```

**Quantitative Score**

Wildlife
Occurrence data

Movements per aircraft types

# DATA-based RISK ANALYSIS PROCESS

Simple to use
Flexible - for any airport size
Adaptable - with or without appropriate field data

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Simple to use
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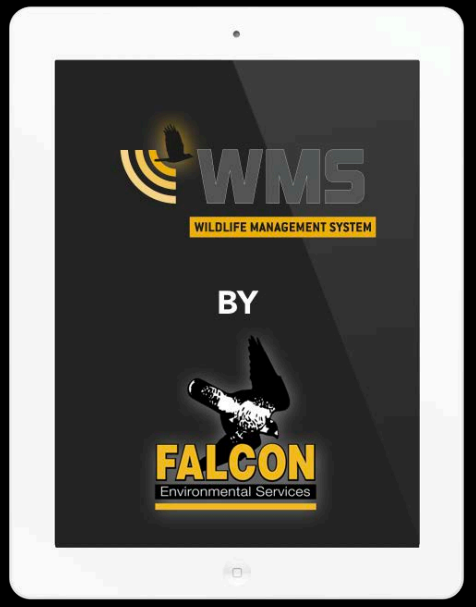
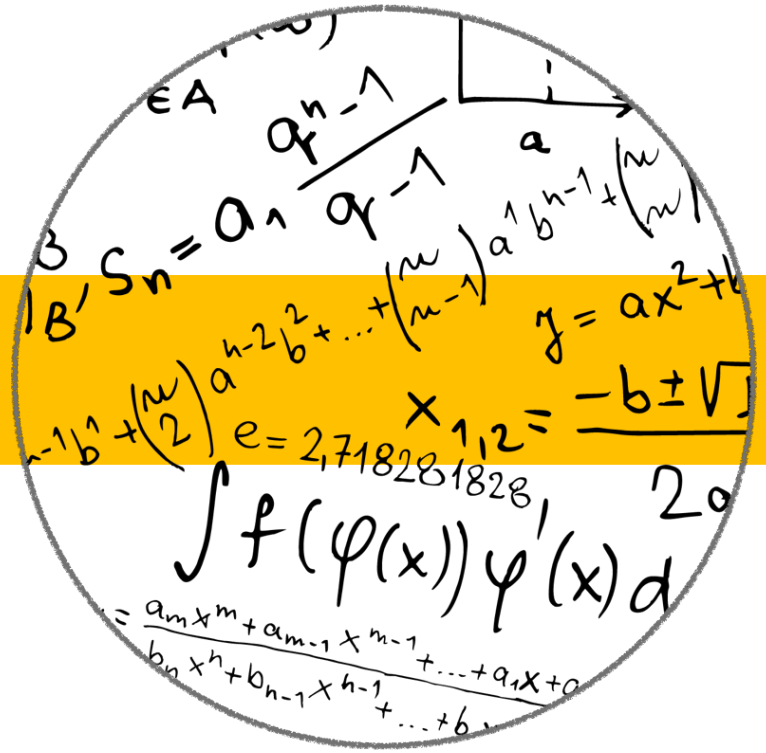


# Wildlife
# Occurrence data

| Ordered Qualitative | Semi-Quantitative | Quantitative |
|---|---|---|
| Low | 1-100 | 16 |
| Moderate | 100-200 | 163 |
| High | 200-300 | 285 |
| Classes | BINS (range) | Real number |


# Repetitive Process

*Developped using data from 20 risk analysis*

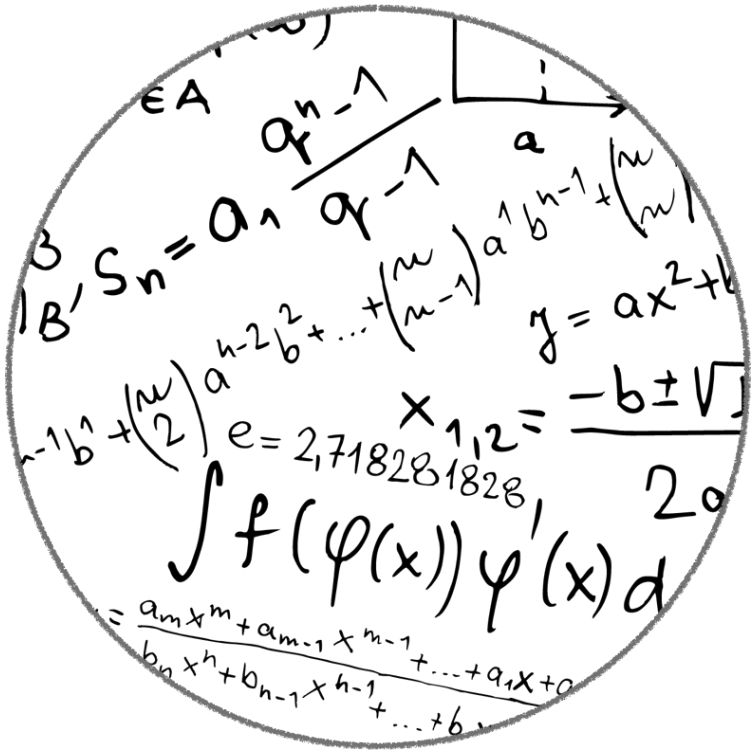


*Validated in more than 30 airports*

**Quantitative Score**

# 3 MAIN MATHEMATICAL EQUATIONS

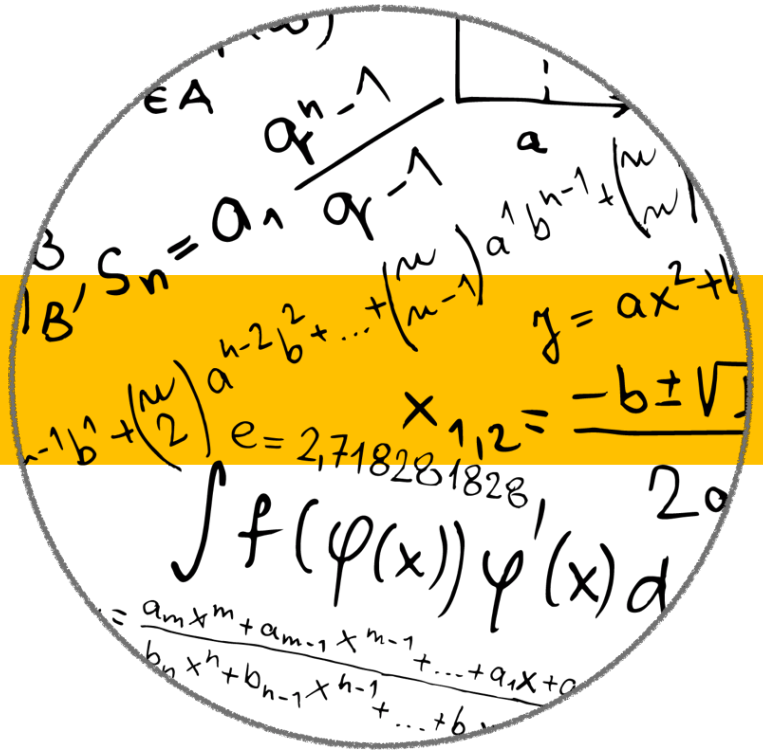
$$P_F = \frac{(P_1 - 1) * P_2}{5} + 1$$



$$S_F = \sqrt{Score\ S_A * Score\ S_{WG}}$$

$$Probability\ Score_{\ Wildlife\ Group} = \sqrt{Score_{Obs\ Freq} * Score_{Runway\ Crossing}}$$

# HOW DO WE KNOW IT IS WORKING?

**Quantitative Probability Score**

Value between 1 and 5

# HOW DO WE KNOW IT IS WORKING?

HAZARD IDENTIFICATION

WILDLIFE

Probability (Likelihood)

**Quantitative Probability Score**

(1-5)

**SMS Semi-Quantitative Score**

AIRCRAFT

3.8

4

## SMS PROBABILITY DEFINITION

**Probability of an event to occur:**

1- Extremely improbable
2- Extremely remote
3- Remote
4- Reasonably probable
5- Frequent

# HOW DO WE KNOW IT IS WORKING?

WILDLIFE

Probability
(Likelihood)

HAZARD
IDENTIFICATION

**<u>Quantitative</u>**
**Probability**
**Score**

3.8✓

AIRCRAFT

