

Final Presentation on Hallman et al.

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22.01.2021

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Introduction

- ▶ ~ 75 % decline in flying insect biomass over 27 years
- ▶ On protected sites of nature conservation
- ▶ Independent on weather, land-use, habitat characteristics
- ▶ ~ 80 % of the effects explaining declines are unknown
- ▶ Highest losses in times of highest biomass Hallmann et al. (2017)

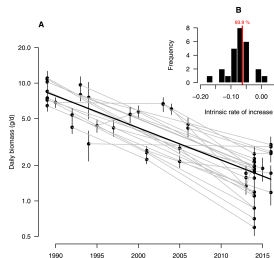


Figure 1: Temporal distribution of insect biomass at selected locations (Hallmann 2017)

Our motivation to re-analyse the paper

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Entomologischer Verein Krefeld
biodiversity loss in protected areas" PLoS ONE. 12 (11): e0188808.
doi:10.1371/journal.pone.0188808 PMID:28043418 Sally Michener
(4 December 2017).
9 KB (802 words) - 13:55, 15 November 2017

Yellow flashcard
decline over 27 years in total flying insect biomass in protected areas" PLoS ONE.
12 (11): e0188808. doi:10.1371/journal.pone.0188808 PMID:28043418.
10 KB (1,173 words) - 09:20, 6 January 2018

Deforestation
PLOS ONE. 12 (11): e0188808. doi:10.1371/journal.pone.0188808.
doi:10.1371/journal.pone.0188808 PMID:28043418.
Mongolian.com. Deforestation. line
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Biodiversity loss
(PLOS ONE. 12 (11): e0188808. doi:10.1371/journal.pone.0188808.
doi:10.1371/journal.pone.0188808 PMID:28043418. PNAS.
Elizabeth. "Common decline".
41 KB (4,108 words) - 16:14, 17 January 2018

Decline in insect populations
PLOS ONE. 12 (11): e0188808. doi:10.1371/journal.pone.0188808.
doi:10.1371/journal.pone.0188808 PMID:28043418. Vogel.
Gretchen (10 May 2017). "Others".
60 KB (6,408 words) - 22:58, 12 January 2018

2017 in science
PLOS ONE. 12 (11): e0188808. doi:10.1371/journal.pone.0188808.
doi:10.1371/journal.pone.0188808 PMID:28043418. QeiosWiki.

Discussed



More than 75 percent decline over 27 years in total flying insect biomass in pro

Ungefähr 260 Ergebnisse (0,32 Sekunden)

Westdeutsche Zeitung

Krefeld: Ehrenplaketten für fünf Bürger der Stadt

In ihrer Studie „More than 75 percent decline over 27 years in total flying insects biomass in protected areas“ wiesen sie ein Insektensterben ...
11.02.2019

RP ONLINE

**Krefeld: Bundespräsident ehrt Insektenforscher mit
deutschem ...**

... haben mit „More than 75 percent decline over 27 years in total flying insects biomass in protected areas“, für ein weltweites Echo gesorgt.
02.09.2020

Helmholtz-Gemeinschaft Deutscher Forschungszentren

Klar Sowelt? #65 – Summ, summ, stumm

(2017) More than 75 percent decline over 27 years in total flying insect biomass in protected areas. PLoS ONE 12(11): e0188808. viele ...
17.09.2019



Mein schöner Garten

**Alarmierender Insektenschwund wissenschaftlich
bestätigt**

„More than 75 percent decline over 27 years in total flying insect biomass in protected areas“ bestätigt. Und die Zahlen sind alarmierend: Mehr als 75 Prozent der Fluginsekten sind in den letzten 27 Jahren ...
13.09.2019



Mein schöner Garten



Aim for our re-analysis

- ▶ Comprehend the methods used by this highly relevant publication
- ▶ Assess the robustness of decline
- ▶ Therefore rule out any regression to the mean effect
- ▶ Enhance our skills in bayesian statistics

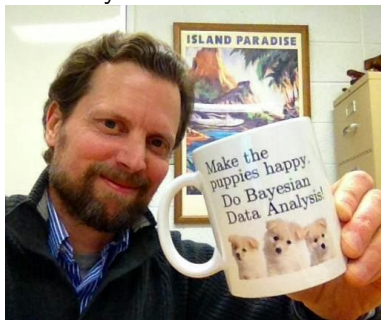


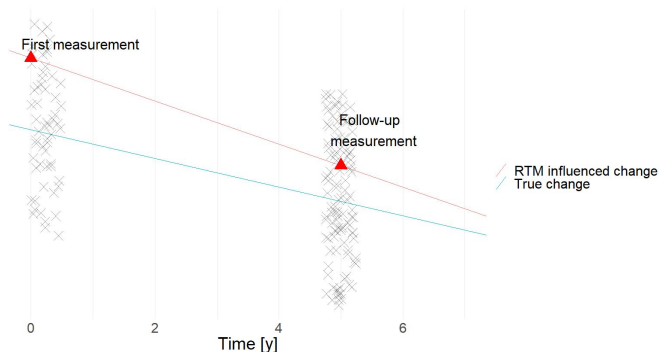
Figure 2: J. K. Kruschke amazon-page image, author of Doing Bayesian Data Analysis

