
Aeshna mixta, Lisa Nicvert

Linking conservation status and species traits:

a case study on European dragonflies

Lisa Nicvert (FRB-Cesab), Diana E. Bowler, Jason Bried, Aurélie Coulon, Geert De Knijf, Thore Engel, Roy H. A. van Grunsven, Alienor Jeliazkov, Marie Lamouille-Hébert, Martin Jeanmougin, Colin Fontaine & Reto Schmucki

Ecology & Behaviour conference, Montpellier — 14/08/2025

Introduction

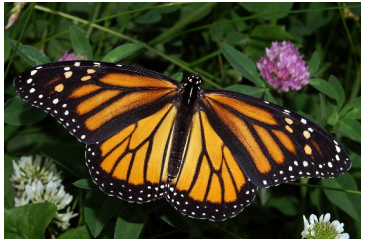
Global changes: variable responses

Introduction

Global changes: variable responses

Atlantic puffin
Charles J. Sharp, CC BY-SA 4.0

Cheetah *AfricanConservation, CC BY-SA 4.0*



Monarch butterfly
Kenneth Dwain Harrelson, CC BY-SA 3.0

Icons: Elzicon from Flaticon

Introduction

Global changes: variable responses

Atlantic puffin
Charles J. Sharp, CC BY-SA 4.0

Cheetah *AfricanConservation, CC BY-SA 4.0*

Monarch butterfly
Kenneth Dwain Harrelson, CC BY-SA 3.0

Mallard *Richard Bartz, CC BY-SA 2.5*

Coypu *Petar Milošević, CC BY-SA 3.0*

Blue-tailed damselfly
Thomas Bresson, CC BY 2.0

Icons: Elzicon from Flaticon

Introduction

vulnerability ~ exposure + sensitivity + adaptive capacity

Foden et al., 2019

Introduction

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habitat loss, pollution, climate change...

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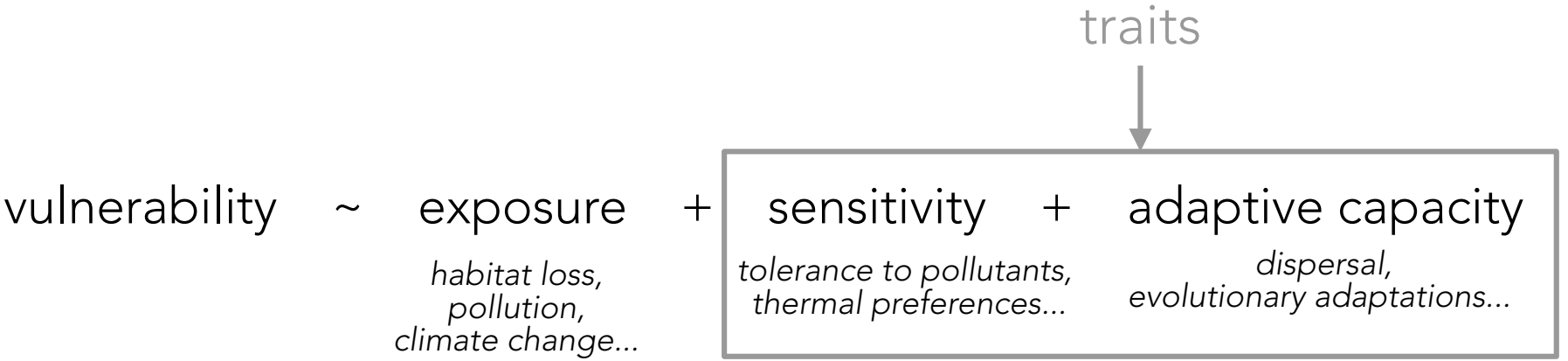
habitat loss, pollution, climate change...

tolerance to pollutants, thermal preferences...

dispersal, evolutionary adaptations...

Foden et al., 2019

Introduction



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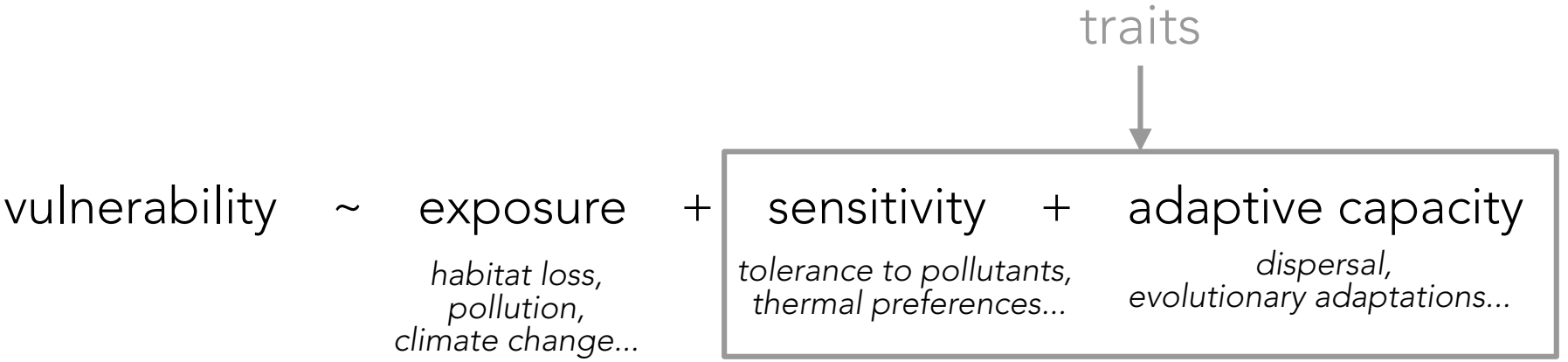
Introduction

