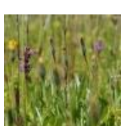
Assessing ButterfLies in Europe (ABLE)

eBMS results: new indicators

Chris van Swaay

ABLE meeting, Laufen,

5 December 2019

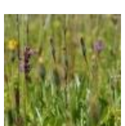


Two types of indicators

- MultiSpecies Indicators (MSI)
    - All Butterfly Indicator
    - Grassland butterfly indicator
    - Woodland butterfly indicator
    - (wetland and urban)
- Community indicators


MultiSpecies Indicators

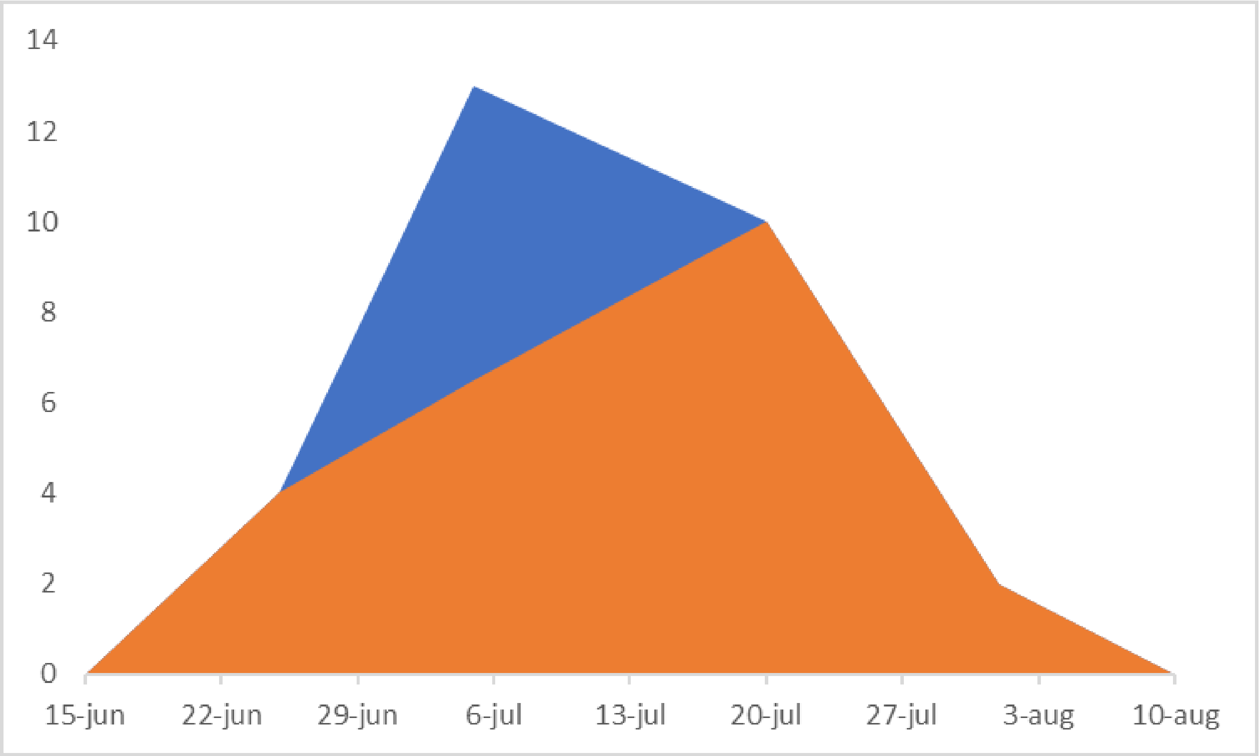
- Step 1: get species trends per BMS
- Step 2: make European trend per species
- Step 3: combine indexes and trends to indicators




Step 1: get species trends per BMS

- Combine counts per transect
  - Linear interpolation
  - GAM
  - GAI
- Result: density per transect per year
- Calculate species indexes and trend per BMS:
  - Rtrim
  - GAI


