

Final Presentation Hallman

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Content

1. Introduction
2. Our Motivation to re-analyze the paper
3. Our Aims and objectives
4. Crucial points in the analysis
5. Methods
6. Results
7. Discussion

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)

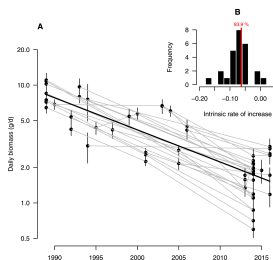


Figure 1: Temporal distribution of insect biomass at selected locations (Hallmann 2017)

Our motivation to re-analyse the paper

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Decline in insect populations
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2017 in science
PLOS ONE, 12 (10): e0188808 doi:10.1371/journal.pone.0188808
doi:10.1371/journal.pone.0188808 PMID 29645418, GSA, GSA, GSA

Discussed ?



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

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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 ...
11.02.2023

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 Soweit? #05 – Summ, summ, stumm

(2017) More than 75 percent decline over 27 years in total flying insect
biomass in protected areas PLOS ONE 12(10): e0188808 viele ...
17.04.2019

Mein schöner Garten

Alarmierender Insektenchwund 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 Flugeszeiten 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

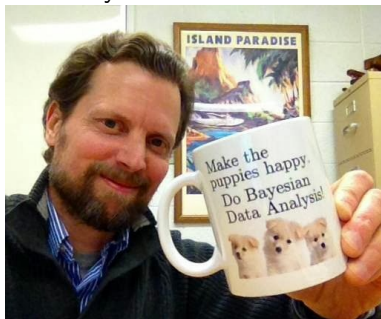


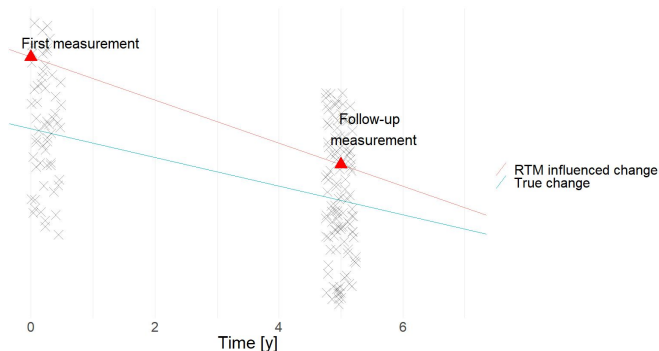
Figure 2: J. K. Kruschke's amazon-page image, author of *Doing Bayesian Data Analysis*

Possible issues of the paper

- ▶ Years 1989 and 2014 are over-represented
- ▶ Few locations were re-sampled
- ▶ Only one trap per location
- ▶ The exposure time varies greatly among years
 - ▶ Longer 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 → exceptional high insect biomass
- ▶ Second (or third) time sampling the same location → sampled biomass closer to true mean



Method 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

Modelling of the insect biomass decline

- ▶ Bayesian model
- ▶ Priors
- ▶ Fixed and random effects
- ▶ Latent daily (but unobserved) biomass

Results

- ▶ Our result (only first sampling of every plot) is within xx% of the original result
- ▶ No Regression to the mean found
- ▶ nice graphs

Our Results and Hallmann et al.s

- ▶ Some other nice graphs

What could be the reason for this similar results

- ▶ Hallmann et al. did a great job
- ▶ We did a bad job
- ▶ Better explanation :-)

Slide 12

Varying trapping exposure intervals

- ▶ The actual catches per trapping bottle did not strongly decline, the strong decline only comes about when calculating values per day.
- ▶ 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 behaviour, not abundance of insects

Overall performance of the analysis

Improvement of the paper?

- ▶ In this case, a control group could be:
 - ▶ third or fourth sampling on each location
- ▶ Blomqvist (1987) emphasized the need to include control groups
 - ▶ make adjustments for the RTM effect possible

1

- “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)

[illegible]

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

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