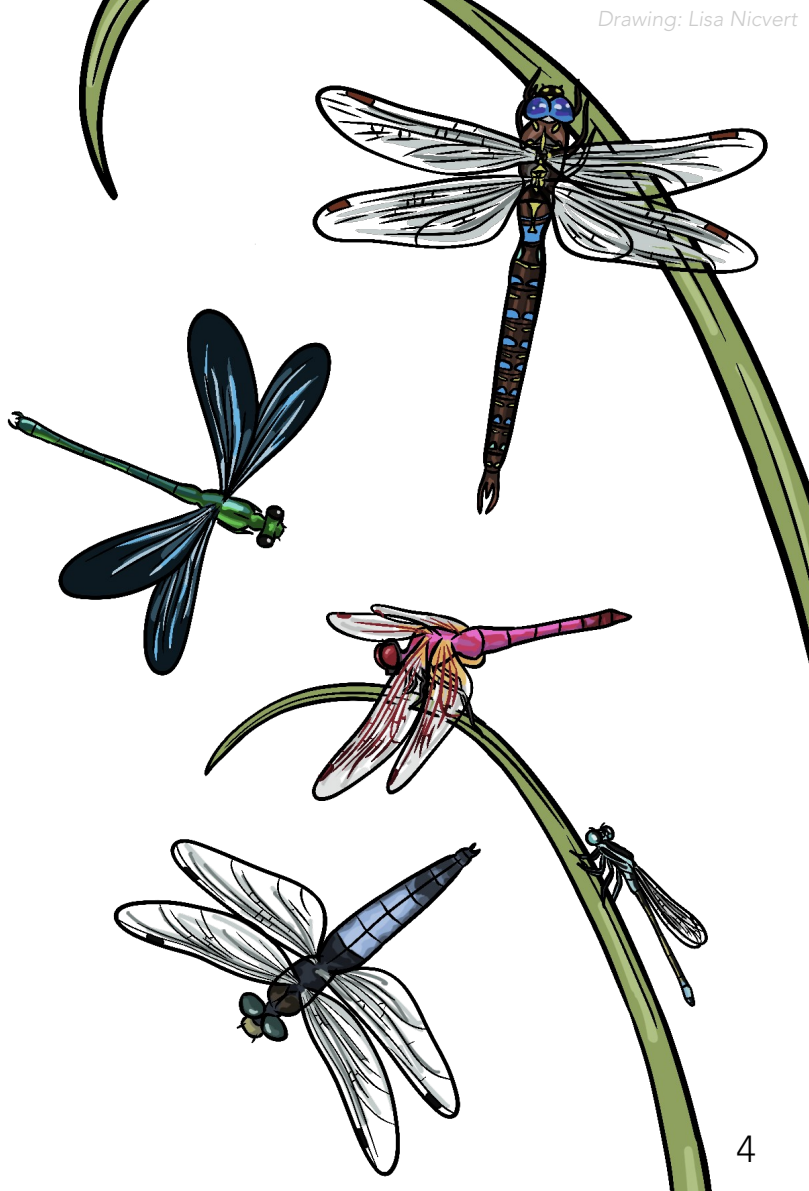


→ Traits as a mechanistic driver of species vulnerability

Foden et al., 2019

Introduction

The Odonata order

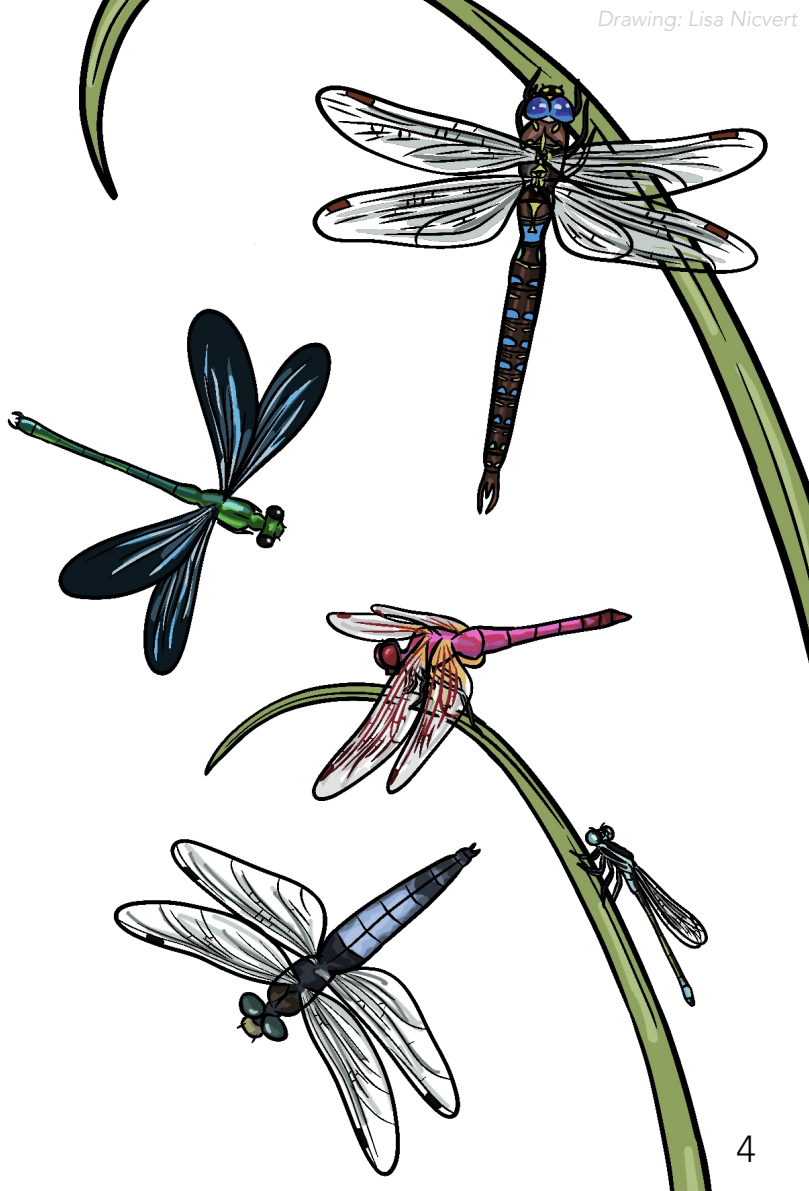


Drawing: Lisa Nicvert

Introduction

The Odonata order

- 6400 species, 140 European species



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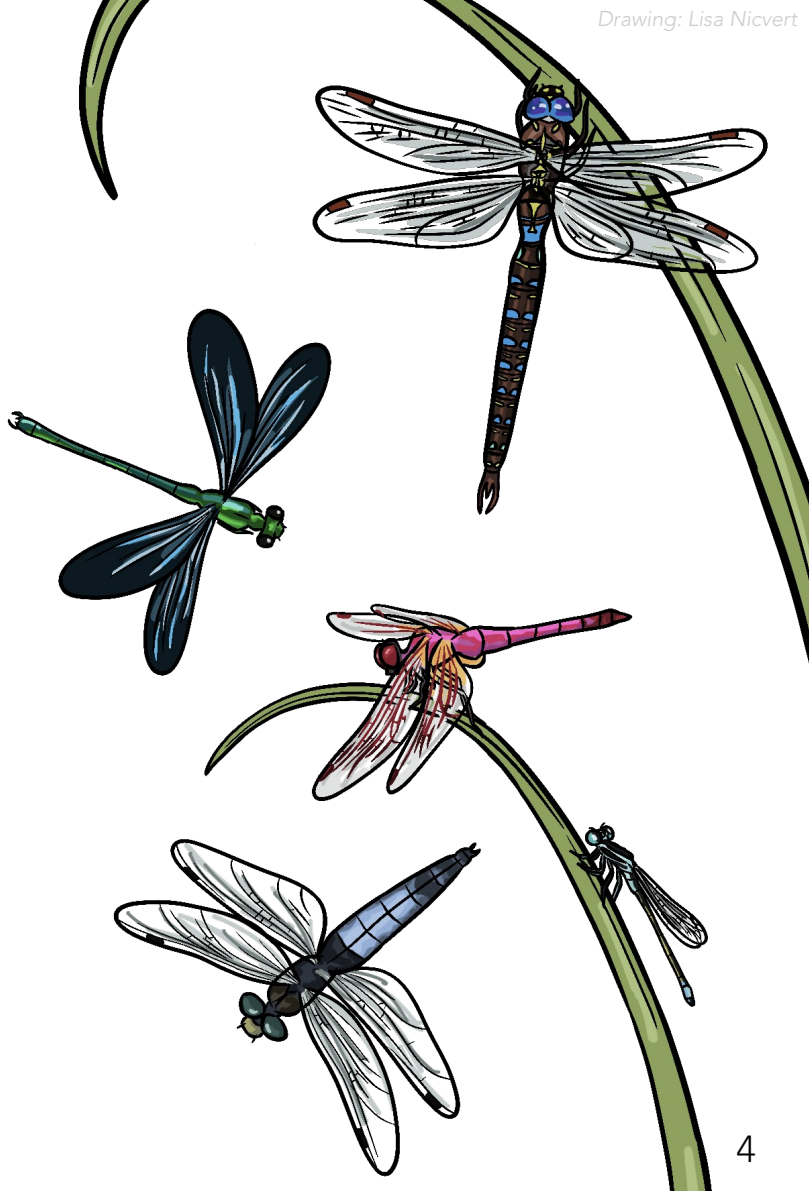
Introduction

The Odonata order

- 6400 species, 140 European species
- Freshwater environments: ¼ threatened *Sayer et al. 2025*

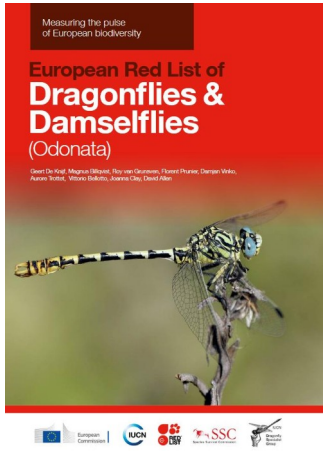


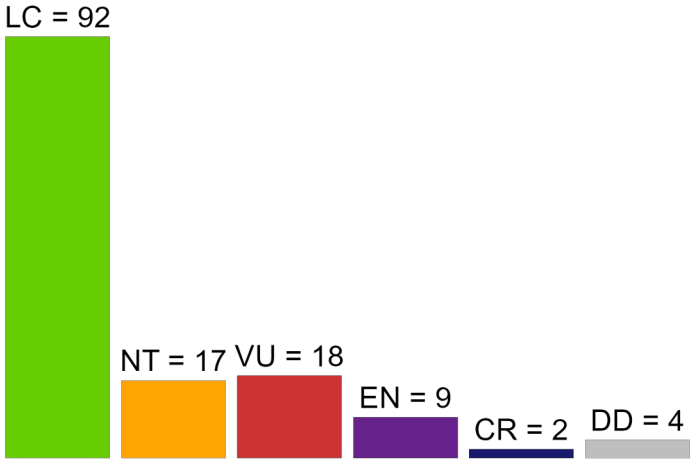
Drawing: Lisa Nicvert

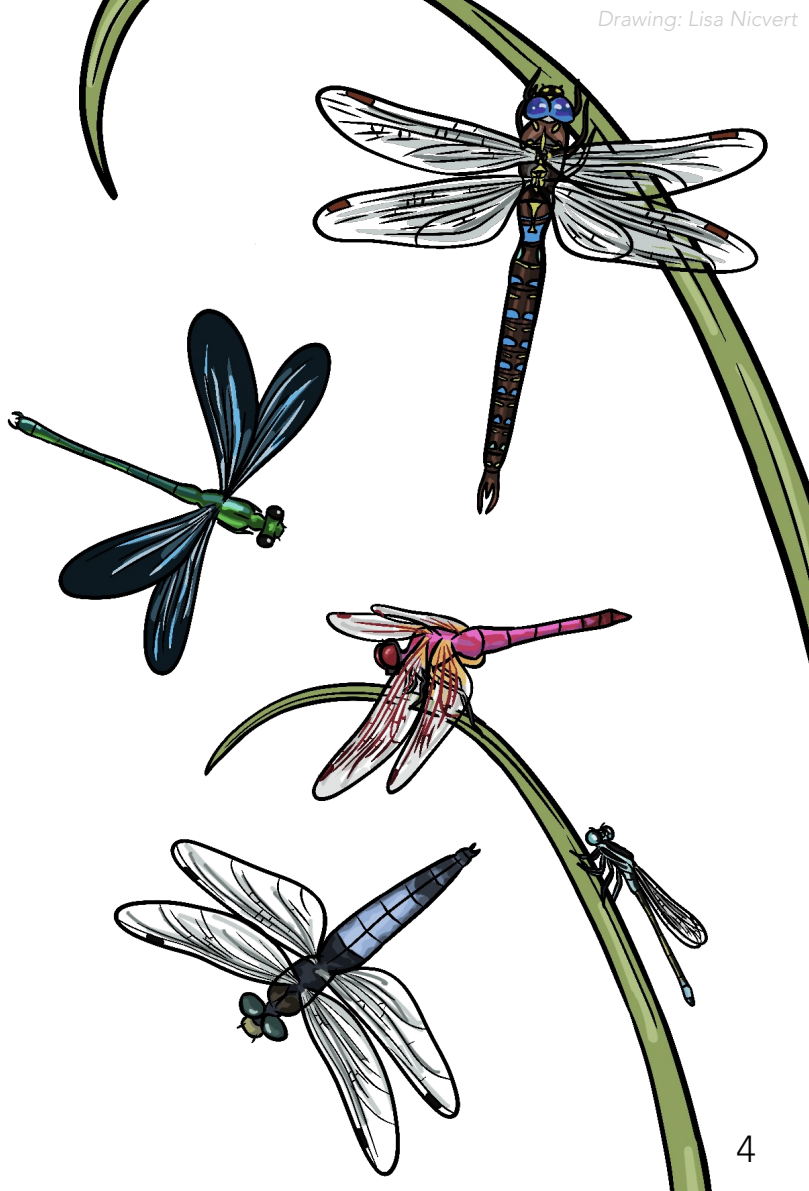
Introduction

The Odonata order

- 6400 species, 140 European species
- Freshwater environments: ¼ threatened *Sayer et al. 2025*
- In Europe: variety of responses *De Knijf et al. 2024*







