

Phenology - Diversity – Biogeography -

From single species trends to communities in space

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ANL conference centre, Laufen

4 Dec. 2019

Butterfly Phenology



Butterfly phenology

- Bioclimatic region phenology
- A discrete region – where does it start and where does it end?

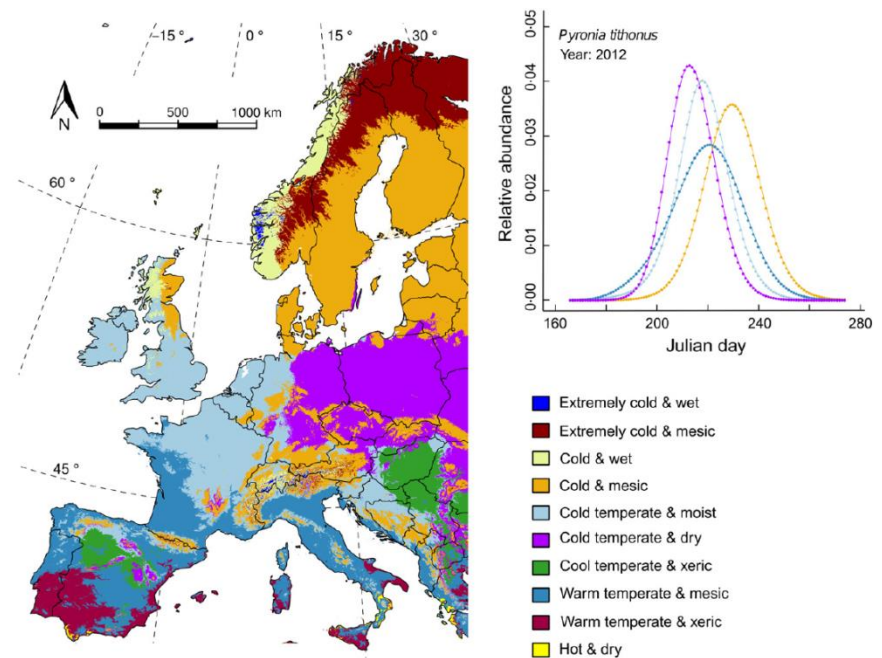


Fig. 1. Climate regions across Europe as defined in Metzger *et al.* (2013) with the flight curve of *Pyronia tithonus* observed in 2012 within four regions (Cold & mesic [yellow], Cold temperate & moist [pale blue], Cold temperate & dry [purple], Warm temperate & mesic [blue]).

- 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)

Phenology relative to what?

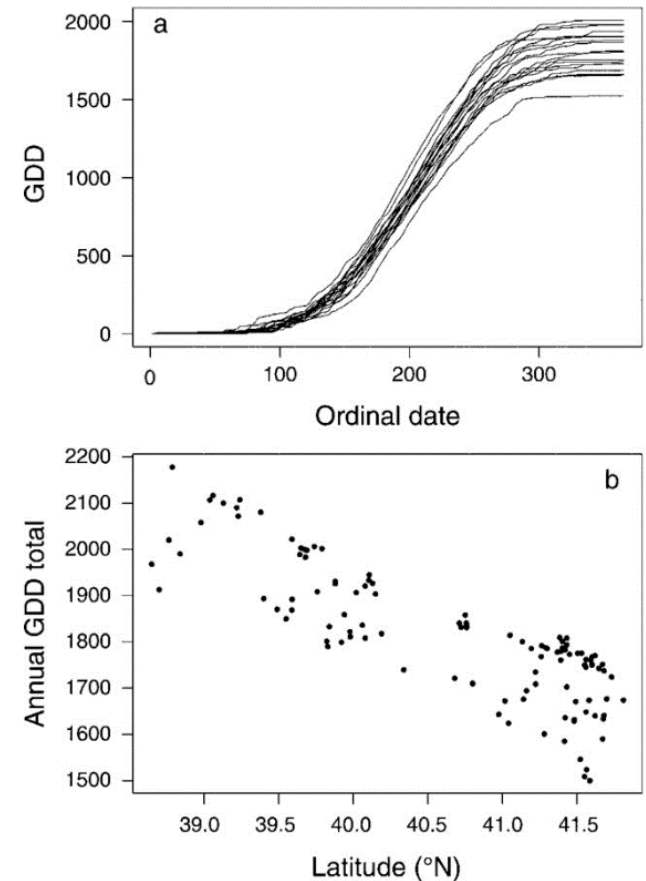
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Do growing degree days predict phenology across butterfly species?