Possible issues of the paper

- ▶ Years 1989 and 2014 are over-represented
 - ▶ 1989: 162 catchment days, 2014: 348 catchment days
- ▶ Few locations were re-sampled
- ▶ 26 of 63 one third only
- ▶ Only one trap per location
- ▶ The trap exposure time varies greatly among years
 - ▶ Longer trapping intervals in the later part of the data collection
- ▶ Unknown site selection procedure
- ▶ Lack of control group

Why could this introduce an regression to the mean (RTM) effect?

- ▶ First time sampling a location \rightarrow exceptional high insect biomass
- ▶ Second (or third) time sampling the same location \rightarrow sampled biomass closer to true mean



Methods to prove this hypothesis

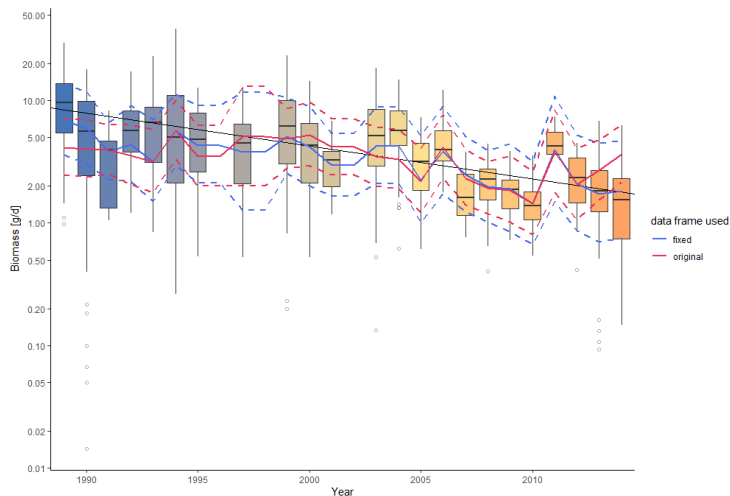
- ▶ Only use the first observation of each location
 - ▶ no follow up or baseline observations appear
- ▶ Use the basic model of Hallmann et al.
 - ▶ Which was used for the prediction of the decline
 - ▶ Replicate the model specifications with an other subset of the data
- ▶ Models diagnostics
- ▶ Compare results of both analyses
- ▶ Asses the robustness of the stated decline
- ▶ Check like this for RTM

Modelling of the insect biomass decline

- ▶ Bayesian modeling
 - ▶ JAGS (Just Another Gibbs Sampler) and R2Jags (Su and Masanao Yajima 2020)
- ▶ Uninformative priors
- ▶ Fixed and random (site specific random intercept) effects
- ▶ Latent daily (but unobserved) biomass

Results

- ▶ Our result (only first sampling of every plot)
- ▶ No Regression to the mean found



Our Results and Hallmann et al.s

- ▶ The decay was calculated using

$$\log(\lambda)$$

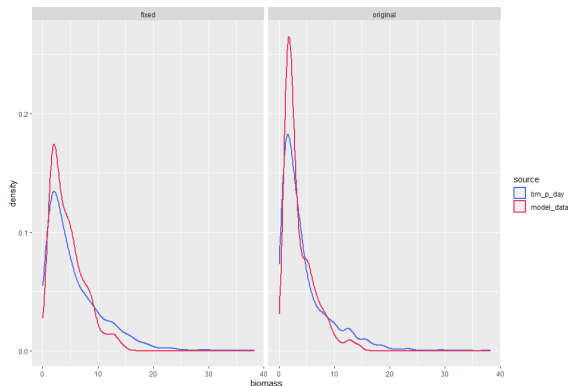
- ▶ 6.27% with the original data
 - ▶ 6.19% with one sample per site
- ▶ We calculated a decline within 27 years as follows n

$$(1 + \log(\lambda))^{26} - 1$$

- ▶ 81,4% with the original data
 - ▶ 81% with our variation of the data

What could be the reason for this similar results

- ▶ Both statistical analyses are fine
 - ▶ Our model performed well in diagnostics