# HOW DO WE KNOW IT IS WORKING?

HAZARD IDENTIFICATION

WILDLIFE

Probability (Likelihood)

**Quantitative Probability Score**

3.8 ✓

X

WILDLIFE

Severity

**Quantitative Probability Score**

4.8 ✓

**SMS Semi-Quantitative Score**

AIRCRAFT

=

RISK ASSESSMENT

(1-25)

18.24

✓

# ANY AIRPORT SIZE

| BIG AIRPORTS | | SMALL AIRPORTS |
|---|---|---|
| Regular patrols | Wildlife Patrols | Some patrols |
| Extensive<br>Every sightings are noted;<br>Regular and standardized<br>**bird survey program** | Data Collection | Daily **summary** of bird activity. |
| Software | Data Logging | Usually on **paper** |
| **Dedicated** Staff trained for wildlife management | Staff | Airport staff does everything. Wildlife management is just a part of their job. |

**Quantitative Data**

**Semi-Quantitative Data**

# SAFETY MANAGEMENT SYSTEM

HAZARD IDENTIFICATION

WILDLIFE

Probability (Likelihood)

(1-5)

X

WILDLIFE

Severity

(1-5)

=

RISK ASSESSMENT

(1-25)

AIRCRAFT

AIRCRAFT

Taking action (if needed) / Reevaluation

# SAFETY MANAGEMENT SYSTEM

**Occurrence**
**Runway Crossing Behaviour**

**Mass/Flocking**
**Score**

HAZARD IDENTIFICATION

Probability (Likelihood)

Severity

RISK ASSESSMENT

(1-5) **X** (1-5) **=** (1-25)

**Number of Movements**

**Aircraft Susceptibility to Strikes**

Taking action (if needed) / Reevaluation

# Variable - WILDLIFE OCCURRENCE

| Score | Wildlife Group Observation Frequency | Observation Probability During a Patrol |
|---|---|---|
| **1** | < 1 % | Extremely Improbable/Exceptional |
| **2** | ] 1-5 % ] | Unlikely/Improbable |
| **3** | ] 5-25 % ] | Remote/Possible |
| **4** | ] 25-50 % ] | Reasonably Probable/Occasional |
| **5** | > 50 % | Frequent/Certain |

BIG AIRPORTS

**Quantitative**

↓

**Semi-Quantitative**

SMALL AIRPORTS

**Ordered Qualitative**

# Variable - WILDLIFE

| Score | Transport Canada Levels | Mass Flocking |
|---|---|---|
| 1 | Levels 5 and 6 | Small (50 g-300 g), solitary or Very small (<50 g), flocking or solitary |