Heather L. Cayton , Nick M. Haddad, Kevin Gross, Sarah E. Diamond, Leslie Ries

- Cayton, H. L., Haddad, N. M., Gross, K., Diamond, S. E., & Ries, L. (2015). Do growing degree days predict phenology across butterfly species? *Ecology*, 96(6), 1473–1479. doi: [10.1890/15-0131.1](https://doi.org/10.1890/15-0131.1)



Phenology & Growing Degree Days (GDD)

- Wepprich T.M. PhD thesis ([2017](#)) Effects of Climatic Variability on a Statewide Butterfly Community

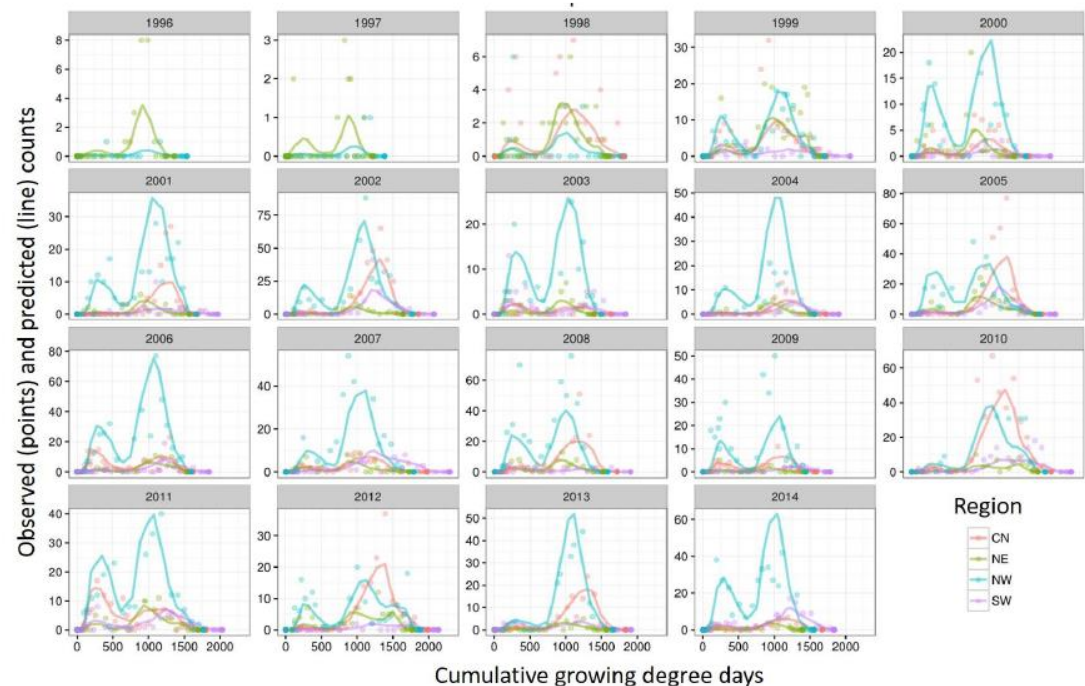
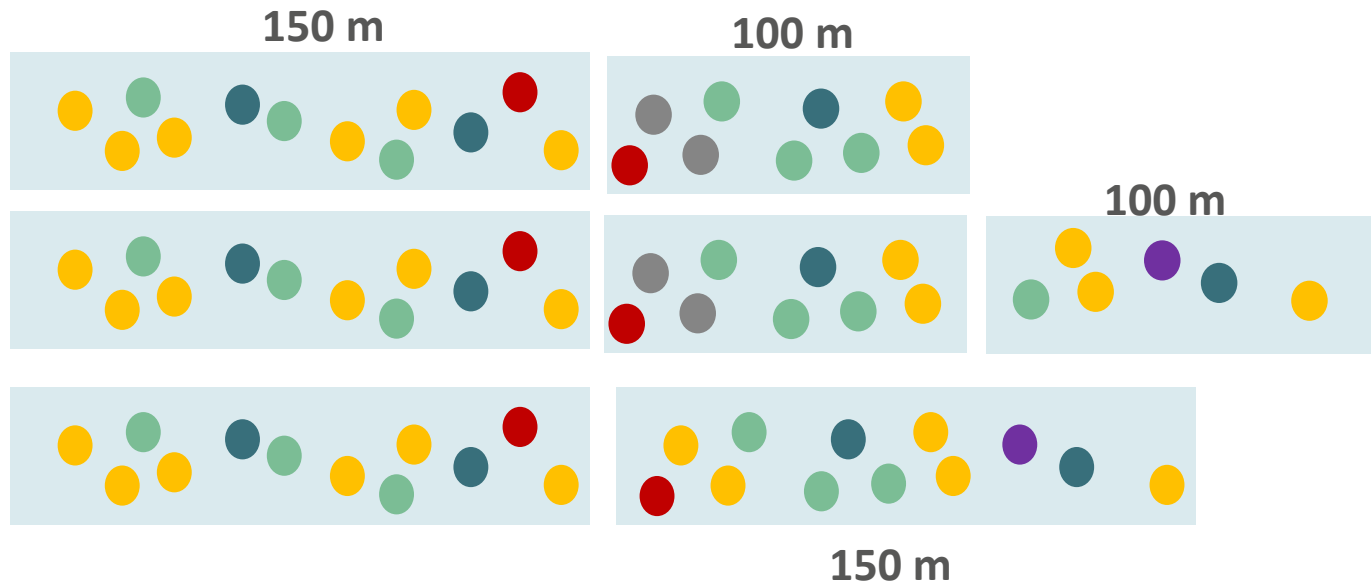


