How to produce national indicators from BMS

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David Roy

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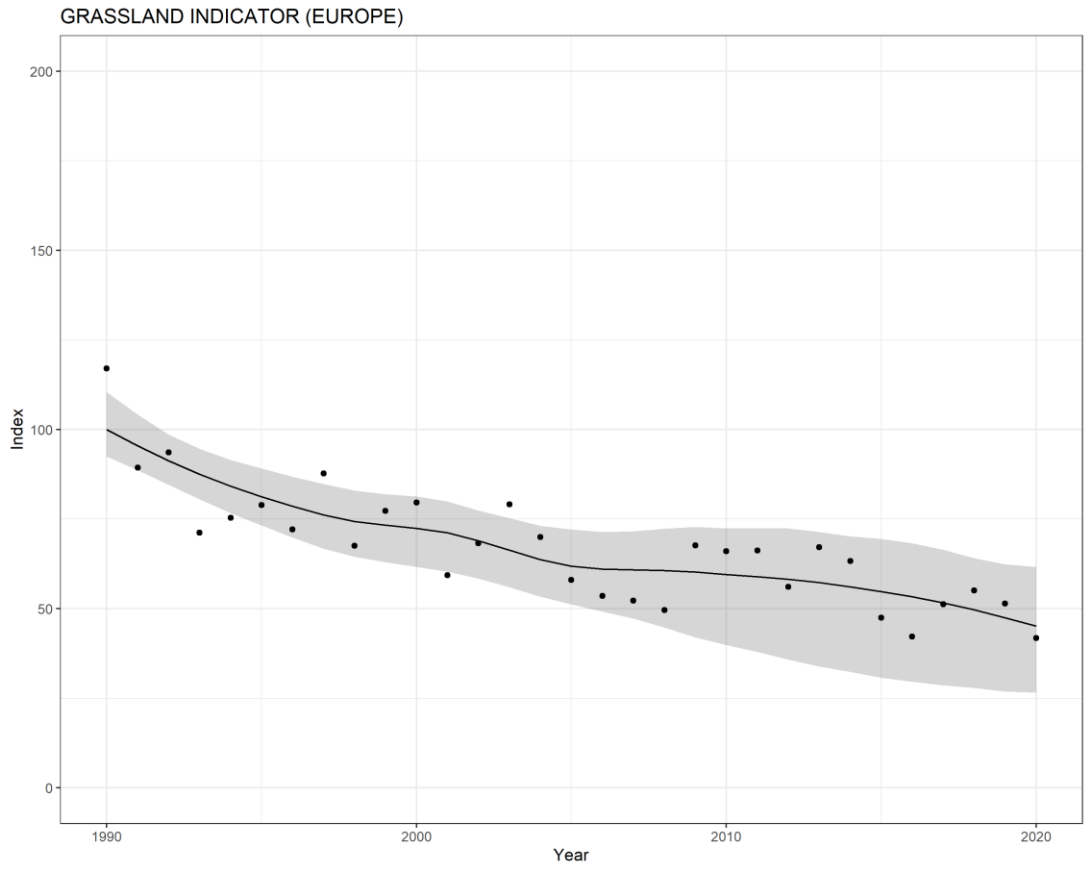
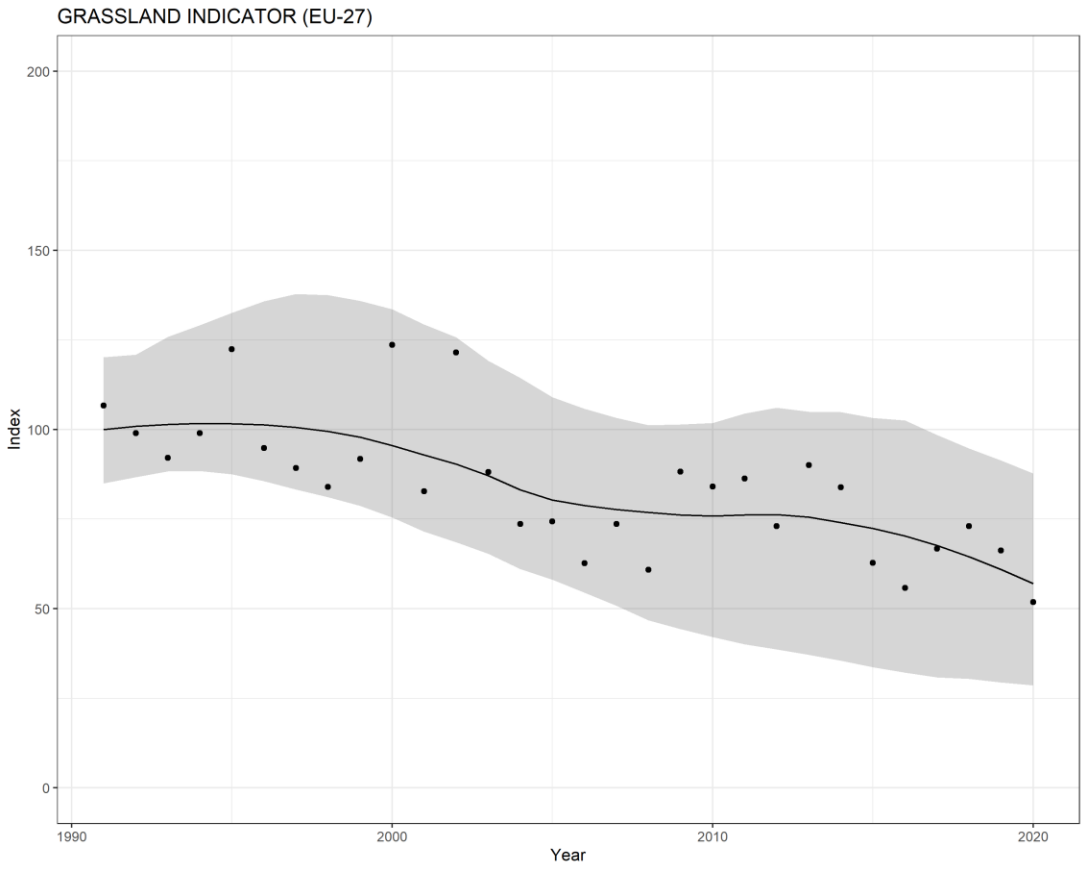
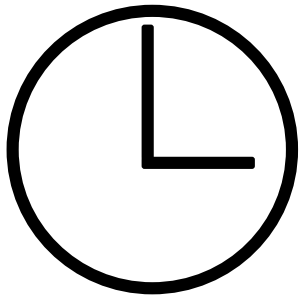
The European Grassland Indicator (1990 - 2020)
eBMS v4.2