| 2 | Level 4 | Medium (300 g-1 kg), solitary or Small (50 g-300 g), flocking |
| 3 | Level 3 | Large (1-1.8 kg), solitary or Medium (300 g-1 kg), flocking |
| 4 | Level 2 | Very large (>1.8 kg), solitary or Large (1-1.8 kg), flocking |
| 5 | Level 1 | Very large (>1.8 kg), flocking |

Biology

| Score | Runway Crossing Behaviour |
|---|---|
| 1 | Generally stay away from the runways |
| 2 | Sometimes crossing runways, but mostly on the ground (the rest of the airfield) |
| 3 | Regularly crossing runways when moving |
| 4 | Sometimes feeding on runways and often crossing them |
| 5 | Feeding on or above runways, or resting on runways for a long period of time |

Social Surveys
Biologist Experience

# Variable - AIRCRAFT

| Severity Score | Engine type |
|---|---|
| 1 | Gliders |
| 1 | Pistons |
| 2 | Helicopters |
| 3 | Turboprops |
| 5 | Turbofans |

| Probability Score | Relative percent of movements for an aircraft type |
|---|---|
| 1 | < 1% |
| 2 | 1 à 5% |
| 3 | 5 à 25% |
| 4 | 25 à 50% |
| 5 | > 50% |

# SAFETY MANAGEMENT SYSTEM

**Occurrence**
**Runway Crossing Behaviour**

**Mass/Flocking**
**Score**

HAZARD IDENTIFICATION

Probability (Likelihood)

Severity

RISK ASSESSMENT

(1-25)

**Number of Movements**

**Aircraft Susceptibility to Strikes**

Taking action (if needed) / Reevaluation

# RISK ASSESSMENT

| Wildlife Groups | Turbojets | Turboprops | Helicopters | Pistons |
|---|---|---|---|---|
| Blackbirds | 11 | 7 | 3 | 2 |
| Coyote | 8 | 5 | 3 | 2 |
| Crows and Ravens | 17 | 11 | 5 | 3 |
| Ducks and Associated Species | 13 | 9 | 4 | 3 |
| Eagles | 10 | 7 | 4 | 3 |
| Falcons | 9 | 6 | 3 | 2 |
| Geese | 12 | 8 | 5 | 3 |
| Grouse | 13 | 9 | 4 | 3 |
| Gulls and Terns | 18 | 12 | 5 | 4 |
| Hawks | 15 | 10 | 4 | 3 |
| Herons | 9 | 6 | 4 | 3 |
| Other Small Birds | 9 | 6 | 3 | 2 |
| Owls | 8 | 5 | 3 | 2 |
| Pigeons and Doves | 11 | 7 | 3 | 2 |
| Shorebirds | 13 | 8 | 4 | 3 |