Figure 1-A1: Butterfly counts versus model predictions in different years and regions. Example predictions from a generalized additive model versus the observed Spicebush Swallowtail counts from 4 sites in different regions across years.

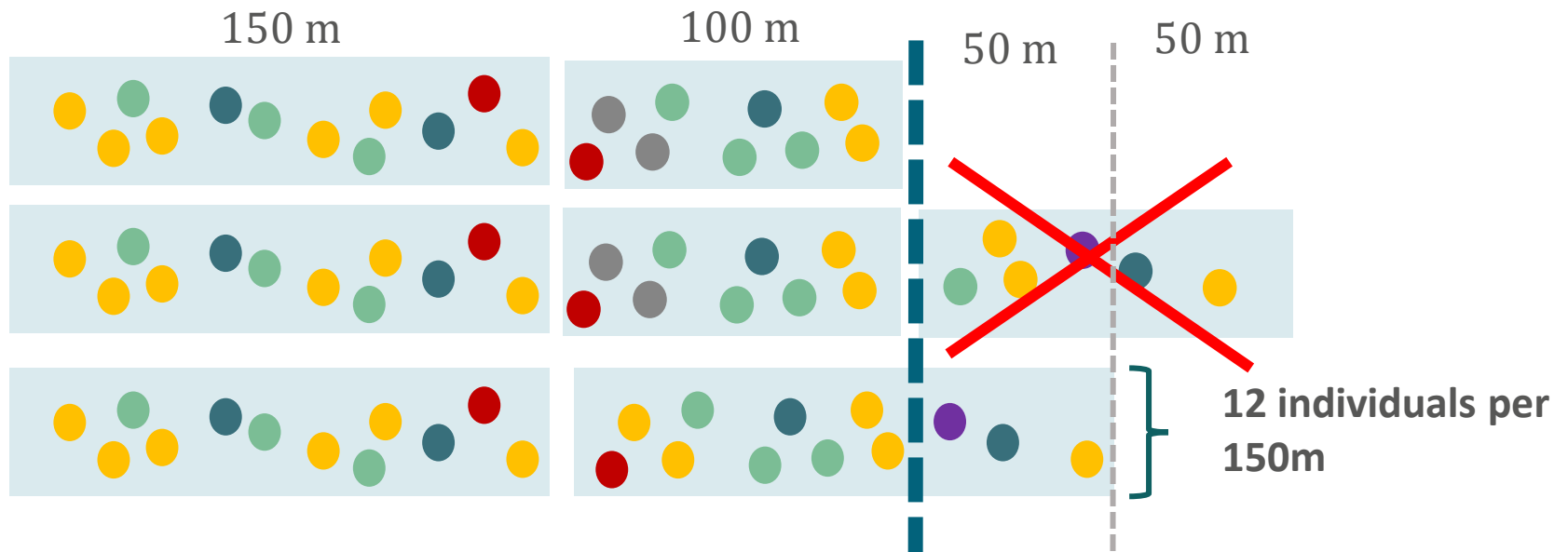
Butterfly Diversity



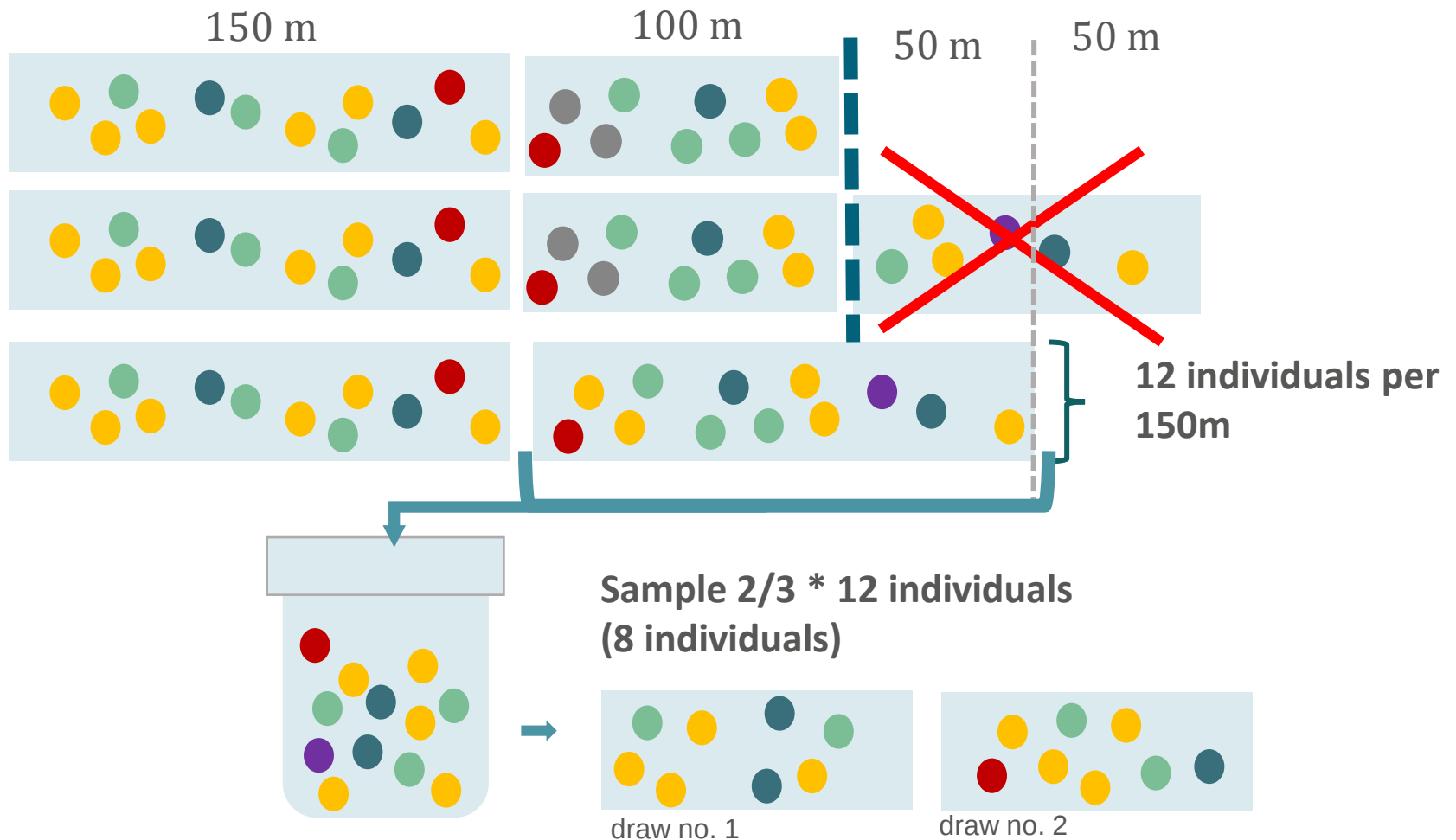
