

Discussion 2: Analysing monitoring data

- New tools and future development



Reto Schmucki – David Roy – Emily Dennis

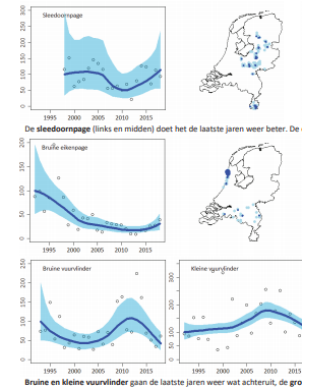


ANL conference centre, Laufen

4 Dec. 2019

Butterfly count Site indices Status and trends

- From the butterfly count to the indices and statistics
- From indices and statistics to knowledge and understanding



Analysing Butterfly counts (BMS)



Biological Conservation
Volume 12, Issue 2, September 1977, Pages 115-134



A method for assessing changes in the abundance of butterflies

E. Pollard

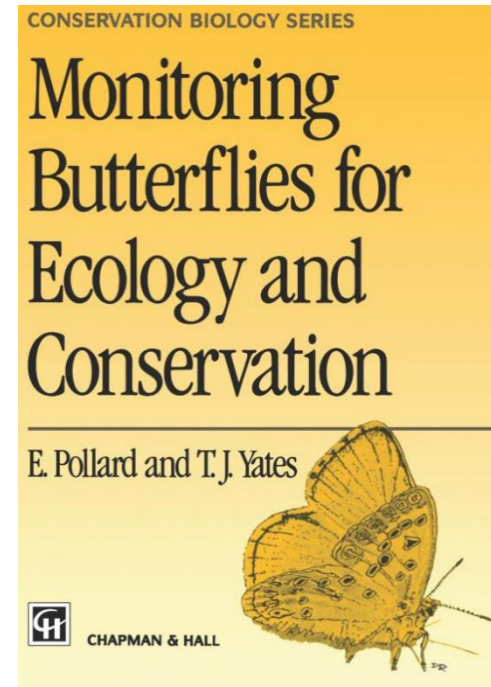
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[https://doi.org/10.1016/0006-3207\(77\)90065-9](https://doi.org/10.1016/0006-3207(77)90065-9)

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Abstract

A method based on transect count has been developed to assess changes in abundance of butterflies from year to year. The method involves weekly walks around a transect route making counts of butterflies seen within defined limits. The transects are divided into sections related to habitat or management units. Walks



- Pollard, E. (**1977**). A method for assessing changes in the abundance of butterflies. *Biological Conservation*, 12(2), 115–134. doi: [10.1016/0006-3207\(77\)90065-9](https://doi.org/10.1016/0006-3207(77)90065-9)

Analysing Butterfly counts (BMS)

- Moss, D., & Pollard, E. (**1993**). Calculation of collated indices of abundance of butterflies based on monitored sites. *Ecological Entomology*, 18(1), 77–83. doi: [10.1111/j.1365-2311.1993.tb01083.x](https://doi.org/10.1111/j.1365-2311.1993.tb01083.x)
- Rothery, P., & Roy, D. B. (**2001**). Application of generalized additive models to butterfly transect count data. *Journal of Applied Statistics*, 28(7), 897–909. doi: [10.1080/02664760120074979](https://doi.org/10.1080/02664760120074979)
- Van Swaay, C.A.M., Plate, C. & Van Strien, A.J. (**2002**) Monitoring butterflies in the Netherlands: how to get unbiased indices. *Proc. of the Sect. Exp. and Appl. Ent. of the Netherlands Ent. Soc.*, 13, 21–27



Calculation of collated indices of abundance of butterflies based on monitored sites

D. MOSS, E. POLLARD

First published: February 1993 | <https://doi.org/10.1111/j.1365-2311.1993.tb01083.x> | Citations: 10

Original Articles

Application of generalized additive models to butterfly transect count data

Peter Rothery & David B. Roy

Pages 897-909 | Published online: 02 Aug 2010

Download citation | <https://doi.org/10.1080/02664760120074979>

Monitoring butterflies in the Netherlands: how to get unbiased indices

C.A.M. van Swaay¹, C.L. Plate² & A.J. van Strien²

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Analysing Butterfly counts (BMS)

