

# How to produce national indicators from BMS

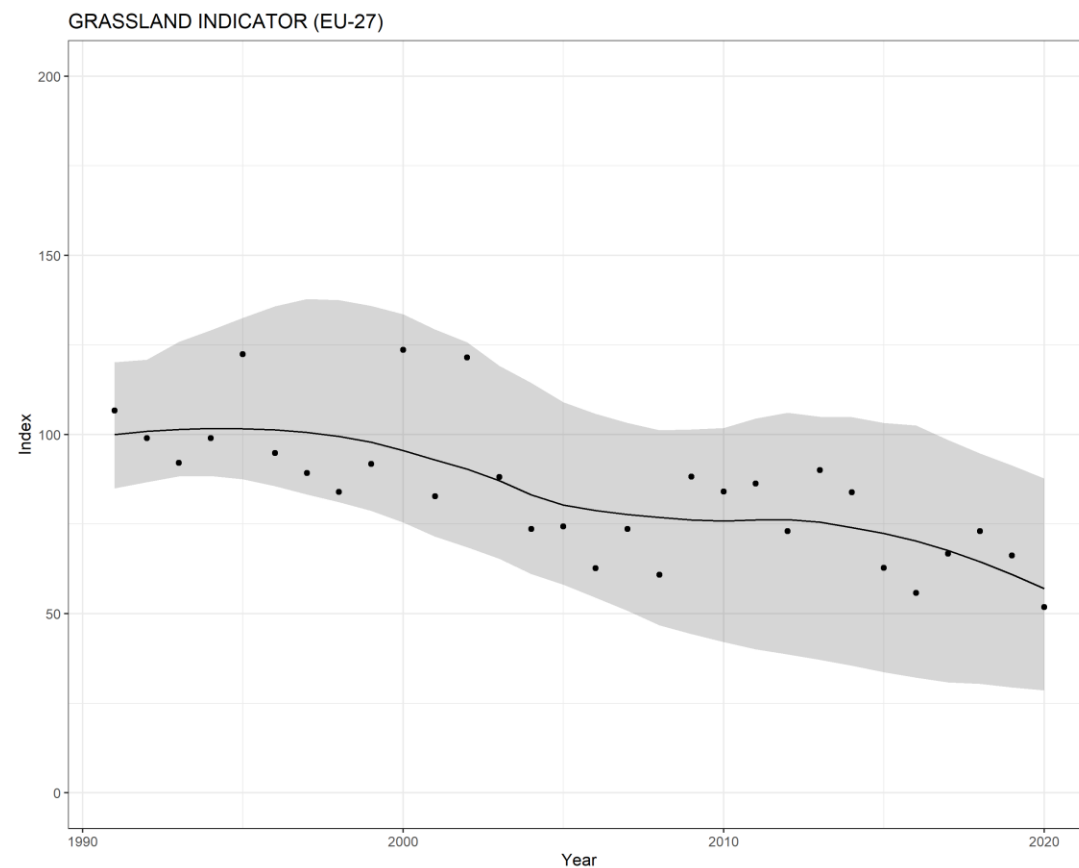
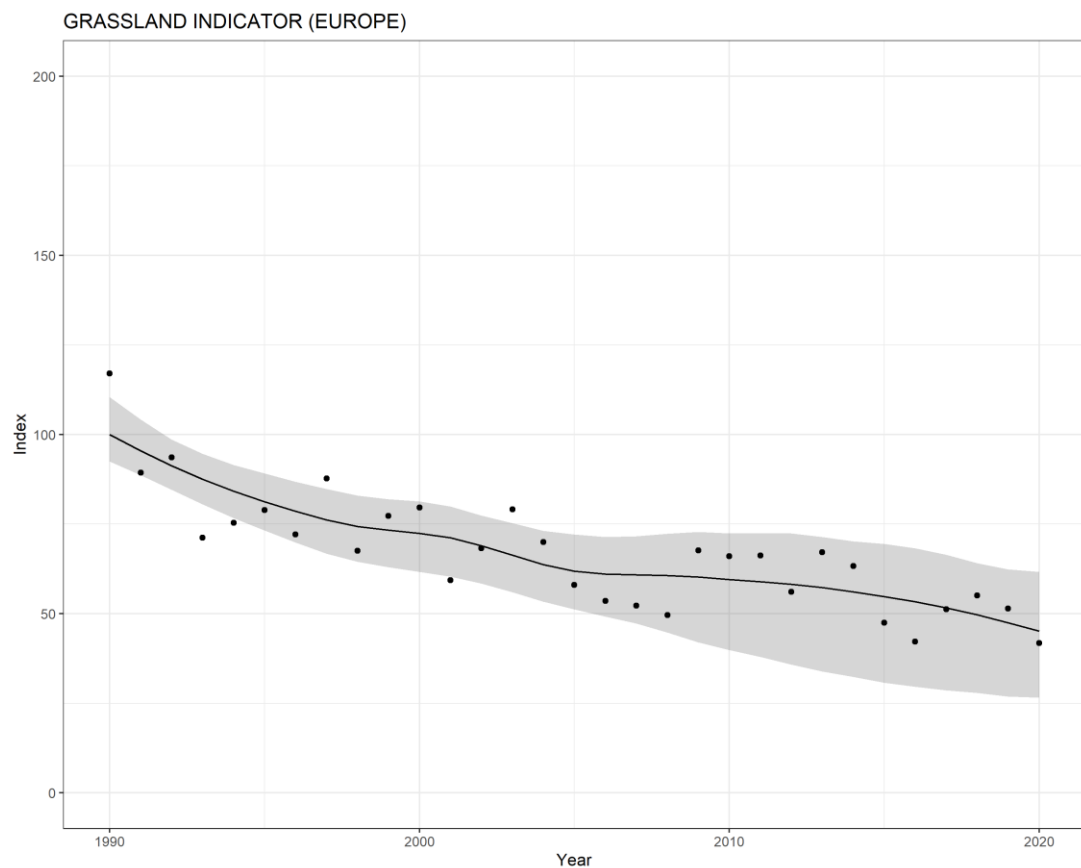
Reto Schmucki,  
Emily Dennis,  
Chris van Swaay,  
David Roy



[retoschm@ceh.ac.uk](mailto:retoschm@ceh.ac.uk)