Butterfly Diversity along transects



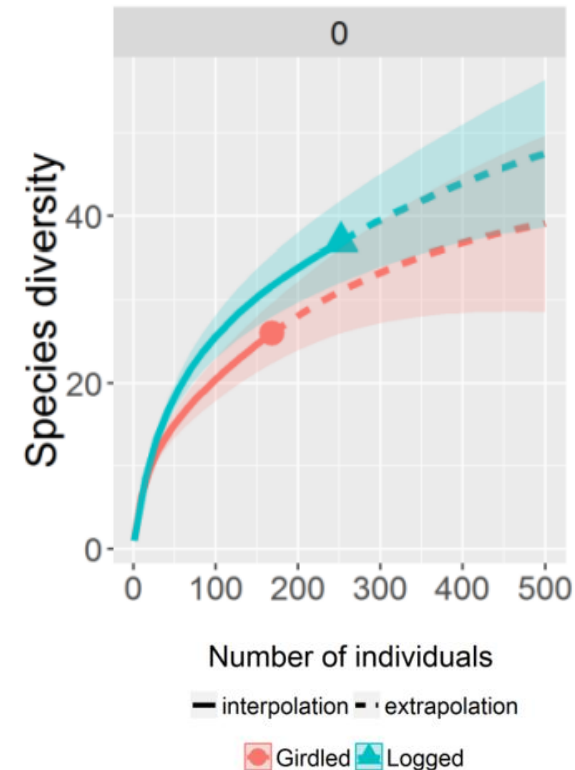
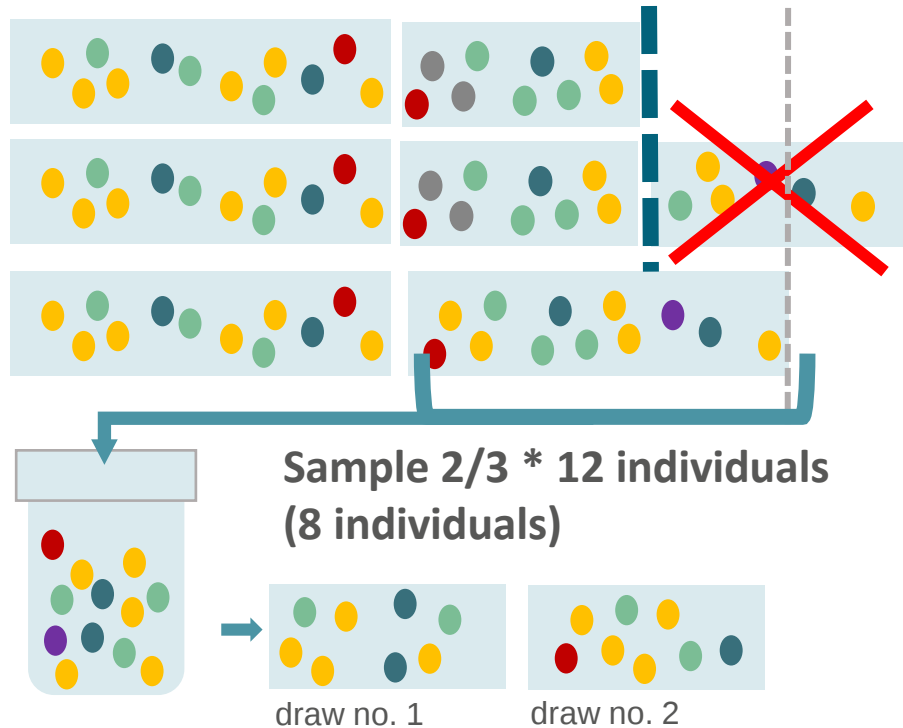
Butterfly Diversity