Linear interpolation



GAM

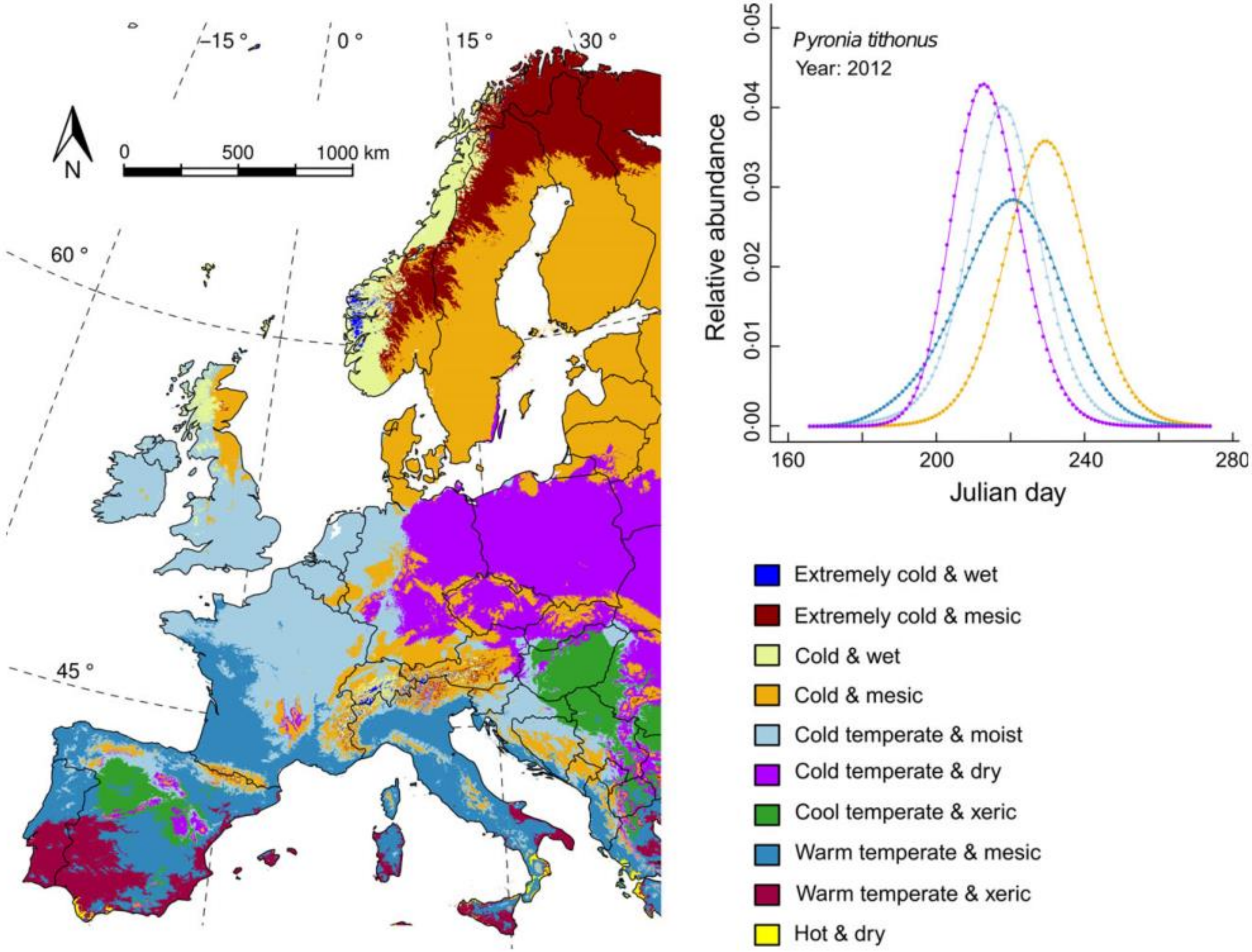


Fig. 1. Climate regions across Europe as defined in Metzger *et al.* (2013) with the flight curve of *Pyronia tithonus* observed in 2012 within four regions (Cold & mesic [yellow], Cold temperate & moist [pale blue], Cold temperate & dry [purple], Warm temperate & mesic [blue]).

- Combine counts per transect
  - Linear interpolation
  - GAM
  - GAI
- Result: density per transect per year
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Result of the regional_gam

SITE	SPECIES	YEAR	regional_gam	prop_pheno_sampled
31	heivlinder	1990	38	0,989076469
32	heivlinder	1990	54,5	0,989076469
33	heivlinder	1990	0	0,89310116
42	heivlinder	1990	0	0,549306465
43	heivlinder	1990	20,9	0,686428603
45	heivlinder	1990	3	0,910927598
49	heivlinder	1990	0	0,509971155
51	heivlinder	1990	0	0,909249595
52	heivlinder	1990	0	0,997340331
53	heivlinder	1990	3,4	0,54034384
57	heivlinder	1990	2,4	0,854267708
61	heivlinder	1990	0	0,920420823
66	heivlinder	1990	4,6	0,362948483


- Combine counts per transect
  - Linear interpolation
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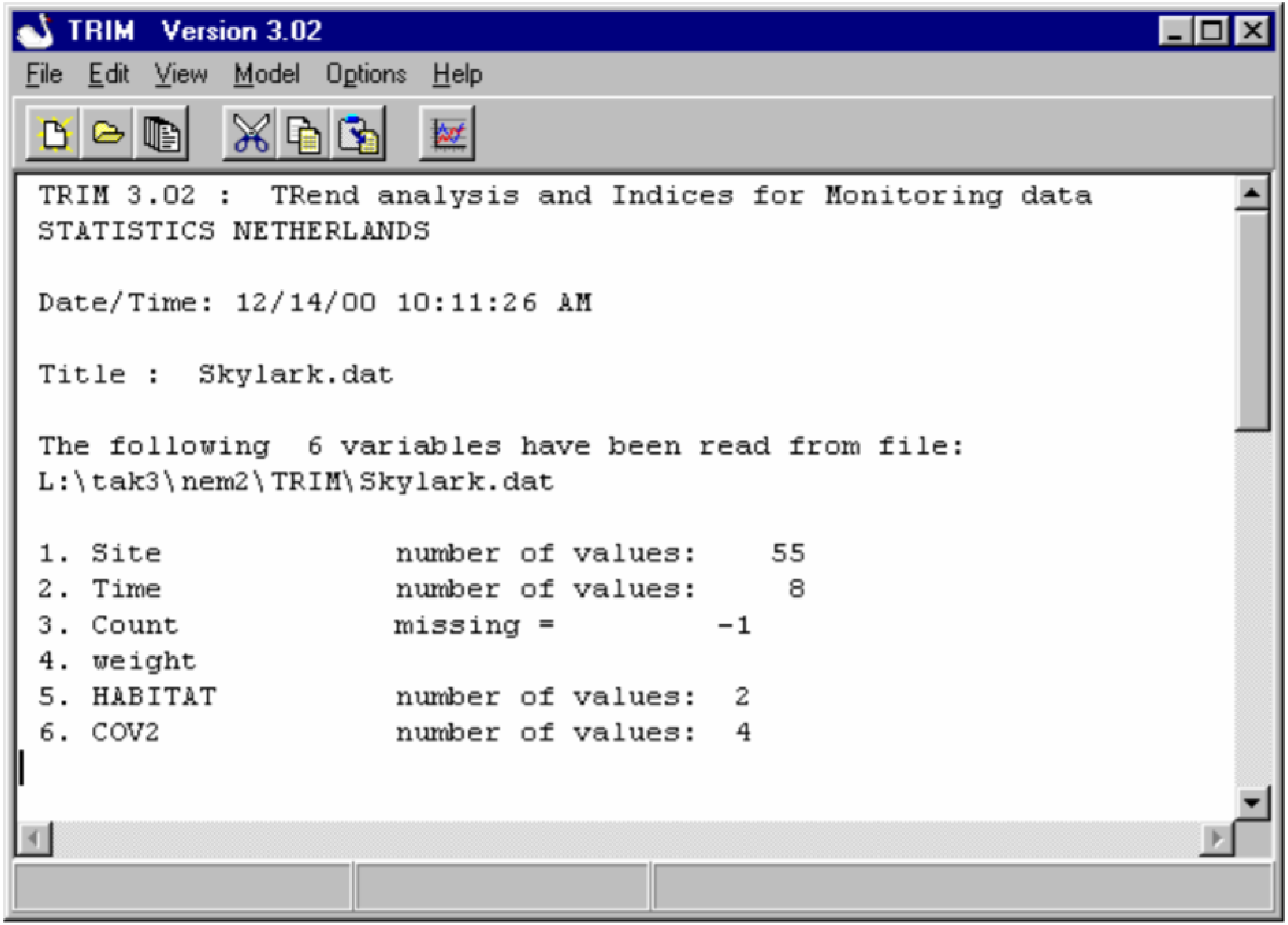
TRIM