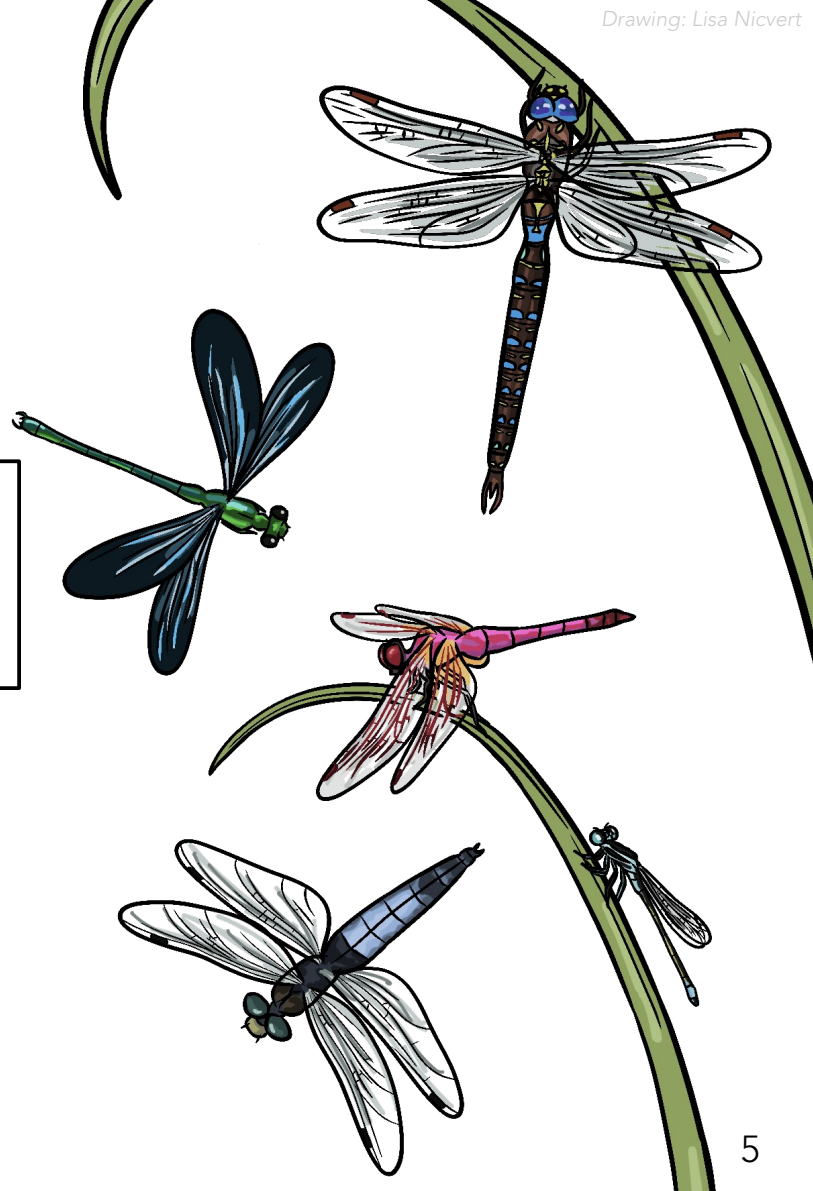
Drawing: Lisa Nicvert

Introduction

Main question

How do traits relate to species vulnerability in European Odonata?

- Which traits?
- How well?



Drawing: Lisa Nicvert

Material & methods

123 European species

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12 traits *De Knijf et al. (in prep)*

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- morphology *(body size, coloration)*

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- distribution trend *(decreasing, stable, increasing)*

Area icon: Freepik on Flaticon; Trend icon: Rakib Hassan Rahim on Flaticon

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- distribution trend *(decreasing, stable, increasing)*

- area of occupancy *(occupied 2×2 km squares)*

- Red List status *(CR, EN, VU, NT, LC)*

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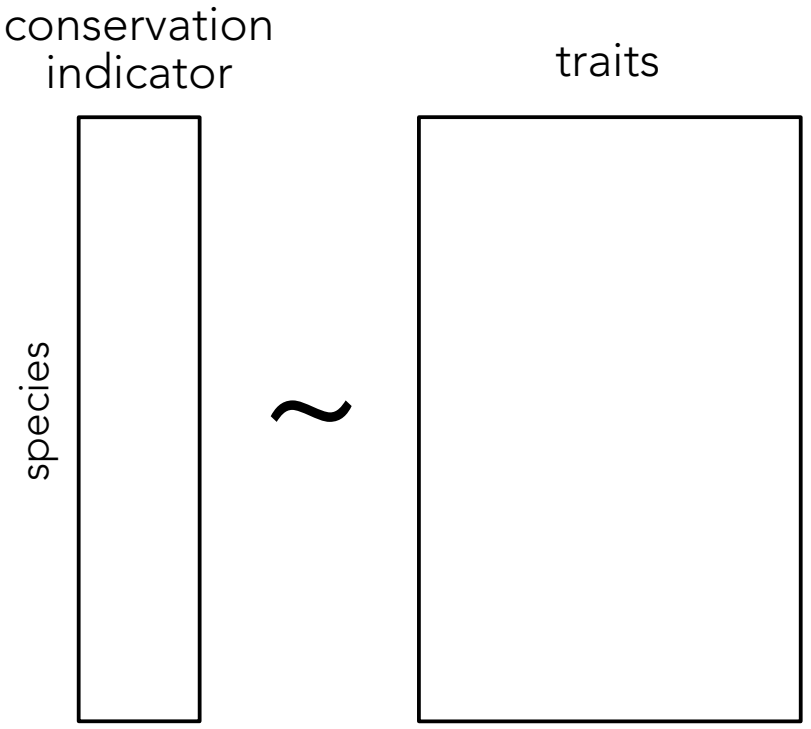
Material & methods

Multivariate analyses



Material & methods

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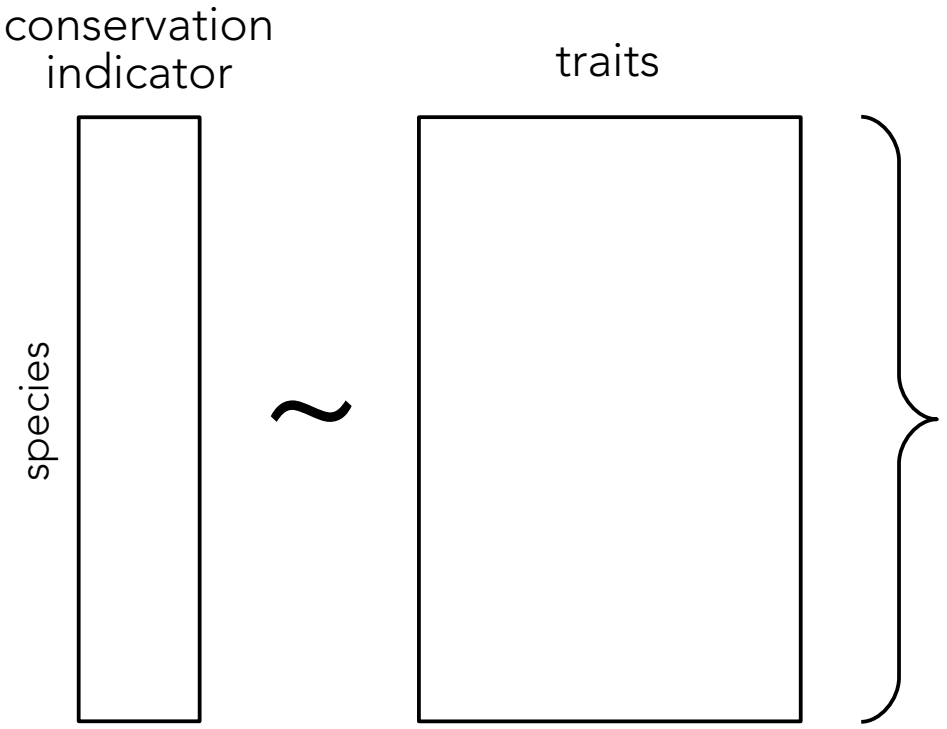
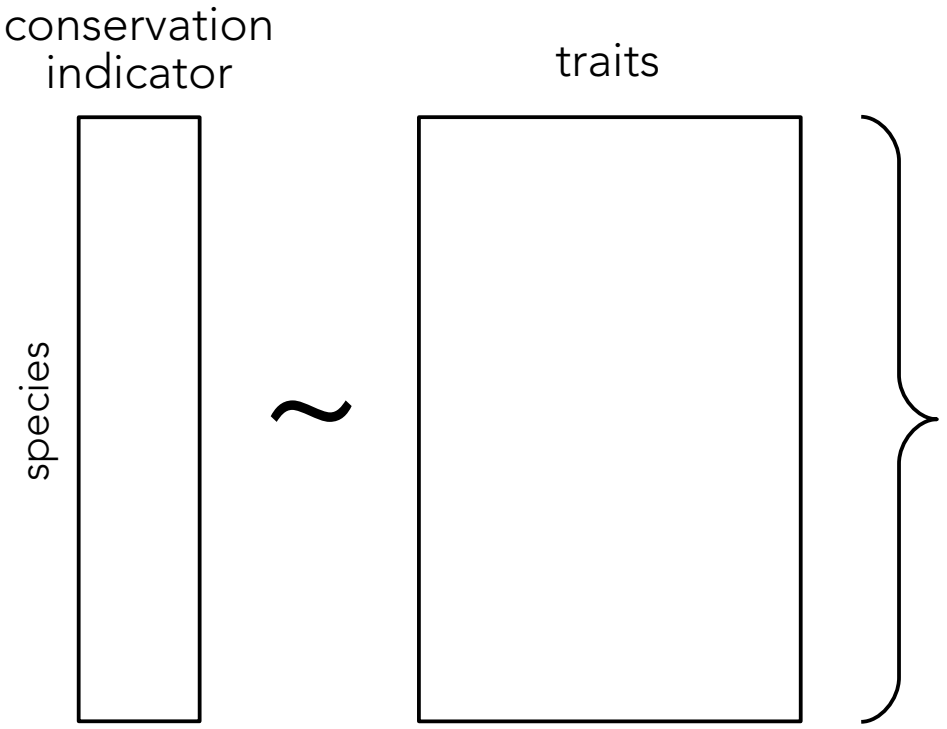


→ discriminant analysis

Area icon: Freepik on Flaticon; Trend icon: Rakib Hassan Rahim on Flaticon

Material & methods

Multivariate analyses



→ discriminant analysis

→ redundancy analysis

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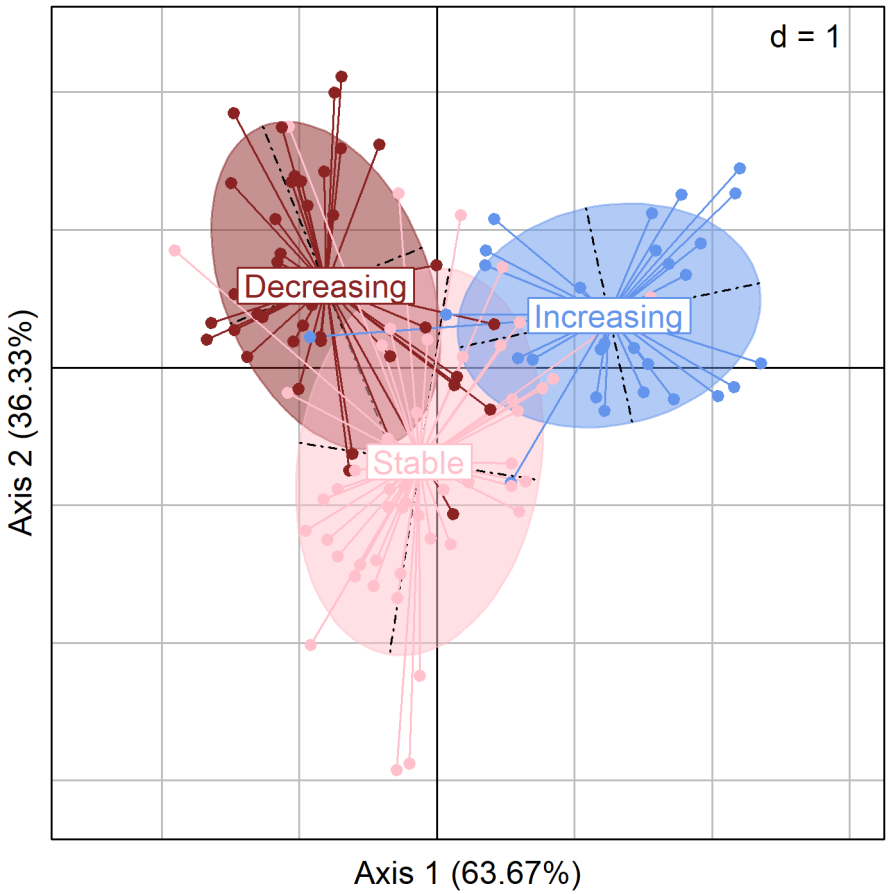
Results