| Snow Buntings | 11 | 7 | 3 | 2 |
| Starlings | 14 | 9 | 4 | 3 |
| Swallows and Associated Species | 9 | 6 | 3 | 2 |
| Very Large Mammals | 5 | 4 | 3 | 2 |
| Medium Mammals | 9 | 6 | 3 | 2 |
| Small Mammals | 4 | 3 | 2 | 1 |

# WILDLIFE MANAGEMENT PRIORITIES

| Wildlife Groups | Turbojets |
|---|---|
| Blackbirds | 11 |
| Coyote | 8 |
| Crows and Ravens | 17 |
| Ducks and Associated Species | 13 |
| Eagles | 10 |
| Falcons | 9 |
| Geese | 12 |
| Grouse | 13 |
| Gulls and Terns | 18 |
| Hawks | 15 |
| Herons | 9 |
| Other Small Birds | 9 |
| Owls | 8 |
| Pigeons and Doves | 11 |
| Shorebirds | 13 |
| Snow Buntings | 11 |
| Starlings | 14 |
| Swallows and Associated Species | 9 |
| Very Large Mammals | 5 |
| Medium Mammals | 9 |
| Small Mammals | 4 |

| Risk Index Value* | Actions |
|---|---|
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| [10.5 – 15[ | High risk. Continue after taking action to manage overall level of risk. |
| ≥ 15<br>[15 – 25] | Very high risk. **STOP**: Do not proceed until sufficient control measures have been implemented to reduce risk to an acceptable level. |

# DATA-based RISK ANALYSIS PROCESS

**Summarize**

## AIRPORT WIDLIFE RISK ANALYSIS

Mean Risk Values based on 5 yrs (2013-2018)

## MONTHLY RISK ANALYSIS

Monthly Mean Risk Values based on 5 yrs
(ex.: May 2013-2018)

**Report**

## ANNUAL RISK Reporting

Last Year Risk Level (2019)

## MONTHLY RISK Reporting

Last Month Risk Level (May 2019)

# MONTHLY RISK ANALYSIS

CYYZ

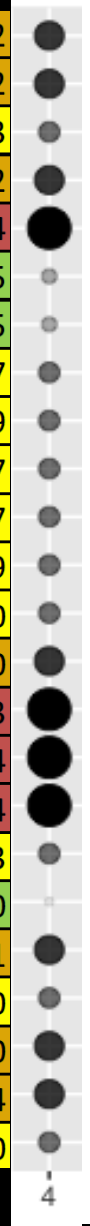
April

2013-2018

| Wildlife Groups | RISK |
|---|---|
| Vultures | 12.2 |
| Turkeys | 12.2 |
| Swallows and Allies | 6.3 |
| Starlings | 12.2 |
| Snowy Owls | 22.4 |
| Snow Buntings | 5.5 |
| Small Mammals, Reptiles and Amphibians | 5.5 |
| Shorebirds | 8.7 |
| Pigeons and Doves | 8.9 |
| Owls | 7.7 |
| Other Small Birds | 8.7 |
| Medium Mammals | 8.9 |
| Kestrels | 10.0 |
| Herons | 11.0 |
| Hawks | 17.3 |
| Gulls and Terns | 19.4 |