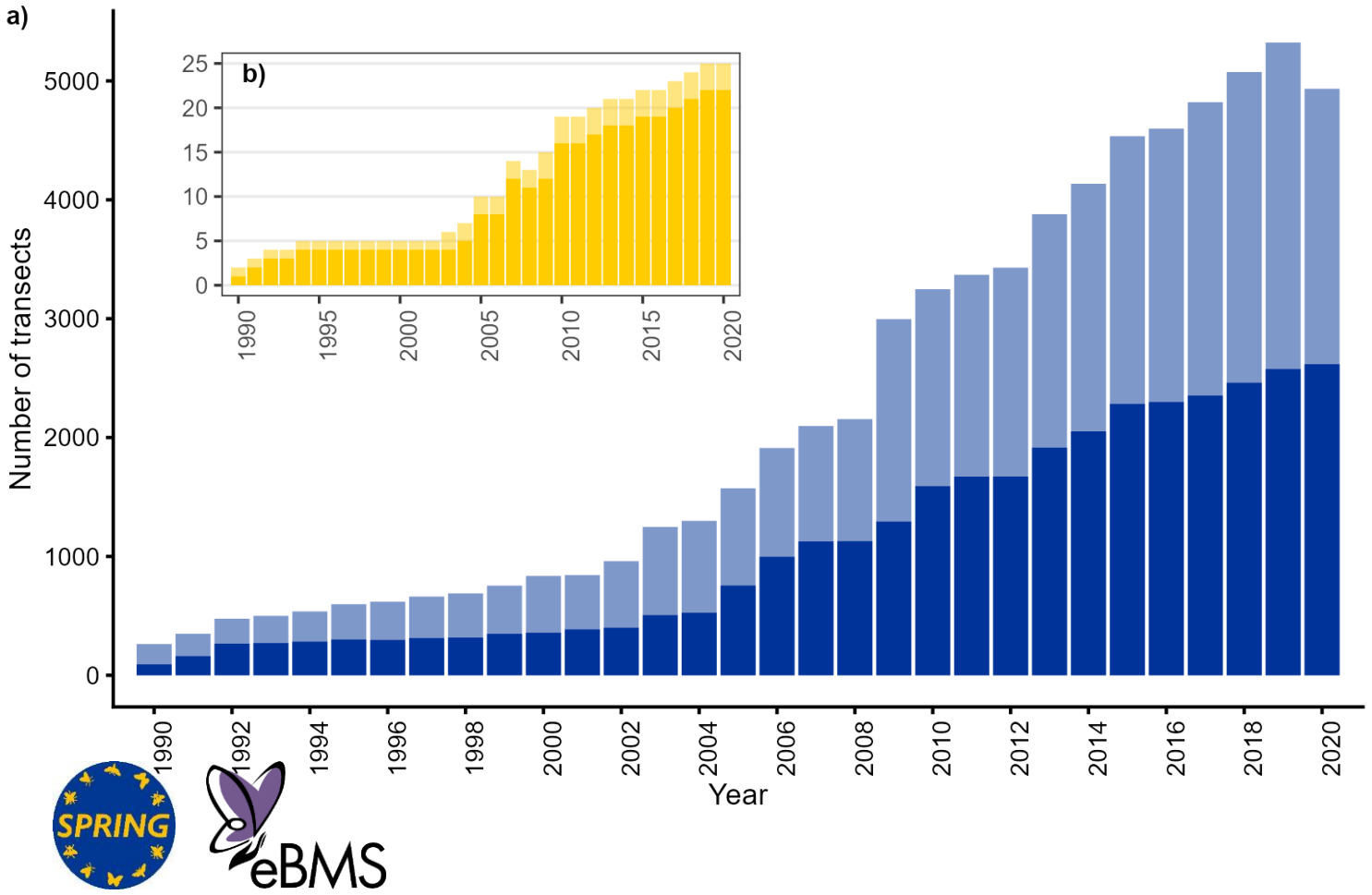
Ingredients

- 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_
as year,
    EXTRACT(MONTH from v.visit
as month,
    EXTRACT(DAY from v.visit_d
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
(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[1,2]*, Stephen N. Freeman[2], Tom Brereton[3] and David B. Roy[2]

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

Journal of Applied Ecology

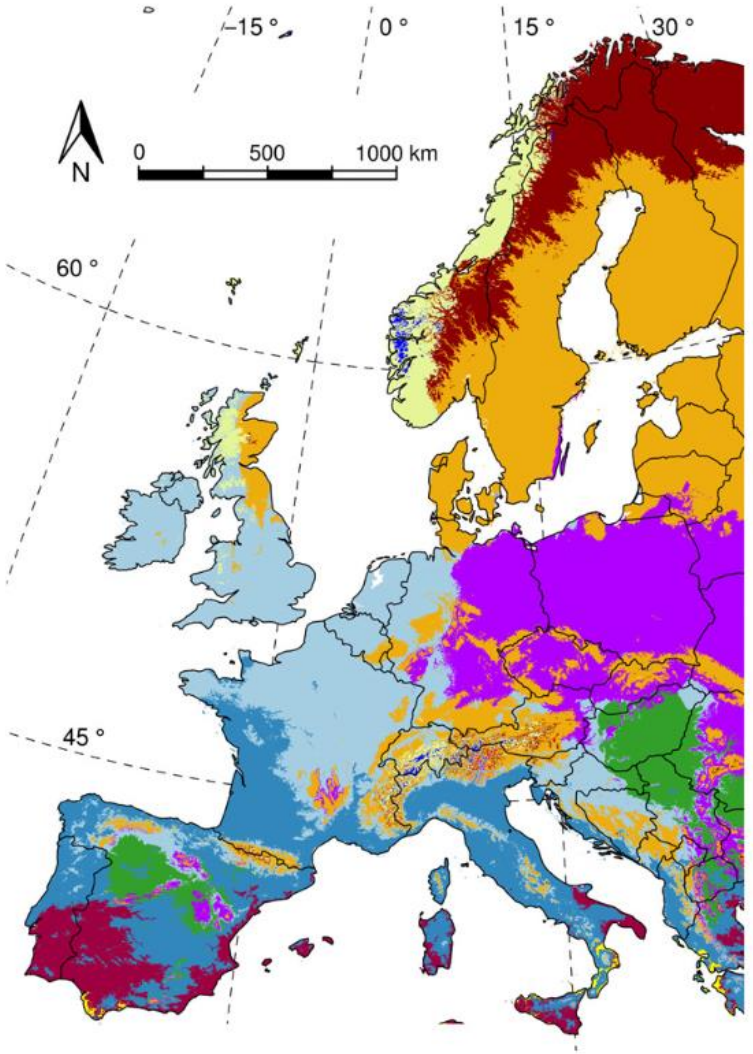
Journal of Applied Ecology 2016, **53**, 501–510 doi: 10.1111/1365-2664.12561

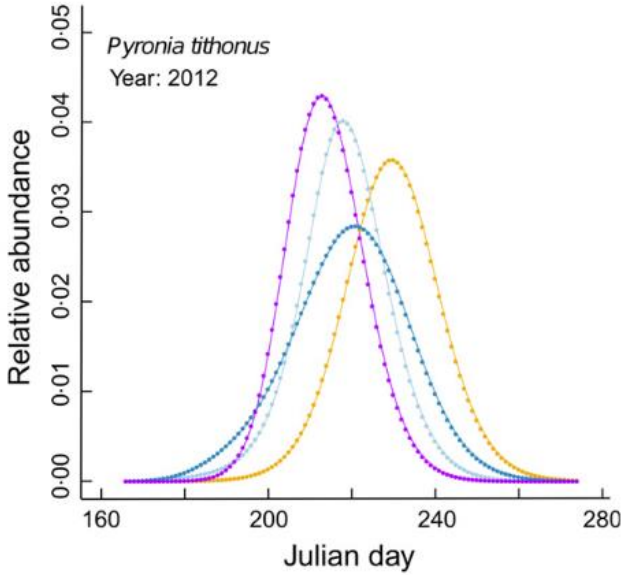
A regionally informed abundance index for supporting integrative analyses across butterfly monitoring schemes