Distribution trends

Trend icon: Rakib Hassan Rahim on Flaticon

Results

Distribution trends



Trend icon: Rakib Hassan Rahim on Flaticon

Results

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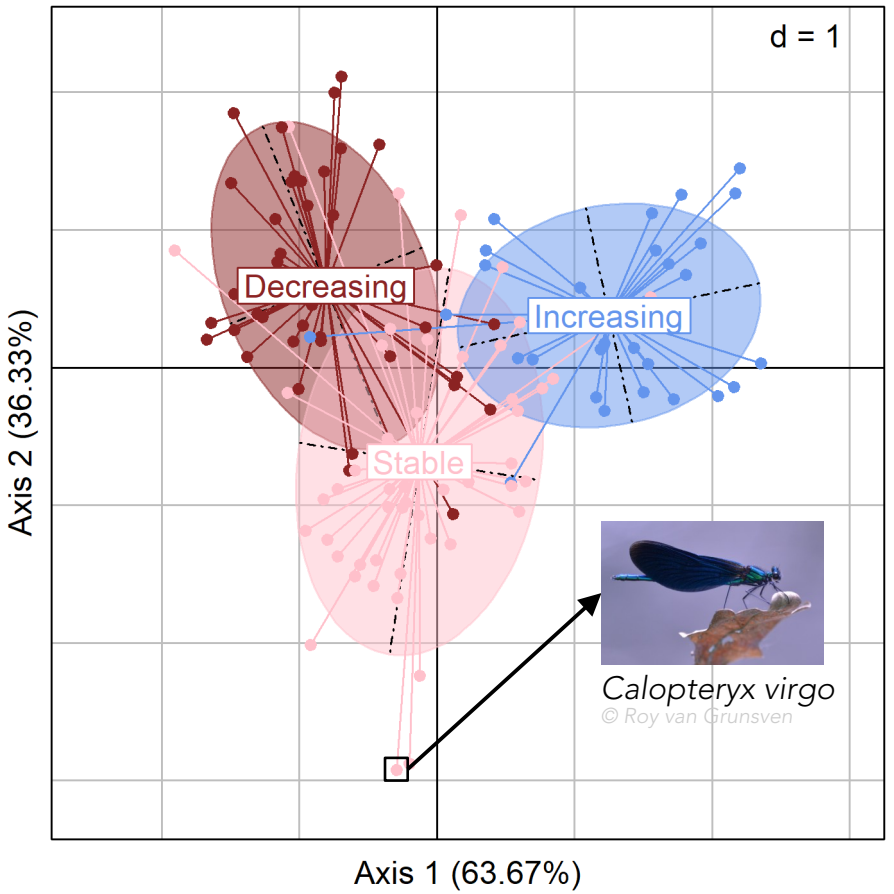

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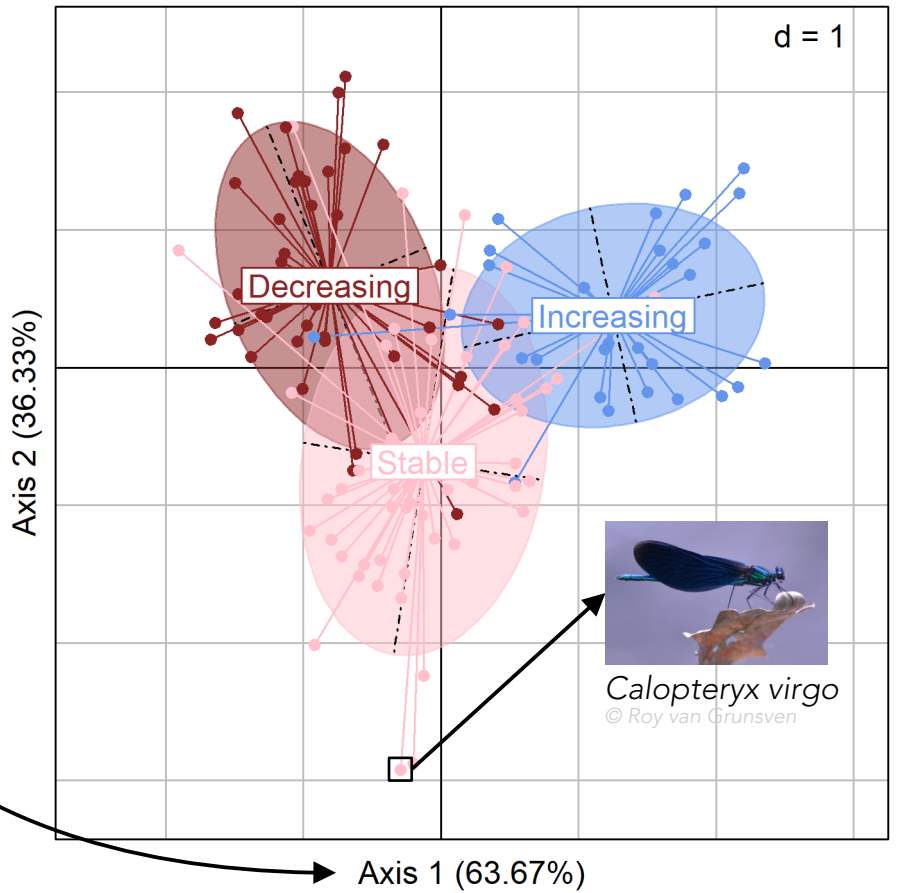
Results

Axes that best separate trends categories



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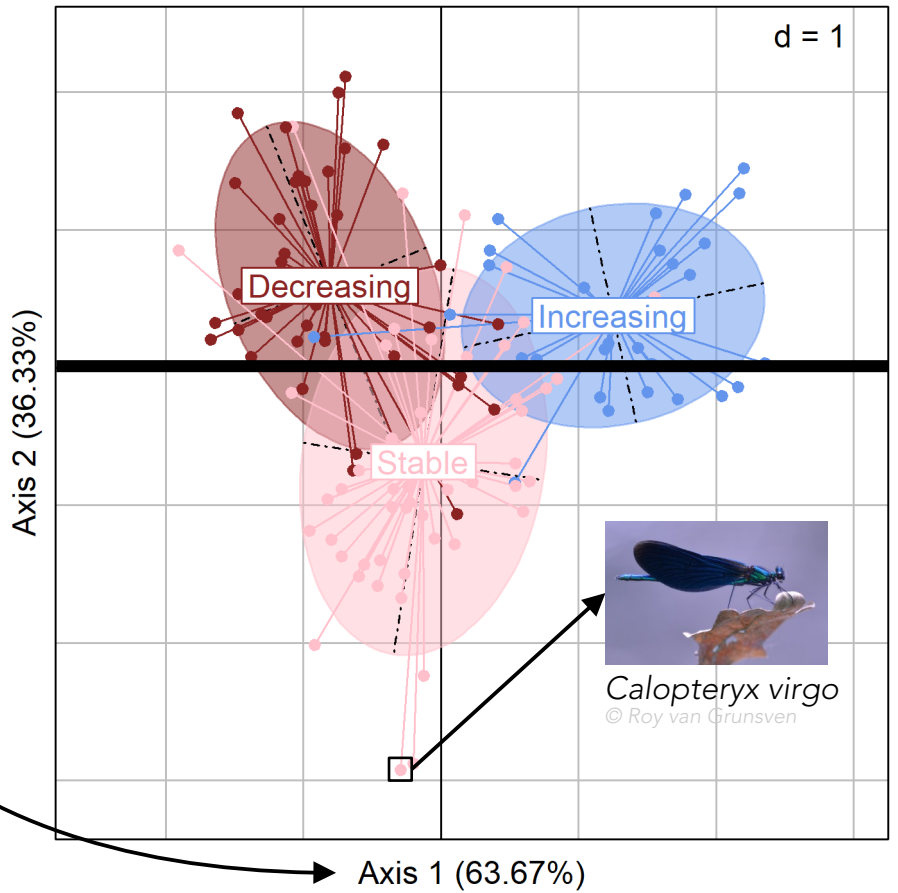

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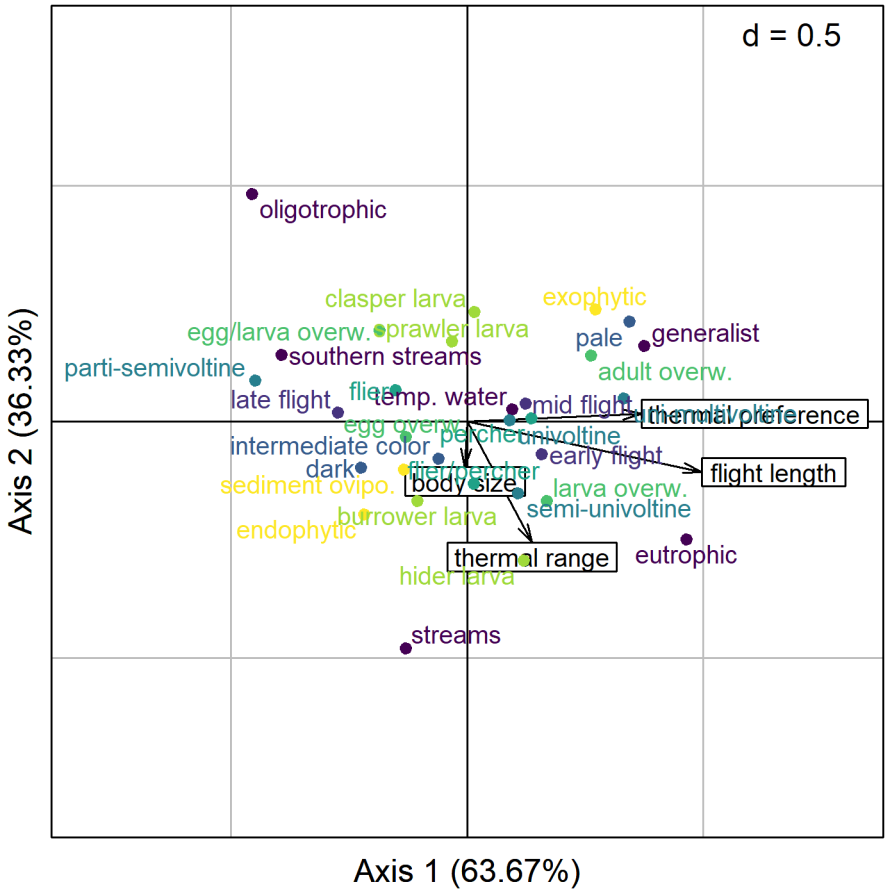
Results