- Dennis, E. B., Freeman, S. N., Brereton, T., & Roy, D. B. (2013). Indexing butterfly abundance whilst accounting for missing counts and variability in seasonal pattern. *Methods in Ecology and Evolution*, 4(7), 637–645. doi: [10.1111/2041-210X.12053](https://doi.org/10.1111/2041-210X.12053)
- Schmucki, R., Pe'er, G., Roy, D. B., Stefanescu, C., Van Swaay, C. A. M., Oliver, T. H., ... Julliard, R. (2016). A regionally informed abundance index for supporting integrative analyses across butterfly monitoring schemes. *Journal of Applied Ecology*, 53(2), 501–510. doi: [10.1111/1365-2664.12561](https://doi.org/10.1111/1365-2664.12561)
- Dennis, E. B., Morgan, B. J. T., Freeman, S. N., Brereton, T. M., & Roy, D. B. (2016). A generalized abundance index for seasonal invertebrates. *Biometrics*, 72(4), 1305–1314. doi: [10.1111/biom.12506](https://doi.org/10.1111/biom.12506)

Methods in Ecology and Evolution



Standard Paper | [Free Access](#)

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

Emily B. Dennis✉, Stephen N. Freeman, Tom Brereton, David B. Roy

First published: 26 March 2013 | <https://doi.org/10.1111/2041-210X.12053> | Citations: 18

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. Roy⁵, Constanti Stefanescu^{6,7},
Chris A.M. Van Swaay⁸, Tom H. Oliver^{5,9}, Mikko Kuussaari¹⁰, Arco J. Van Strien¹¹,
Leslie Ries^{12,13}, Josef Settele^{4,14}, Martin Musche¹⁴, Jofre Carnicer^{6,15}, Oliver Schweiger¹⁴,

A Generalized Abundance Index for Seasonal Invertebrates

Emily B. Dennis,^{1,3,*} Byron J. T. Morgan,¹ Stephen N. Freeman,² Tom M. Brereton,³ and David B. Roy²

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Site indices to inform local trends

Received: 22 December 2016 | Revised: 18 August 2017 | Accepted: 22 August 2017
DOI: 10.1111/geb.12659

RESEARCH PAPER

WILEY

Global Ecology
and Biogeography


A Journal of
Biogeography

European butterfly populations vary in sensitivity to weather across their geographical ranges



Simon C. Mills¹  | Tom H. Oliver² | Richard B. Bradbury^{3,4,5} |
Richard D. Gregory^{4,6} | Tom Brereton⁷ | Elisabeth Kühn⁸ | Mikko Kuussaari⁹ |
Martin Musche⁸ | David B. Roy¹⁰ | Reto Schmucki¹⁰ | Constantí Stefanescu^{11,12} |
Chris van Swaay¹³ | Karl L. Evans¹

Conservation Biology



Contributed Paper |  Full Access

Effects of Natura 2000 on nontarget bird and butterfly species based on citizen science data

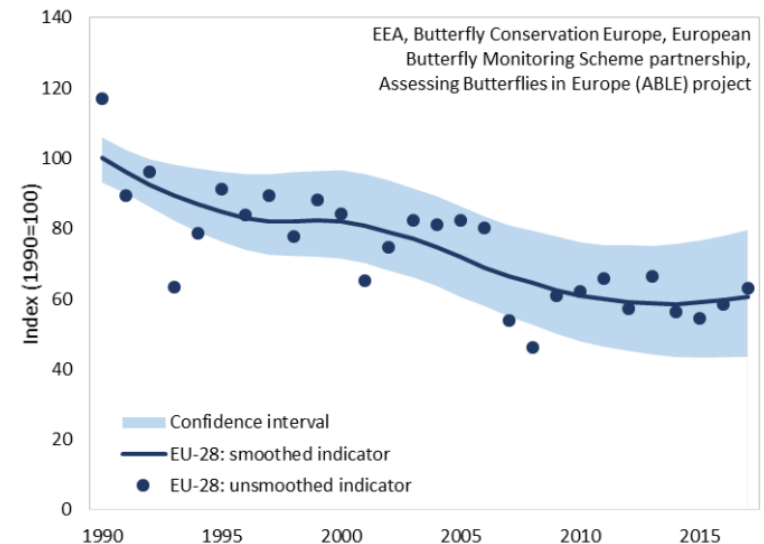
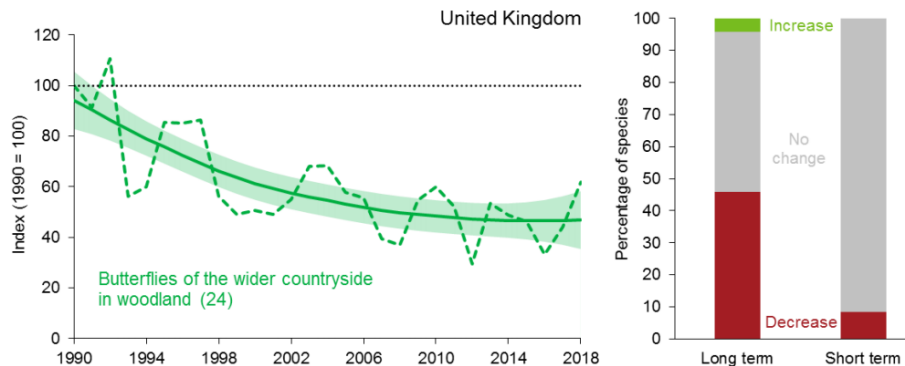
V. Pellissier  R. Schmucki, G. Pe'er, A. Aunins, T.M. Brereton, L. Brotons, J. Carnicer, T. Chodkiewicz, P. Chylarecki, J.C. del Moral, V. Escandell, D. Evans, R. Foppen, A. Harpke, J. Heliölä ... See all authors 