Butterfly Diversity

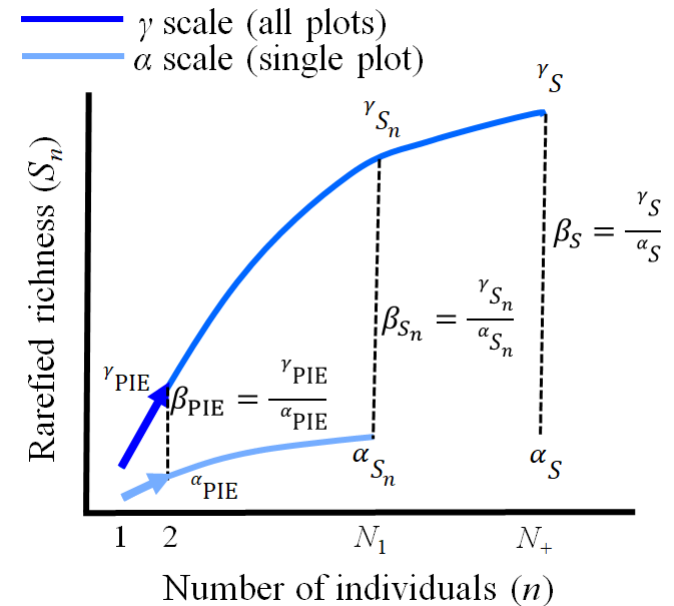
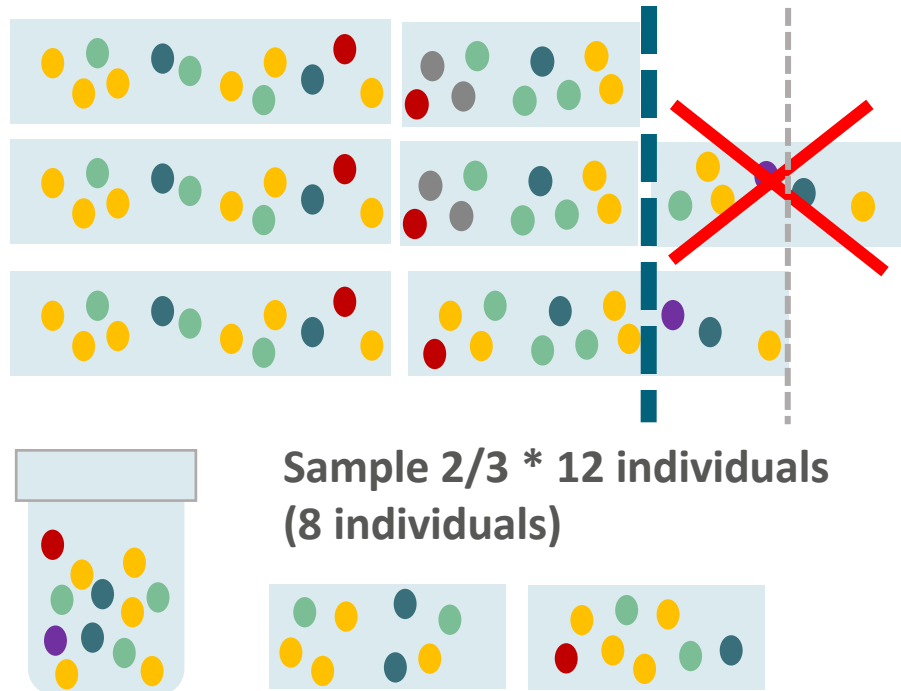


Butterfly Diversity (Hill numbers)