TRIM Version 3.02
File Edit View Model Options Help
TRIM 3.02 : TRend analysis and Indices for Monitoring data
STATISTICS NETHERLANDS
Date/Time: 12/14/00 10:11:26 AM
Title : Skylark.dat
The following 6 variables have been read from file:
L:\tak3\nem2\TRIM\Skylark.dat
1. Site number of values: 55
2. Time number of values: 8
3. Count missing = -1
4. weight
5. HABITAT number of values: 2
6. COV2 number of values: 4

rtrim

Package ‘rtrim’

August 24, 2018

Version 2.0.6

Date 2018-08-16

Title Trends and Indices for Monitoring Data

Description The TRIM model is widely used for estimating growth and decline of animal populations based on (possibly sparsely available) count data. The current package is a reimplementation of the original TRIM software developed at Statistics Netherlands by Jeroen Pannekoek. See
<https://www.cbs.nl/en-gb/society/nature-and-environment/indices-and-trends%2d%2dtrim%2d%2d>
for more information about TRIM.

URL https://github.com/markvanderloo/rtrim

BugReports https://github.com/markvanderloo/rtrim/issues

LazyLoad yes

LazyData no

License EUPL

Type Package

Butterfly Conservation Europe

Butterfly Conservation

Centre for Ecology & Hydrology
NATURAL ENVIRONMENT RESEARCH COUNCIL

De Vlinderstichting

HELMHOLTZ CENTRE FOR ENVIRONMENTAL RESEARCH – UFZ

BIOMETRICS DOI: 10.1111/biom.12506

A Generalized Abundance Index for Seasonal Invertebrates

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[2]Centre for Ecology & Hydrology, Benson Lane, Crowmarsh Gifford, Wallingford, Oxfordshire, U.K.
[3]Butterfly Conservation, Manor Yard, East Lulworth, Wareham, Dorset, U.K.
*email: E.B.Dennis@kent.ac.uk

SUMMARY. At a time of climate change and major loss of biodiversity, it is important to have efficient tools for monitoring populations. In this context, animal abundance indices play an important rôle. In producing indices for invertebrates, it is important to account for variation in counts within seasons. Two new methods for describing seasonal variation in invertebrate counts have recently been proposed; one is nonparametric, using generalized additive models, and the other is parametric, based on stopover models. We present a novel generalized abundance index which encompasses both parametric and nonparametric approaches. It is extremely efficient to compute this index due to the use of concentrated likelihood techniques. This has particular relevance for the analysis of data from long-term extensive monitoring schemes with records for many species and sites, for which existing modeling techniques can be prohibitively time consuming. Performance of the index is demonstrated by several applications to UK Butterfly Monitoring Scheme data. We demonstrate the potential for new insights into both phenology and spatial variation in seasonal patterns from parametric modeling and the incorporation of covariate dependence, which is relevant for both monitoring and conservation. Associated R code is available on the journal website.

KEY WORDS: Butterflies; Citizen science; Concentrated likelihood; Normal mixtures; Phenology; UKBMS.

Trends per BMS

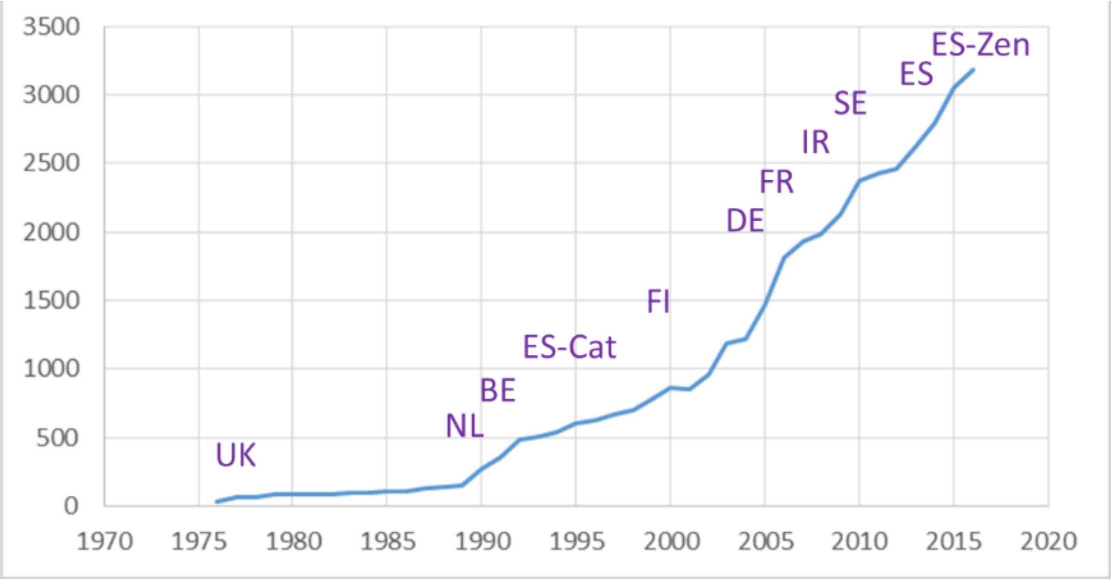
Getting EU species trends

- We now have species trends per BMS.
- These have to be combined to get trends for the whole of the EU
- But not all BMS’s are counted in all years

Number of transects

Butterfly monitoring is growing in popularity across Europe

3.9m counts from 640,000 transect walks (11 schemes)