First published: 07 November 2019 | <https://doi.org/10.1111/cobi.13434>

- Mills, S. C., Oliver, T. H., Bradbury, R. B., Gregory, R. D., Brereton, T., Kühn, E., ... Evans, K. L. (2018). European butterfly populations vary in sensitivity to weather across their geographical ranges. *Global Ecology and Biogeography*, 26(12), 1374–1385. doi: [10.1111/geb.12659](https://doi.org/10.1111/geb.12659)
- Pellissier, V., Schmucki, R., Pe'er, G., Aunins, A., Brereton, T. M., Brotons, L., ... Julliard, R. (2019). Effects of Natura 2000 on nontarget bird and butterfly species based on citizen science data. *Conservation Biology*, n/a(n/a). doi: [10.1111/cobi.13434](https://doi.org/10.1111/cobi.13434)

Butterfly indicators to inform National and International trends

Figure C6iii. Trends for butterflies of the wider countryside in UK woodland, 1990 to 2018.



- Department for Environment, Food and Rural Affairs, UK (2019). UK Biodiversity Indicators 2019.
- Van Swaay, C.A.M., Dennis, E.B., Schmucki, R., Sevilleja, C.G., Balalaikins, M., ... & Roy, D.B. (2019). The EU Butterfly Indicator for Grassland species: 1990-2017: Technical Report. Butterfly Conservation Europe & ABLE/eBMS (www.butterfly-monitoring.net)



Building capacity

Collecting & data curation

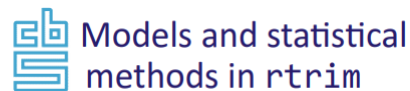
- ✓ Indica (data warehouse & tools)
- ✓ eBMS app
- ✓ eBMS database
- ✓ GBIFF

Analysing

- R packages
 - ✓ BRCindicator
 - ✓ rtrim
 - ✓ MSI
 - ✓ rbms

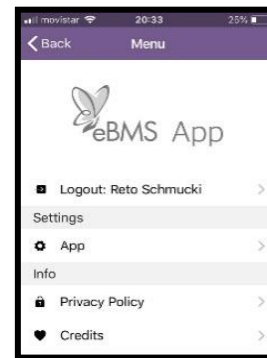


Monitoring & Data science “ecosystem”



MSI (R-script)

BRCindicator



rbms – R package

- Generalised Abundance Indices (GAI) – spline
- Phenology – flight curve
- Site abundance indices
- Collated index
- Bootstrap confidence interval

rbms 1.0.0

Reference

Articles

rbms

With `rbms`, our aim is to facilitate the implementation of statistical and mathematical methods developed for computing relative abundance indices from yearly time-series of butterfly counts. These data are characterized by a strong phenology that must be accounted for when deriving abundance from counts. As a toolbox, we plan to implement more methods to compute and visualize metrics as they develop. The `rbms` package will provide the option of being coupled and work in line with other tools available and developed by the community (e.g. `rtrim`, `BRCIndicators`). Together with the development of the 'rbms' R package, we also aim to provide tutorial to facilitate its use and understanding.

Although `rbms` implements methods that have been develop independently and for which the original source should be cited, user should also citing the `rbms` package and its version to ensure appropriate referencing and therefore improve transparency and repeatability of the work.

Suggested citation for the `rbms` package

Schmucki R., Harrower C., Dennis E. (2019) `rbms`: Computing generalised abundance indices for butterfly monitoring count data. R package version 1.0.0. <https://github.com/RetoSchmucki/rbms>

Installation

To install this package from GitHub, you need to install the package `devtools` available on CRAN. Once installed, use the function `devtools::install_github()` to install the `rbms` package on your system.

