

Energetic and behavioral responses of aquatic ectotherms to projected climate change

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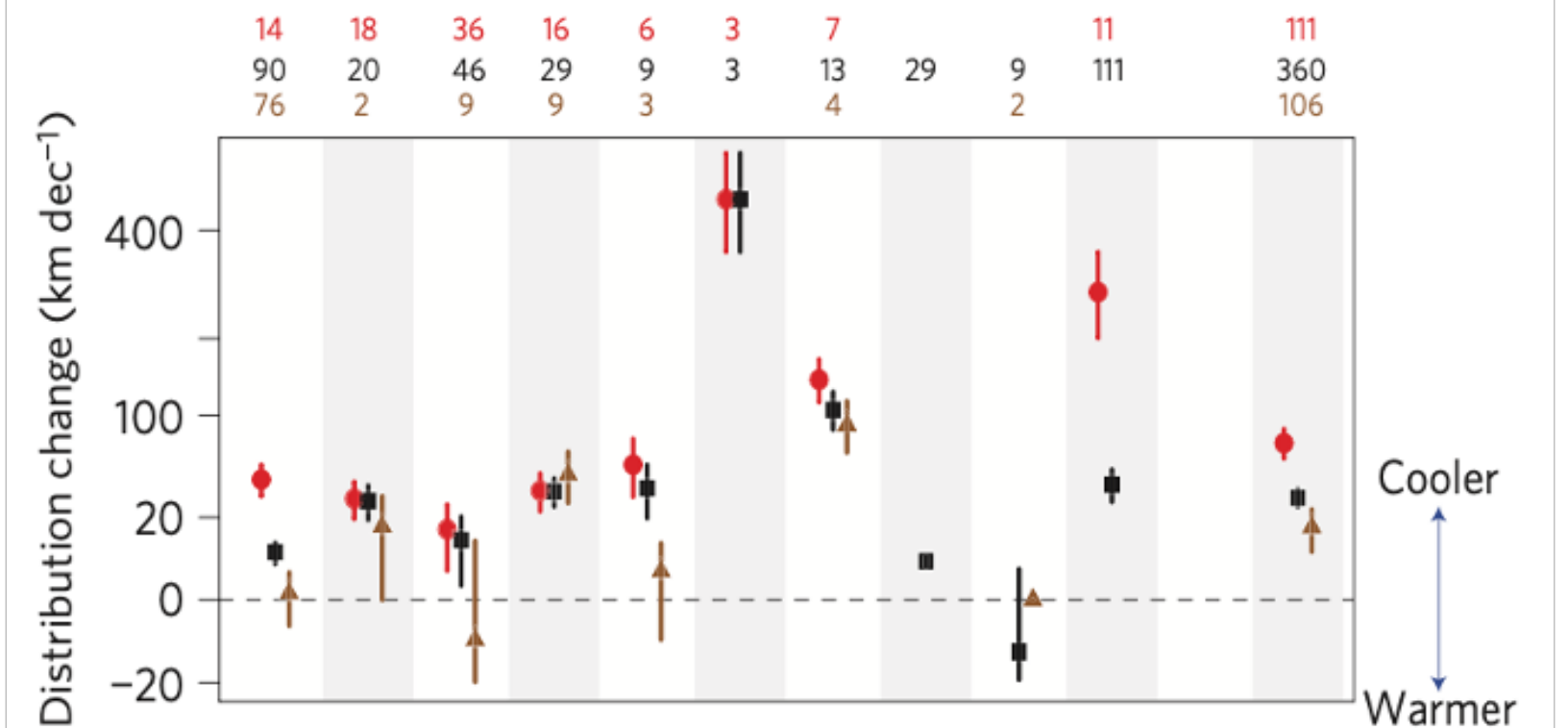
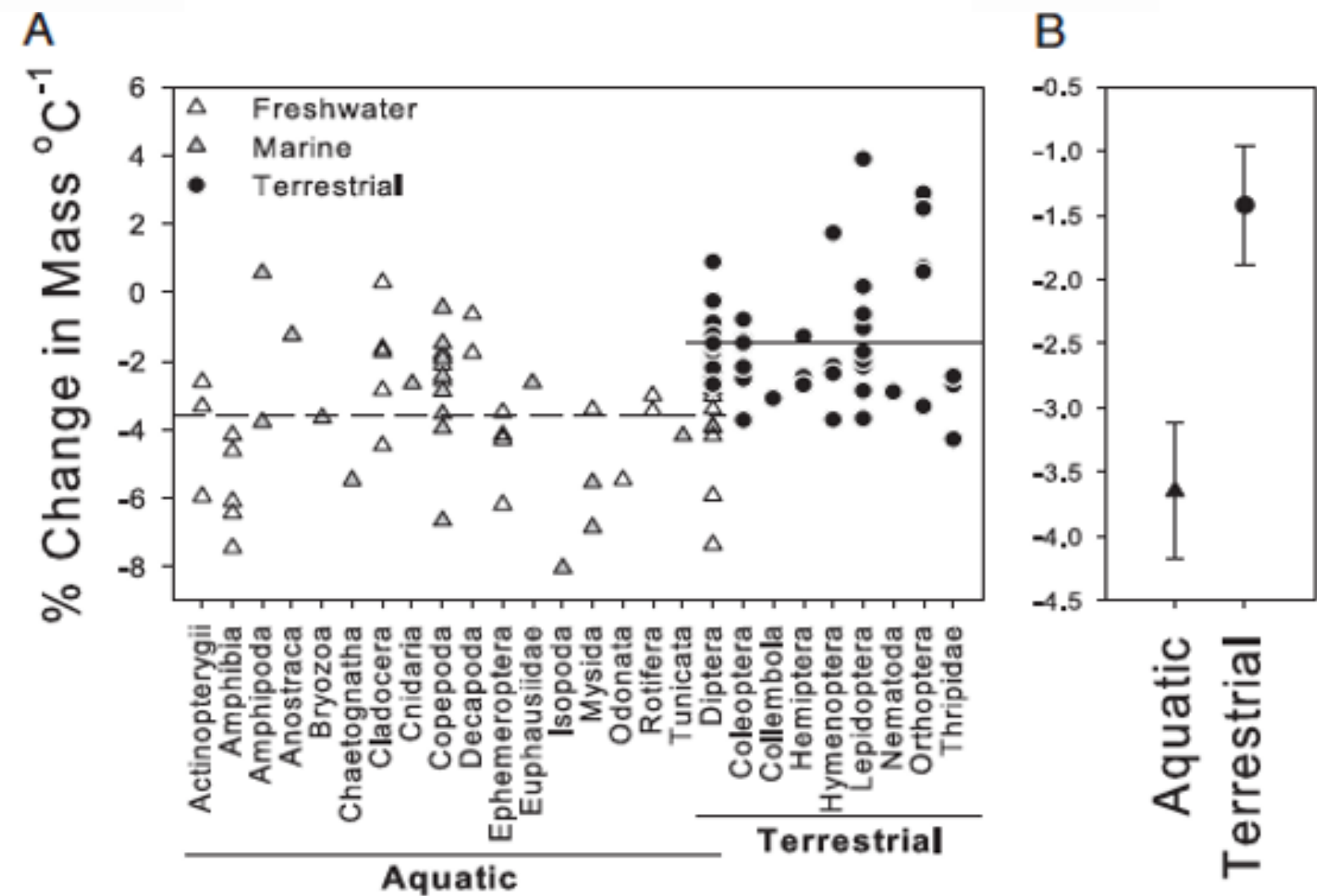
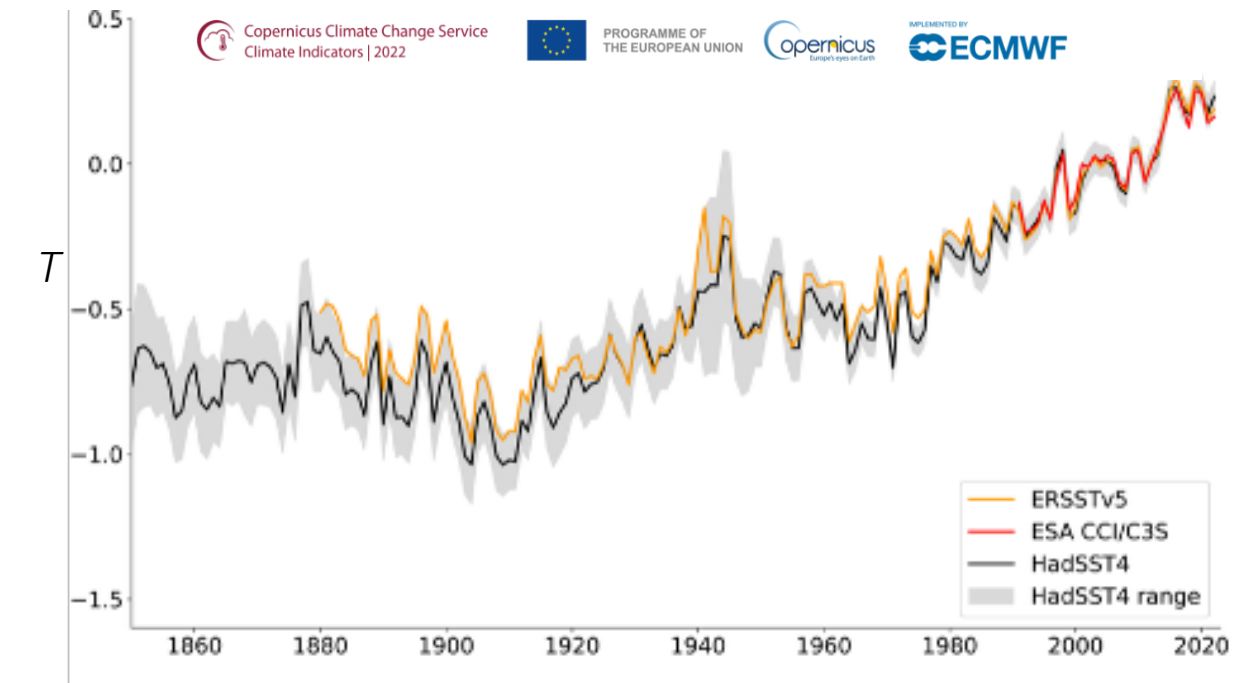


