

CONTRIBUTION OF TROPHIC GROUPS TO CARBON FLOWS IN SOIL



website



preprint

Pierre Quévreur^{1,2,3}
Franck Jabot¹

¹ *Unité Mixte de Recherche sur l'Ecosystème Prairial (UREP - UMR 0874), INRAE-VetAgro Sup, 5 chemin de Beaulieu, 63000 Clermont-Ferrand, France*

² *Department of Physical Geography, Stockholm University, Stockholm SE-106 91, Sweden*

³ *Bolin Centre for Climate Research, Stockholm University, Stockholm SE-106 91, Sweden*

INTRODUCTION

- Understanding carbon flows in ecosystems to promote carbon storage in soils (4 per 1000 initiative)
- Models focusing on microbes to represent biological activity
- Soil fauna with major functions (litter decomposition and microbe regulation) but neglected in models
- **How does soil fauna contribute to soil carbon flows?**

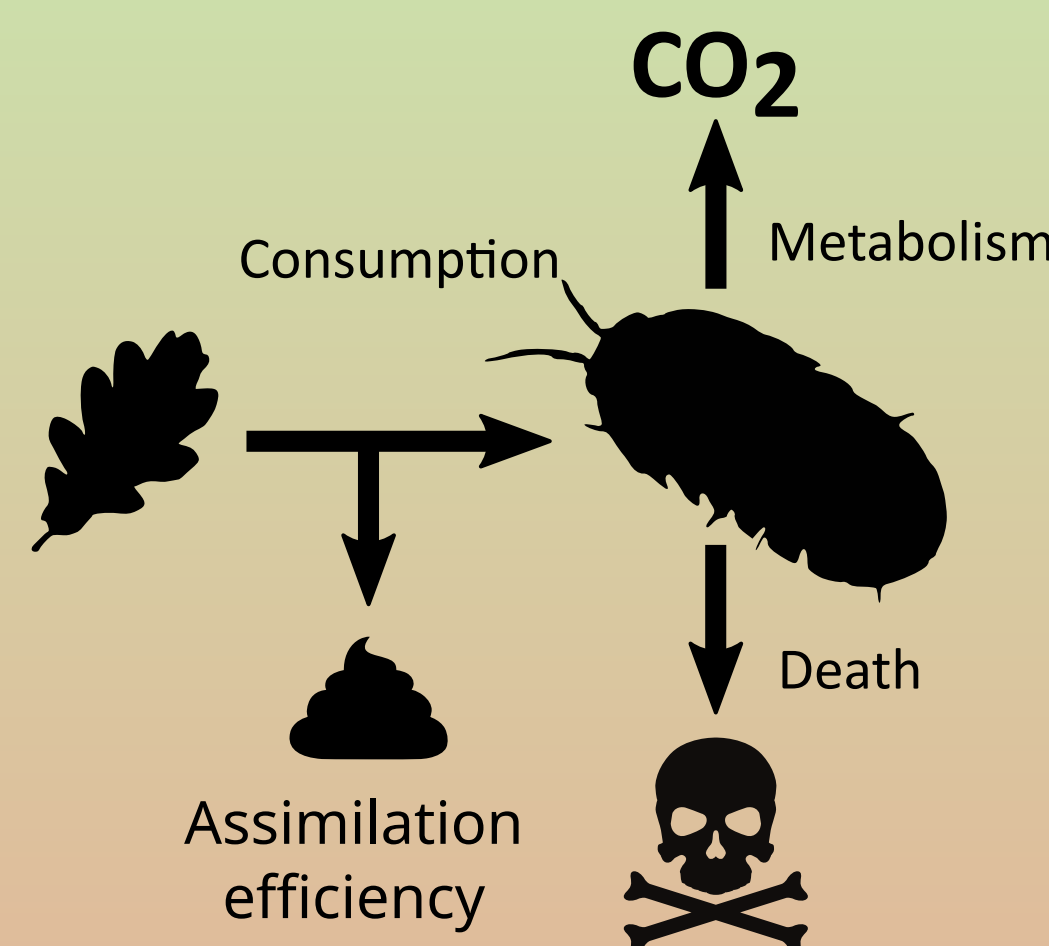


without fauna

with fauna

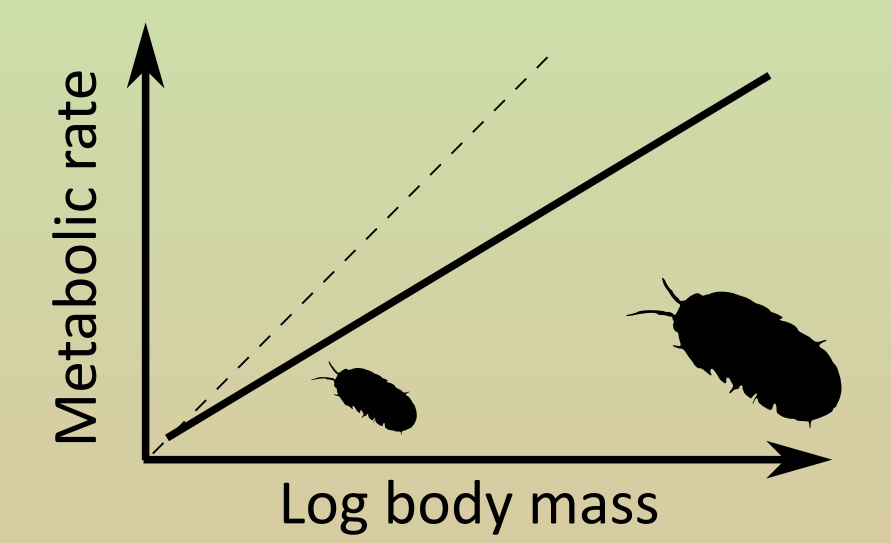


METHODS: METABOLIC THEORY OF ECOLOGY AND FOOD WEBS

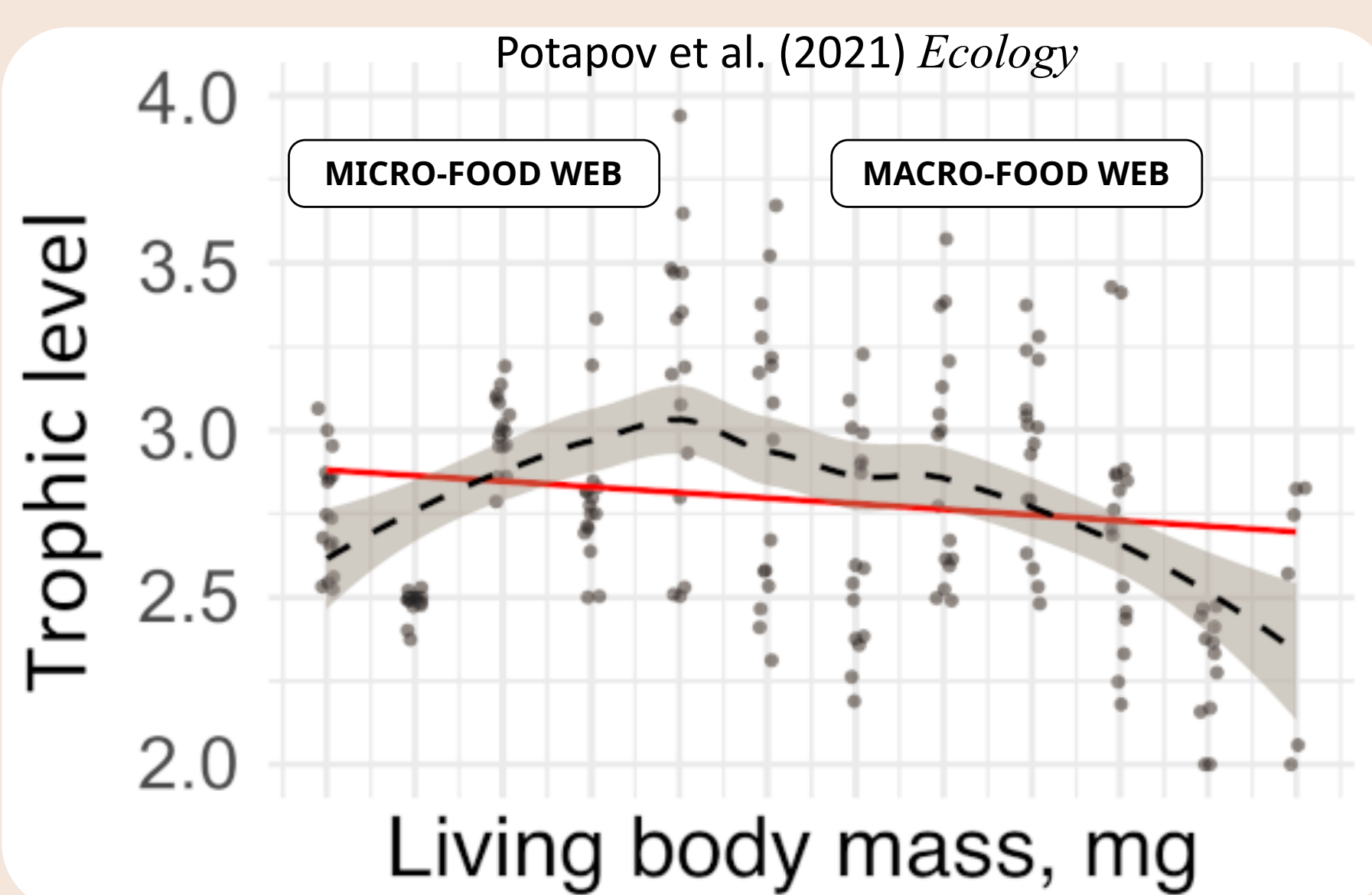
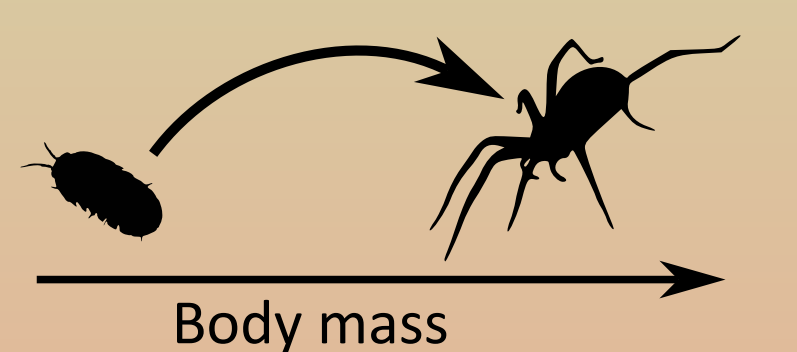


- Link between biological rates and carbon flows
- Scaling of metabolic rate x with body mass M ($a < 1$)