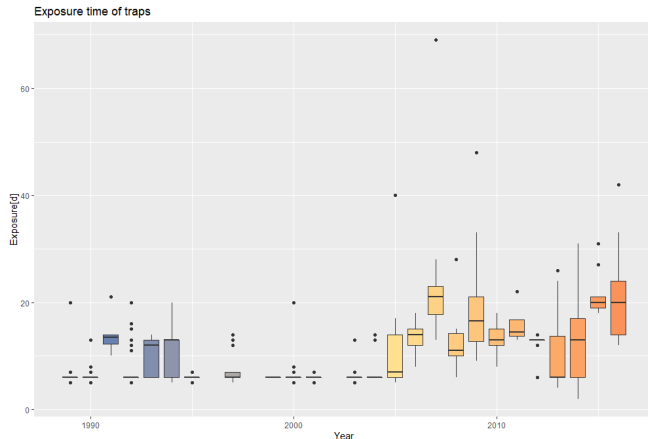
No major influence of temporal effect per plot + Leaving out the second round of sampling on locations sampled twice

So is there no RTM effect?

- ▶ Not that we could measure it
- ▶ The effect it has on the results is minor

Varying trap exposure intervals

- ▶ The actual catches per trapping do not strongly decline, decline appears when corrected for daily biomass
- ▶ biomass collection “saturation” phenomenon?



Weak explanation of insect biomass decline

- ▶ Negative relationship between trees/forest and flying insect biomass
 - ▶ Insects might be flying higher
 - ▶ further succession of land (from arable to shrubland/forest) affects flying insects
- ▶ Only relevant drivers of decline could potentially only alter behavior, but must not affect abundance of insects

Overall performance of the analysis

- ▶ The statistical methods were reasonable for the dataset given
- ▶ Most of the criticized issues were introduced by the sampling procedure
- ▶ Although the sampling was carried out by trained amateurs and experts, it was not designed by statisticians, let alone the team around Hallmann
- ▶ Problem of designing or gaining ecological long term data

Improvement of the paper?

- ▶ In this case, a control group could be:
 - ▶ third or fourth sampling round on each location
- ▶ Blomqvist (1987) emphasized the need to include control groups
 - ▶ make adjustments for the RTM effect possible
- ▶ needs to be further included in environmental sciences
 - ▶ “For example, birds feeding nestlings lose weight, but initially heavier birds lose more weight than lighter birds, a result expected from the regression effect.” (Kelly et al. 2005; Gebhardt-Henrich 2000)

RTM in ecology

regression to the mean ecology



Ungültig 1.892.088 Ergebnisse (8,88 Sek.)

Correcting for regression to the mean in behavior and ecology

C Kelly, III *Ecology* - The American Naturalist, 2005 - journals.schickel.edu

If two successive trait measurements have a less than perfect correlation, individuals or populations will, on average, tend to be closer to the mean on the second measurement (the so-called regression effect). Thus, there is a negative correlation between an individual's ...

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First evidence for a significant effect of the regression to the mean fallacy in meta-copying: a comment on Davies et al

E Giacchi, S Nohel, A Suckale - *Behavioral Ecology*, 2009 - academic.sage.com

Danchin E, Nohel S, Pockwinse A, Duguet AC, Denay L, Akhand M, Ranty-Ruby S, van Renswalle L, Boree M, Georges E et al. 2010. Cultural Rite, conformist social learning in buffles predicts long-lasting mate-choice traditions. *Science*, 332: 1025-1028. Davies AD ...

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Elicitator: an expert elicitation tool for regression in ecology

A Jones, SL Clay, G Margopagn - *Environmental Modelling & Software*, 2010 - Elsevier

Communicating with experts to elicit regression parameters has been found useful in several contexts relevant to environmental applications, ranging from ecology to socio-economics ...

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Multiple regression and inference in ecology and conservation biology: further comments on identifying important predictor variables

B Mag, Italy - *Biodiversity & Conservation*, 2002 - Springer

MR typically is used in conservation ecology to model the occurrence or density ... The hierarchical organization in evaluative regression-model building states because of ... for each variable can be expressed as $Z_{\text{score}}(\text{observed} - \text{mean transformation}) / \text{SD}(\text{transformation})$...

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Partial least squares regression as an alternative to current regression models used in ecology

LM Cangelosi, L Cangelosi, G Gopal - *Oikos*, 2009 - Wiley Online Library

... a combination of regression and multivariate methods, which are more commonly used in ecology ... probable models when analyzing datasets with high predictor variables (response Y) ... In summary, partial least squares regression analysis provides similar results to those ...