Global footprint of climate change



Species have shifted their distribution Northward ~ 6 km/decade

Several aquatic species have shrunk by approximately -3.65% per $^{\circ}\text{C}$ increase



(Forster et al, 2012; Poloczanska et al, 2013)



$$MR = b_0 M^{3/4}$$

Kleiber, M. (1932, 1947)

- M is the animal's mass
- B_0 is a mass-independent normalization

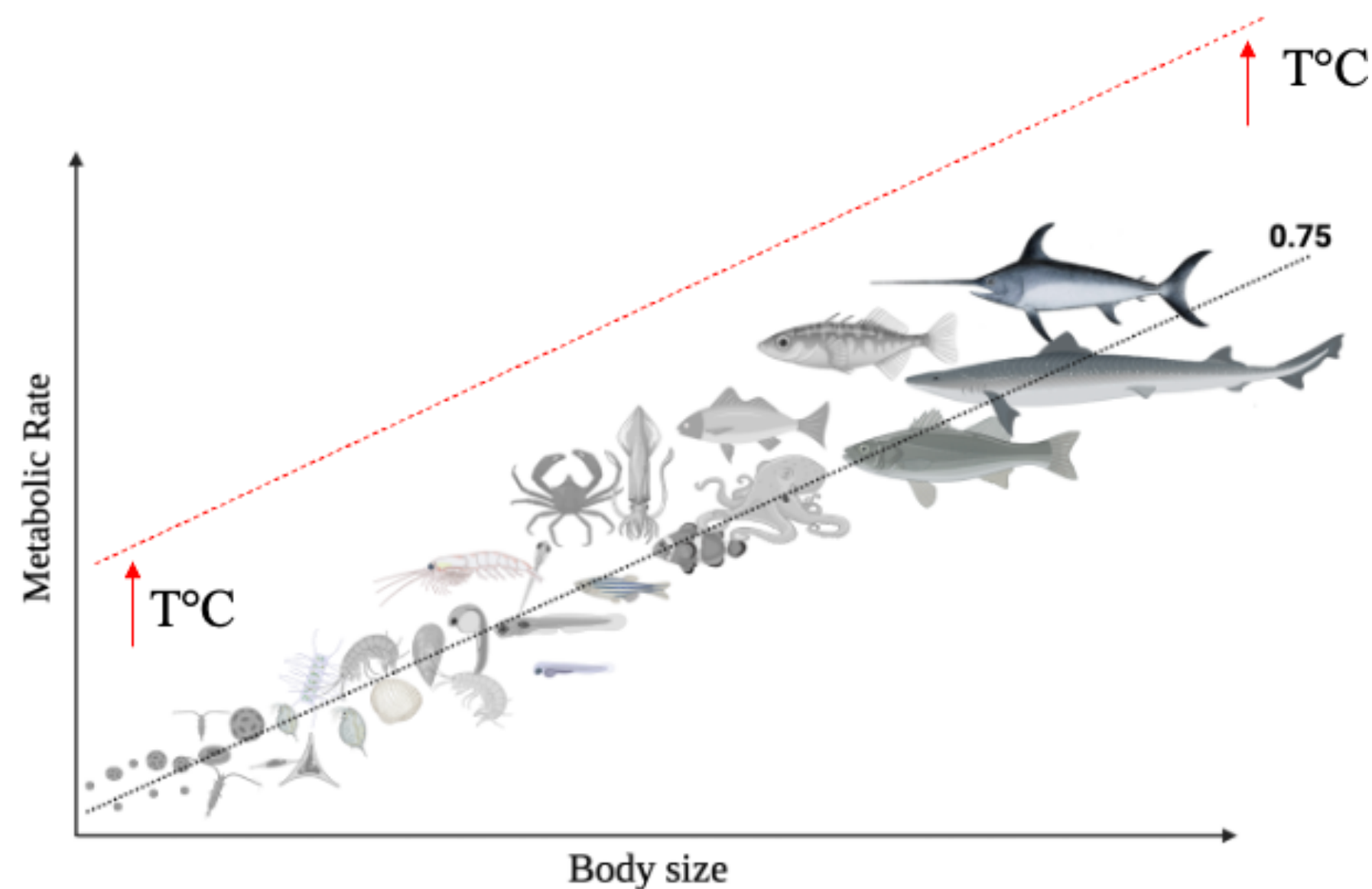
$$k = Ae^{-Ea/RT}$$

Arrhenius, S. (1889)

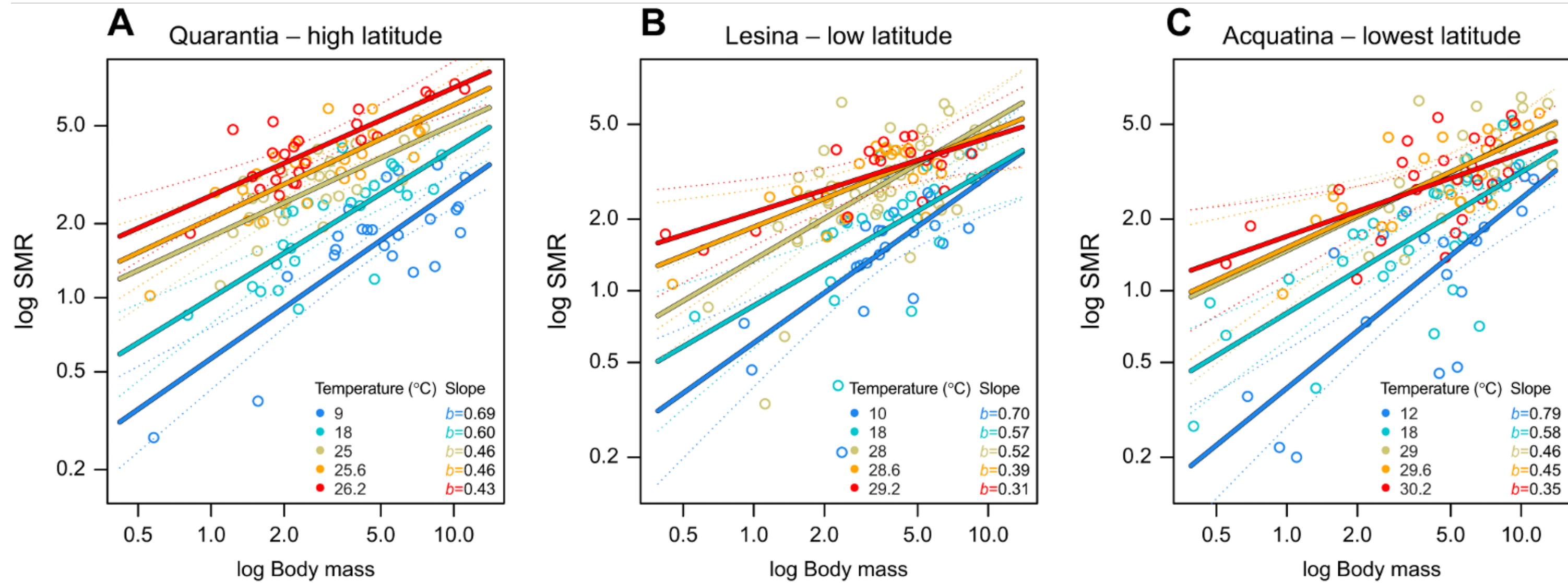
- k is the rate constant
- T is the absolute temperature
- A is the pre-exponential factor
- Ea is the activation energy for the reaction
- R is the universal gas constant