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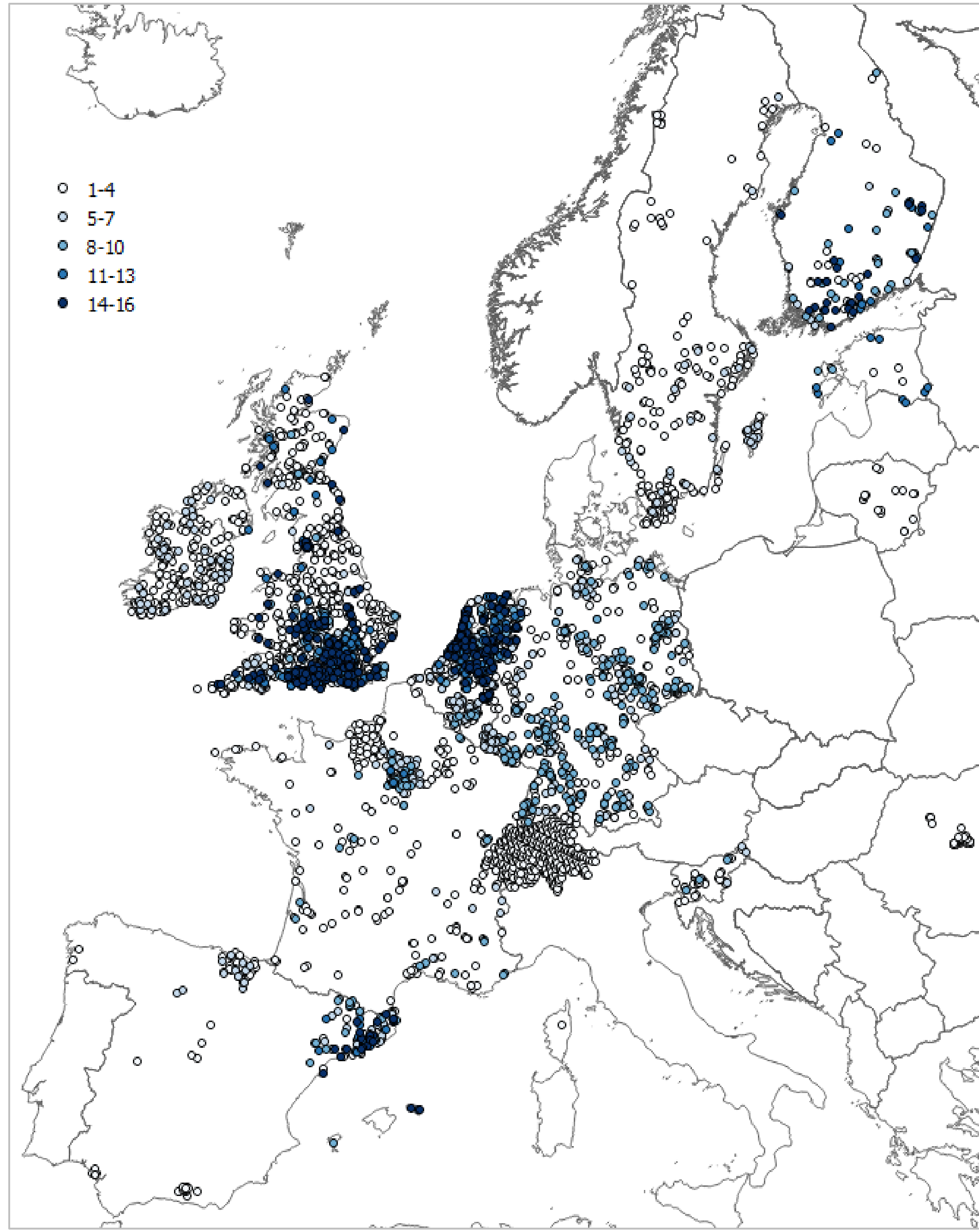
Weighting

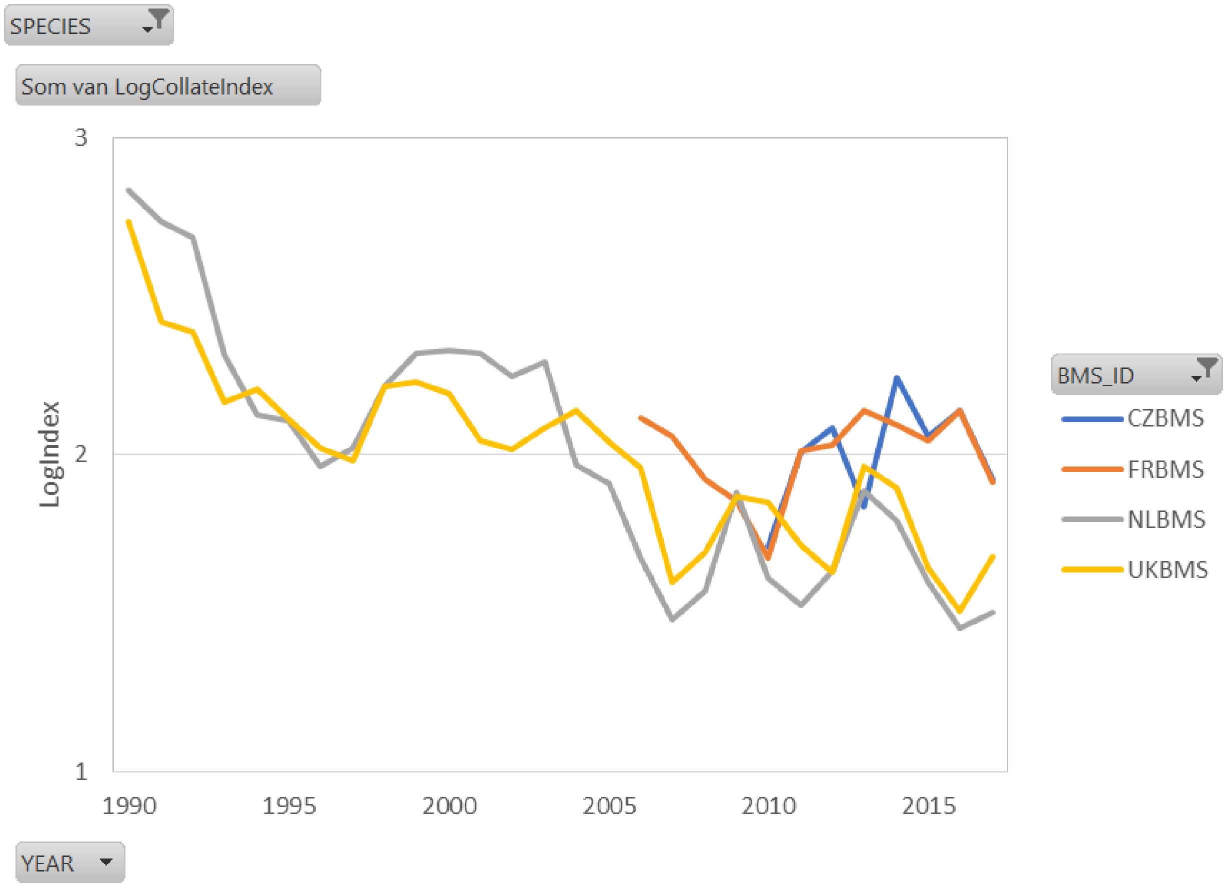
- Without weighting the UKBMS and NLBMS would dominate all EU indexes and trends, as they have by far the most transects.
- Weighting is based on the overlay of distribution map with BMS polygon combined with the density.
- As a consequence transects in the UK and NL are downweighted, and in other parts of Europe upweighted.