Note that `rbms` has been build with R 3.6.0, so you might have to update your R system before installation.

```
if(!requireNamespace("devtools")) install.packages("devtools")
devtools::install_github("RetoSchmucki/rbms")
```

Reporting Issues

For reporting issues related to this package, please visit the [issue](#) and see if your problem has not yet been reported before opening a new [issue](#) [here](#)

License

Full license
MIT

Developers

Reto Schmucki
Author, maintainer
Colin A. Harrower
Author
[All authors...](#)

Dev status

build passing

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

rbms – R package

rbms 1.0.0



Reference

Articles ▾

1. Get started with rbms - phenology

From counts to flight curve

Reto Schmucki (UKCEH)

28 November 2019

In this short tutorial, we will show how to fit a flight curve function on butterfly count recorded on a weekly base. We will use R functions implemented in the `rbms` package and data bundled within the same package. The data we use are real Butterfly Monitoring Scheme counts and transect visit dates. The flight curve are based on spline fitted on count collected over multiple sites and standardized to sum to 1 (area under the curve is one).

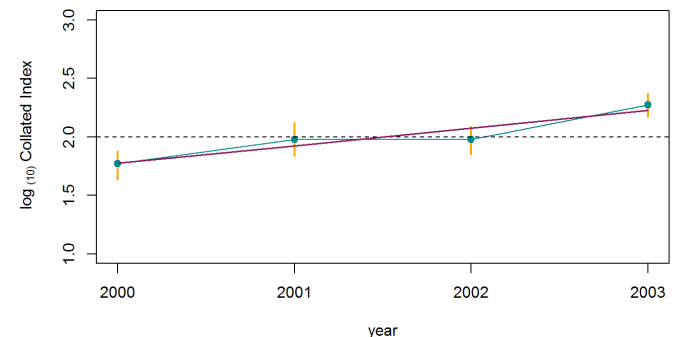
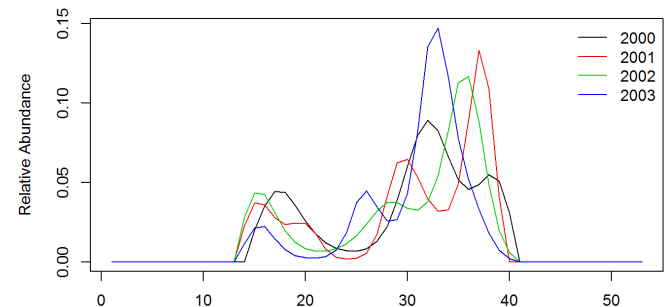
1. load package and data included in the package

```
library(rbms)
```

```
## Welcome to rbms, version 1.0.0
## While this package has been tested by several users,
## it is still in active development and feedbacks are welcome
## https://github.com/RetoSchmucki/rbms/issues
```