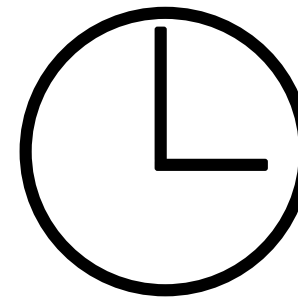
# The European Grassland Indicator (1990 - 2020)

## eBMS v4.2



# Ingredients

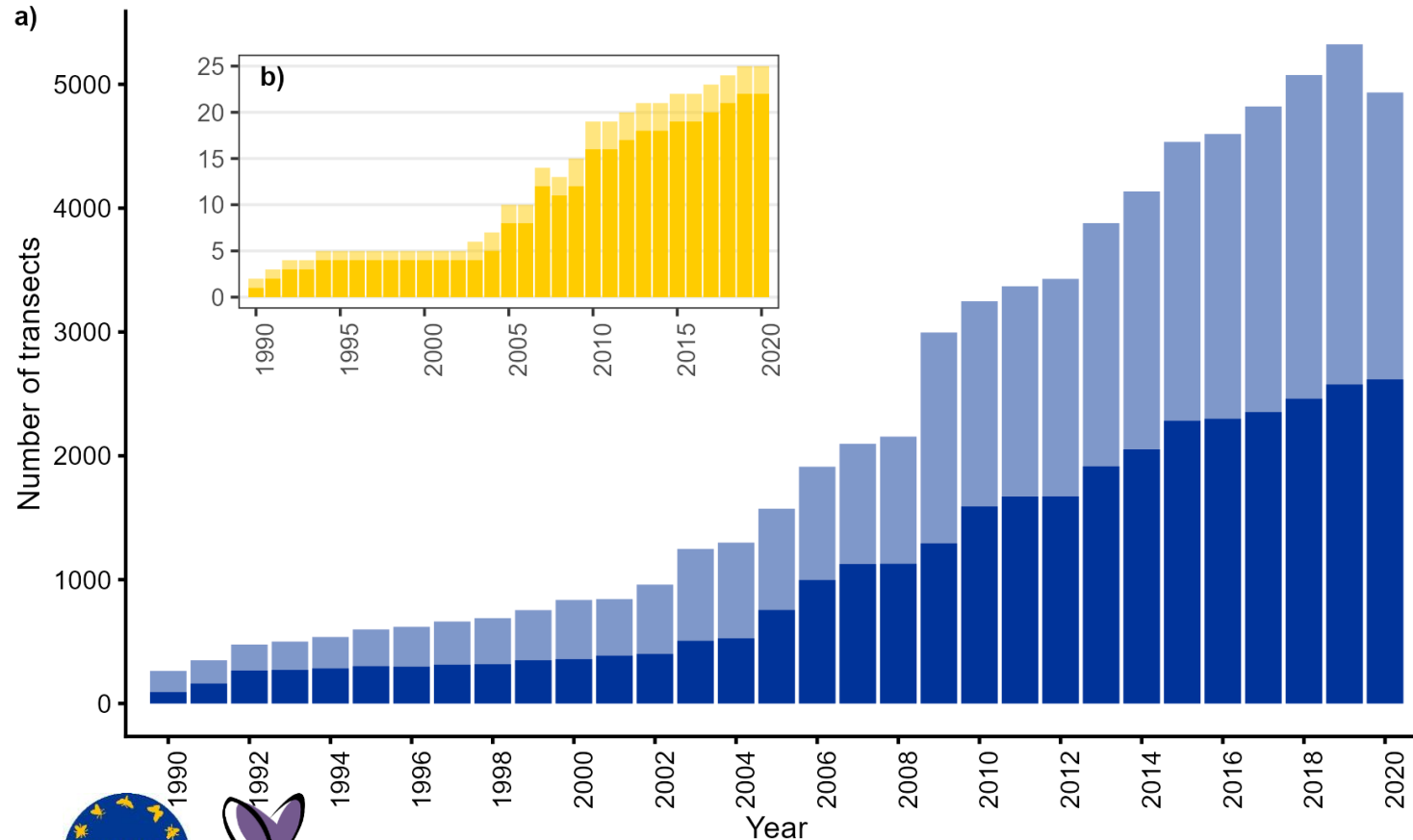
- ▶ 2,500 transects in 2020
- ▶ 22 BMS in EU-27 and 25 in Europe
- ▶ ~ 5,000 transect in 2020
- ▶ 25 in Europe
- ▶ 6350 EU-27 (since 1990)
- ▶ 11,500 Europe (since 1990)
- ▶ 17 Grassland species
- ▶ Time and some code



```
## Visit (transects and area)
visitQ <-
  "SELECT
    v.visit_id,
    v.bms_id,
    v.transect_id,
    v.visit_date,
    EXTRACT(YEAR from v.visit_date)
    as year,
    EXTRACT(MONTH from v.visit_date)
    as month,
    EXTRACT(DAY from v.visit_date)
    as day,
    s.ebms_partner
  FROM
    ebms.m_visit as v
  JOIN (SELECT DISTINCT
        transect_id,
        monitoring_type,
        ebms_partner,
        ebms_partner_embar
      FROM ebms.m_site) as s
    (v.transect_id = s.transect_id)
```



# Ingredients



1. *Ochlodes sylvanus*
2. *Anthocharis cardamines*
3. *Lycaena phlaeas*
4. *Polyommatus icarus*
5. *Lasiommata megera*
6. *Coenonympha pamphilus*
7. *Maniola jurtina*
8. *Erynnis tages*
9. *Thymelicus action*
10. *Spialia Sertorius*
11. *Cupido minimus*
12. *Phengaris arion*
13. *Phengaris nausithous*
14. *Lysandra bellargus*
15. *Cyaniris semiargus*
16. *Lysandra coridon*
17. *Euphydryas aurinia*



# Index and Climate data

- Calculate site abundance index
- Regional flight curves

## Methods in Ecology and Evolution

Methods in Ecology and Evolution 2013, 4, 637–645

doi: 10.1111/2041-210X.12053

### Indexing butterfly abundance whilst accounting for missing counts and variability in seasonal pattern

Emily B. Dennis<sup>1,2\*</sup>, Stephen N. Freeman<sup>2</sup>, Tom Brereton<sup>3</sup> and David B. Roy<sup>2</sup>