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On the misuse of residuals in ecology: testing regression residuals vs. the analysis of covariance

E Giacchi *Ecology* - Journal of Animal Ecology, 2001 - jstor.org

... in aquatic sciences, statistical shortcomings with mean depth and the morphological index ... Kleinbaum, DG, Kupper, LL & Muller, NE (1988) *Applied Regression Analysis and other Multivariate Methods* ... *Journal of Animal Ecology*, 25, 203-213

[PDF] jstor.org

[PDF] oup.com

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Full View

regression to the mean Epidemiology



Ungültig 2.632.088 Ergebnisse (8,88 Sek.)

Regression to the mean: what it is and how to deal with it

AG Barakat, JG Van Der Pols - *Journal of Epidemiology*, 2005 - academic.sage.com

Background **Regression to the mean** (RTM) is a statistical phenomenon that can make random variation in repeated data look like real change. It happens when unusually large or small measurements tend to be followed by measurements that are closer to the mean ...

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pen: The effect of regression to the mean in epidemiologic and clinical studies

CE Davis - *American journal of epidemiology*, 1976 - Elsevier

Regression to the mean is the phrase used to clarify the phenomenon that a variable that is extreme on its first measurement will tend to be closer to the center of the distribution for a later measurement. In studies based on biological measurements, this capability can be ...

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Introduction to the use of regression models in epidemiology

R Bender - *Cancer Epidemiology*, 2003 - Springer

... chapter, an overview of the most important multiple regression models is given with a focus on applications in modern epidemiology ... But their parent needs (1). However, modern applications of regression methods do not only analyze such "regression to the mean" effects ...

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Regression to the mean in treated versus untreated chronic pain

CM Whitney, M Von Korf - *Pain*, 1992 - Elsevier

E. and Sommers, E. **Epidemiology** of signs and symptoms in temporomandibular disorders. Clinical signs in cases and controls. *J. Am. Dent. Assoc.*, 120 (1989) 273-281. Edsberg, J. Serum cholesterol changes: effects of diet and regression toward the mean. *J. Chronic Dis.*, 25 ...

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Multiple additive regression trees with application in epidemiology

dt Friedberg, JZ Meisner - *Statistics in medicine*, 2003 - Wiley Online Library

Multiple additive regression trees with application in epidemiology ... Here y (response) is the mean of the response y in each region S_j , and x is a tree predicts a constant value ... Regression trees are induced by top-down recursive splitting based on a least-squares fitting criterion ...

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pen: Do leukocyte telomere length dynamics depend on baseline telomere length? An analysis that corrects for regression to the mean

S Vukobrat, A Kuo, A Brenner, GS Rose - *Journal of epidemiology*, 2013 - Springer

Leukocyte telomere length (TL) shortens with age. Longitudinal studies have reported accelerated TL attrition when baseline TL is larger. However, the dependency of TL attrition on baseline TL might stem from a statistical artifact known as regression to the ...

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[PDF] wiley.com

[PDF] springer.com

Figure 3: Only two articles are actually on RTM in ecology, cited under 200 times. In Epidemiology, G. Scholar finds > 6 articles on RTM, some cited > 1000 times

References

- Blomqvist, Nils. 1987. "On the Bias Caused by Regression Toward the Mean in Studying the Relation Between Change and Initial Value." *Journal of Clinical Periodontology* 14 (1): 34–37.
<https://doi.org/10.1111/j.1600-051X.1987.tb01510.x>.
- Gebhardt-Henrich, Sabine G. 2000. "When Heavier Birds Lose More Mass During Breeding: Statistical Artefact or Biologically Meaningful?" *Journal of Avian Biology* 31 (2): 245–46.
<https://doi.org/10.1034/j.1600-048X.2000.310216.x>.
- Hallmann, Caspar A., Martin Sorg, Eelke Jongejans, Henk Siepel, Nick Hofland, Heinz Schwan, Werner Stenmans, et al. 2017. "More Than 75 Percent Decline over 27 Years in Total Flying Insect Biomass in Protected Areas." *PLOS ONE* 12 (10): 1–21. <https://doi.org/10.1371/journal.pone.0185809>.
- Kelly, Colleen, Trevor D. Price, Associate Editor: Stuart A. West, and Editor: Michael C. Whitlock. 2005. "Correcting for Regression to the Mean in Behavior and Ecology." *The American Naturalist* 166 (6): 700–707.
<http://www.jstor.org/stable/10.1086/497402>.
- Su, Yu-Sung, and Masanao Yajima. 2020. *R2jags: Using R to Run 'Jags'*.
<https://CRAN.R-project.org/package=R2jags>.