Distribution trends



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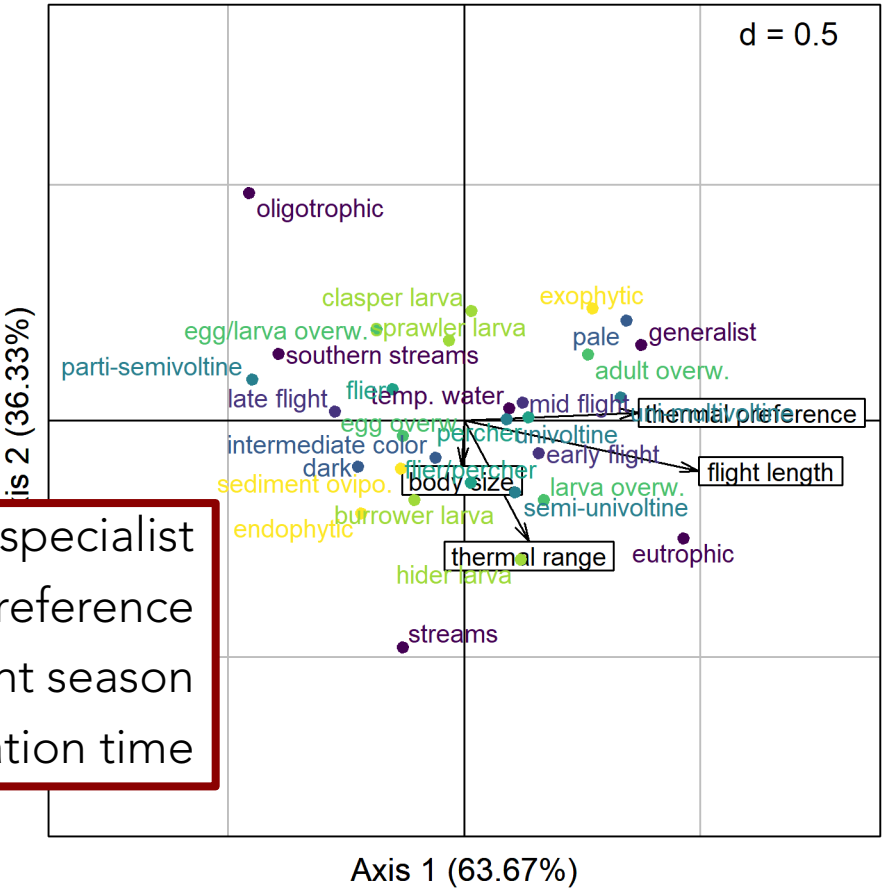
Results

Distribution trends

Leucorrhinia albifrons



decreasing

Nutrient-poor specialist

Low thermal preference

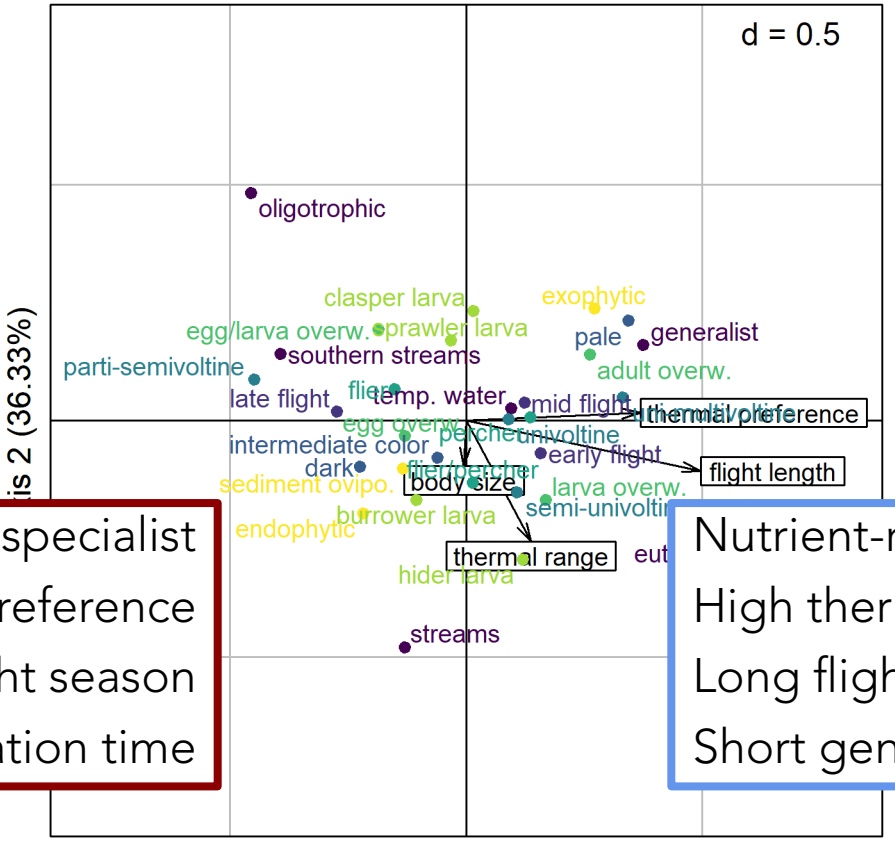
Short flight season

Long generation time

Results

Distribution trends

Leucorrhinia albifrons



Crocothemis erythrea

decreasing

Nutrient-poor specialist
Low thermal preference
Short flight season
Long generation time

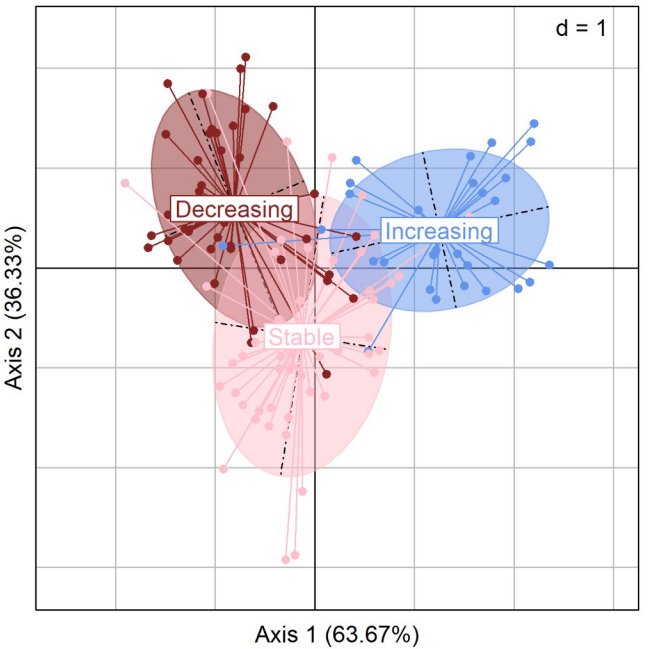
increasing

Nutrient-rich specialist
High thermal preference
Long flight season
Short generation time

Results

Distribution trends

How well do traits explain distribution trends?

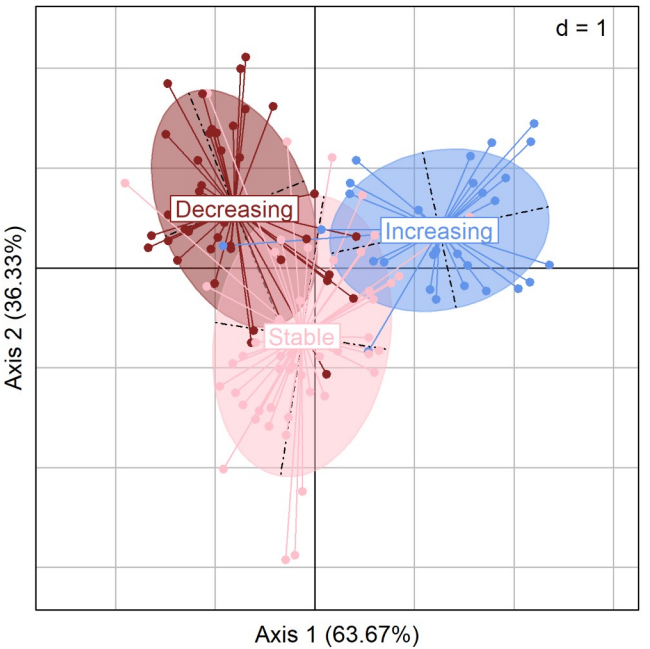


Trend icon: Rakib Hassan Rahim on Flaticon

Results

How well do traits explain distribution trends?

→ Multinomial GLM: *trend ~ axis1 + axis2*



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How well do traits explain distribution trends?

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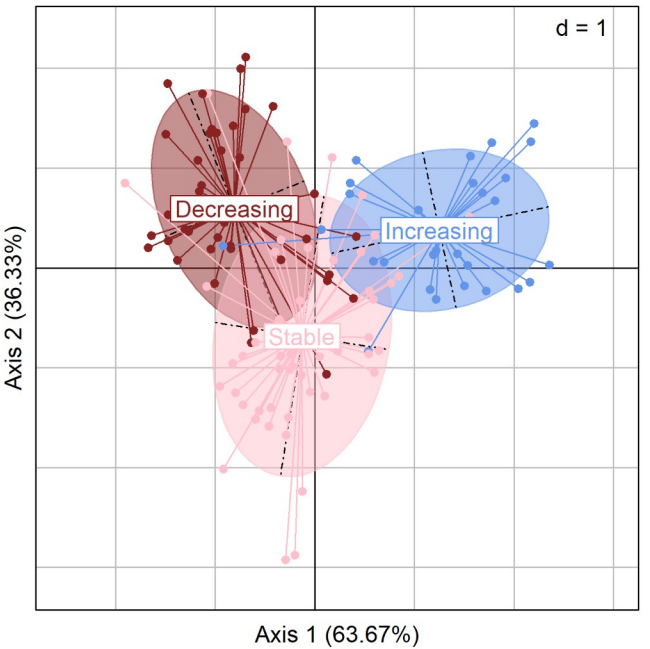
McFadden's pseudo-R^2 = 0.51 *(CI_{95} = [0.40, 0.59])*
McFadden, 1987