<sup>1</sup>National Centre for Statistical Ecology, School of Mathematics, Statistics and Actuarial Science, University of Kent, Canterbury, Kent, CT2 7NF, UK; <sup>2</sup>NERC Centre for Ecology & Hydrology, Maclean Building, Benson Lane, Crowmarsh Gifford Wallingford Oxfordshire OX10 8RR UK; and <sup>3</sup>Butterfly Conservation, Manor Yard East Lutterworth Wareham Dorset

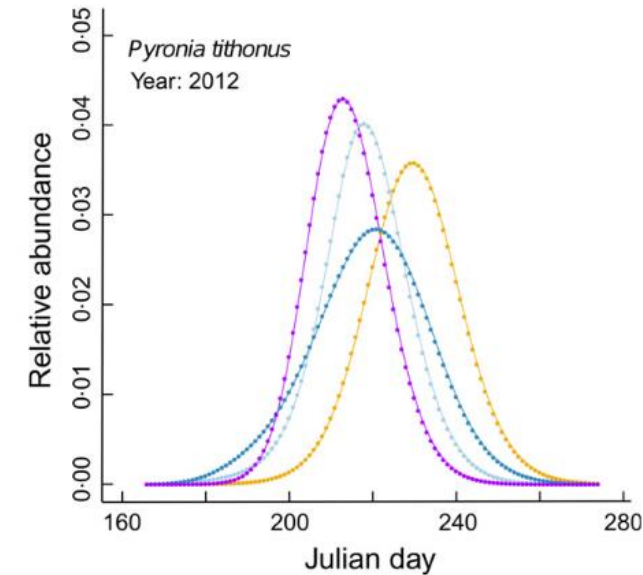
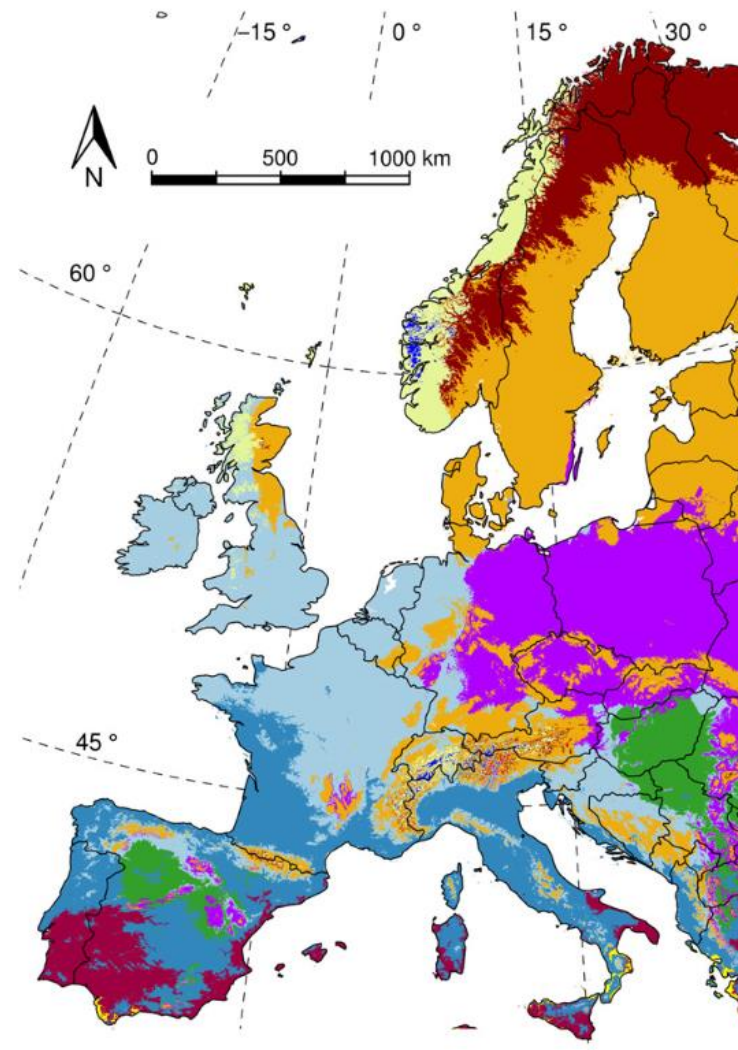
## Journal of Applied Ecology

Journal of Applied Ecology 2016, 53, 501–510

doi: 10.1111/1365-2664.12561

### A regionally informed abundance index for supporting integrative analyses across butterfly monitoring schemes

Reto Schmucki<sup>1,2\*</sup>, Guy Pe'er<sup>3,4</sup>, David B. Roy<sup>5</sup>, Constanti Stefanescu<sup>6,7</sup>, Chris A.M. Van Swaay<sup>8</sup>, Tom H. Oliver<sup>9,9</sup>, Mikko Kuussaari<sup>10</sup>, Arco J. Van Strien<sup>11</sup>, Leslie Ries<sup>12,13</sup>, Josef Settele<sup>4,14</sup>, Martin Musche<sup>14</sup>, Jofre Carnicer<sup>6,15</sup>, Oliver Schweiger<sup>14</sup>, Tom M. Brereton<sup>16</sup>, Alexander Harpe<sup>14</sup>, Janne Heliölä<sup>10</sup>, Elisabeth Kühn<sup>14</sup> and Romain Julliard<sup>1</sup>



- Extremely cold & wet
- Extremely cold & mesic
- Cold & wet
- Cold & mesic
- Cold temperate & moist
- Cold temperate & dry
- Cool temperate & xeric
- Warm temperate & mesic
- Warm temperate & xeric
- Hot & dry

# Tools

BMS data processing





rbms 1.1.3

Reference

Articles ▾

## Authors

Reto Schmucki. Author, maintainer. 

Colin A. Harrower. Author. 

Emily Dennis. Contributor. 