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

SPRING

eBMS





- 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/

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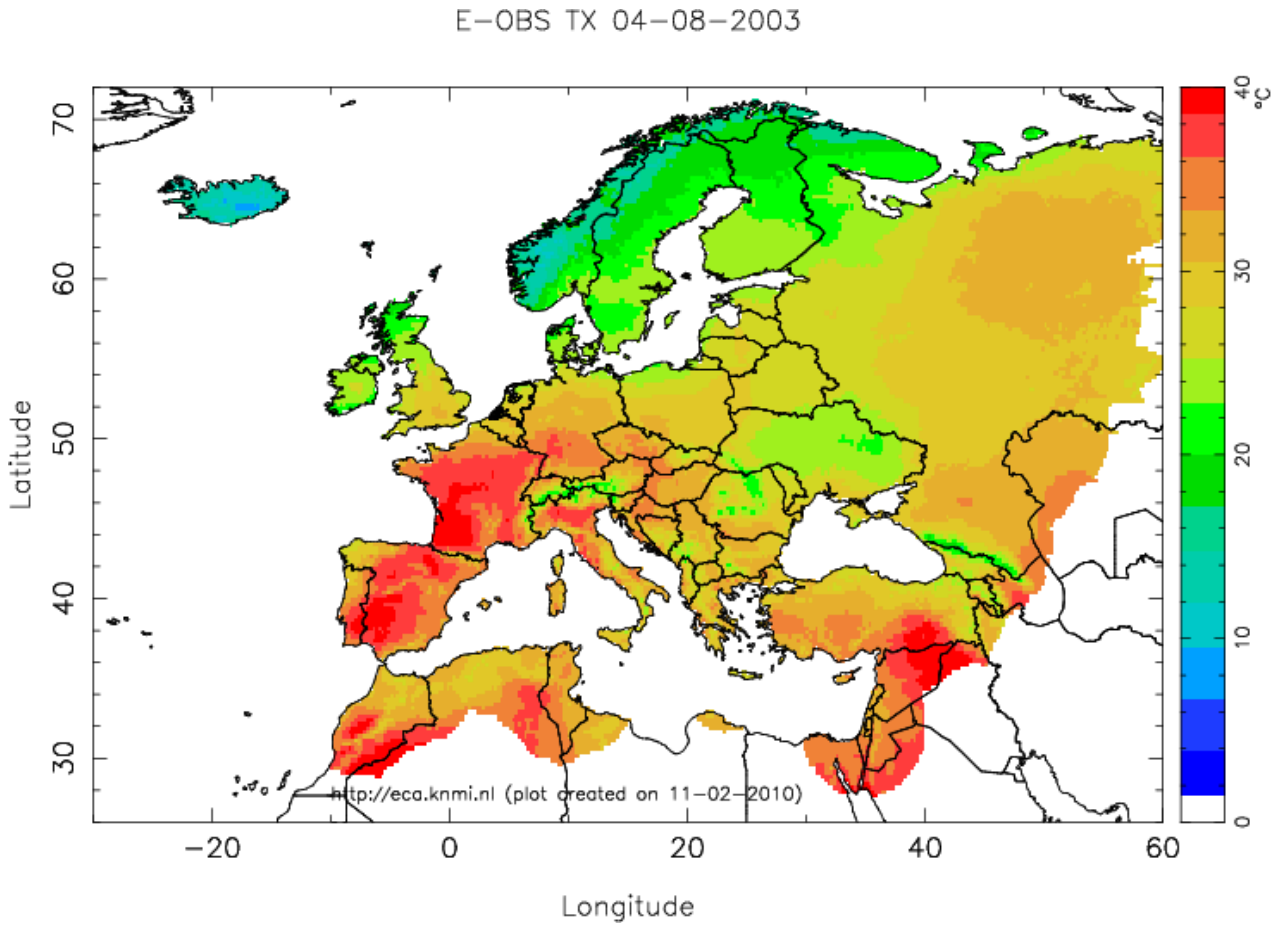
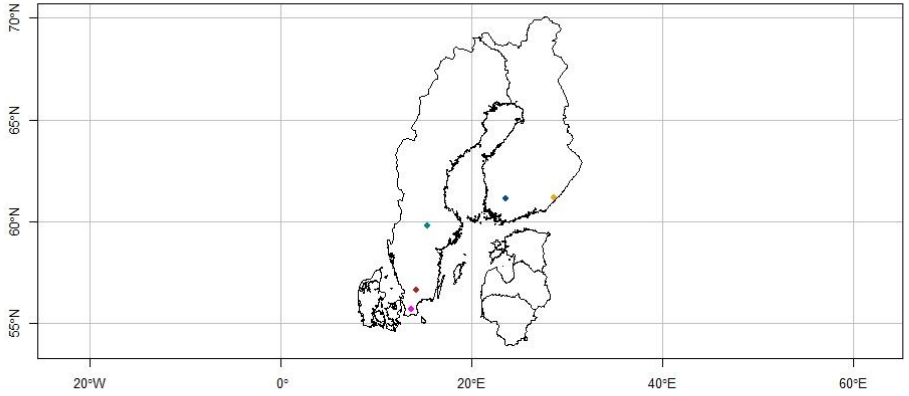
Index and Climate data

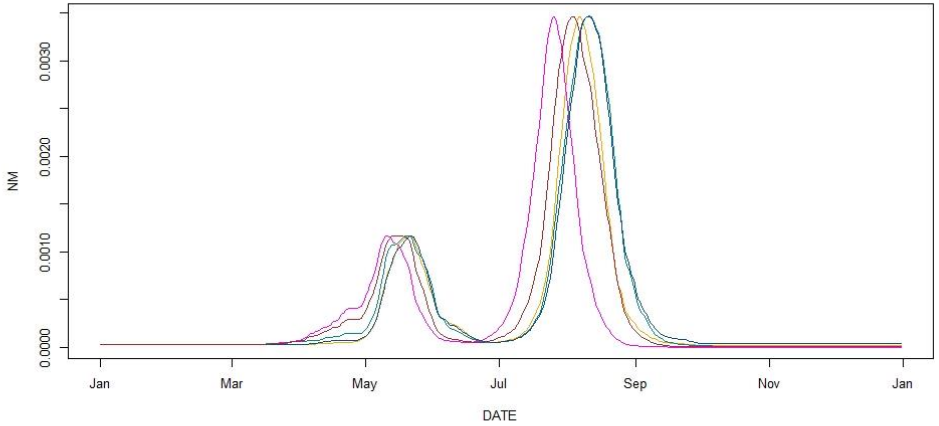
https://retoschmucki.github.io/climateExtract/