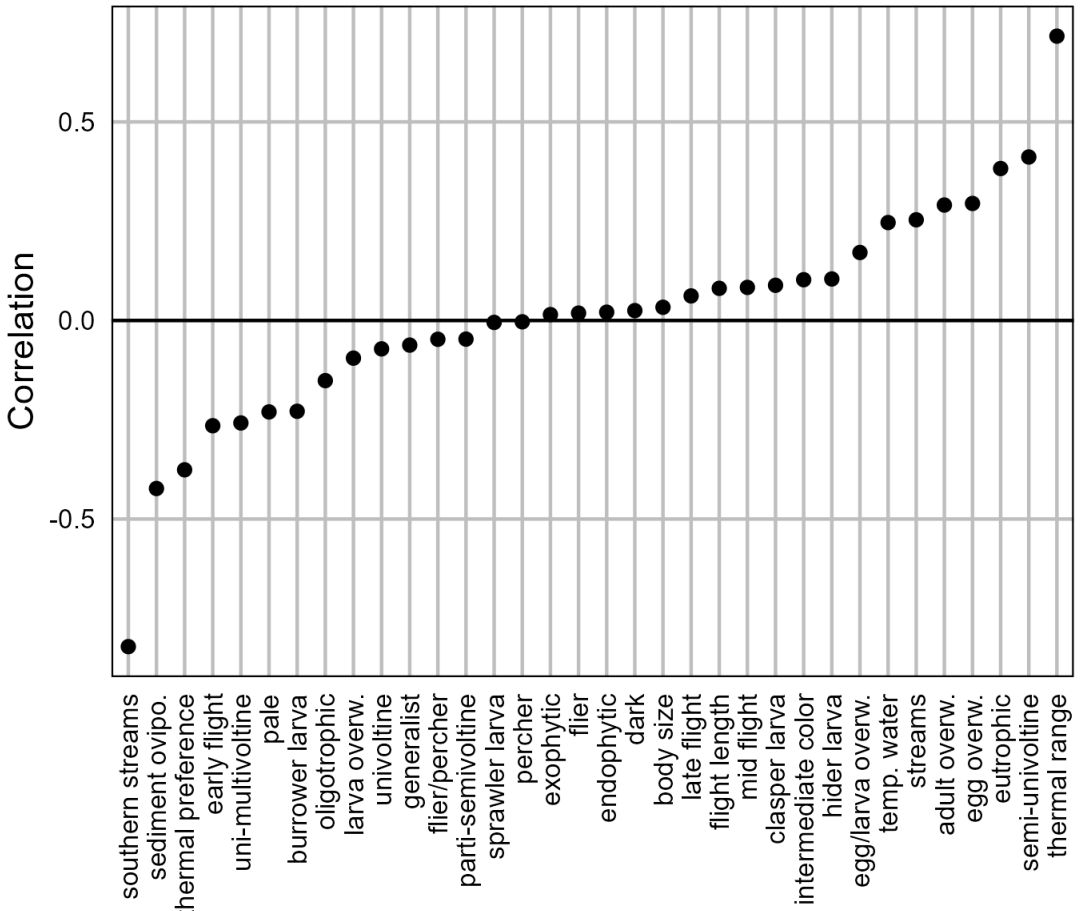
Results

Area of occupancy 

Area icon: Freepik on Flaticon

Results

Area of occupancy

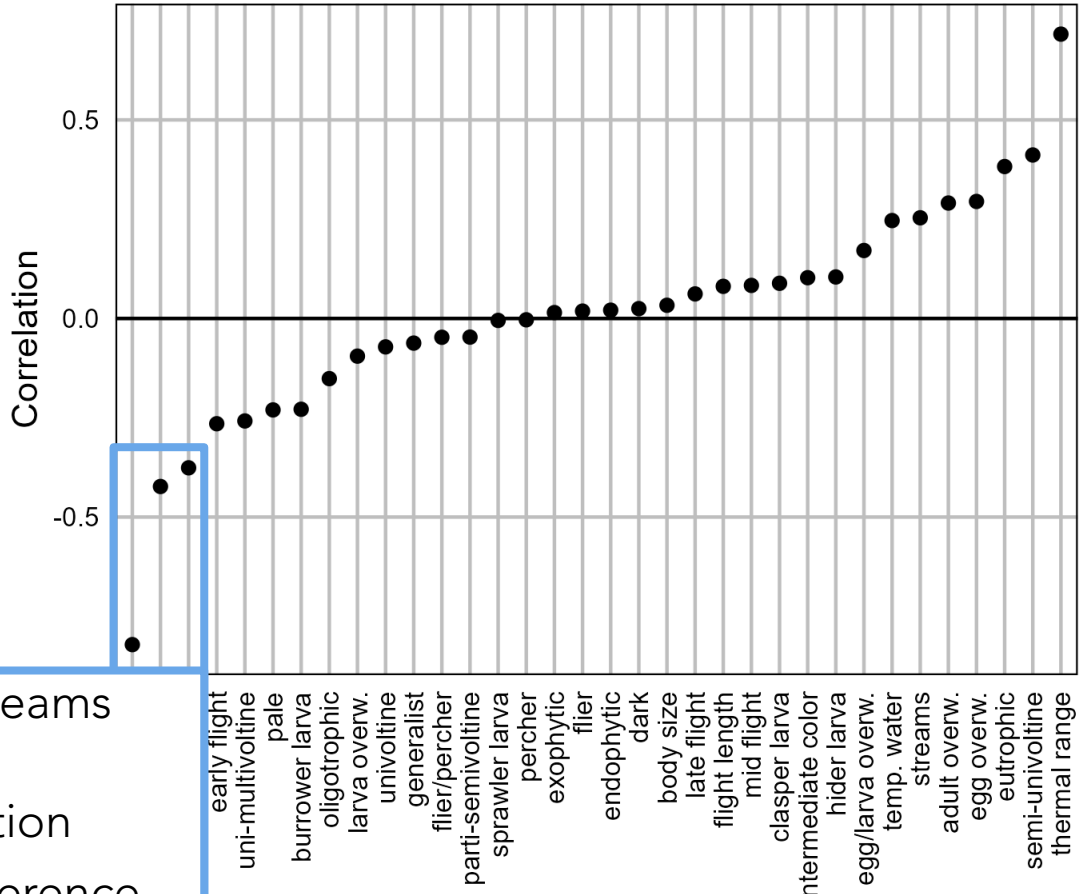


Area icon: Freepik on Flaticon

Results

Area of occupancy

Pyrrhosoma elisabethae



smaller area

Mediterranean streams specialist

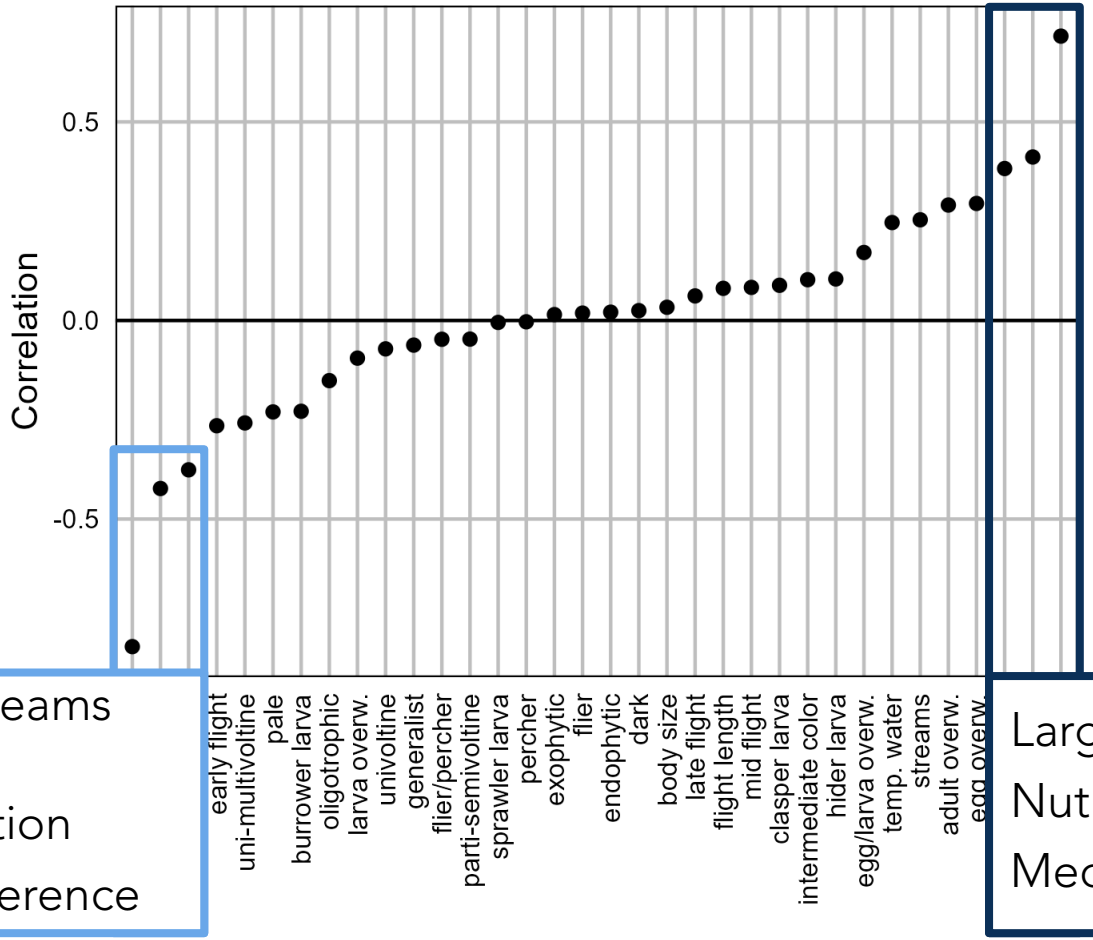
Sediment oviposition

High thermal preference

Results

Area of occupancy

Pyrrhosoma elisabethae
Daniel Linzbauer, CC BY 4.0



Sympetrum striolatum
Loz (L. B. Tettenborn), CC BY-SA 3.0

smaller area

- Mediterranean streams specialist
- Sediment oviposition
- High thermal preference