## Citation

Source: `inst/CITATION`

Schmucki R., Harrower C.A., Dennis E.B. (2022) rbms: Computing generalised abundance indices for butterfly monitoring count data. R package version 1.1.3. <https://github.com/RetoSchmucki/rbms>

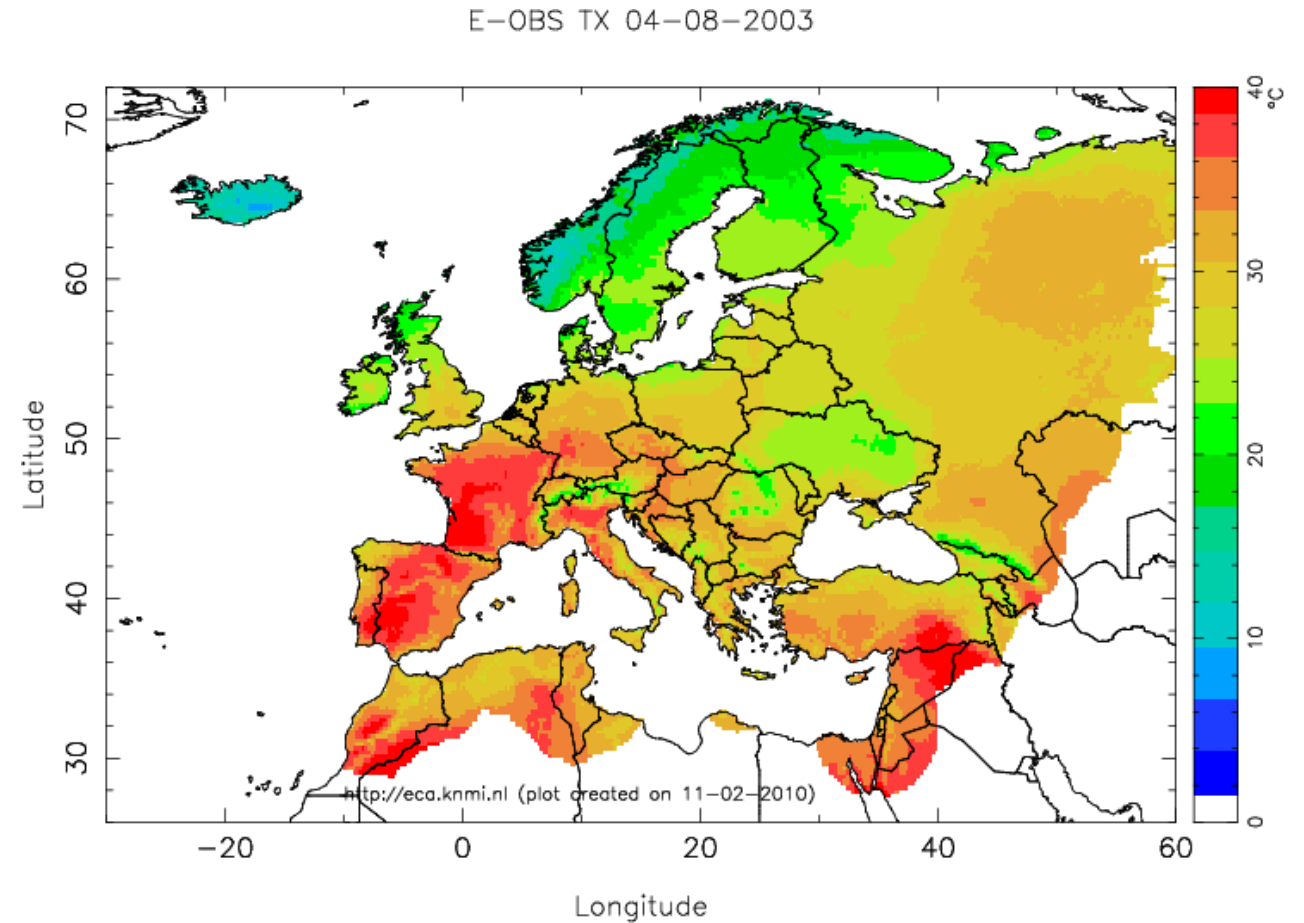
<https://retoschmucki.github.io/rbms/>



# Index and Climate data



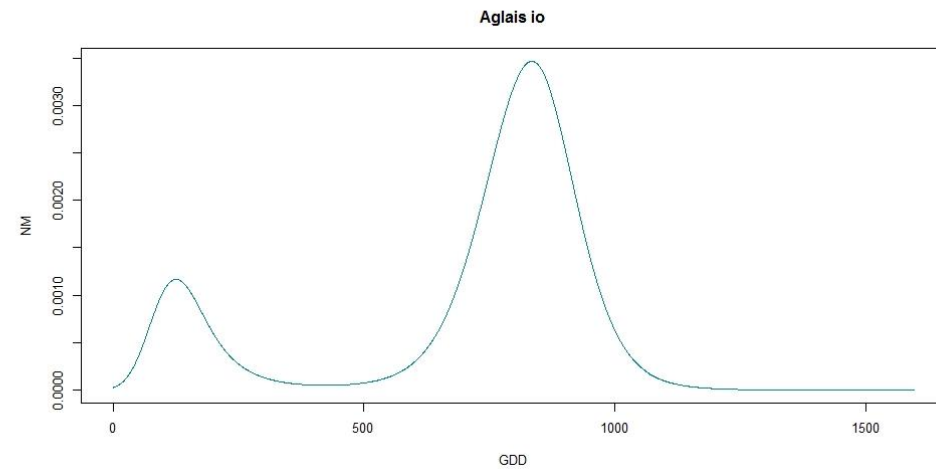
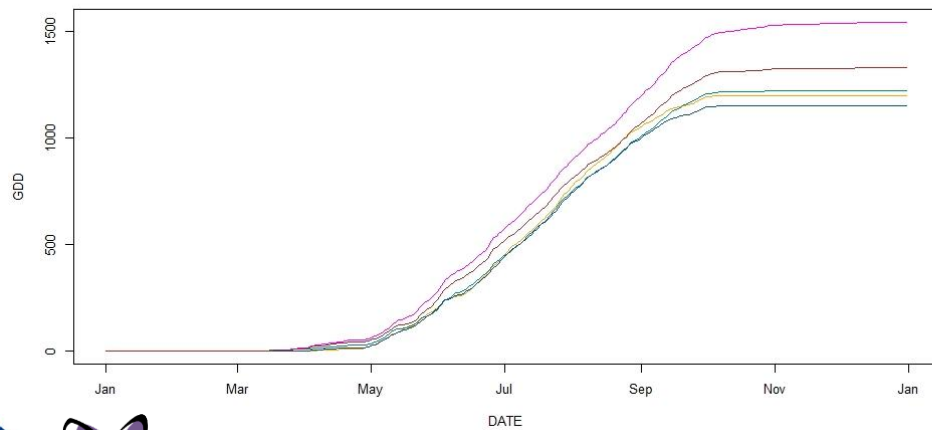
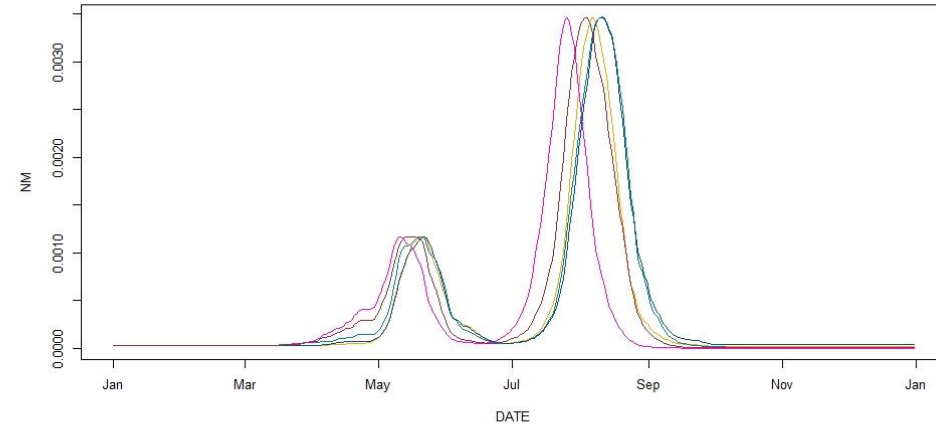
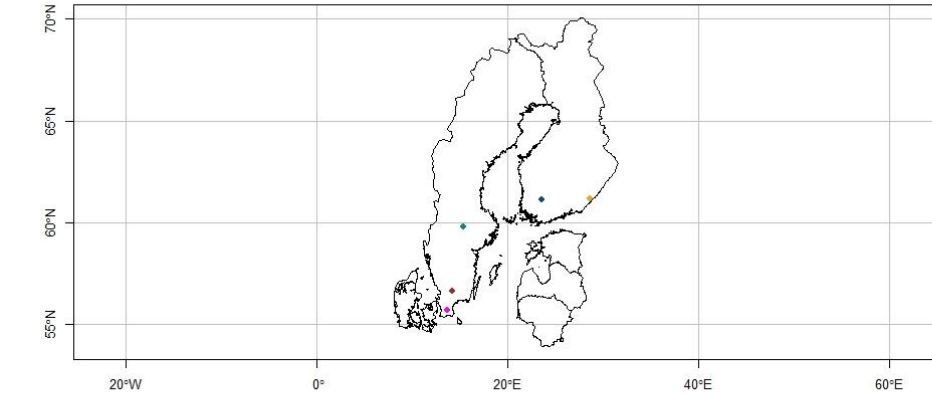