$$MR = b_0 M^{3/4} \times e^{-\frac{E}{kT}}$$

Brown, J. (2004)

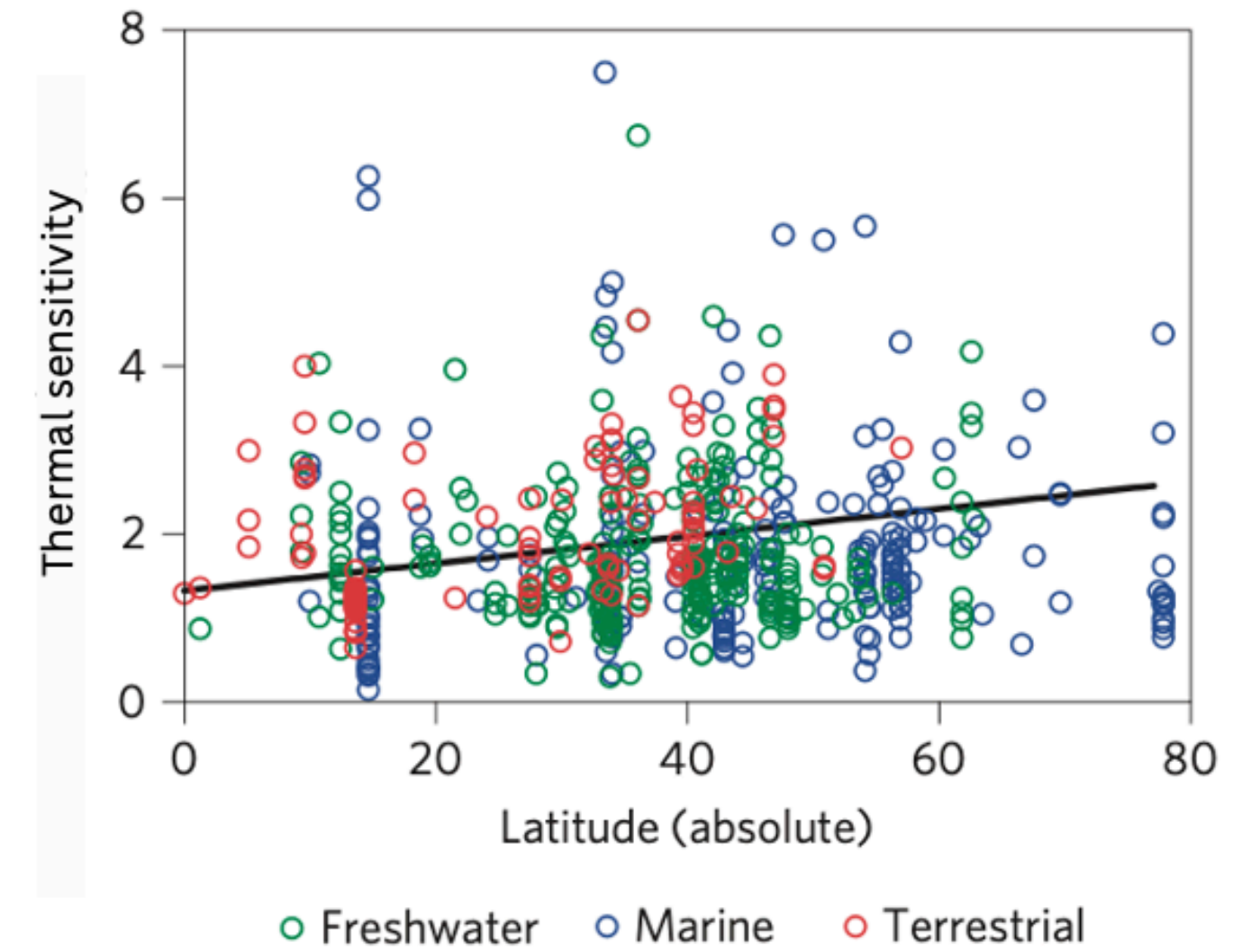
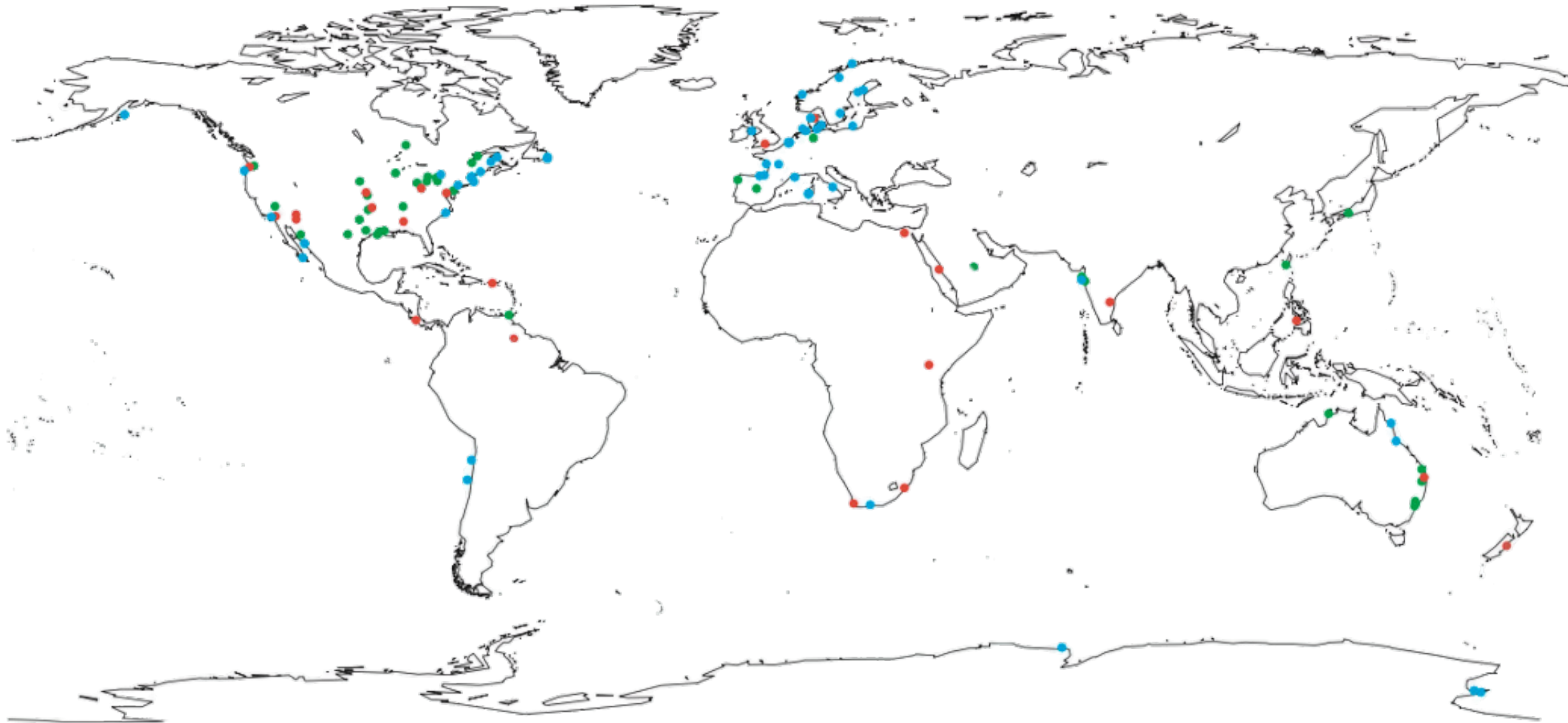