larger area

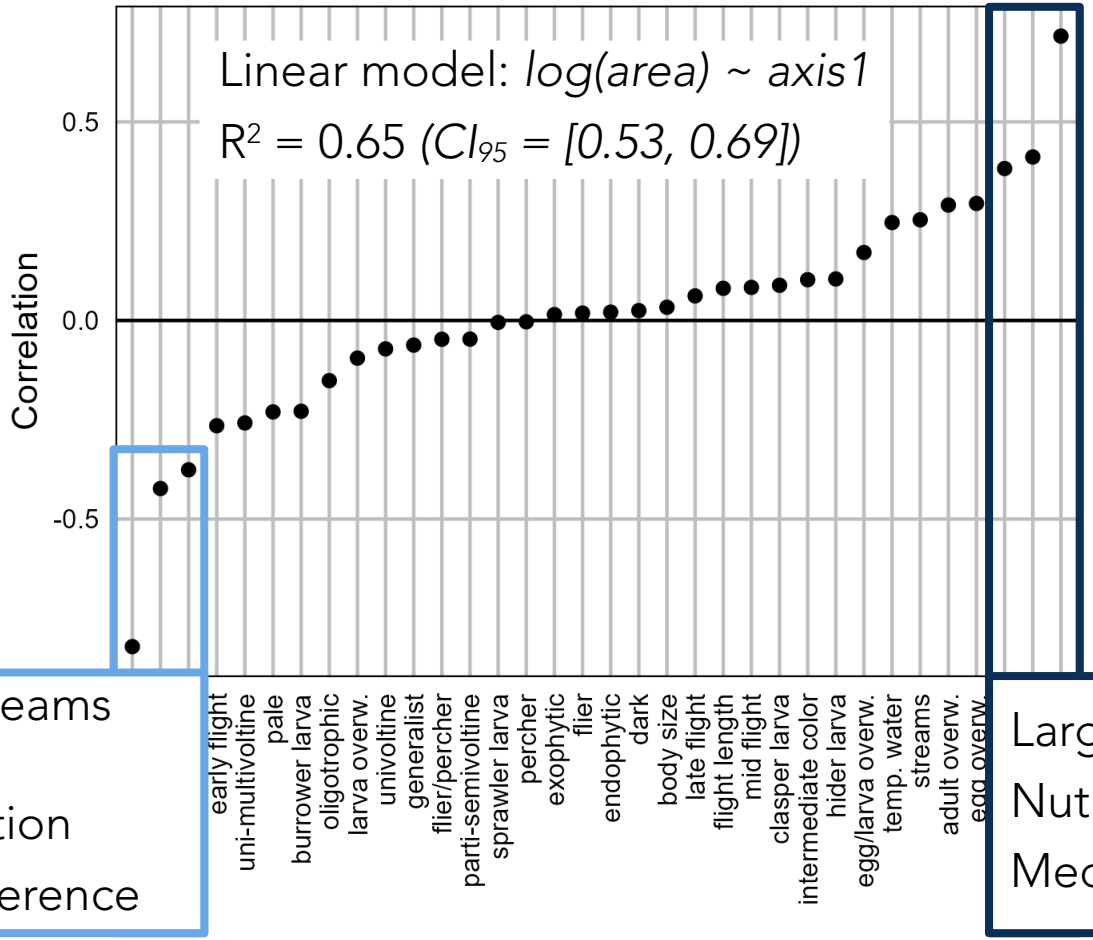
- Large thermal range
- Nutrient-rich specialist
- Medium generation time

Area icon: Freepik on Flaticon

Results

Area of occupancy

Pyrrhosoma elisabethae
Daniel Linzbauer, CC BY 4.0



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Results

Red List category

Results

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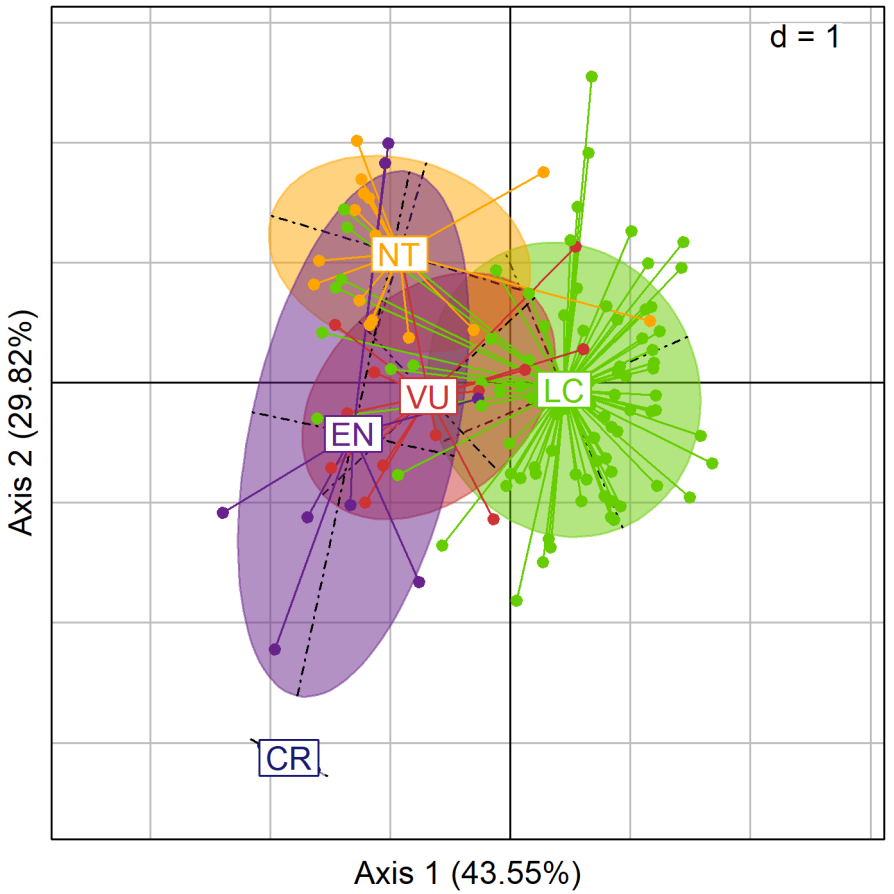

Results

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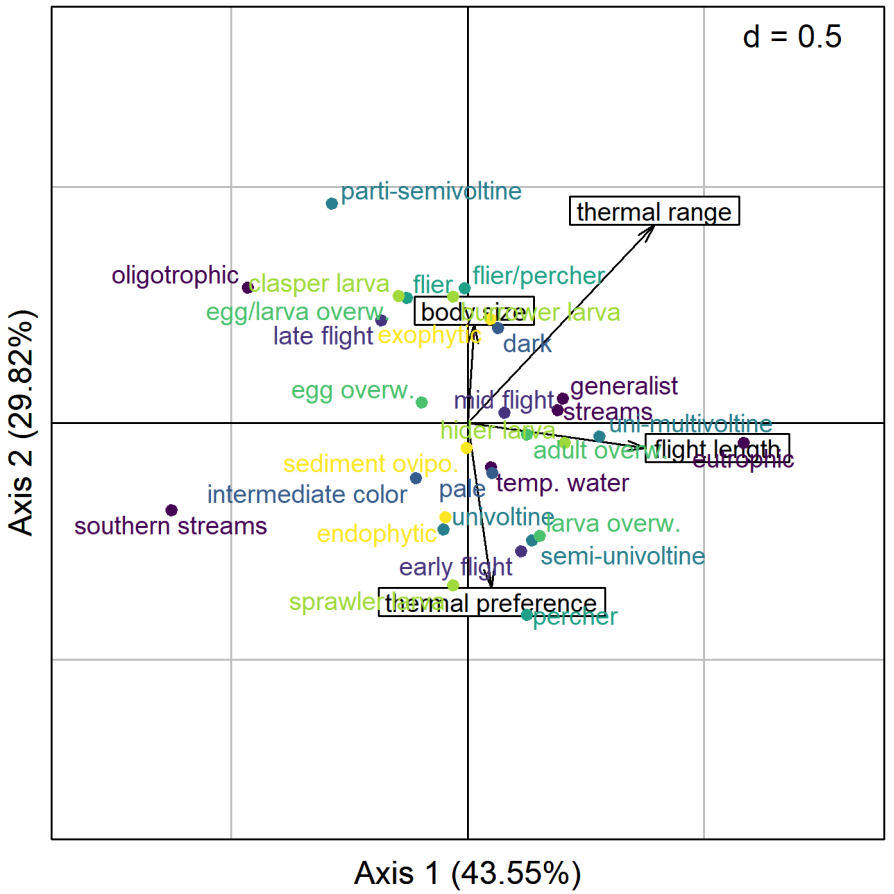
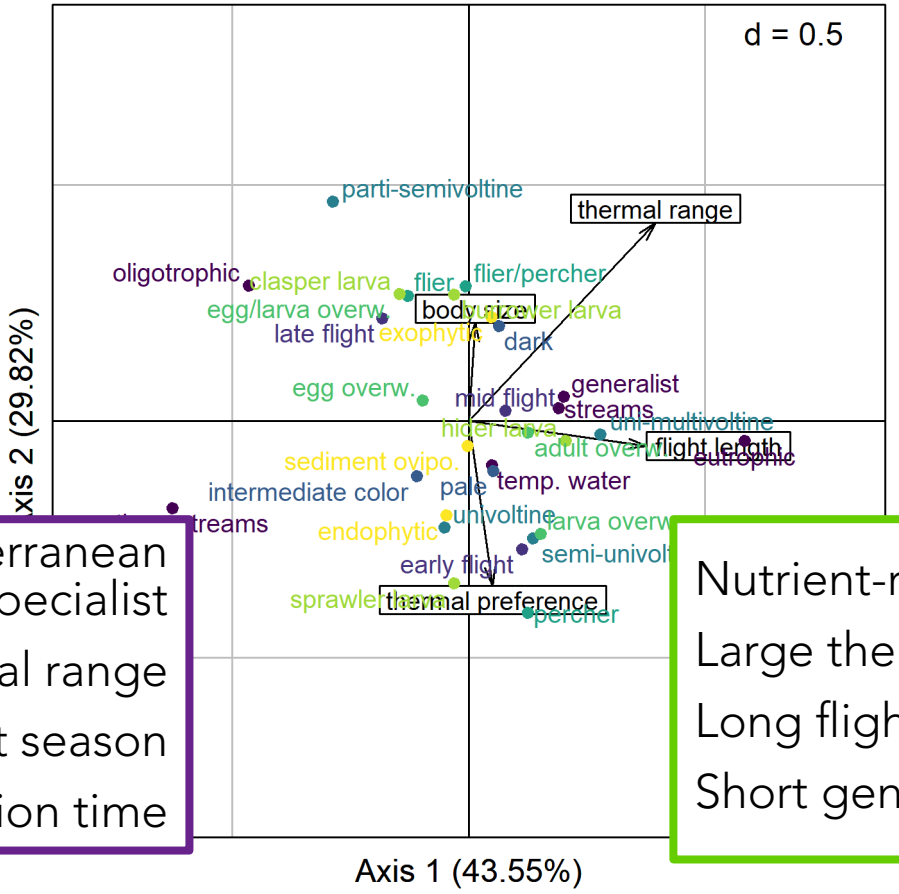