Weights: overlay distribution map with BMS

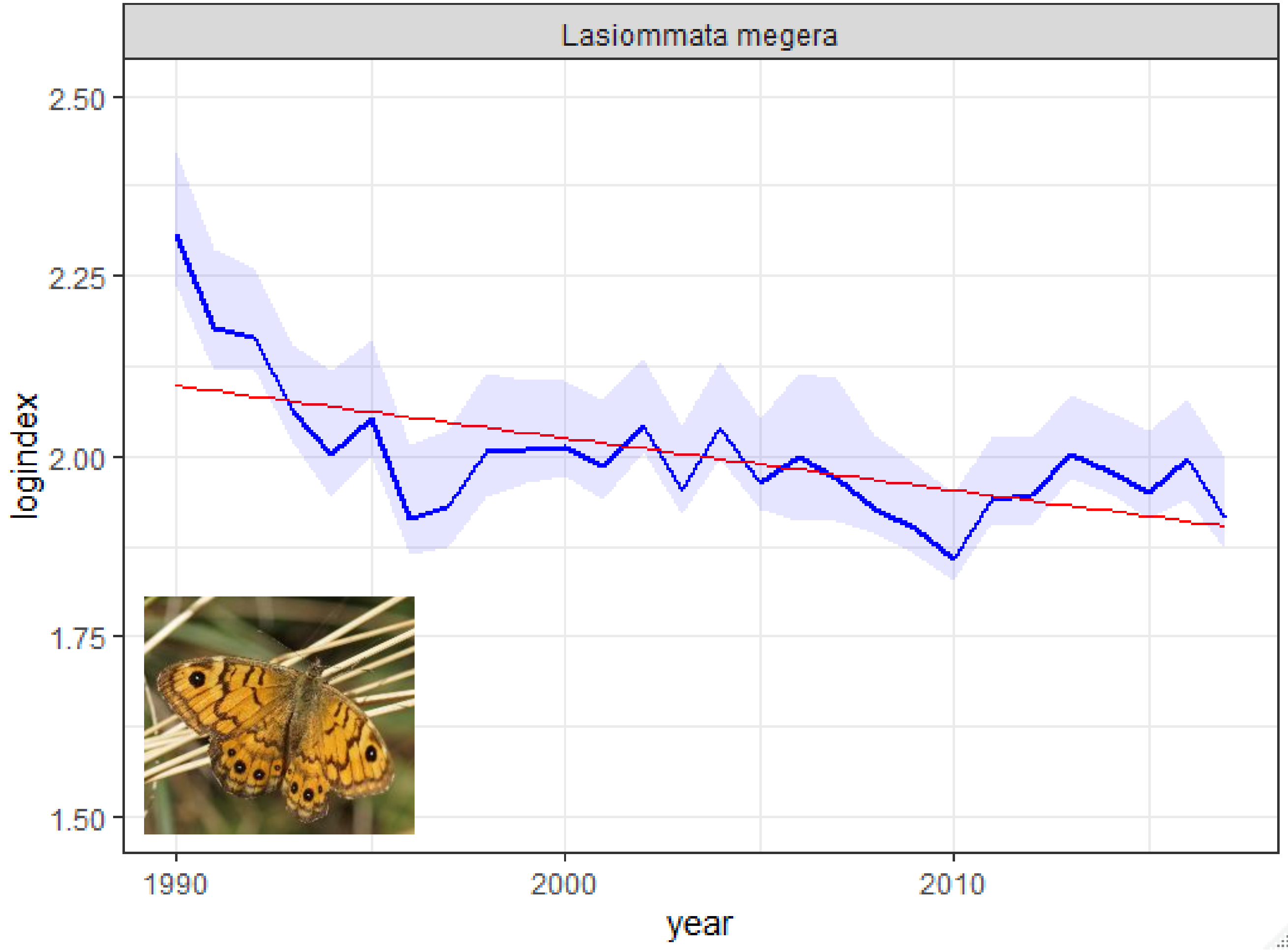
Rijlabels	Som van TotArea_ha
Aglais_io	**229068188**
BEBMS	1358468
BE-WABMS	1693512
DEBMS	35611459
ESBMS	30755713
ES-CBBMS	716367
ES-CTBMS	3112465
FIBMS	18848109
FRBMS	54628024
IRBMS	6778889
LTBMS	6479964
LUBMS	262055
LVBMS	6447460
NLBMS	3529269
ROBMS	6830790
SEBMS	26067129
SIBMS	2035178
UKBMS	23913337