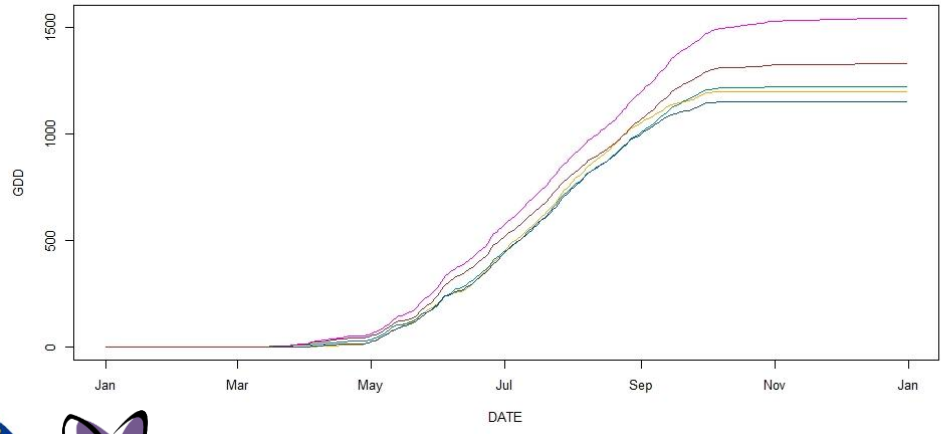


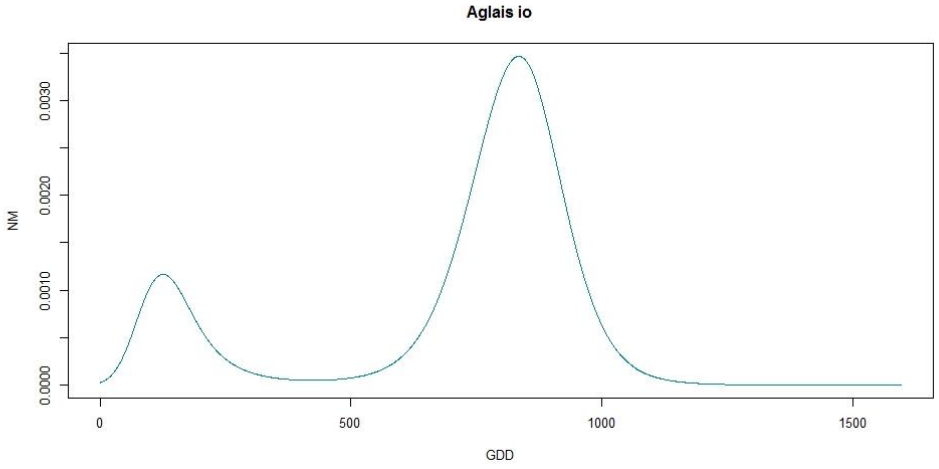
European Climate Assessment & Dataset
https://www.ecad.eu/

Accumulated Growing Degree Days (7-14 °C)









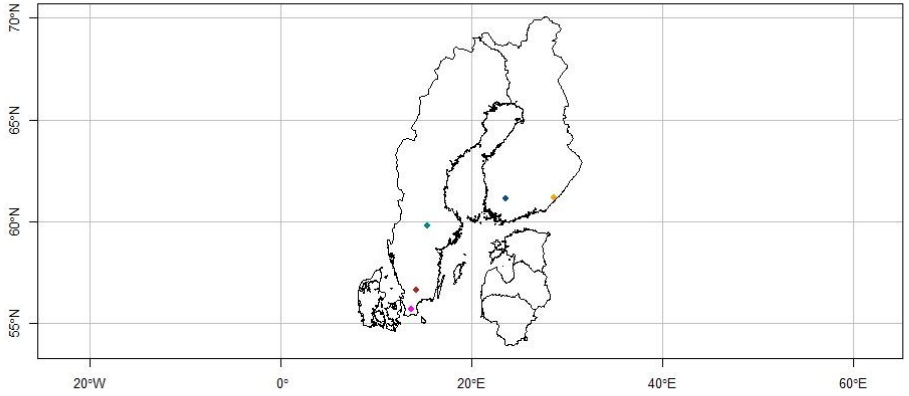
Model

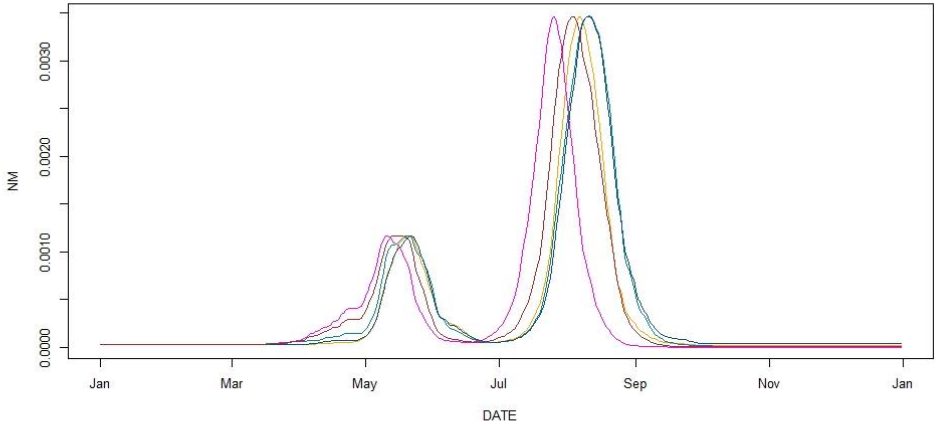

```
COUNT ~ s(ACGDD, bs = c(\"ps\")) +
        s(Y, bs = c(\"ps\")) +
        ti(ACGDD, Y, bs = c(\"ps\",\"ps\")) +
        factor(SITE_ID)
```

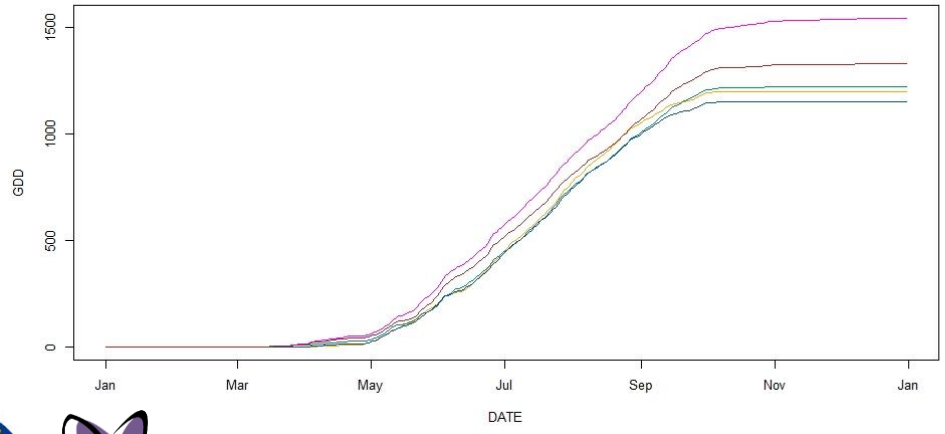
Latitude

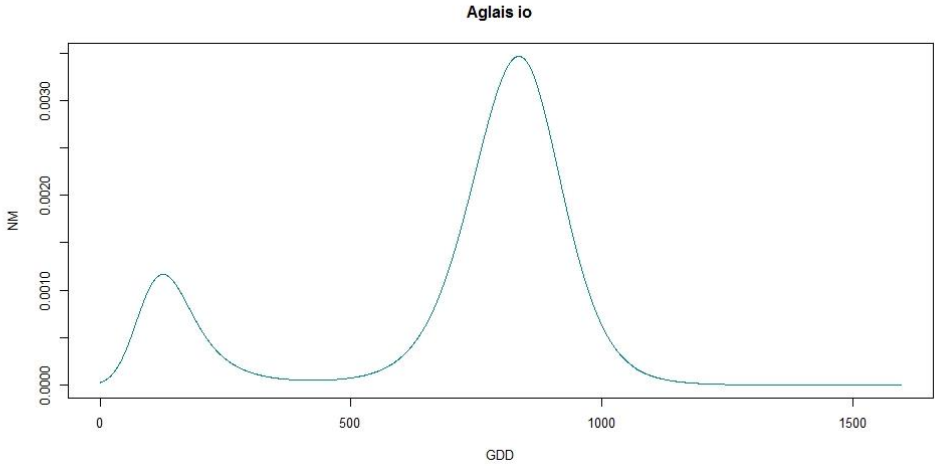

```
flight_curve(count_data, NbrSample = 500, MinVisit = min_visit,
MinOccur = min_count, MinNbrSite = min_site, MaxTrial = 4,
GamFamily = "nb", SpeedGam = FALSE, CompltSeason = TRUE, SelectYear = N
TimeUnit = "d", mod_form = my_mod4,
tp_col = c("ACGDD", "GDD", "Y"))
```