<https://retoschmucki.github.io/climateExtract/>



**European Climate Assessment & Dataset**  
<https://www.ecad.eu/>



# Accumulated Growing Degree Days (7-14 °C)





## Model



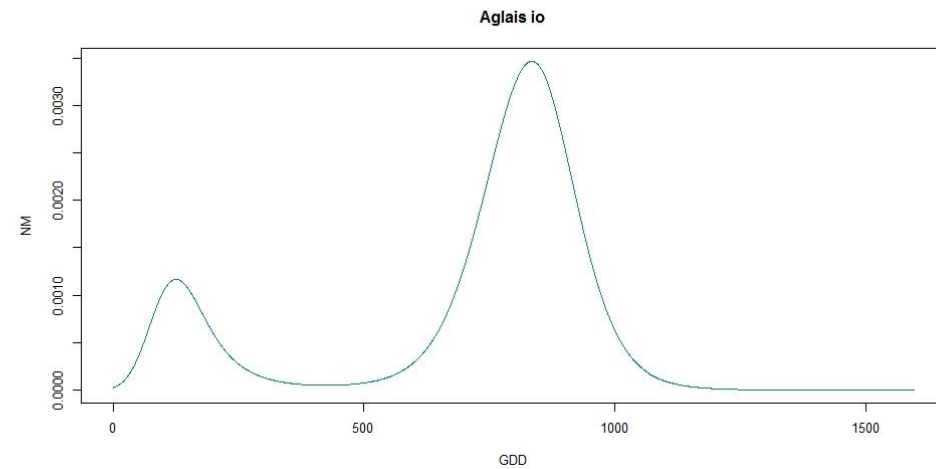
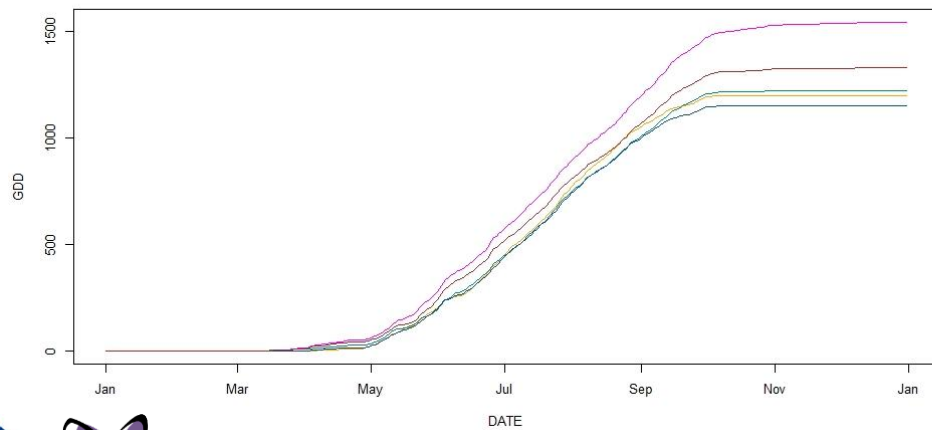
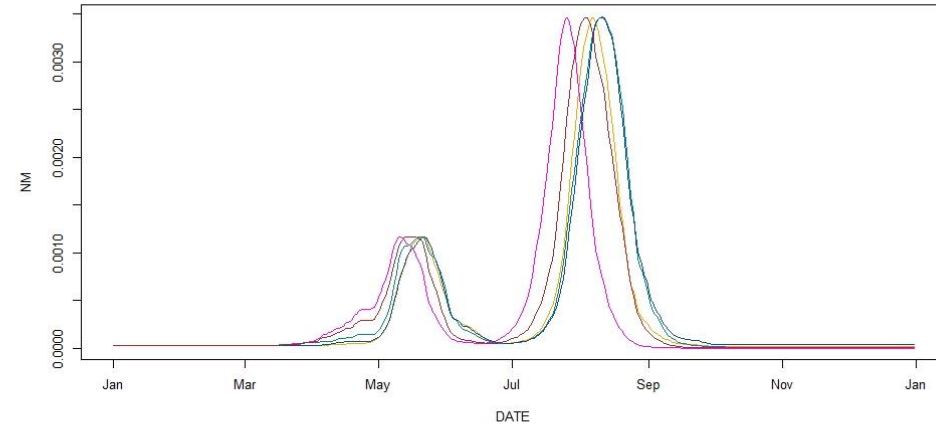
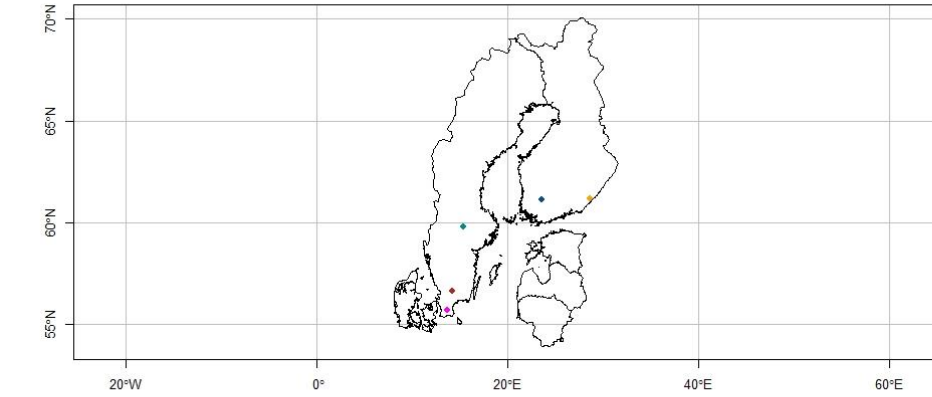
```
COUNT ~ s(ACGDD, bs = c("\ps\")) +  
s(Y, bs = c("\ps\")) +  
ti(ACGDD, Y, bs = c("\ps\","\ps\")) +  
factor(SITE_ID)
```