The relationship between standard metabolic rate and body size



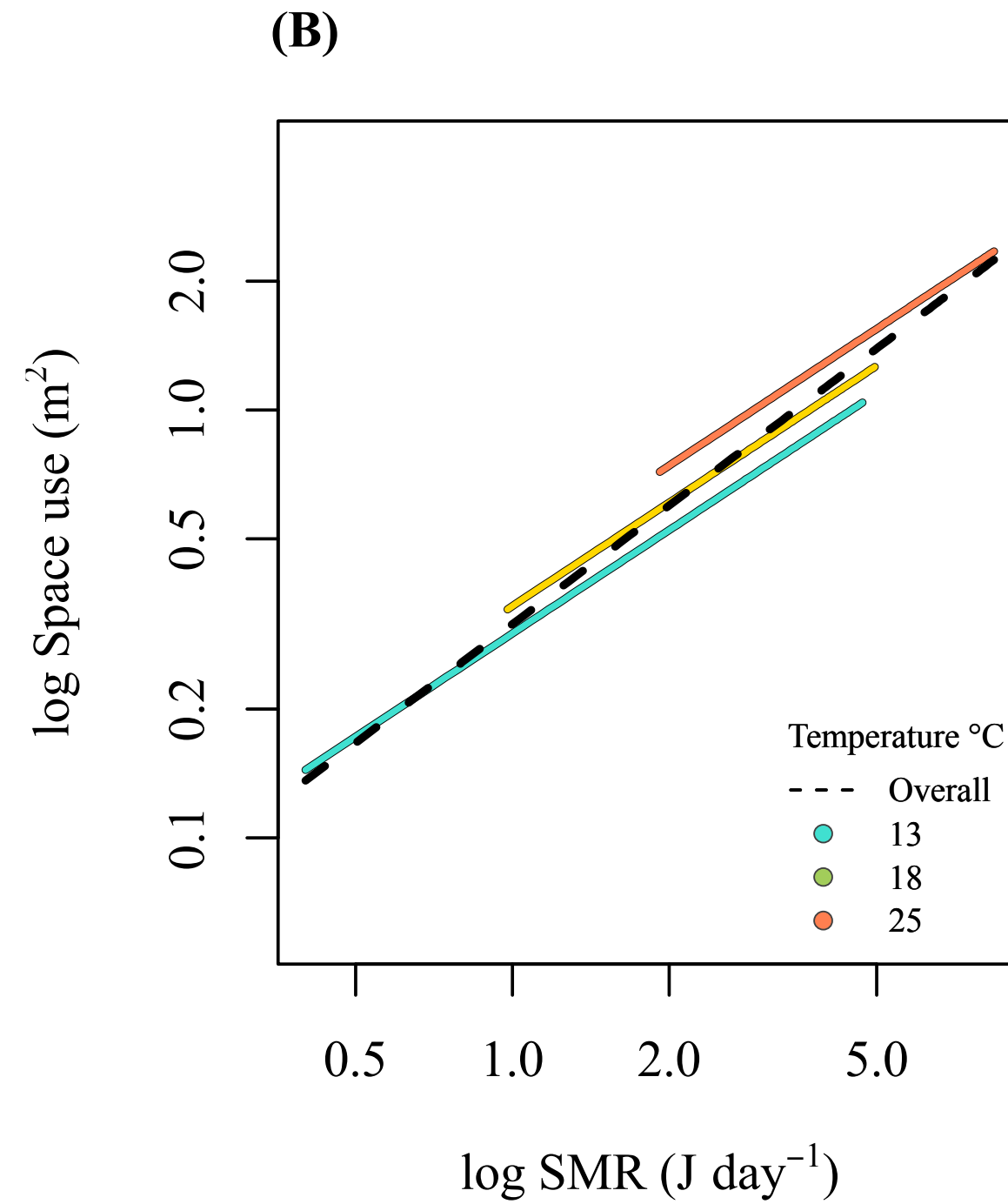