Accumulated Growing Degree Days (7-14 °C)

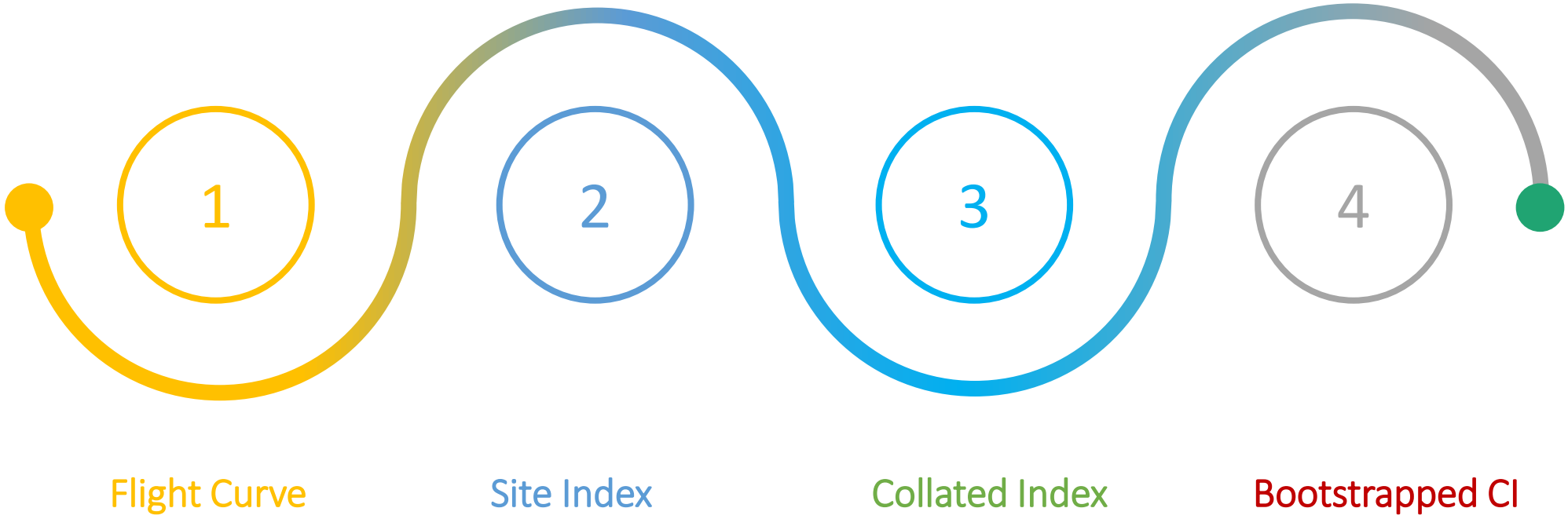








Collated abundance index with Confidence Intervals



Multi-site multi-species trend

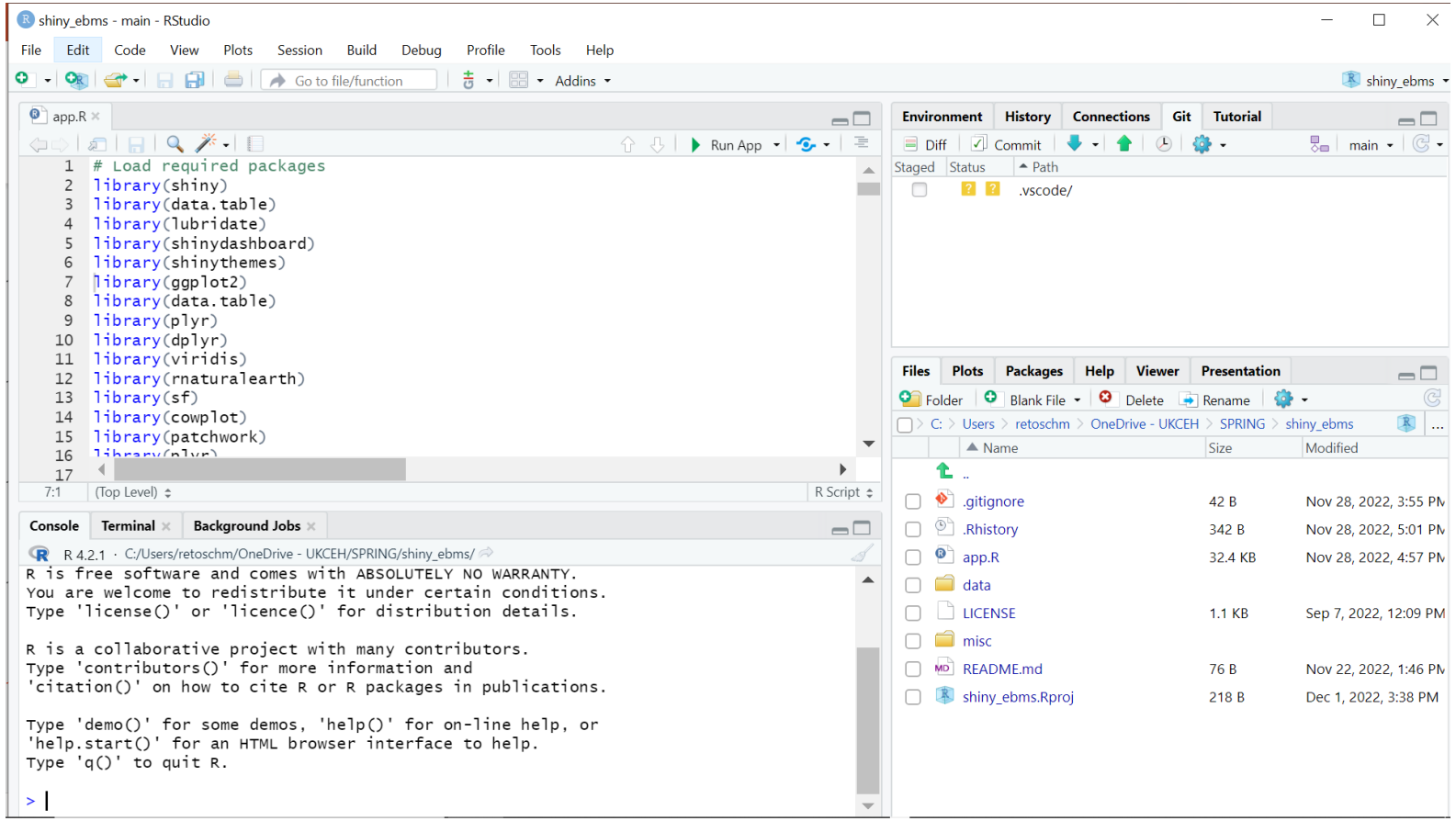
	sp1	sp2	Sp1 & sp2	sp3	sp3 Adj.	Multi-sp Index
t	100	100	100	NA		100
t + 1	97	85	90.8	NA		90.8
t + 2	76	83	79.4	100	79.4	79.4
t + 3	80	75	77.4	86	68.3	74.2
t + 4	75	56	64.8	78	61.9	63.8
t + 5	80	60	69.2	65	51.6	62.8
t + 6	72	64	67.8	55	43.6	58.6
t + …	65	62	63.4	65	51.6	59.2