| Geese | 22.4 |
| Falcons | 6.3 |
| Eagles | 0.0 |
| Ducks and Allies | 14.1 |
| Deers | 10.0 |
| Crows and Ravens | 11.0 |
| Coyotes | 13.4 |
| Blackbirds | 10.0 |

# MONTHLY RISK FORECASTING

| Wildlife Groups | RISK |
|---|---|
| Vultures | 12.2 |
| Turkeys | 12.2 |
| Swallows and Allies | 6.3 |
| Starlings | 12.2 |
| Snowy Owls | 22.4 |
| Snow Buntings | 5.5 |
| Small Mammals, Reptiles and Amphibians | 5.5 |
| Shorebirds | 8.7 |
| Pigeons and Doves | 8.9 |
| Owls | 7.7 |
| Other Small Birds | 8.7 |
| Medium Mammals | 8.9 |
| Kestrels | 10.0 |
| Herons | 11.0 |
| Hawks | 17.3 |
| Gulls and Terns | 19.4 |
| Geese | 22.4 |
| Falcons | 6.3 |
| Eagles | 0.0 |
| Ducks and Allies | 14.1 |
| Deers | 10.0 |
| Crows and Ravens | 11.0 |
| Coyotes | 13.4 |
| Blackbirds | 10.0 |




CYYZ

April

2013-2018

Risk

- L
- M
- H
- VH

# MONTHLY RISK FORECASTING

| Wildlife Groups |
| --- |
| Vultures |
| Turkeys |
| Swallows and Allies |
| Starlings |
| Snowy Owls |
| Snow Buntings |
| Small Mammals, Reptiles and Amphibians |
| Shorebirds |
| Pigeons and Doves |
| Owls |
| Other Small Birds |
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| Hawks |
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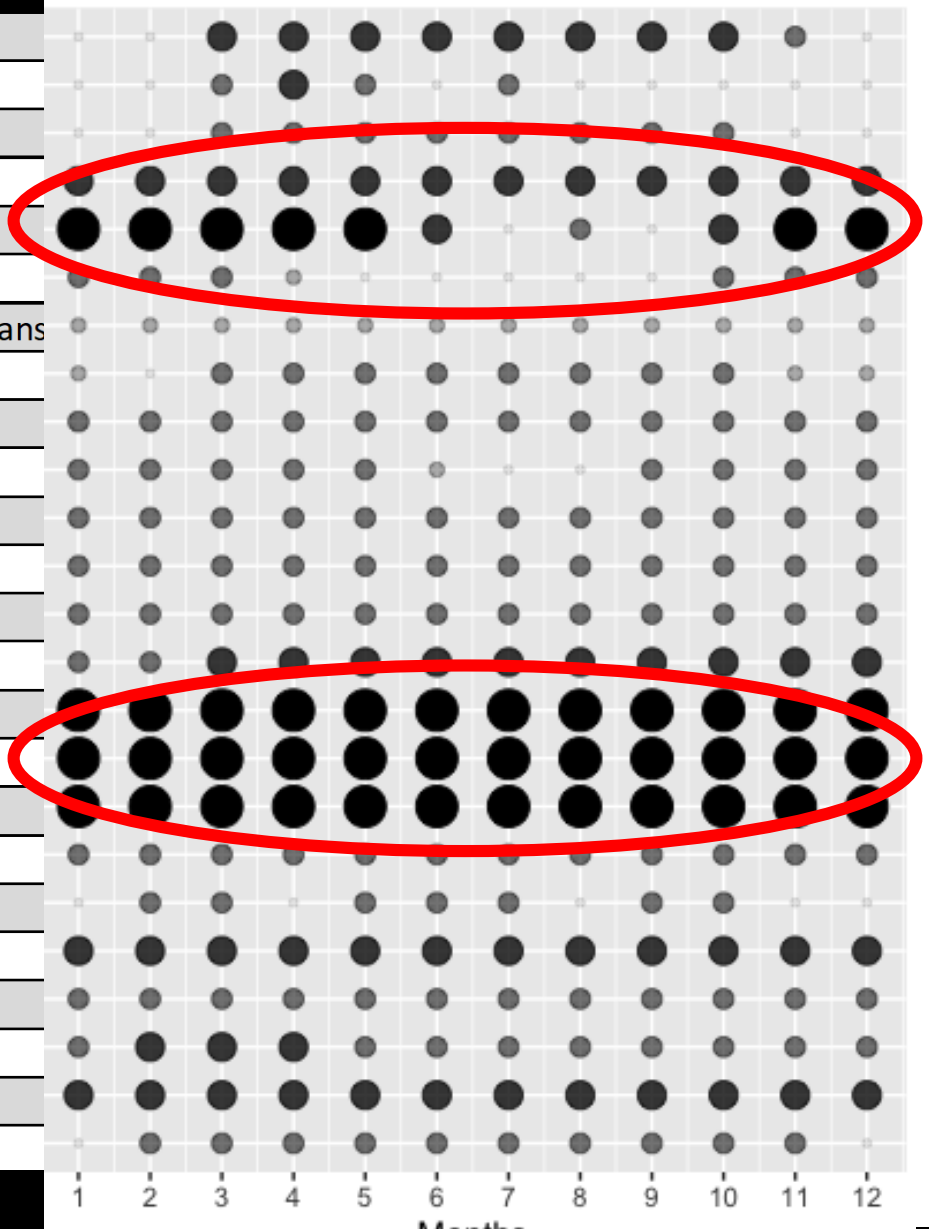
| Blackbirds |




CYYZ

MONTHLY MEANS 2013-2018

Risk

- L
- M
- H
- VH

# MONTHLY RISK FORECASTING

| Wildlife Groups |
| --- |
| Vultures |
| Turkeys |
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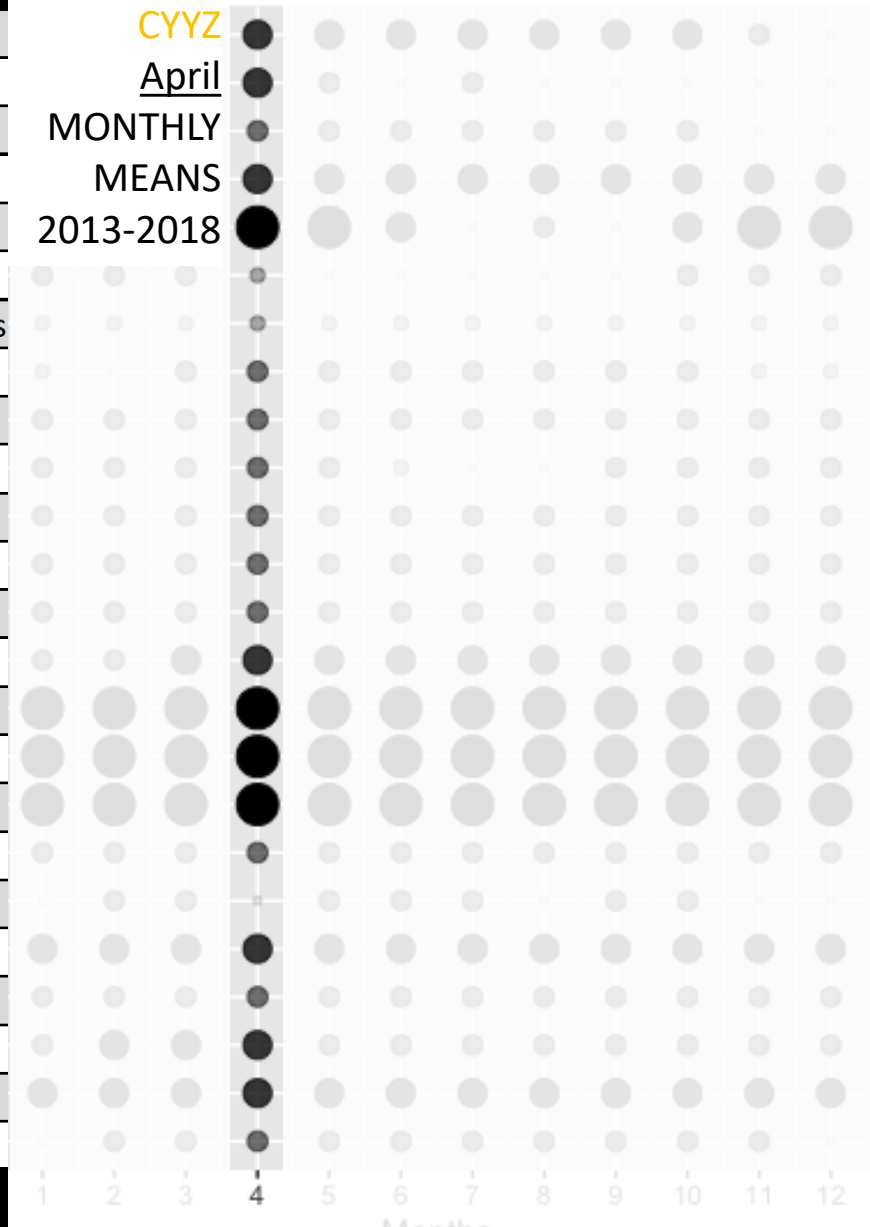


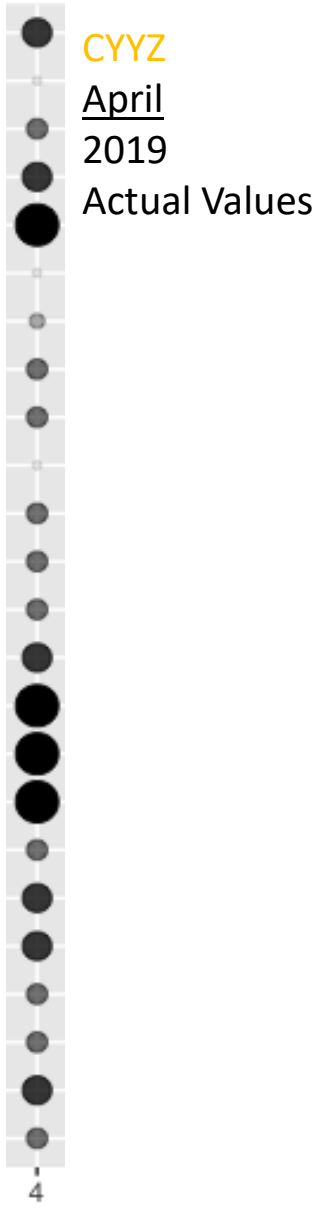


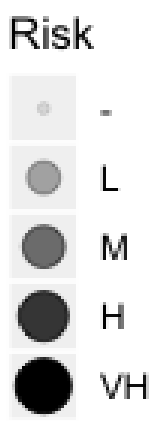

# MONTHLY RISK FORECASTING

| Wildlife Groups |
| --- |
| Vultures |
| Turkeys |
| Swallows and Allies |
| Starlings |
| Snowy Owls |
| Snow Buntings |
| Small Mammals, Reptiles and Amphibians |
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| Eagles |
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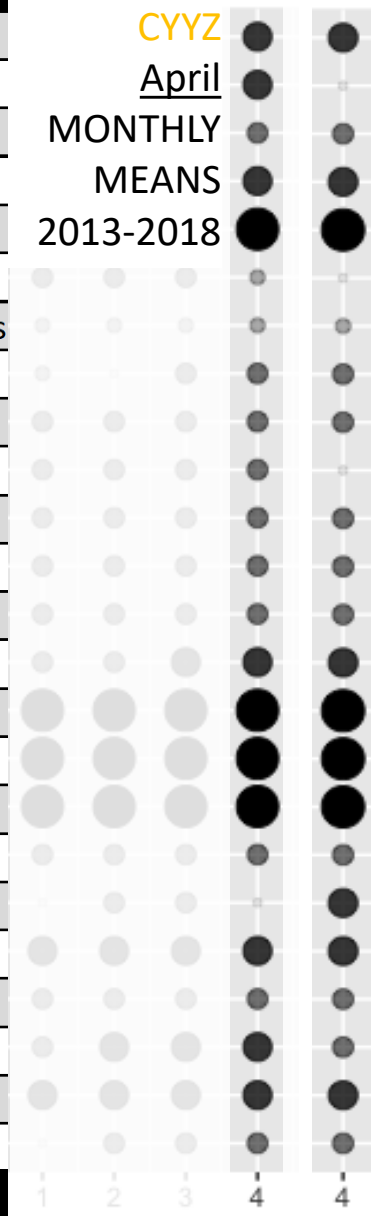