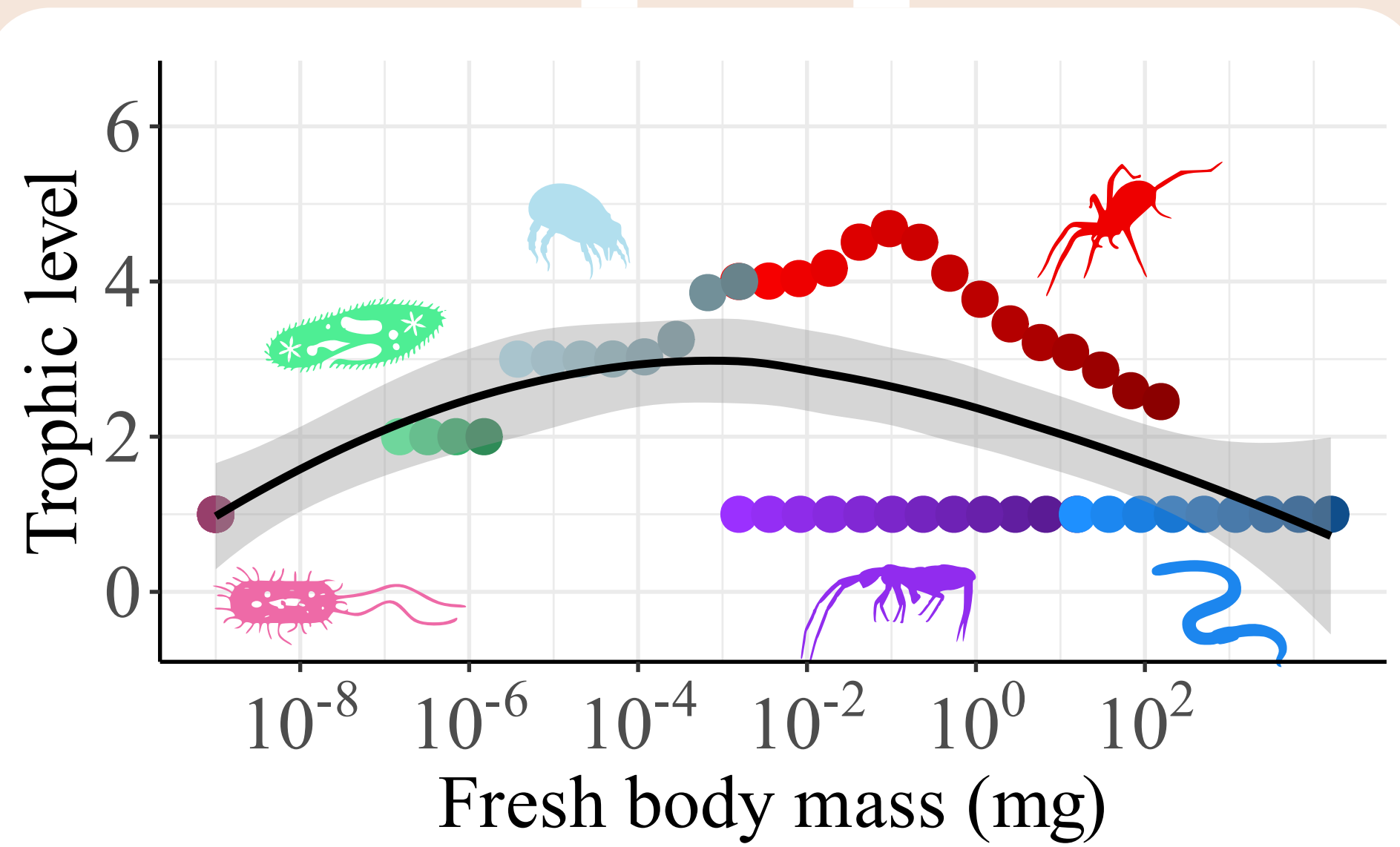
$$x = x_0 M^a$$



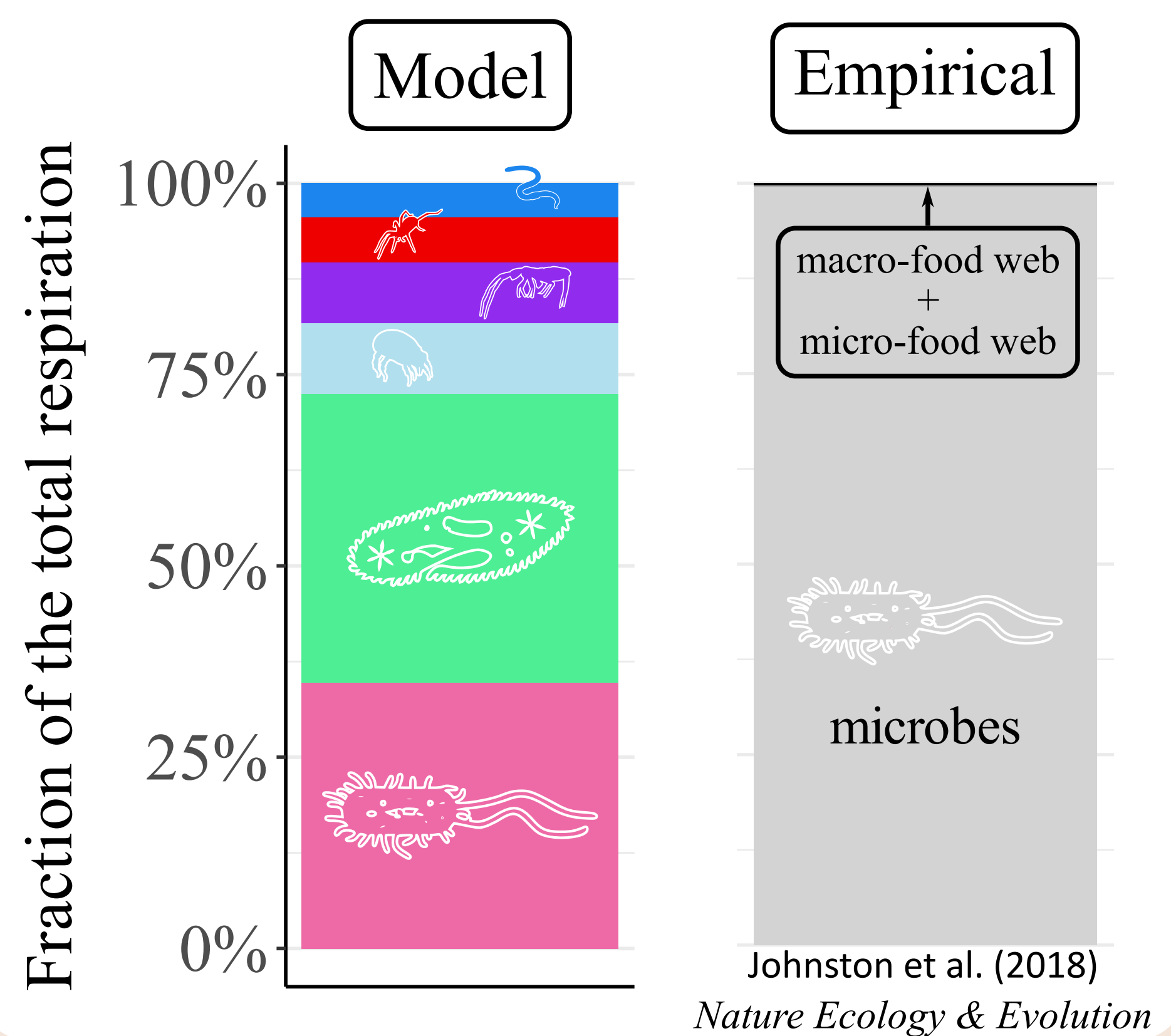
- Size structuration of trophic interactions (large predators eat small prey)
- Dynamical food web model