Informed by 2 species

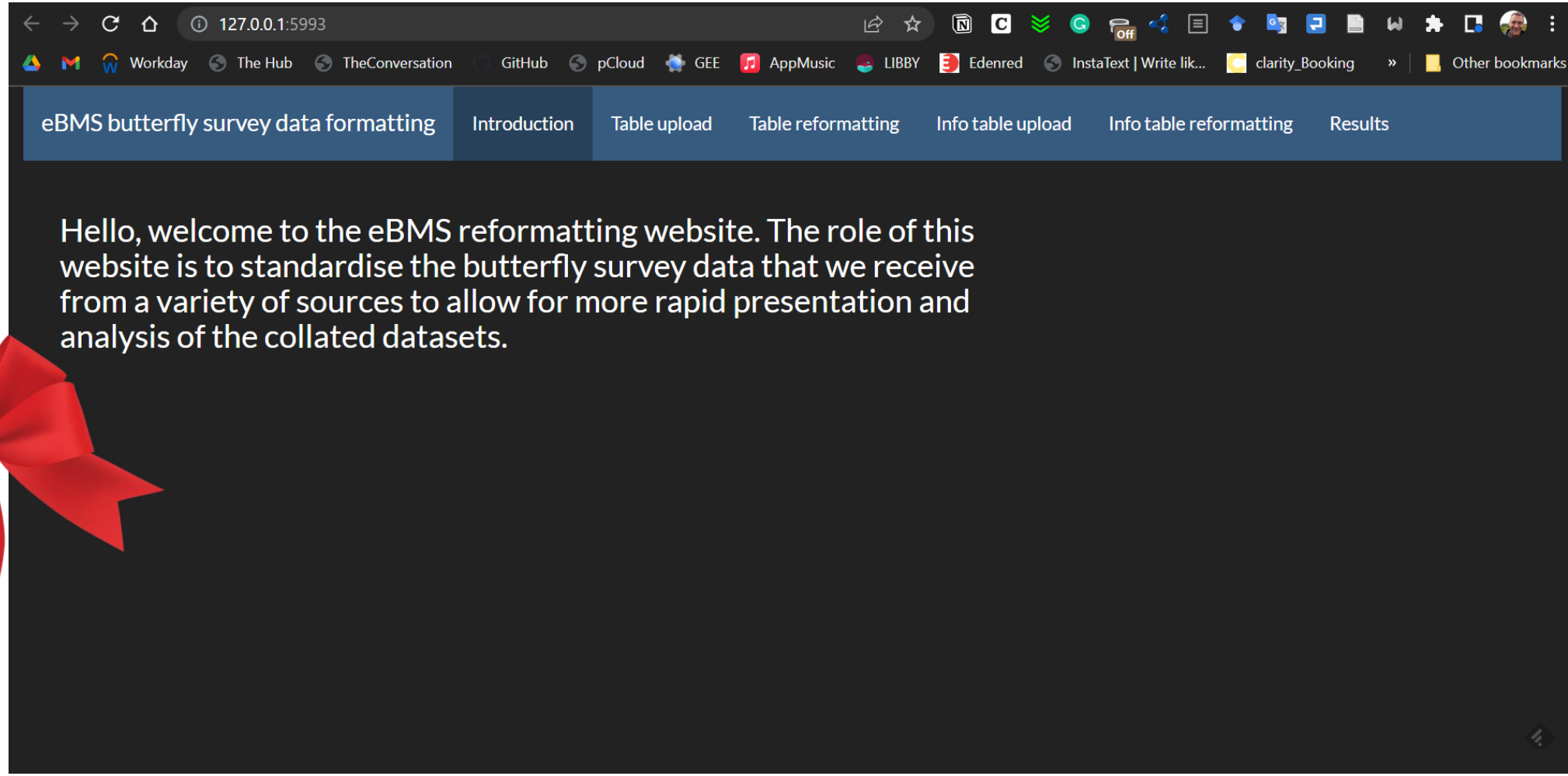
Informed by 3 species

Standardizing your BMS data, visualisation and reporting

Standardizing your BMS data, visualisation and reporting



Standardizing your BMS data, visualisation and reporting



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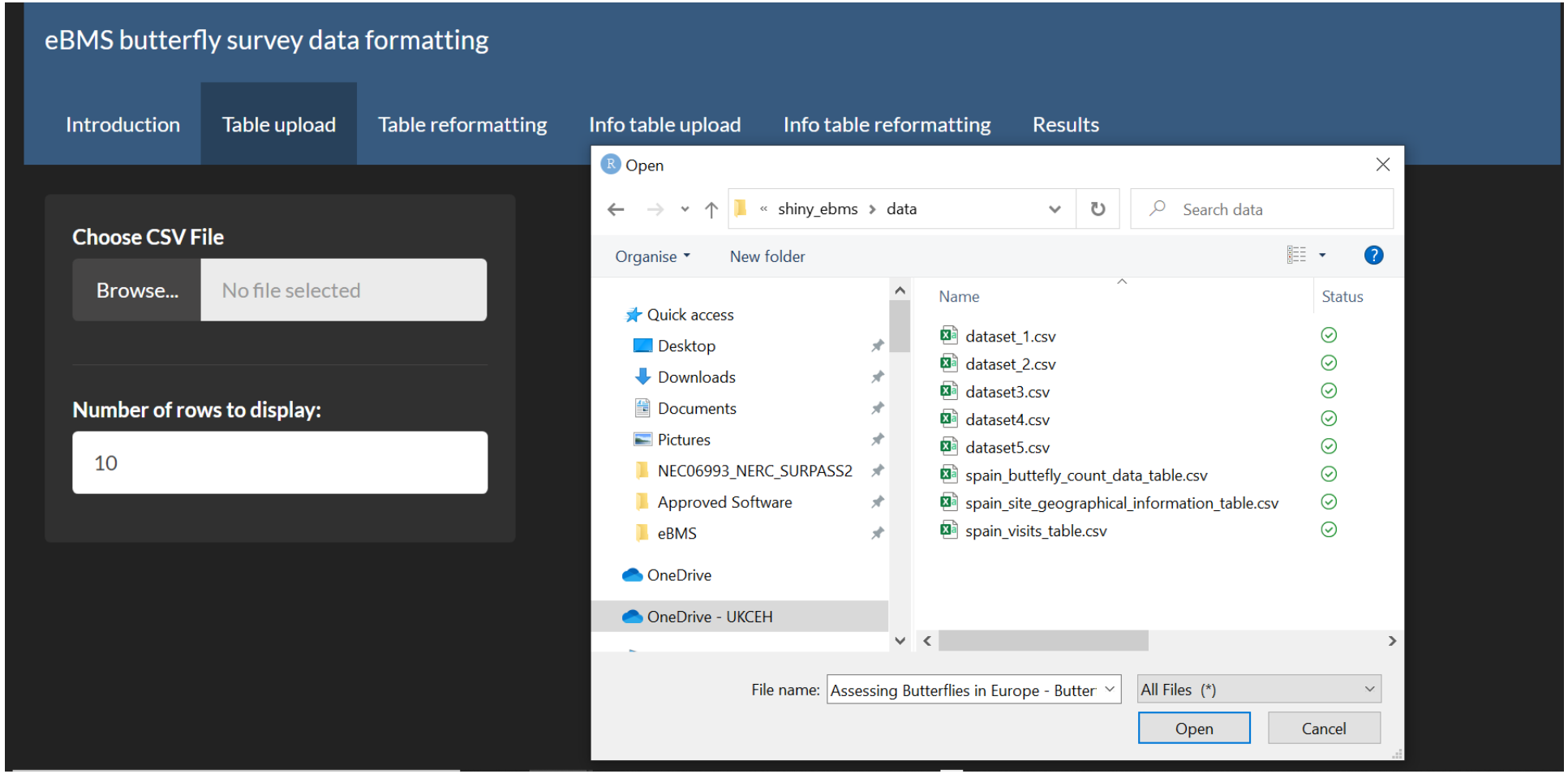
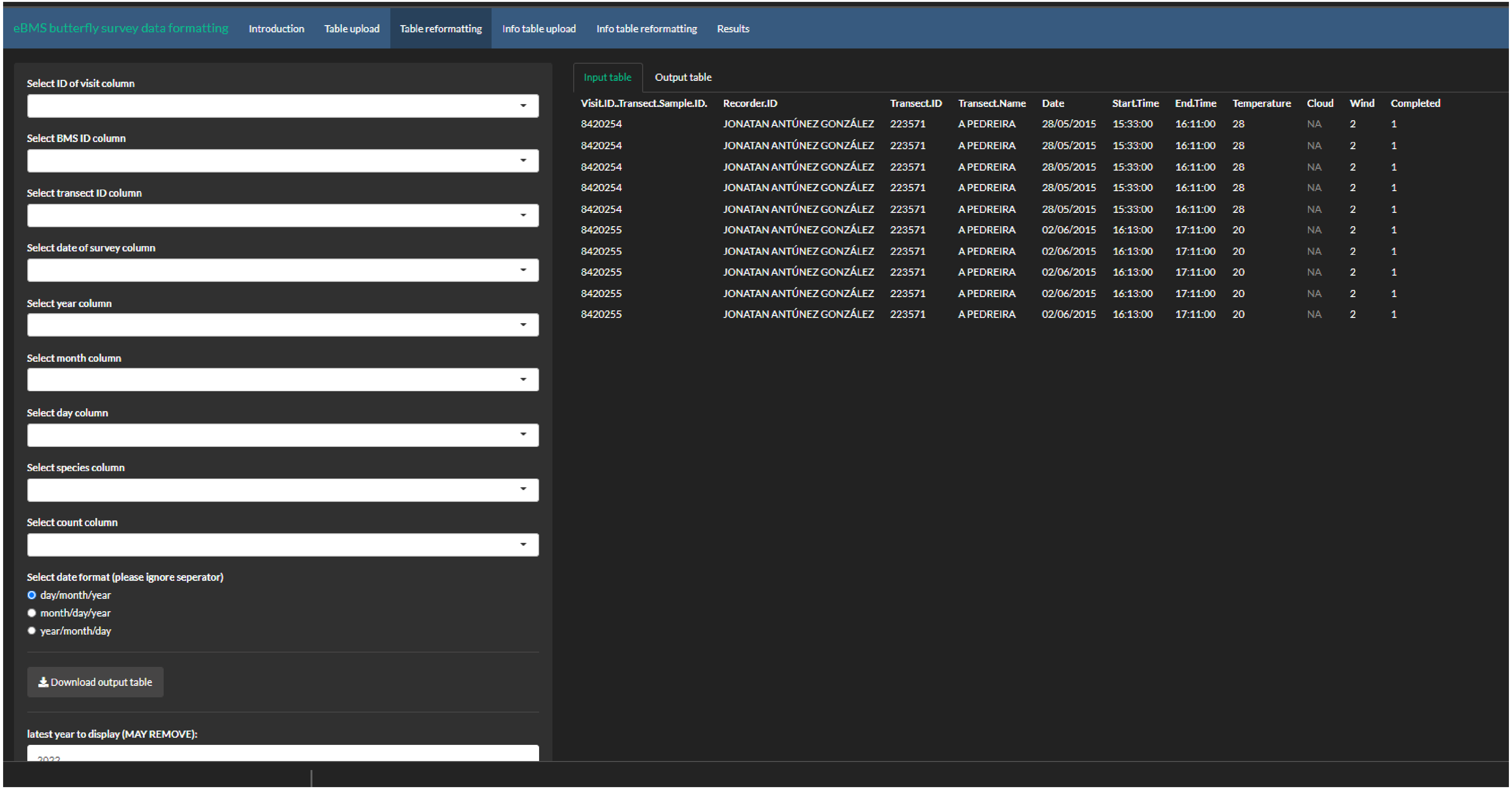
Standardizing your BMS data, visualisation and reporting





Visit.ID..Transect.Sample.ID.	Recorder.ID	Transect.ID	Transect.Name	Date	Start.Time	End.Time	Temperature	Cloud	Wind	Completed
8420254	JONATAN ANTÚNEZ GONZÁLEZ	223571	A PEDREIRA	28/05/2015	15:33:00	16:11:00	28	NA	2	1
8420254	JONATAN ANTÚNEZ GONZÁLEZ	223571	A PEDREIRA	28/05/2015	15:33:00	16:11:00	28	NA	2	1
8420254	JONATAN ANTÚNEZ GONZÁLEZ	223571	A PEDREIRA	28/05/2015	15:33:00	16:11:00	28	NA	2	1
8420254	JONATAN ANTÚNEZ GONZÁLEZ	223571	A PEDREIRA	28/05/2015	15:33:00	16:11:00	28	NA	2	1
8420254	JONATAN ANTÚNEZ GONZÁLEZ	223571	A PEDREIRA	28/05/2015	15:33:00	16:11:00	28	NA	2	1
8420255	JONATAN ANTÚNEZ GONZÁLEZ	223571	A PEDREIRA	02/06/2015	16:13:00	17:11:00	20	NA	2	1
8420255	JONATAN ANTÚNEZ GONZÁLEZ	223571	A PEDREIRA	02/06/2015	16:13:00	17:11:00	20	NA	2	1
8420255	JONATAN ANTÚNEZ GONZÁLEZ	223571	A PEDREIRA	02/06/2015	16:13:00	17:11:00	20	NA	2	1
8420255	JONATAN ANTÚNEZ GONZÁLEZ	223571	A PEDREIRA	02/06/2015	16:13:00	17:11:00	20	NA	2	1
8420255	JONATAN ANTÚNEZ GONZÁLEZ	223571	A PEDREIRA	02/06/2015	16:13:00	17:11:00	20	NA	2	1

eBMS butterfly survey data formatting | Introduction | Table upload | Table reformatting | Info table upload | Info table reformatting | Results

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

eBMS butterfly survey data formatting | Introduction | Table upload | Table reformatting | Info table upload | Info table reformatting | Results