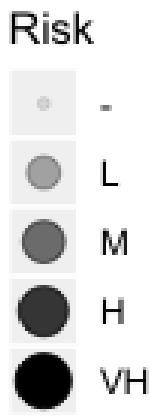
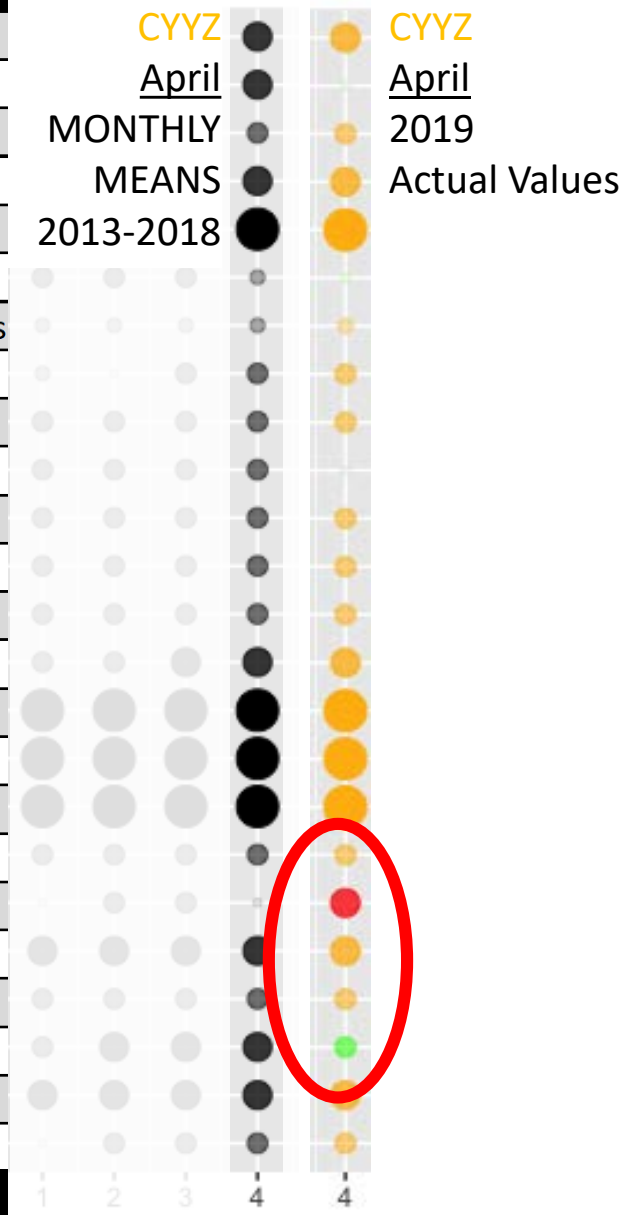
| Deers |
| Crows and Ravens |
| Coyotes |
| Blackbirds |



# MONTHLY RISK FORECASTING

| Wildlife Groups |
| --- |
| Vultures |
| Turkeys |
| Swallows and Allies |
| Starlings |
| Snowy Owls |
| Snow Buntings |
| Small Mammals, Reptiles and Amphibians |
| Shorebirds |
| Pigeons and Doves |
| Owls |
| Other Small Birds |
| Medium Mammals |
| Kestrels |
| Herons |
| Hawks |
| Gulls and Terns |
| Geese |
| Falcons |
| Eagles |
| Ducks and Allies |
| Deers |
| Crows and Ravens |
| Coyotes |
| Blackbirds |




Risk Comparison

- Prevision
- Lower
- Higher
- Identical

Risk

- -
- L
- M
- H
- VH

# MONTHLY RISK RERPORTING AND FORECASTING

| Wildlife Groups |
| --- |
| Vultures |
| Turkeys |
| Swallows and Allies |
| Starlings |
| Snowy Owls |
| Snow Buntings |
| Small Mammals, Reptiles and Amphibians |
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| Kestrels |
| Herons |
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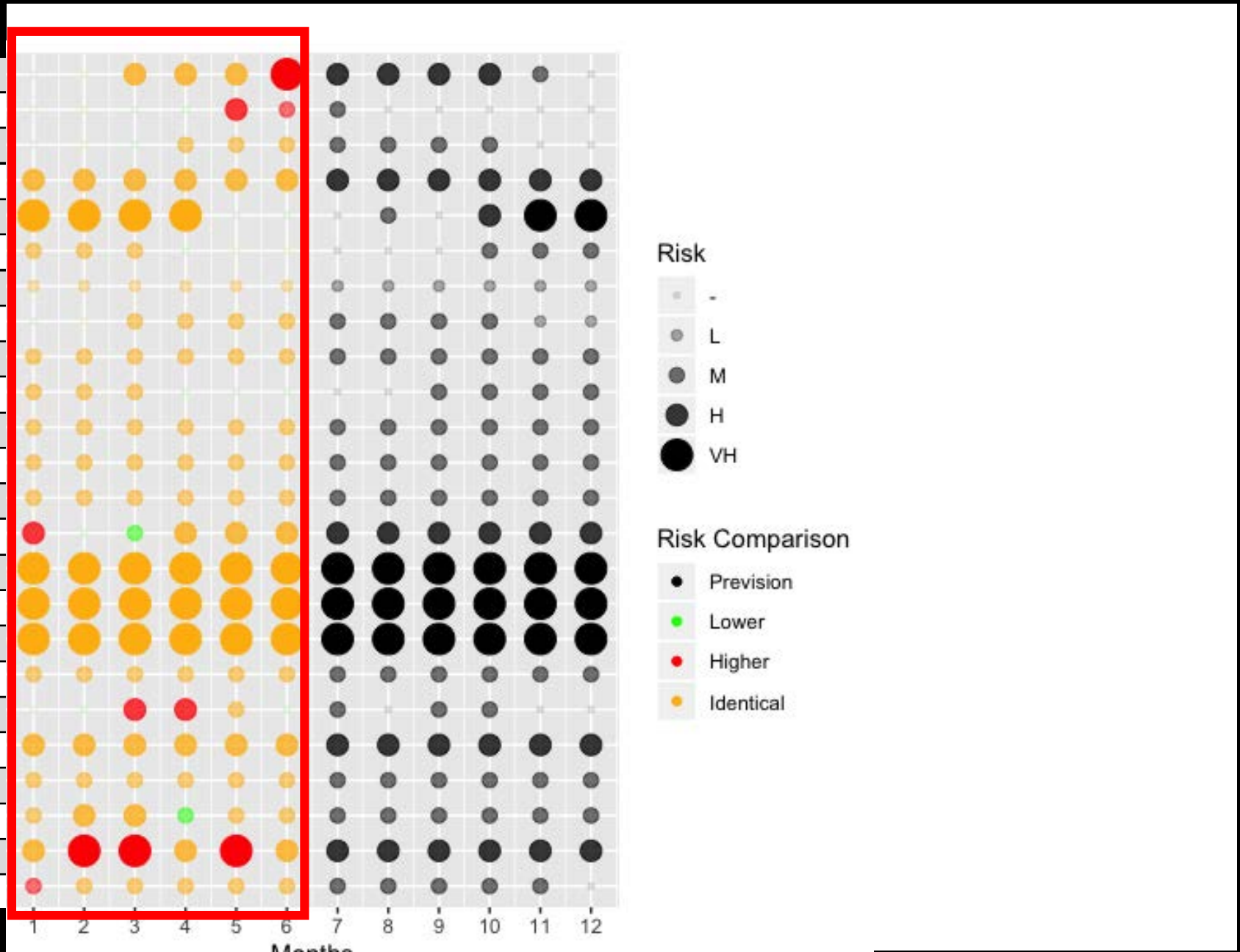
| Gulls and Terns |
| Geese |
| Falcons |
| Eagles |
| Ducks and Allies |
| Deers |
| Crows and Ravens |
| Coyotes |
| Blackbirds |



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| Turkeys |
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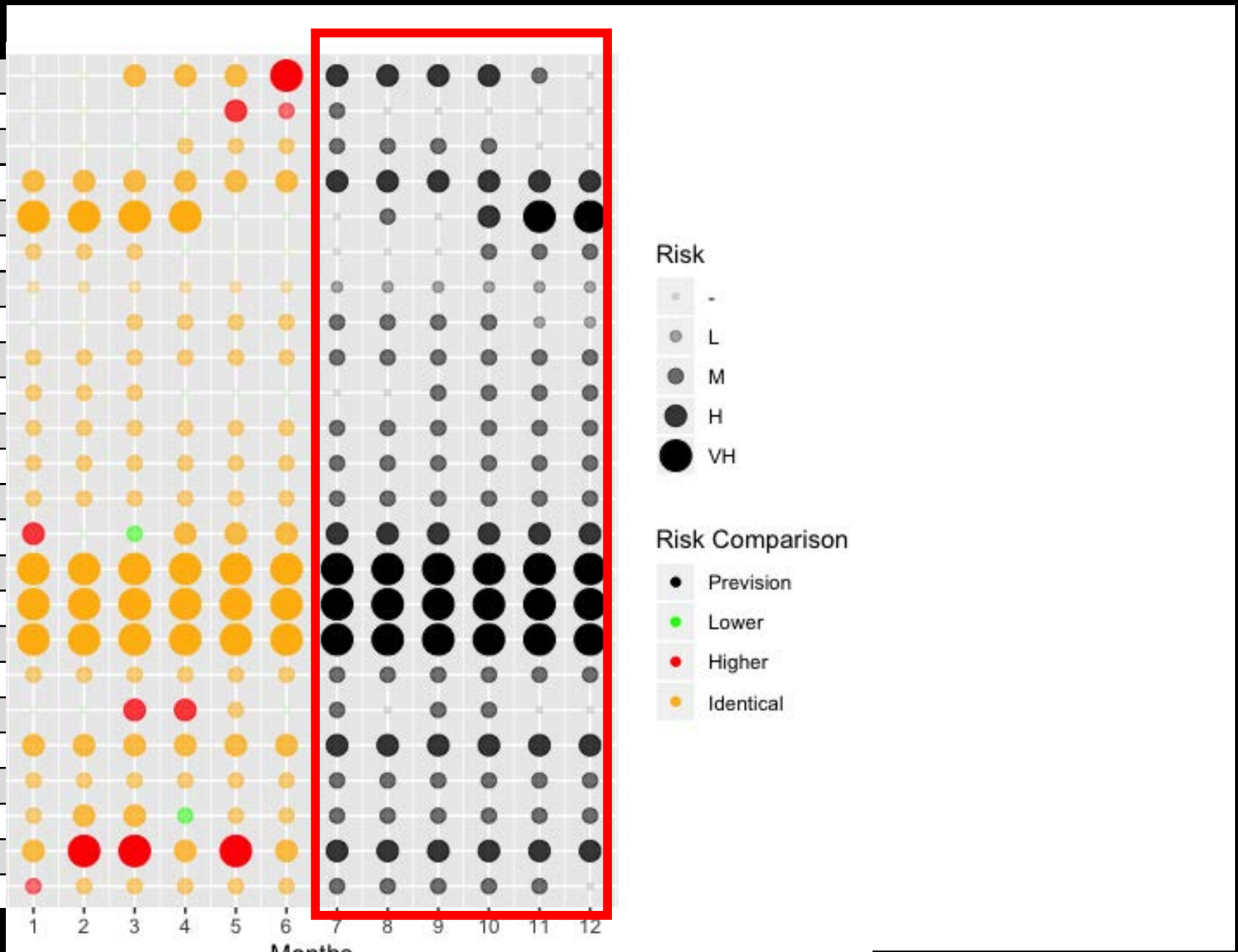
| Gulls and Terns |
| Geese |
| Falcons |
| Eagles |
| Ducks and Allies |
| Deers |
| Crows and Ravens |
| Coyotes |
| Blackbirds |



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| Geese |
| Falcons |
| Eagles |
| Ducks and Allies |
| Deers |
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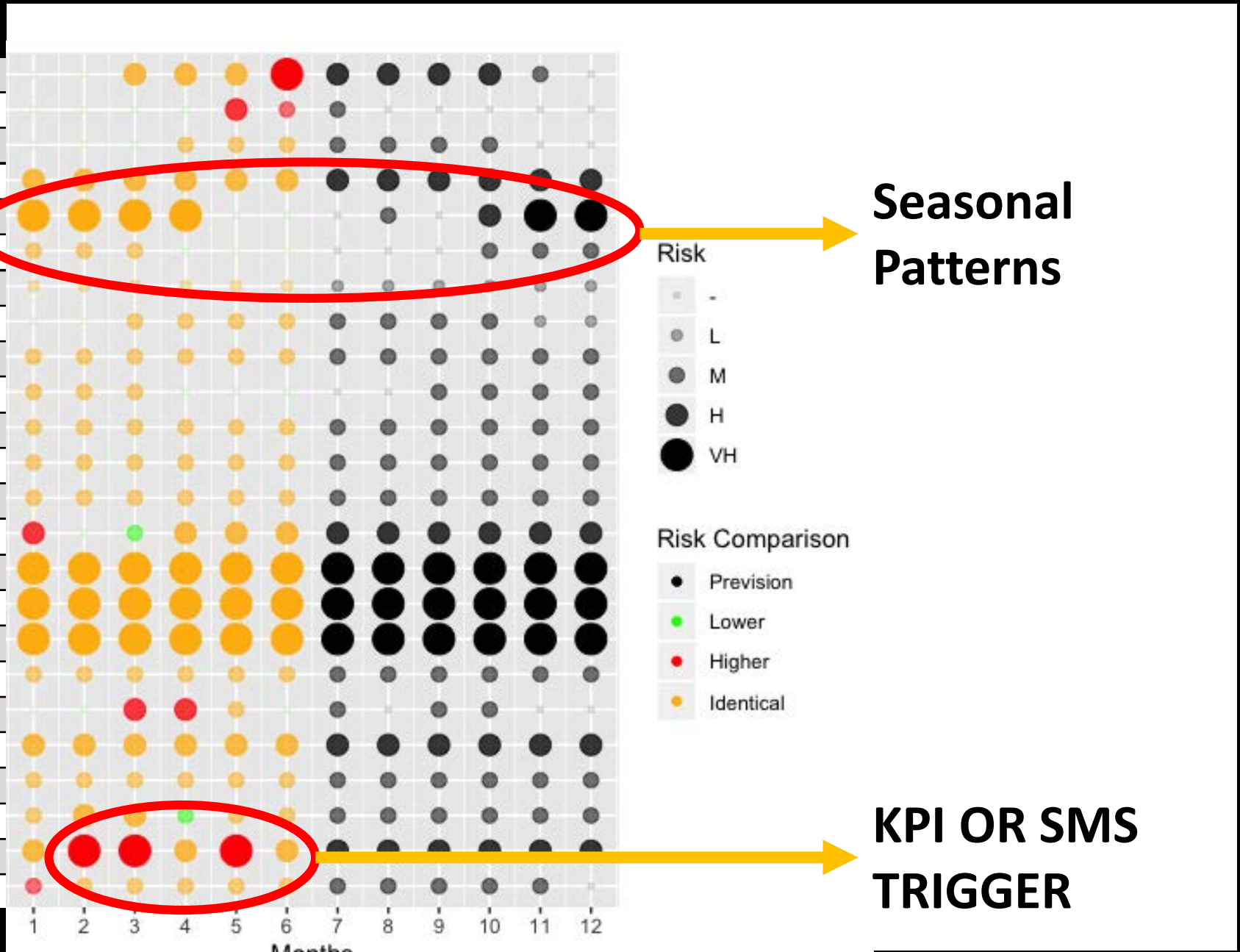


**Seasonal Patterns**

**KPI OR SMS TRIGGER**

# MONTHLY RISK RERPORTING AND FORECASTING

| Wildlife Groups |
| --- |
| Vultures |
| Turkeys |
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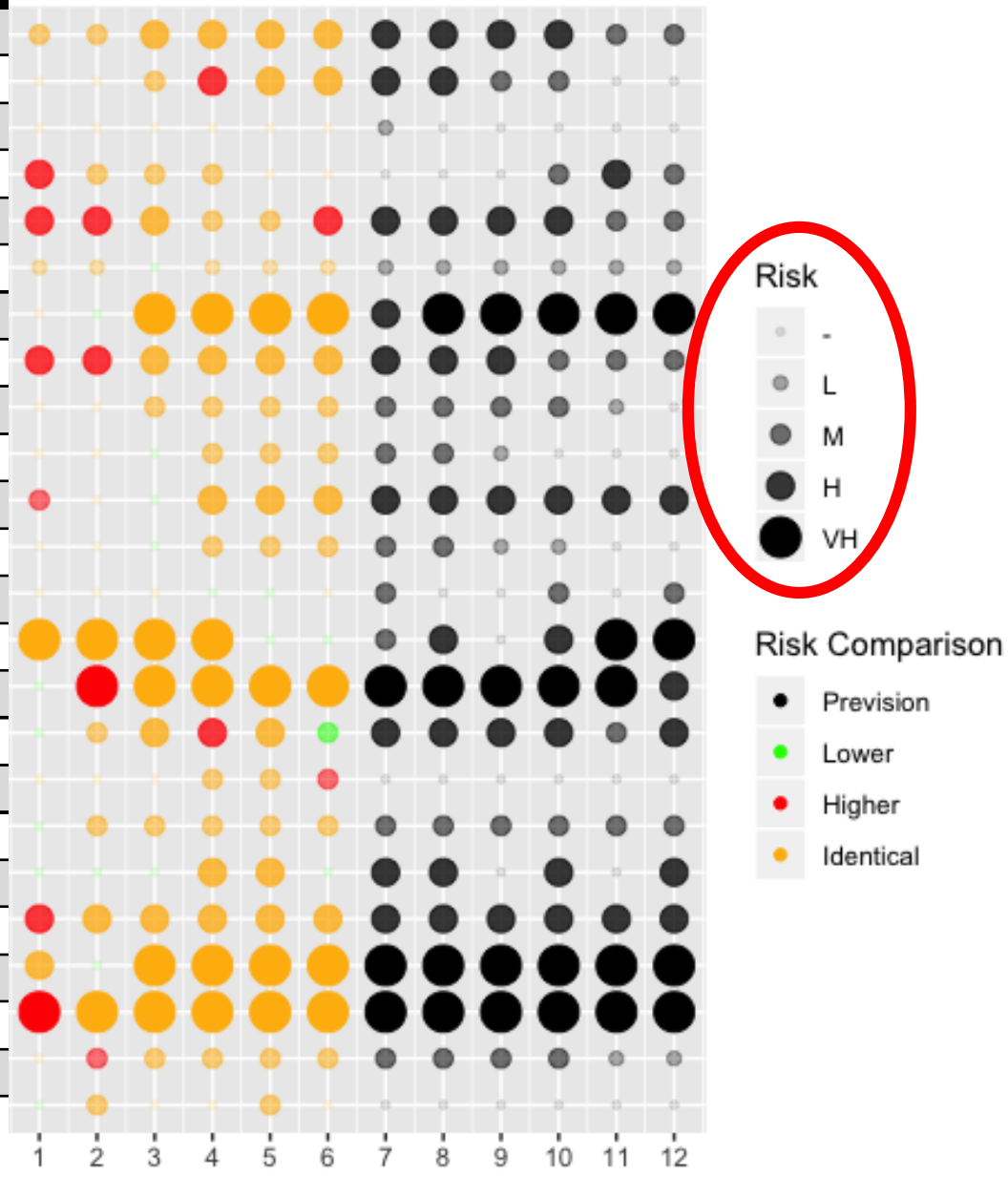