Latitude

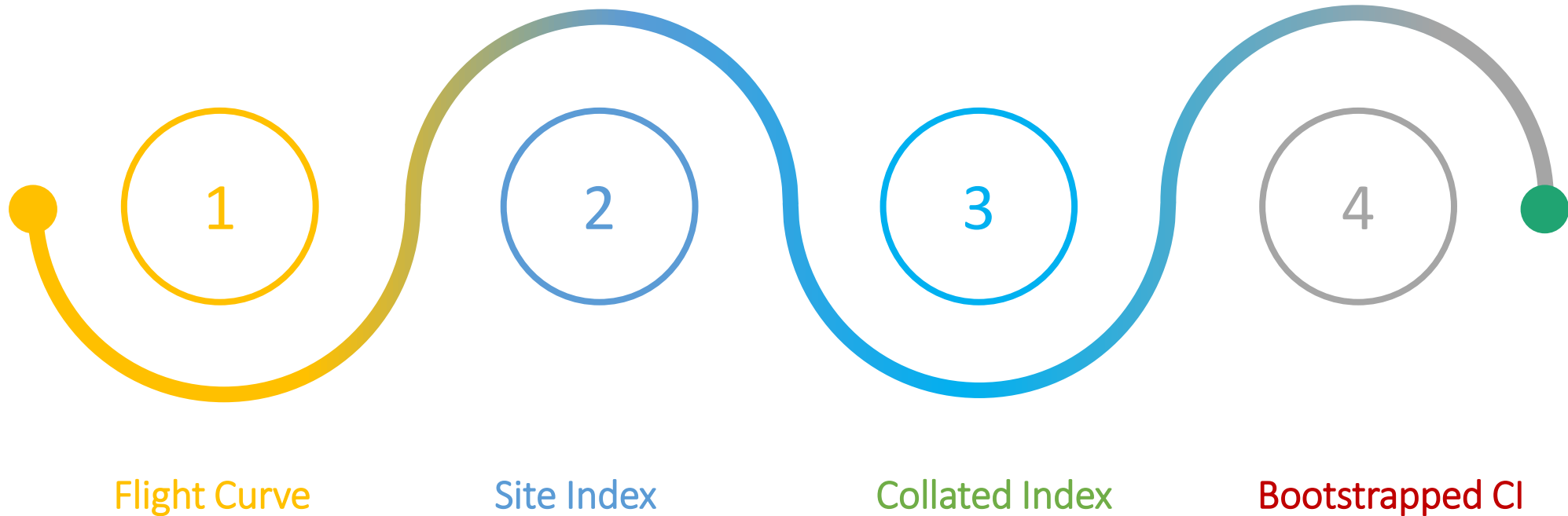


```
flight_curve(count_data, NbrSample = 500, MinVisit = min_visit,  
MinOccur = min_count, MinNbrSite = min_site, MaxTrial = 4,  
GamFamily = "nb", SpeedGam = FALSE, ComplSeason = TRUE, SelectYear = N  
TimeUnit = "d", mod_form = my_mod4,  
tp_col = c("ACGDD", "GDD", "Y"))
```