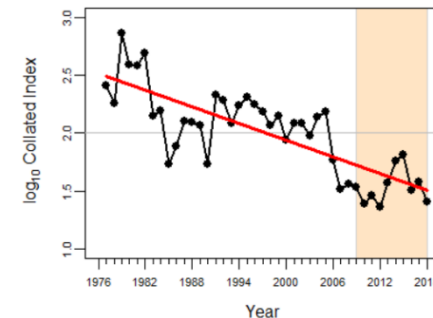
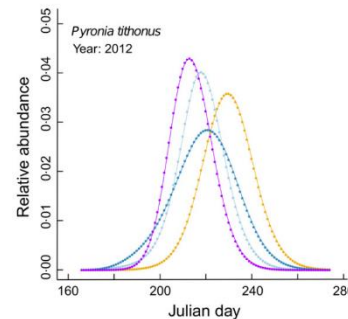
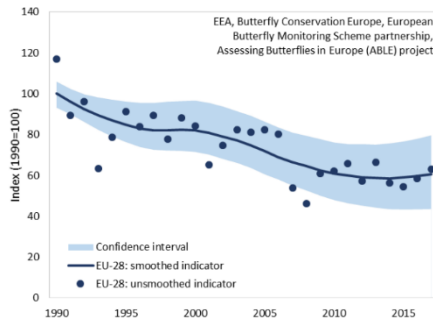
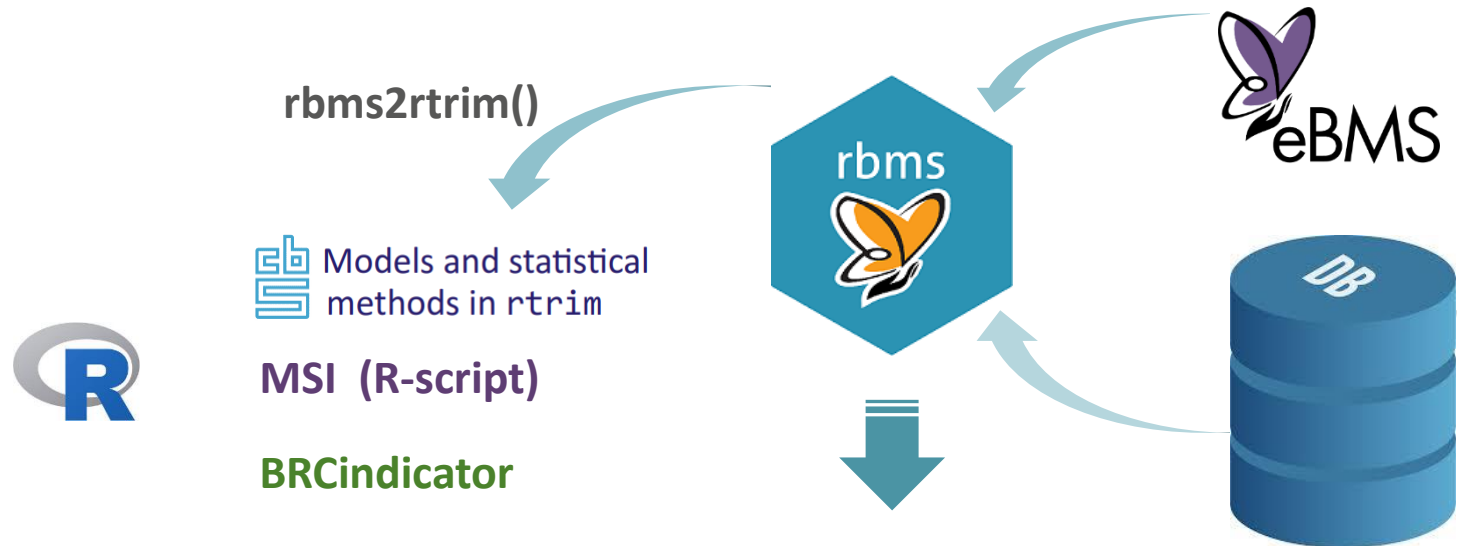
```
data(m_visit)
data(m_count)
```

The visit and count data are packaged in `data.table` format, but can also be provided as `data.frame`. The function will convert them into `data.table` as this format allow us to deal with large data sets in a more efficient way. On the other hand, header names need to be consistent and some columns are essential for the functions to work.

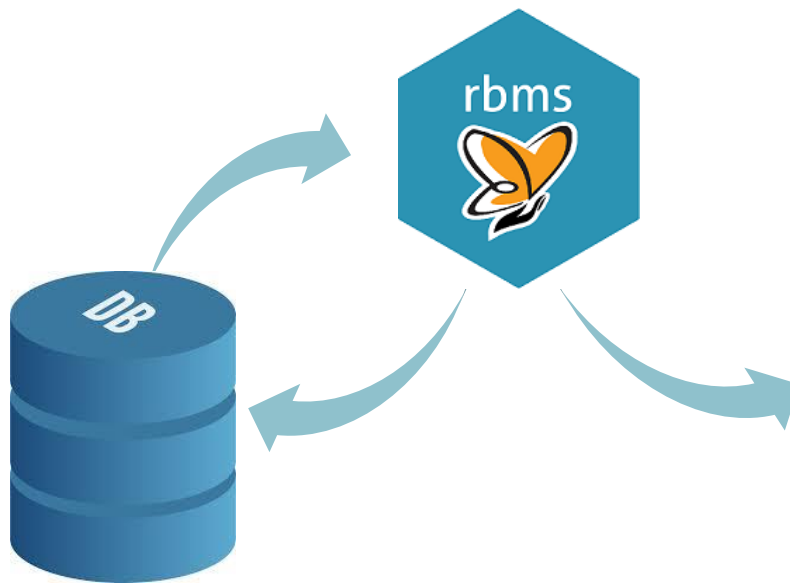


<https://retoschmucki.github.io/rbms/>

Augment the capabilities of rbms



Augment the capabilities of rbms



- Taxonomy resolution tools from standardized check-lists
- Facilitate data transfer and contribution to eBMS

Wish list, feedbacks and prioritization

- Analysis (new methods)
- Visualisation
- Data management
- ... ?

Thank you

Any questions?



UK Centre for
Ecology & Hydrology



Photo: Chris van Swaay