# SMS-BASED PROCESS

| Risk Index Value* | Actions |
|---|---|
| 1 – 6] | Low risk. Proceed after considering all elements of risk. |
| ]6 – 10.5[ | Moderate risk. Continue after taking action to manage overall level of risk |
| [10.5 – 15[ | High risk. Continue after taking action to manage overall level of risk. |
| ≥ 15<br>[15 – 25] | Very high risk. **STOP**: Do not proceed until sufficient control measures have been implemented to reduce risk to an acceptable level. |

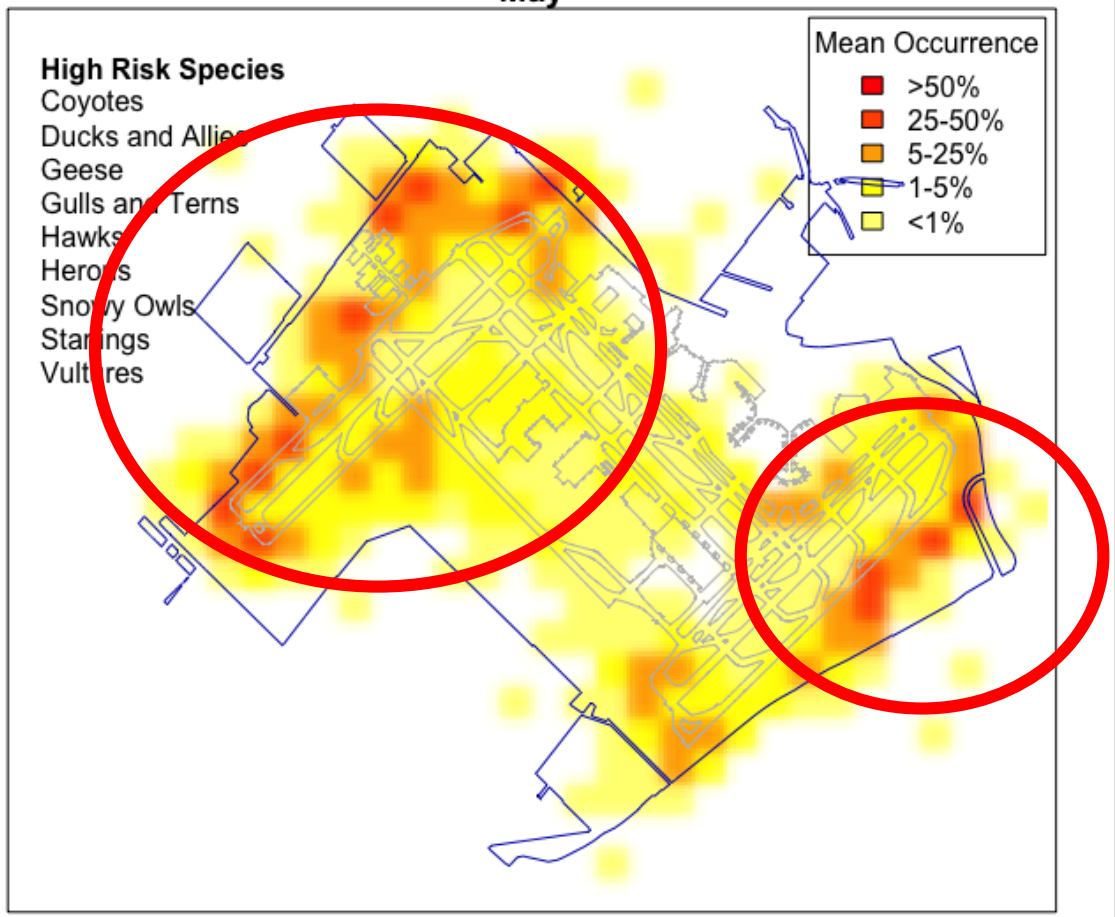
# SMS-BASED PROCESS

## SMS WIDLIFE PRIORITIES

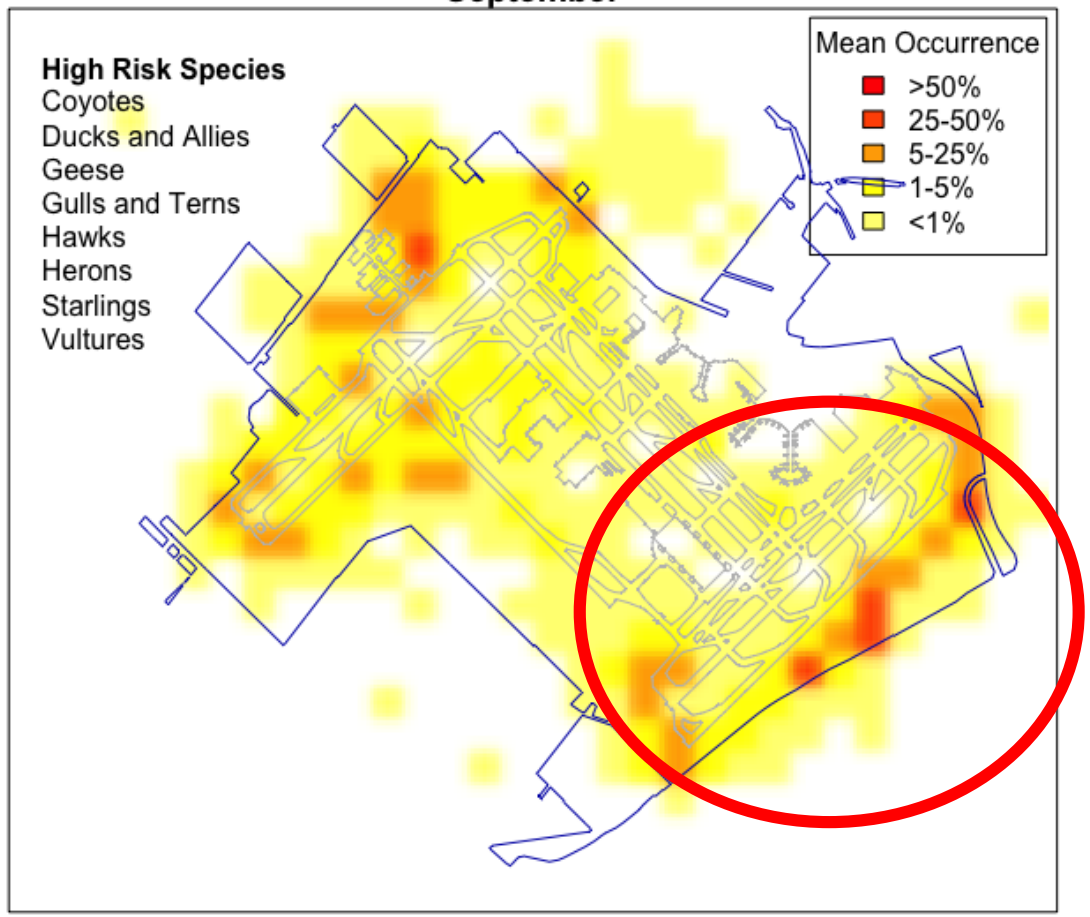
- **Very High :** Passive and active methods are required, and these groups should not be tolerated on the airfield;
- **High :** Passive and active methods are required, and these groups should not be tolerated close to the runways, approaches and manoeuvring areas;
- **Moderate :** Passive methods should be employed against these groups, and vigilance is required;
- **Low :** No action should be necessary, but still can be implemented.

# MONTHLY HIGH-RISK SPECIES OCCURENCES

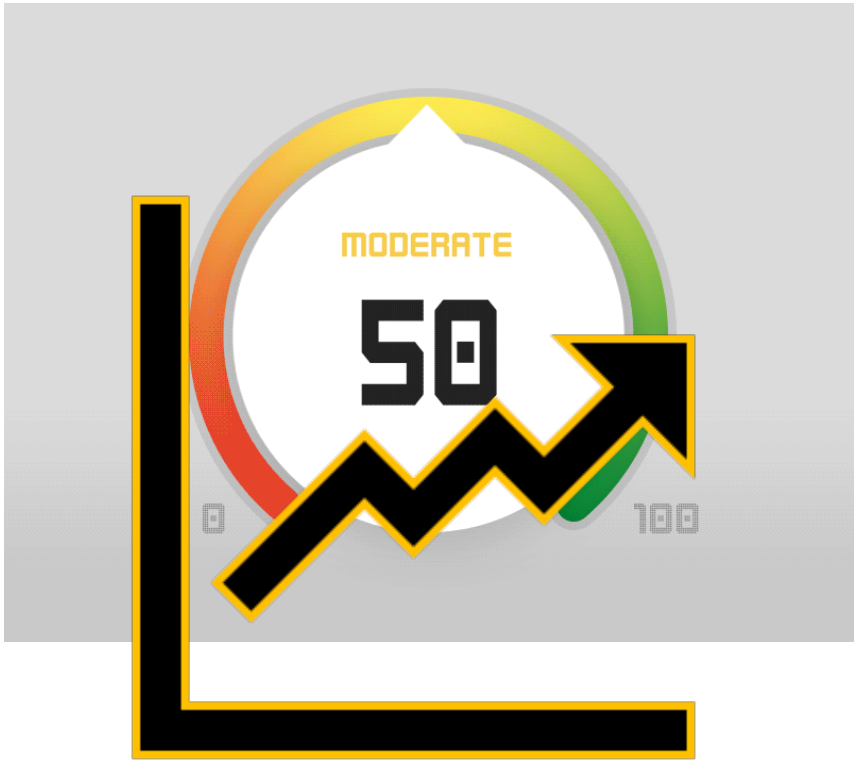
May




September



# MONTHLY RISK FORECASTING




Staff Requirement

Species-specific Effort

Habitat Management

Tools Requirements

Trapping Effort

...

# SAFETY MANAGEMENT SYSTEM

**Occurrence**
**Runway Crossing Behaviour**

**Mass/Flocking**
**Score**

HAZARD IDENTIFICATION

Probability (Likelihood)

Severity

RISK ASSESSMENT

(1-5) **X** (1-5) **=** (1-25)

**Number of Movements**

**Aircraft Susceptibility to Strikes**

Taking action (if needed) / Reevaluation

# SAFETY MANAGEMENT SYSTEM

ONLY 3 FORMULAS AND 5 VARIABLES

HAZARD IDENTIFICATION

RISK ASSESSMENT (1-25)


COMPLETELY FEASIBLE IN MICROSOFT EXCEL

FALCON Environmental Services

Welcome to

WRAP

WILDLIFE RISK ANALYSIS PROGRAM

This software allows airport wildlife specialists to evaluate the wildlife risk using a innovative approach using SMS-based risk evaluation.