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

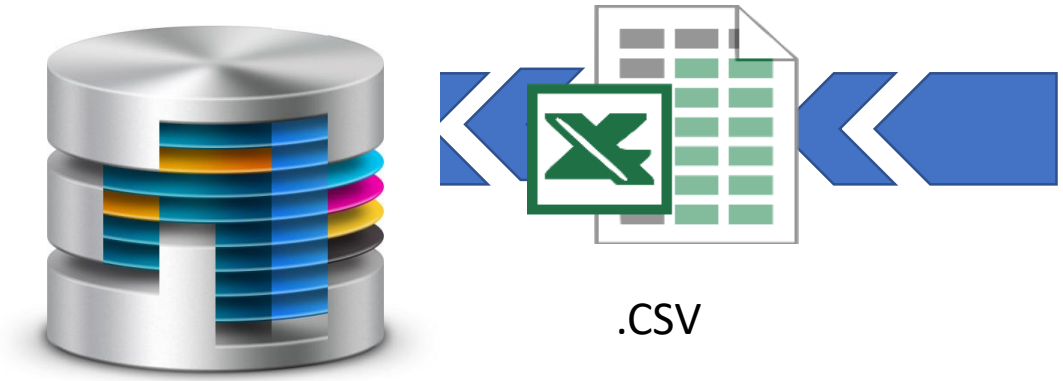
Species.Name

Input table | Output table

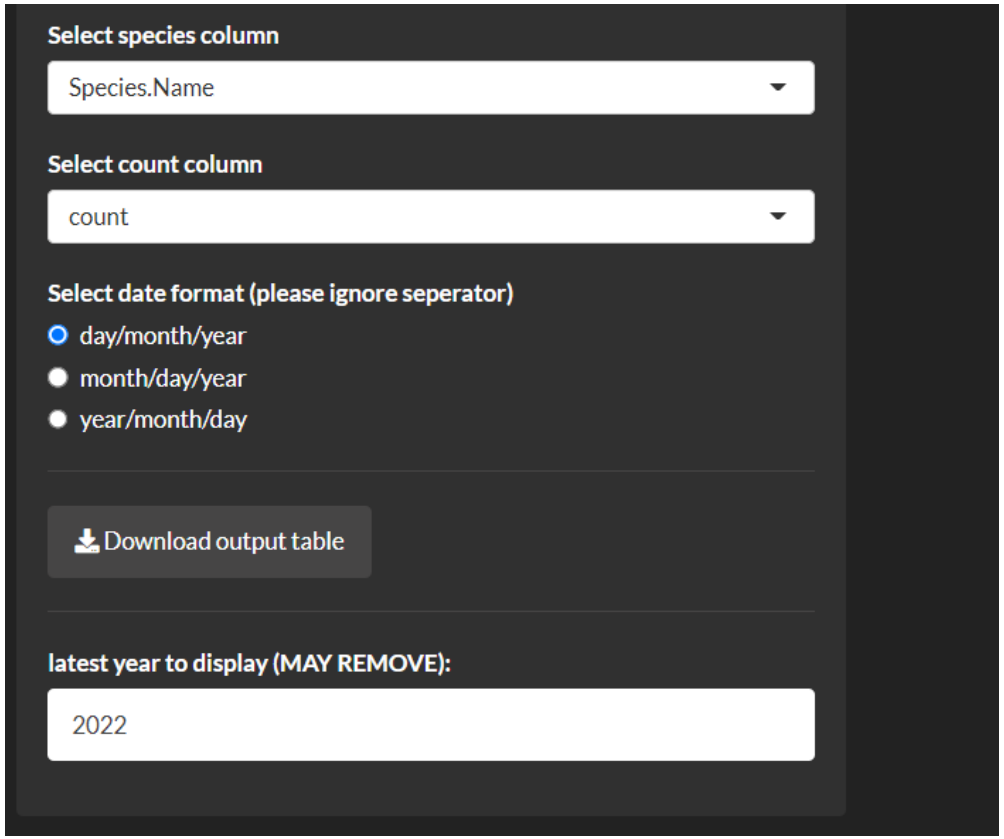
visit_id	bms_id	transect_id	visit_date	year	month	day	species_name	count
8626338	NA	244316	2020-06-05	NA	NA	NA	Leptotes pirithous	2
8626338	NA	244316	2020-06-05	NA	NA	NA	Leptotes pirithous	8
8626338	NA	244316	2020-06-05	NA	NA	NA	Papilio machaon	1
8626338	NA	244316	2020-06-05	NA	NA	NA	Parargе aegeria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



.CSV



eBMS butterfly survey data formatting | Introduction | Table upload | Table reformatting | Info table upload | Info table reformatting | Results

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

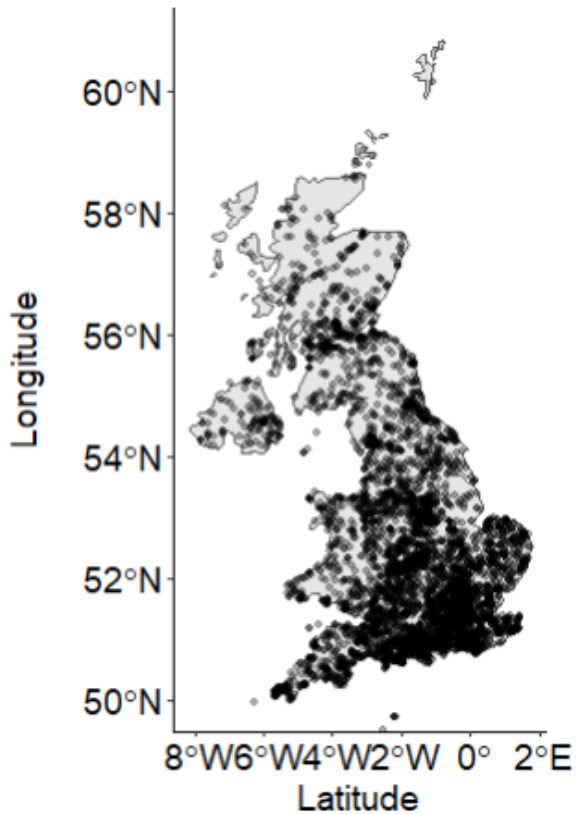
bms_id	transect_id	transect_length	transect_lon	transect_lat
UKBMS	UKBMS.1	2469	-0.222413325	52.41362531
UKBMS	UKBMS.1	2038	-0.215690124	52.42051462
UKBMS	UKBMS.10	5119	-4.165365502	51.56187537
UKBMS	UKBMS.10	4020	-4.14814471	51.56903985
UKBMS	UKBMS.100	5267	-3.945936355	52.54682359
UKBMS	UKBMS.1001	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

eBMS butterfly survey data formatting | Introduction | Table upload | Table reformatting | Info table upload | Info table reformatting | Results

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



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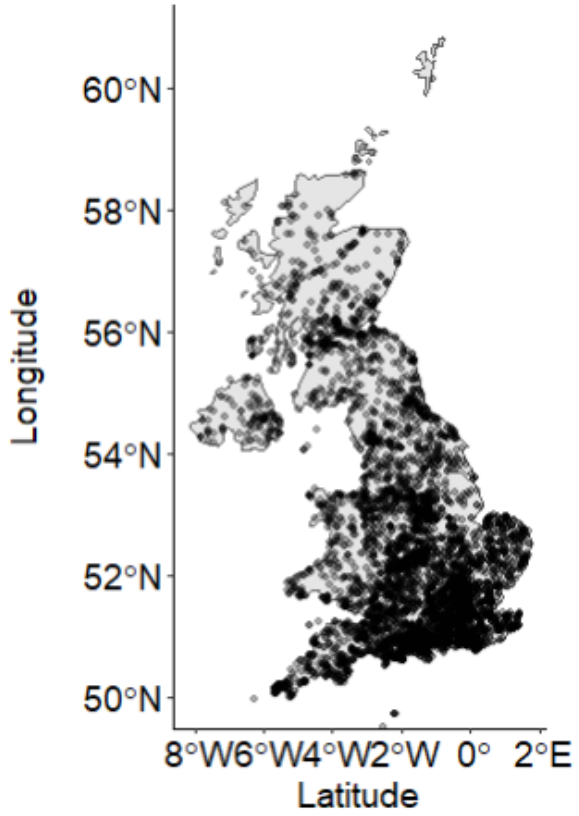

rbms

Integrate rbms functions