Results

Red List category

Boyeria cretensis

Martin Waldhauser on observation.org



Crocothemis erythrea

© Geert de Knijf

threatened

Nutrient-poor or Mediterranean streams specialist

Small thermal range

Short flight season

Long generation time

non-threatened

Nutrient-rich specialist

Large thermal range

Long flight season

Short generation time

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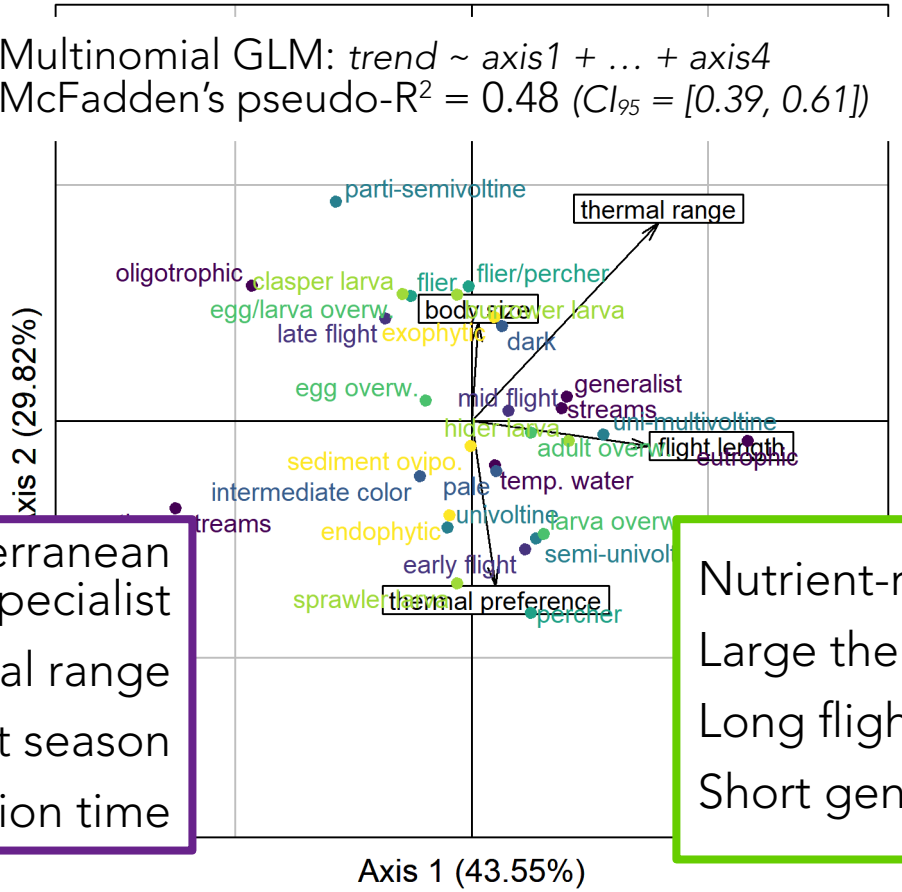
Multinomial GLM: *trend ~ axis1 + … + axis4*

McFadden's pseudo-R^2 = 0.48 *(CI_{95} = [0.39, 0.61])*



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© Geert de Knijf

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Discussion

vulnerability ~ traits

Strong relationship ($R^2 \approx 0.5$)

vulnerability ~ exposure + sensitivity + adaptive capacity

traits

Discussion

vulnerability ~ traits

- Distribution trend
- Area of occupancy
- Red List category

Strong relationship ($R^2 \approx 0.5$)

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Area icon: Freepik on Flaticon; Trend icon: Rakib Hassan Rahim on Flaticon

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Strong relationship ($R^2 \approx 0.5$)

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- Area of occupancy
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→ short-term pressures

Area icon: Freepik on Flaticon; Trend icon: Rakib Hassan Rahim on Flaticon

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vulnerability ~ traits

Strong relationship ($R^2 \approx 0.5$)

vulnerability ~ exposure + sensitivity + adaptive capacity

traits

- Distribution trend → short-term pressures
- Area of occupancy → historical range constraints
- Red List category

Area icon: Freepik on Flaticon; Trend icon: Rakib Hassan Rahim on Flaticon

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- Red List category → integrative measure

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traits


Distribution trend → short-term pressures


Area of occupancy → historical range constraints

Red List category → integrative measure

habitat

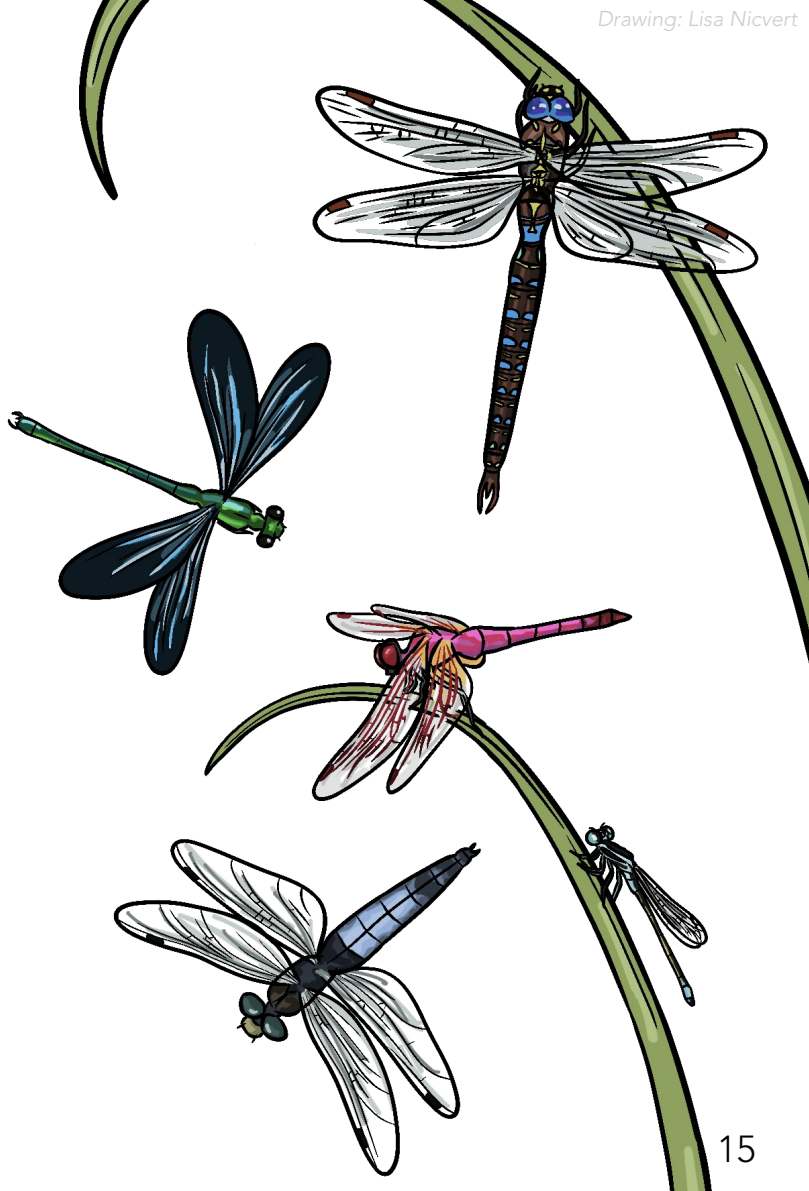
generation time

thermal preferences

Discussion

Trait-based approaches for conservation

- Forecasting
- Monitoring (indicator)
- Understanding



Drawing: Lisa Nicvert

Discussion

Trait-based approaches for conservation

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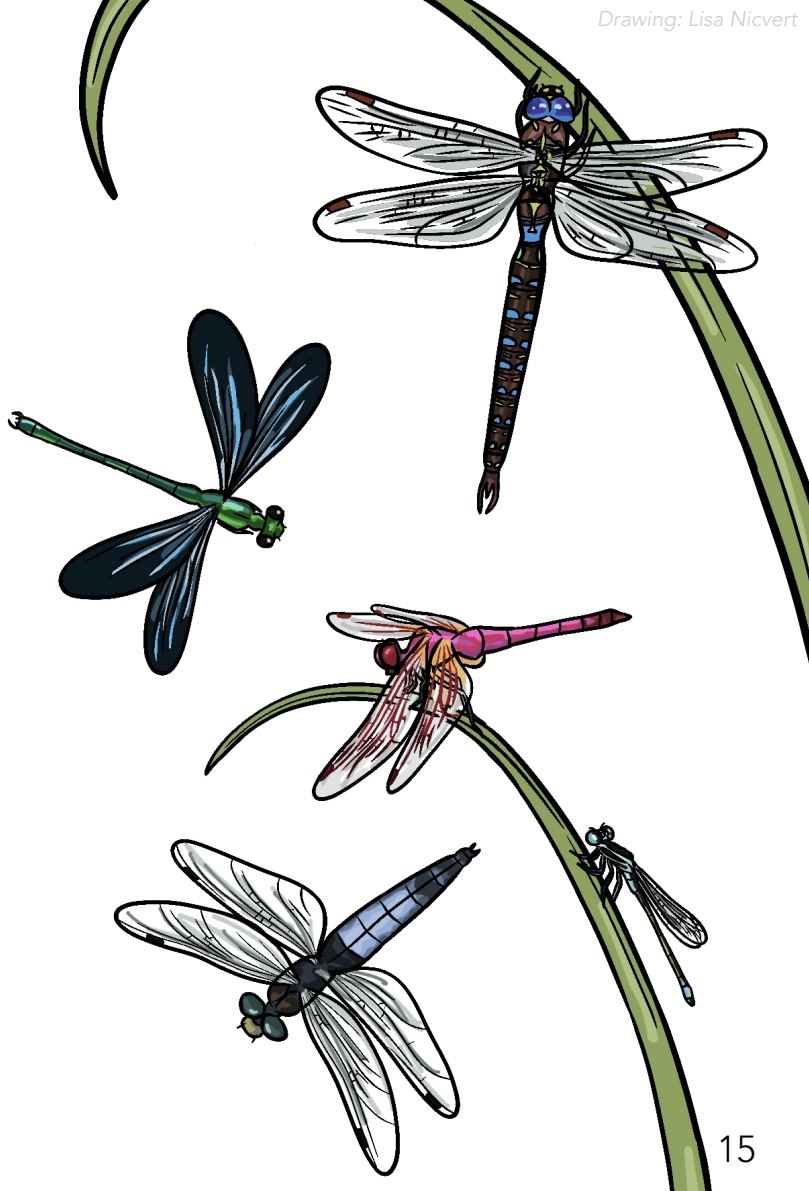
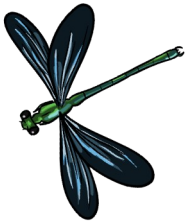
- Understanding

Good knowledge of traits data needed



Drawing: Lisa Nicvert

Calopteryx virgo: Lisa Nicvert



Thank you!

Members of the DRAGON consortium

Lisa Nicvert, FRB-Cesab

References

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