**LOG IN**

**email address**

Go | *Forgot your password ?*

**OR**

**Create New Account**

https://www.falconenvironmental.com/software-solutions/#wrap

AVAILABLE FOR FREE

# CONCLUSION

Any Airports

Any Data

Any Timeframe

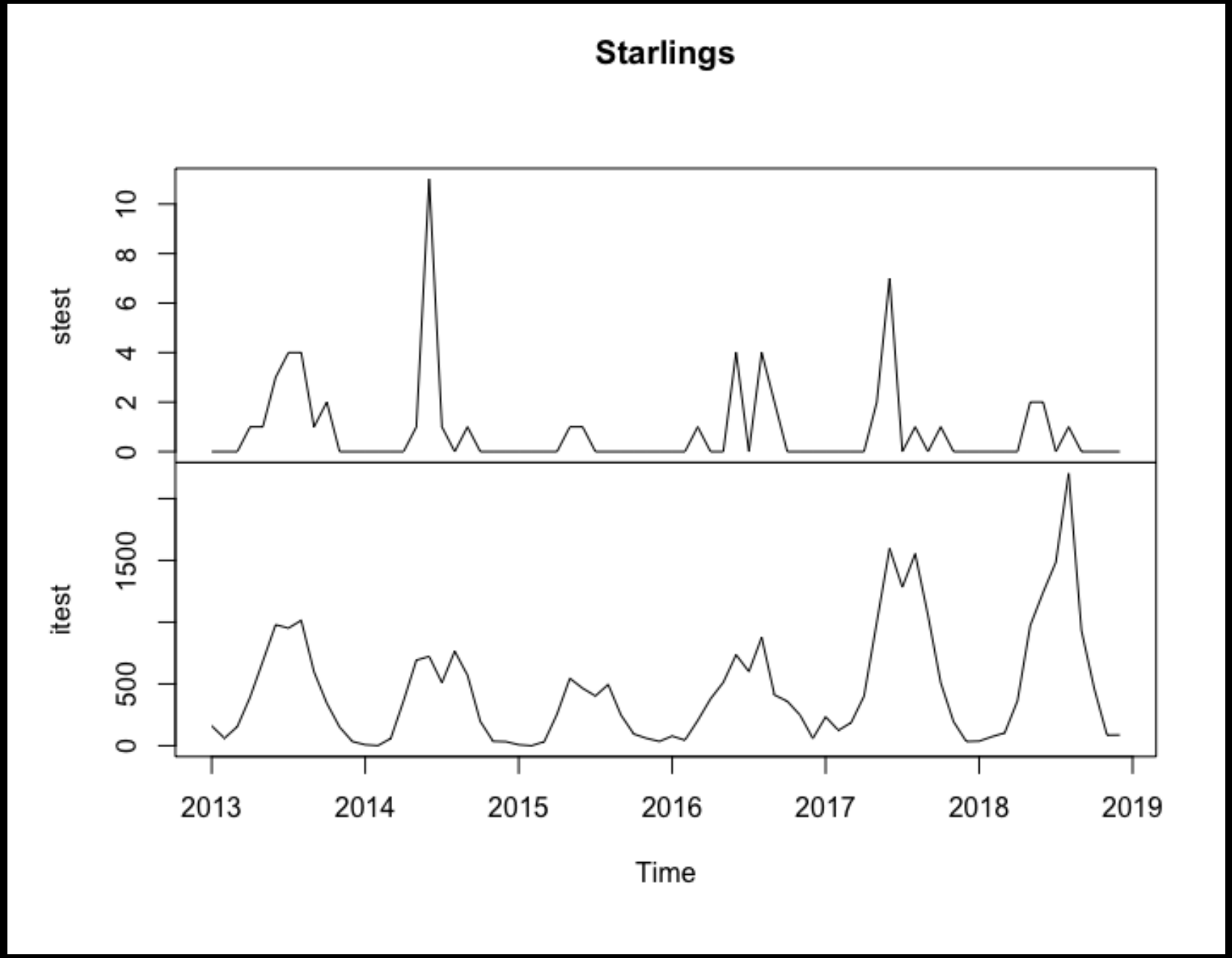
Easy To Compute

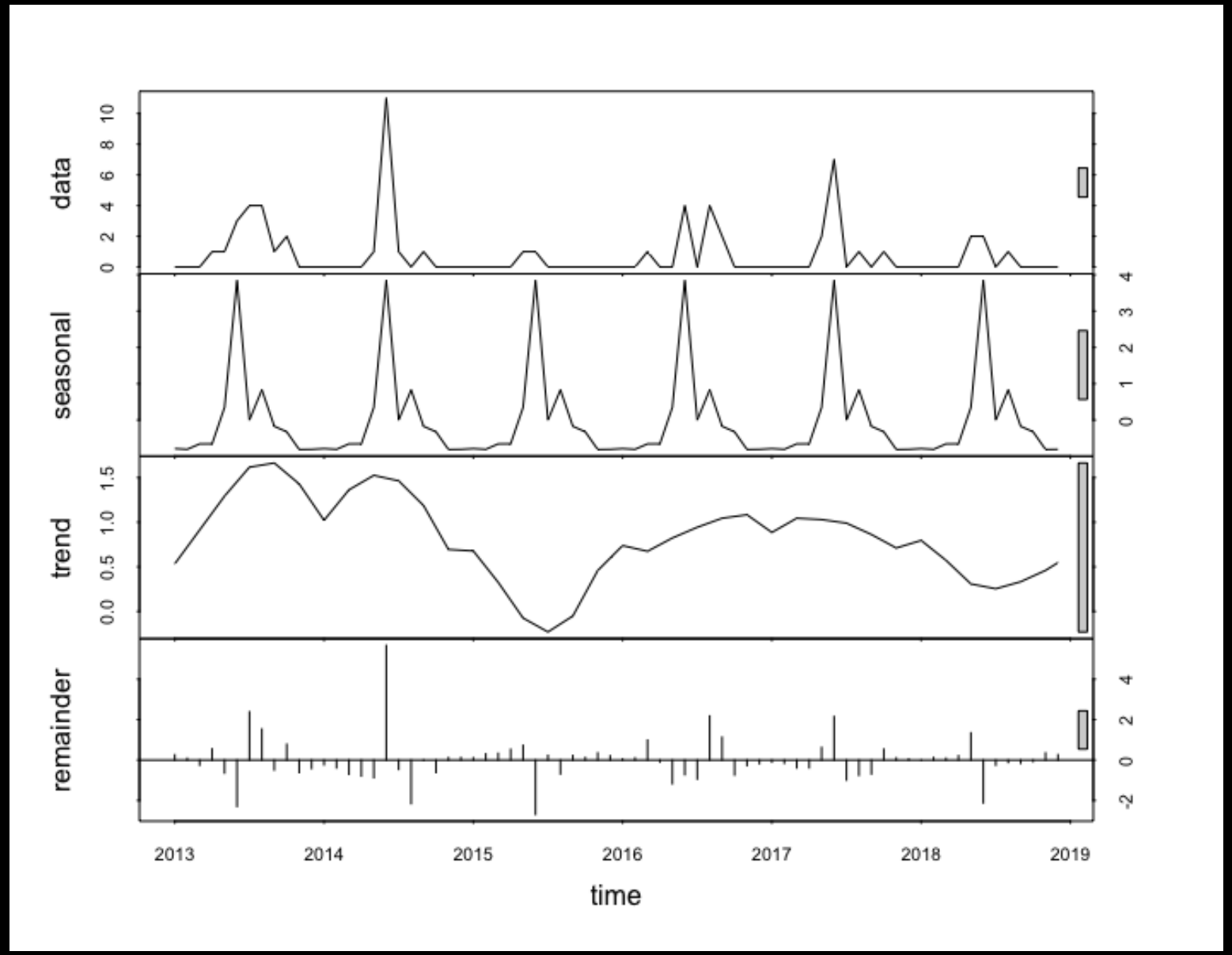
Reactive And Proactive Tool

Provides Management Guidance

# Thank You

FALCON
Environmental Services


Starlings
stest
0
2
4
6
8
10
itest
0
500
1500
2013
2014
2015
2016
2017
2018
2019
Time


data
seasonal
trend
remainder
0 2 4 6 8 10
0 1 2 3 4
0.0 0.5 1.0 1.5
-2 0 2 4
2013
2014
2015
2016
2017
2018
2019
time