# Accumulated Growing Degree Days (7-14 °C)



# Collated abundance index with Confidence Intervals



# Multi-site multi-species trend

	sp1	sp2	Sp1 & sp2	sp3	sp3 Adj.	Multi- sp Index
t	100	100	100	NA		100
t + 1	97	85	90.8	NA		90.8
t + 2	76	83	79.4	100 →	79.4	79.4
t + 3	80	75	77.4	86	68.3	74.2
t + 4	75	56	64.8	78	61.9	63.8
t + 5	80	60	69.2	65	51.6	62.8
t + 6	72	64	67.8	55	43.6	58.6
t + ...	65	62	63.4	65	51.6	59.2

Informed by  
2 species

Informed by  
3 species



# **Standardizing your BMS data, visualisation and reporting**

# Standardizing your BMS data, visualisation and reporting



shiny\_ebms - main - RStudio

File Edit Code View Plots Session Build Debug Profile Tools Help

Go to file/function Addins

app.R

```
1 # Load required packages
2 library(shiny)
3 library(data.table)
4 library(lubridate)
5 library(shinydashboard)
6 library(shinythemes)
7 library(ggplot2)
8 library(data.table)
9 library(plyr)
10 library(dplyr)
11 library(viridis)
12 library(rnaturalearth)
13 library(sf)
14 library(cowplot)
15 library(patchwork)
16 library(plyr)
17
```

7:1 (Top Level) R Script

Console Terminal Background Jobs

R 4.2.1 · C:/Users/retoschm/OneDrive - UKCEH/SPRING/shiny\_ebms/

R is free software and comes with ABSOLUTELY NO WARRANTY.  
You are welcome to redistribute it under certain conditions.  
Type 'license()' or 'licence()' for distribution details.

R is a collaborative project with many contributors.  
Type 'contributors()' for more information and  
'citation()' on how to cite R or R packages in publications.

Type 'demo()' for some demos, 'help()' for on-line help, or  
'help.start()' for an HTML browser interface to help.  
Type 'q()' to quit R.

> |

shiny\_ebms

Environment History Connections Git Tutorial

Diff Commit

Staged Status Path

Files Plots Packages Help Viewer Presentation

Folder Blank File Delete Rename

C:/Users/retoschm/OneDrive - UKCEH/SPRING/shiny\_ebms

	Name	Size	Modified
	..		
	.gitignore	42 B	Nov 28, 2022, 3:55 PM
	.Rhistory	342 B	Nov 28, 2022, 5:01 PM
	app.R	32.4 KB	Nov 28, 2022, 4:57 PM
	data		
	LICENSE	1.1 KB	Sep 7, 2022, 12:09 PM
	misc		
	README.md	76 B	Nov 22, 2022, 1:46 PM
	shiny_ebms.Rproj	218 B	Dec 1, 2022, 3:38 PM

# Standardizing your BMS data, visualisation and reporting



A screenshot of a web browser showing the eBMS reformatting website. The browser's address bar displays "127.0.0.1:5993". The page has a dark blue header with navigation links: "eBMS butterfly survey data formatting" (selected), "Introduction", "Table upload", "Table reformatting", "Info table upload", "Info table reformatting", and "Results". The main content area is dark grey and contains the text: "Hello, welcome to the eBMS reformatting website. The role of this website is to standardise the butterfly survey data that we receive from a variety of sources to allow for more rapid presentation and analysis of the collated datasets." The bottom right corner of the page has a small "eBMS" logo.



# Standardizing your BMS data, visualisation and reporting

eBMS butterfly survey data formatting

Introduction Table upload Table reformatting Info table upload Info table reformatting Results

**Choose CSV File**

Browse... No file selected

**Number of rows to display:**

10

Open

« shiny\_ebms » data

Search data

Organise New folder

Name	Status
dataset_1.csv	✓
dataset_2.csv	✓
dataset3.csv	✓
dataset4.csv	✓
dataset5.csv	✓
spain_butterfly_count_data_table.csv	✓
spain_site_geographical_information_table.csv	✓
spain_visits_table.csv	✓

File name: Assessing Butterflies in Europe - Butter All Files (\*)

Open Cancel





Select ID of visit column

Visit.ID..Transect.Sample.ID.  
Recorder.ID  
Transect.ID  
Transect.Name  
Date  
Start.Time  
End.Time  
Temperature

Select year column

Select month column

Select day column

Input table

Output table

Visit.ID..Transect.Sample.ID.	Recorder.ID	Transect.ID	Transect.Name
8420254	JONATAN ANTÚNEZ GONZÁLEZ	223571	A PEDREIRA
8420254	JONATAN ANTÚNEZ GONZÁLEZ	223571	A PEDREIRA
8420254	JONATAN ANTÚNEZ GONZÁLEZ	223571	A PEDREIRA
8420254	JONATAN ANTÚNEZ GONZÁLEZ	223571	A PEDREIRA
8420254	JONATAN ANTÚNEZ GONZÁLEZ	223571	A PEDREIRA
8420255	JONATAN ANTÚNEZ GONZÁLEZ	223571	A PEDREIRA

Select ID of visit column

Visit.ID..Transect.Sample.ID.