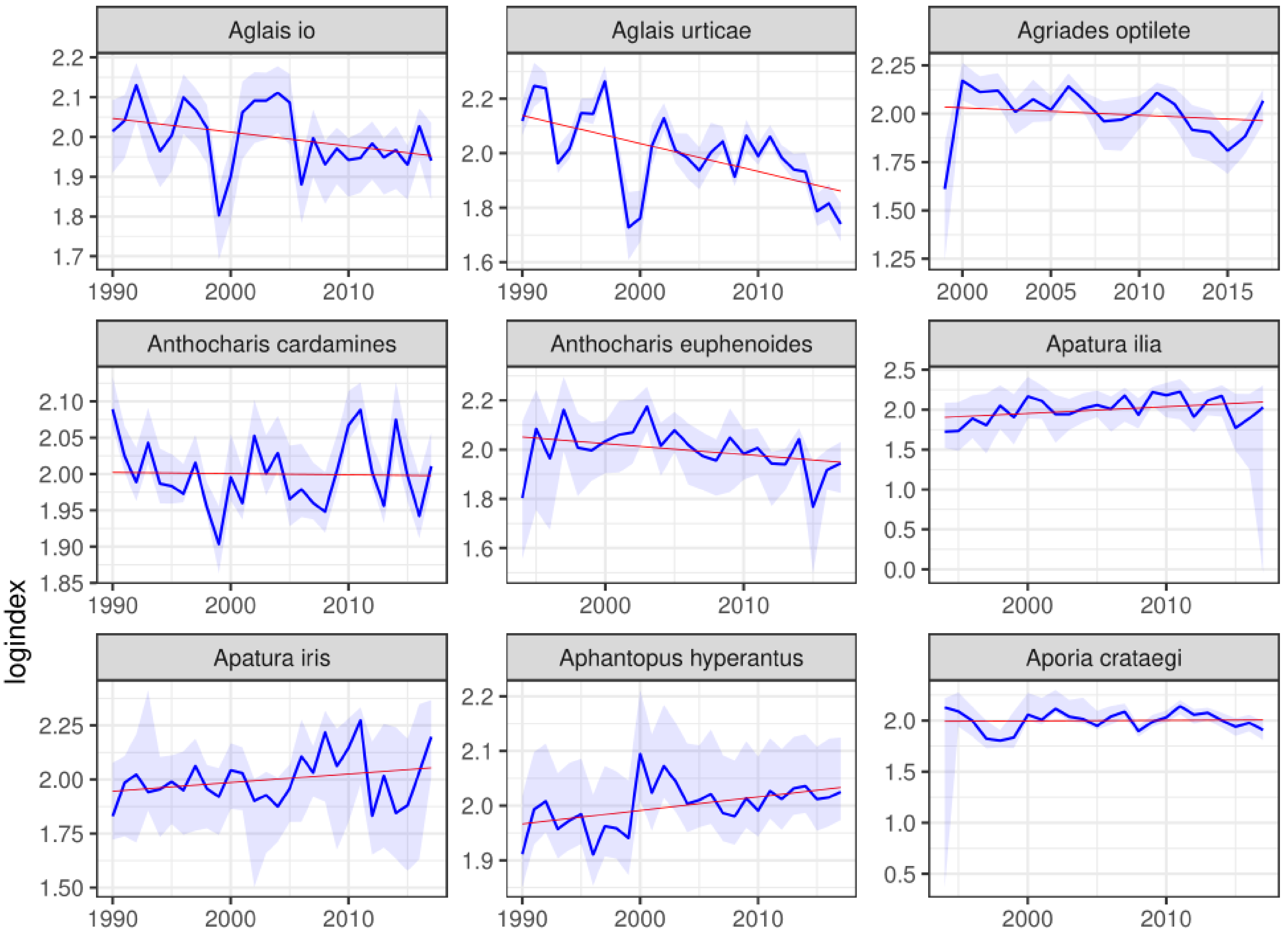


1-4
5-7
8-10
11-13
14-16

EU species abundance trends



EU trend per species



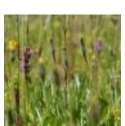

Aglais io
Aglais urticae
Agriades optilete
Anthocharis cardamines
Anthocharis euphenoides
Apatura ilia
Apatura iris
Aphantopus hyperantus
Aporia crataegi
logindex

Effect of weighting on indexes and trends

- Weights of transects in existing BMS's will be affected by new BMS's joining in.
- As a result European/EU indexes and trends will change when new BMS's join.
- And as a results the indicators will change when new BMS's join.

Building indicators

- Indicators are built from the European/EU indexes.
- Method comparable to the Living Planet Index.
- This means the geometric mean is used (mean of the log of the index).
- So the doubling of one species compensates the halving of another species.



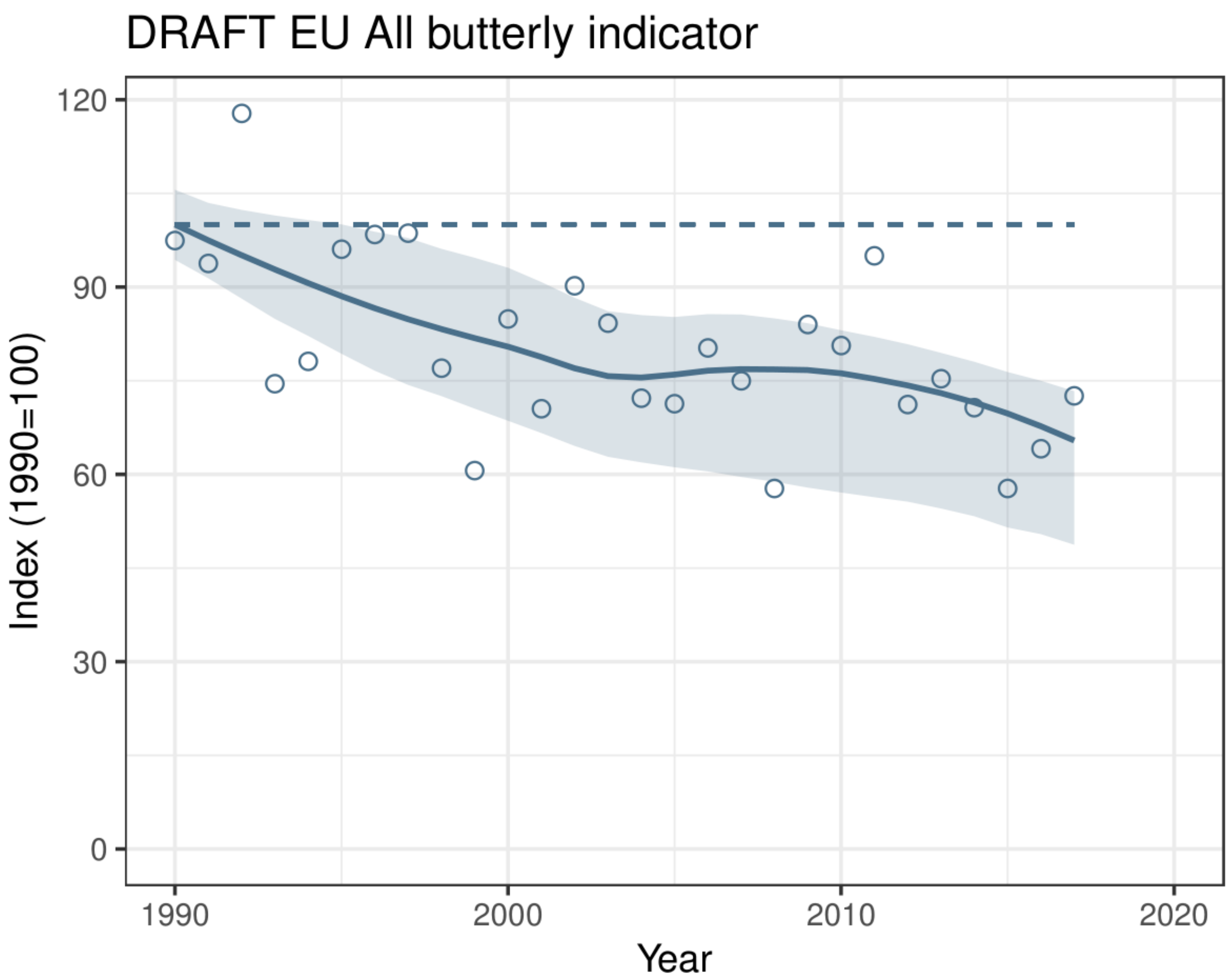

Geometric mean

Species	Year 1	Year 2
Species A	10	5
Species B	500	1000
Arithmetic mean	255	502.5
Geometic mean	70.7	70.7
Indexes		
Species A	100	50
Species B	100	200
Arithmetic mean	100	125
Geometric mean	100	100


Indicators: species selection

- For EU All Butterfly Indicator: all species, and all years with two or more BMS's and a minimum number of remaining species per year.