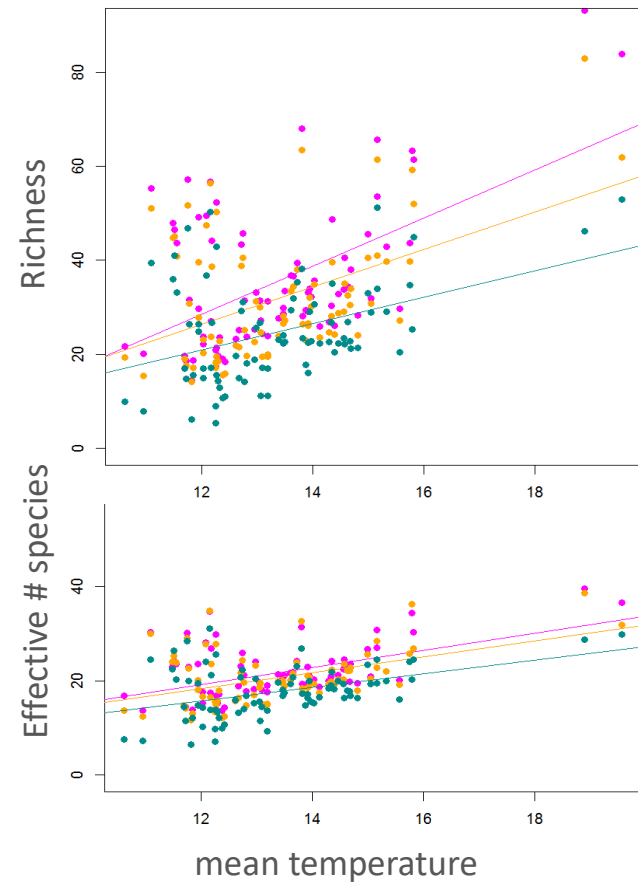
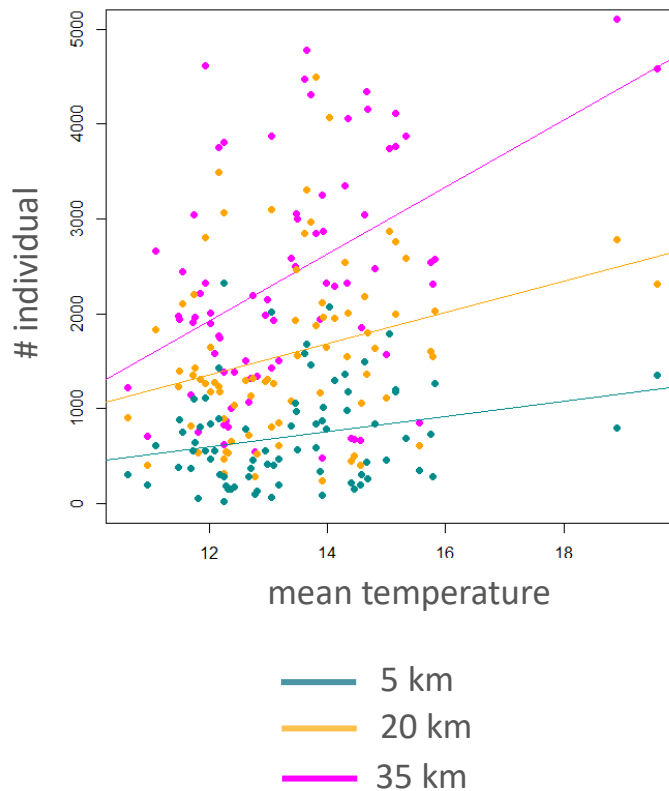
Hsieh, T. C., Ma, K. H., & Chao, A. (2016). iNEXT: an R package for rarefaction and extrapolation of species diversity (Hill numbers). *Methods in Ecology and Evolution*, 7(12), 1451–1456. doi: [10.1111/2041-210X.12613](https://doi.org/10.1111/2041-210X.12613)

Butterfly Diversity (Hill numbers)



McGlinn, D. J., Xiao, X., May, F., Gotelli, N. J., Engel, T., Blowes, S. A., ... McGill, B. J. (2019). Measurement of Biodiversity (MoB): A method to separate the scale-dependent effects of species abundance distribution, density, and aggregation on diversity change. *Methods in Ecology and Evolution*, 10(2), 258–269. doi: [10.1111/2041-210X.13102](https://doi.org/10.1111/2041-210X.13102)

Butterfly Diversity (Hill numbers)



Thank you

Any questions?



UK Centre for
Ecology & Hydrology



Photo: Chris van Swaay