Select BMS ID column

Select transect ID column

Transect.ID

Select date of survey column

Date

Select year column

Select month column

Select day column

Select species column

Species.Name

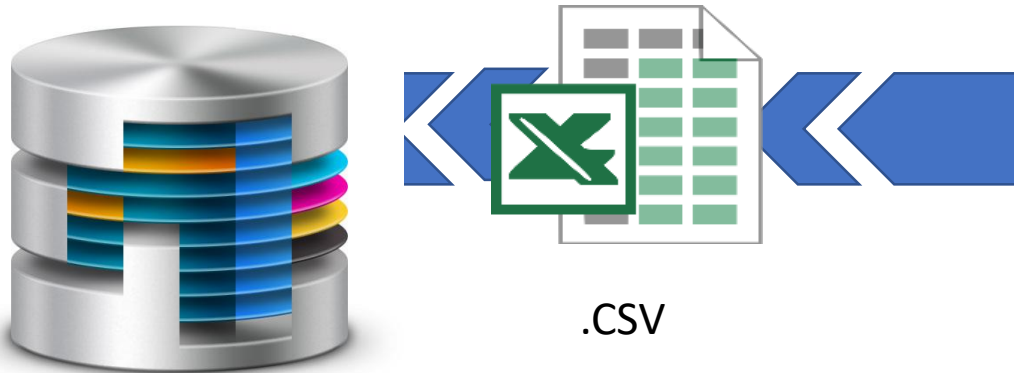
Input table

Output table

visit_id	bms_id	transect_id	visit_date	year	month	day	species_name	count
8626338	NA	244316	2020-06-05	NA	NA	NA	Leptotes pirithous	2
8626338	NA	244316	2020-06-05	NA	NA	NA	Leptotes pirithous	8
8626338	NA	244316	2020-06-05	NA	NA	NA	Papilio machaon	1
8626338	NA	244316	2020-06-05	NA	NA	NA	Pararge aegeria	6
8626338	NA	244316	2020-06-05	NA	NA	NA	Pararge aegeria	4
8626338	NA	244316	2020-06-05	NA	NA	NA	Pararge aegeria	16
8626338	NA	244316	2020-06-05	NA	NA	NA	Pararge aegeria	2
8626338	NA	244316	2020-06-05	NA	NA	NA	Pieris	1
8626338	NA	244316	2020-06-05	NA	NA	NA	Pieris	1
8626338	NA	244316	2020-06-05	NA	NA	NA	Pieris	1

# Standardizing your BMS data

## Export to eBMS database



Select species column  
Species.Name

Select count column  
count

Select date format (please ignore separator)  
☒ day/month/year  
☐ month/day/year  
☐ year/month/day

Download output table

latest year to display (MAY REMOVE):  
2022



Select BMS ID column

bms\_id

Select transect ID column

transect\_id

Select transect length column


transect\_length

Select transect longitude column

transect\_lon

Select transect latitude column

transect\_lat

 Download output info table

Select the latitude and longitude format

Decimal degrees

Name country of survey

United Kingdom

Input info table

Output info table

bms_id	transect_id	transect_length	transect_lon	transect_lat
UKBMS	UKBMS.1	2469	-0.222413325	52.41362531
UKBMS	UKBMS.1	2038	-0.215690124	52.42051462
UKBMS	UKBMS.10	5119	-4.165365502	51.56187537
UKBMS	UKBMS.10	4020	-4.14814471	51.56903985
UKBMS	UKBMS.100	5267	-3.945936355	52.54682359
UKBMS	UKBMS.1001	1500	-1.455691314	51.11122729
UKBMS	UKBMS.1002	2400	-0.943141845	51.03577961
UKBMS	UKBMS.1002	2000	-0.943141845	51.03577961
UKBMS	UKBMS.1003	1500	-1.485929493	51.21836956
UKBMS	UKBMS.1004	2190	-1.348412477	50.8157278

Number of transects per year

[Map of transects](#)

Number of visits per transects

Number of visits per month of the year

Number of species per year

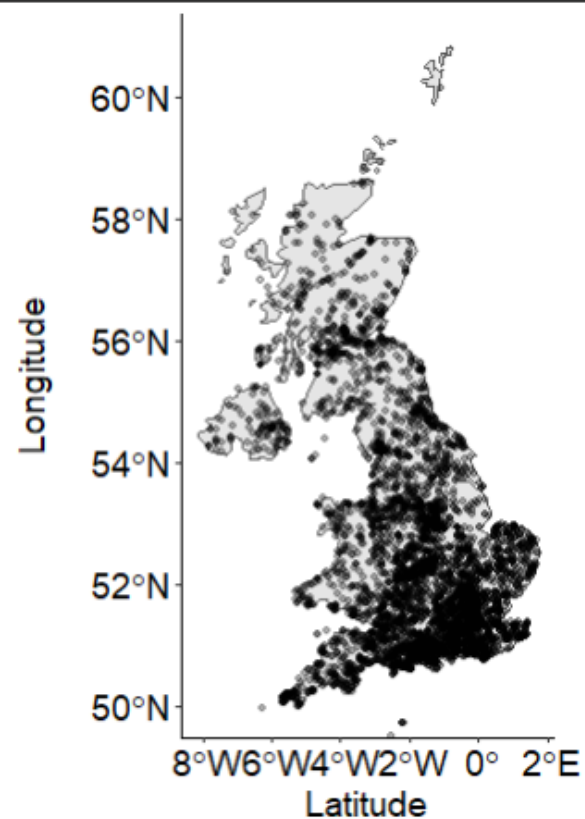
Number of individuals per year

Number of species

Distribution and species richness of each transect

Number of species detected in each butterfly monitoring week in 2020

Number of individuals counted per km in each butterfly monitoring week in 2020





Number of transects per year

[Map of transects](#)

Number of visits per transects

Number of visits per month of the year

Number of species per year

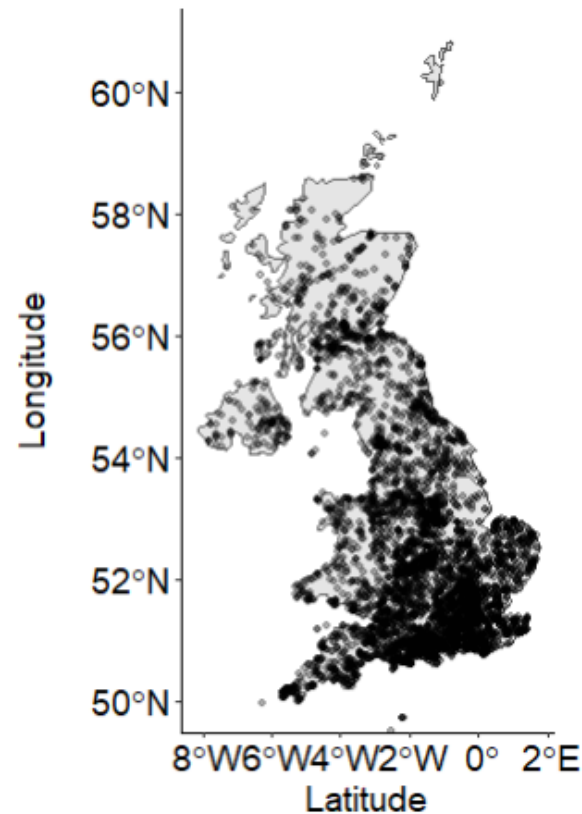
Number of individuals per year

Number of species

Distribution and species richness of each transect

Number of species detected in each butterfly monitoring week in 2020

Number of individuals counted per km in each butterfly monitoring week in 2020



Integrate rbms functions