EU All butterfly indicator



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Indicators: species selection

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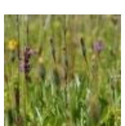
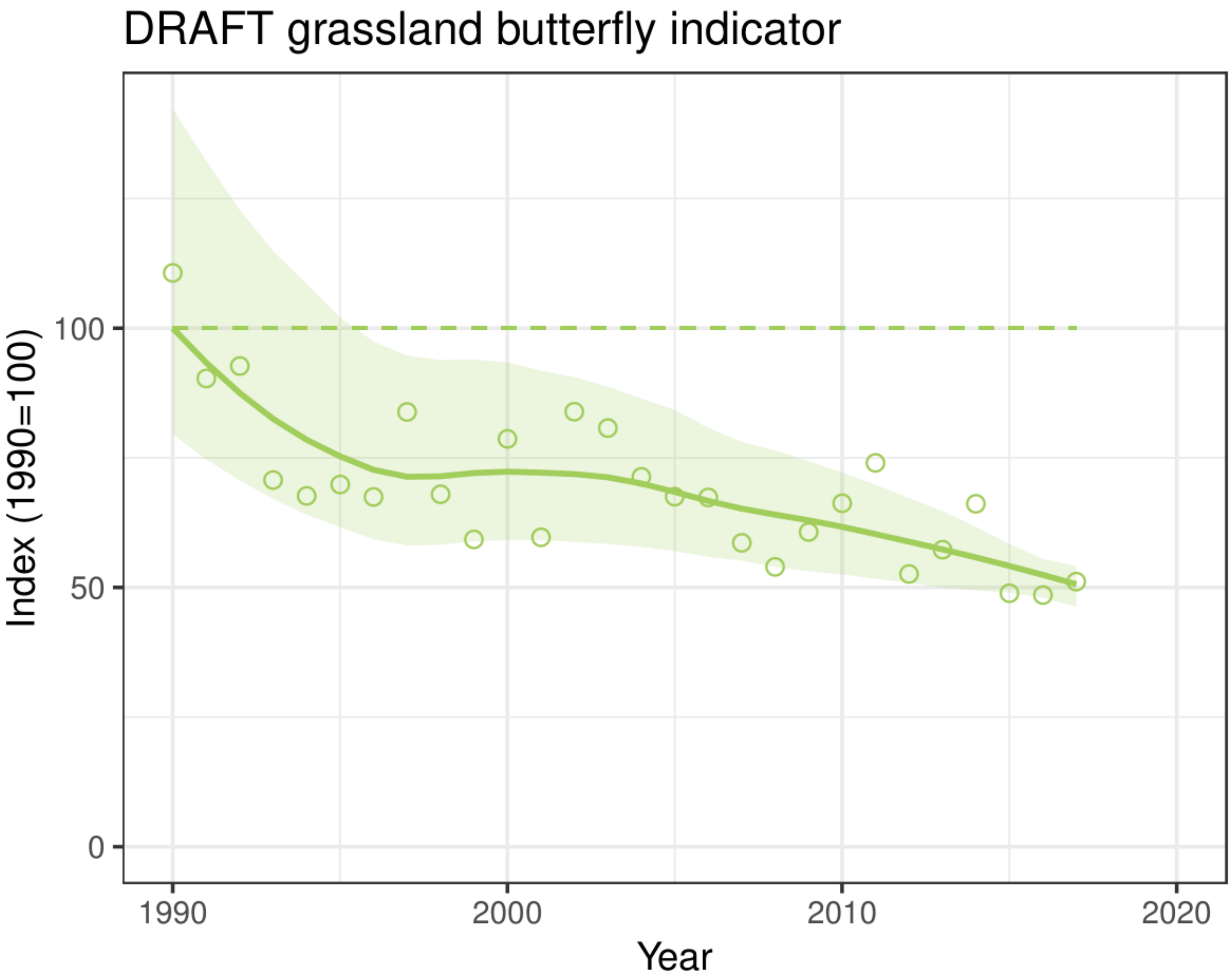
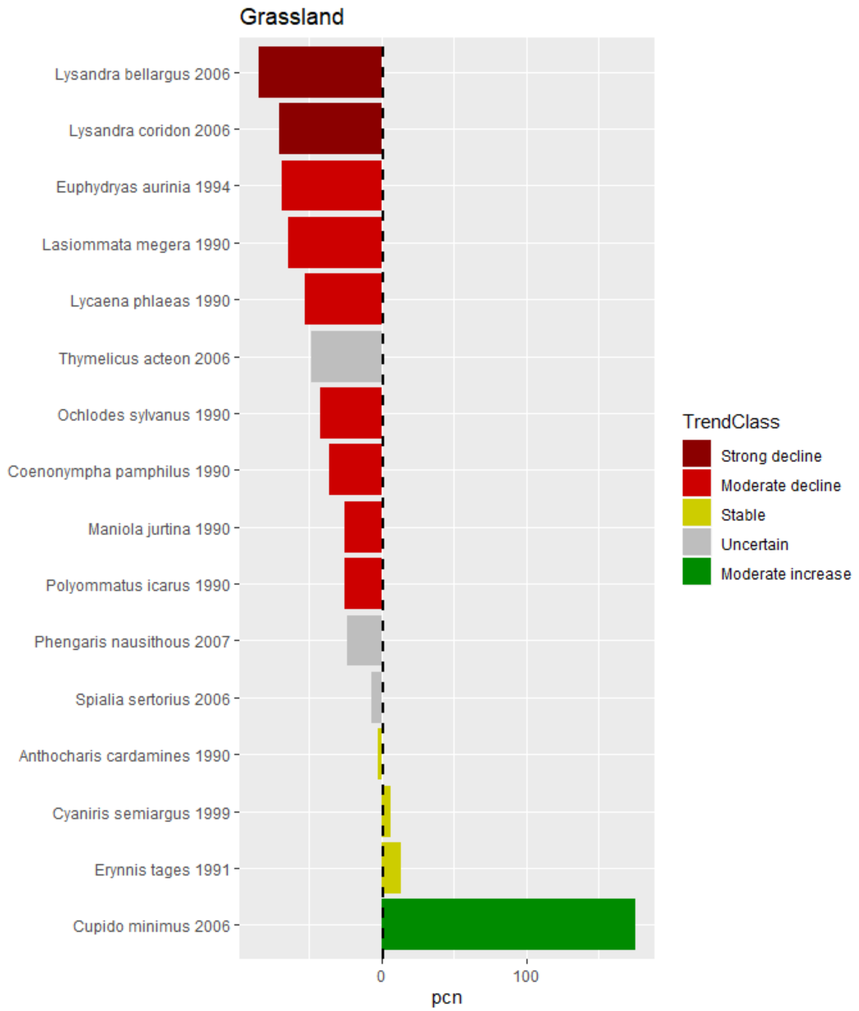
- EU Grassland Butterfly Indicator: same species as in existing indicator, and for each species use years with two or more BMS's.