Reproduction of empirical patterns

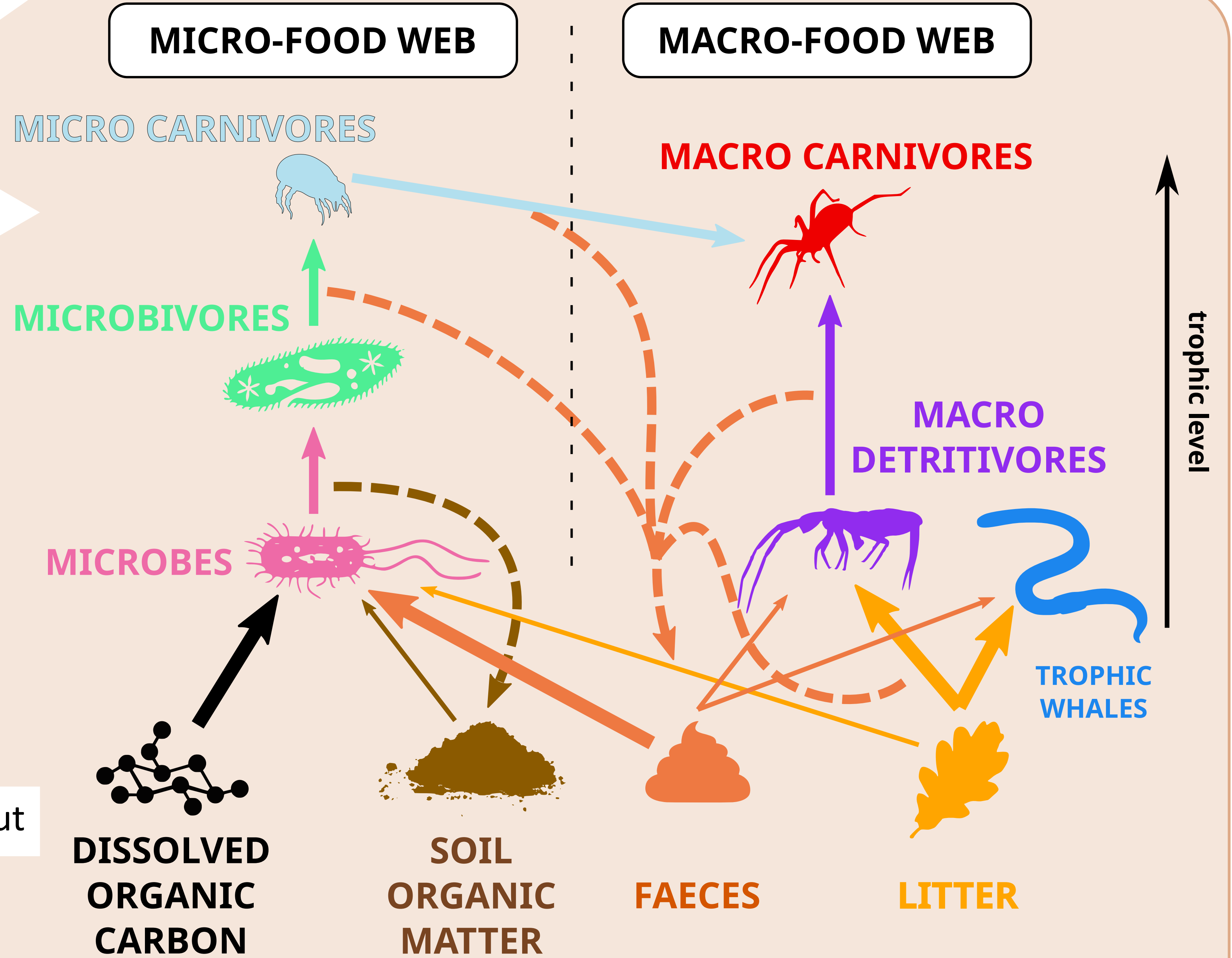


Model output



Johnston et al. (2018)
Nature Ecology & Evolution

Empirical data



Model: high respiration of microbes and their predators
Empirical: overwhelming respiration of microbes (~100%)

Why such a difference?

Respiration = field biomass x mass specific metabolic rate

Two biases in empirical estimations:

- 1 - All microbial biomass is considered as active, while 80-90% is dormant
- 2 - Averaging protist metabolic rate neglects small species with high mass-specific metabolic rate

DISCUSSION

- The model reproduces well features of soil food webs
- Probable overestimation of microbial respiration and underestimation of microfauna respiration from empirical data

TAKE HOME MESSAGE

- Dynamical models challenge empirical estimations
- Trophic interactions are important to understand soil respiration
- Future empirical studies should dedicate more attention to soil micro-fauna