EU Grassland Butterfly Indicator



EU Grassland Butterfly Indicator



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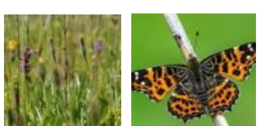
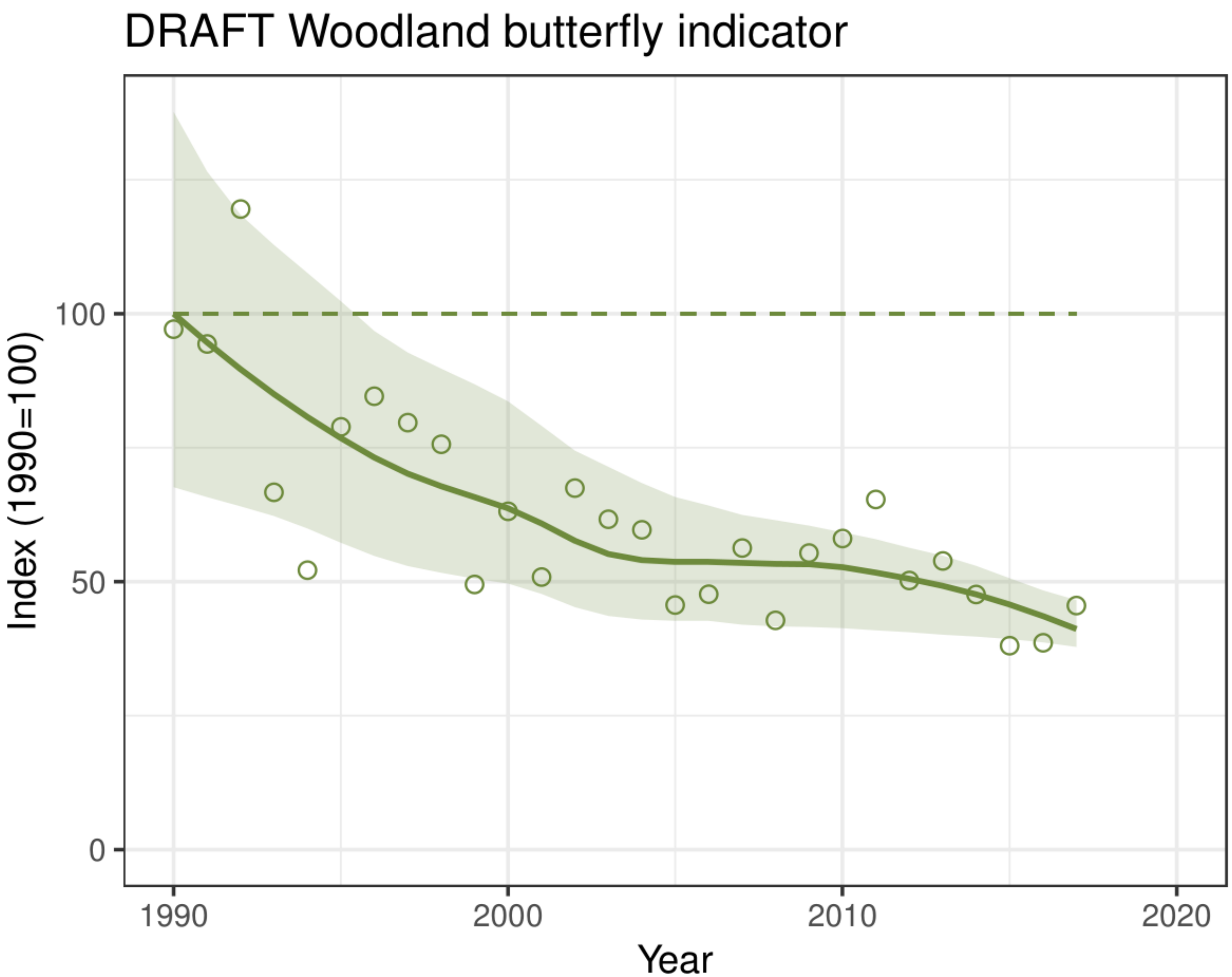
Indicators: species selection

- For EU All Butterfly Indicator: all species, and all years with two or more BMS's.
- EU Grassland Butterfly Indicator: same species as in existing indicator, and for each species use years with two or more BMS's.
- EU Woodland Butterfly Indicator: all species occurring more in woodland, than in any other habitat, based on 2006 paper (which was based on Red Data Book of 1999).
- 28 species



EU Woodland Butterfly Indicator



Future indicators

- Wetland Butterfly Indicator and Urban Butterfly Indicator
- However wetlands only have very few species (mainly of bogs, e.g. Agriades optilete) and very few transects.
- Urban sites usually only have generalist species.
- We still have time to develop these, but ideas are welcome.


ABLE

- Central database up and running
- Data from all existing schemes gathered up to 2017, will be updated upto 2019, also new schemes
- Input portal for recorders working, first version of app ready
- New schemes starting up, workshops given (today in Salzburg)
- R package for data-analysis developed, first version running
- Grassland indicator (using 2005 method) published
- New indicators ready in 2019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