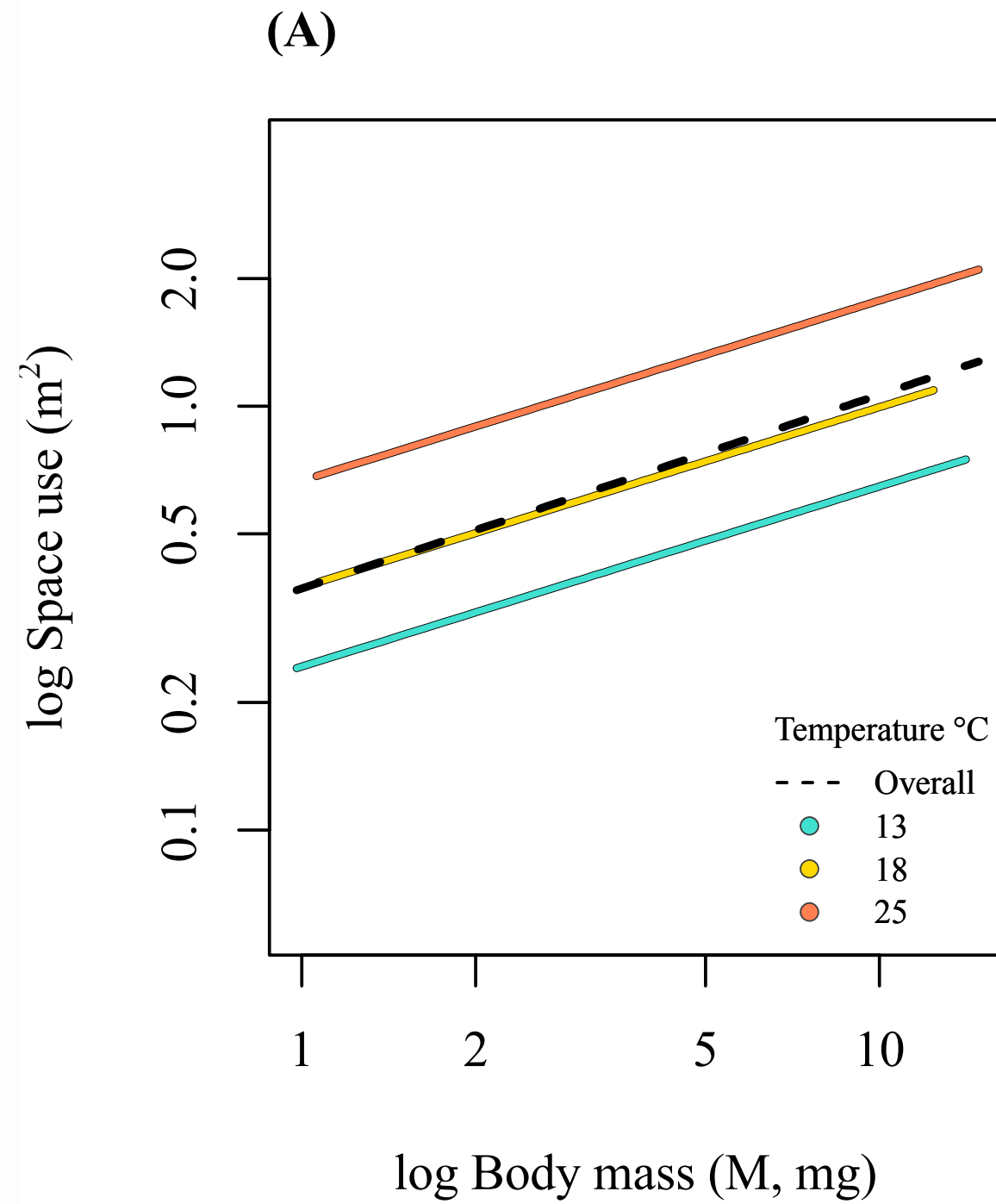
Shokri et al. (2022)

Thermal sensitivity of metabolic rate



(Seebacher et al., 2014)

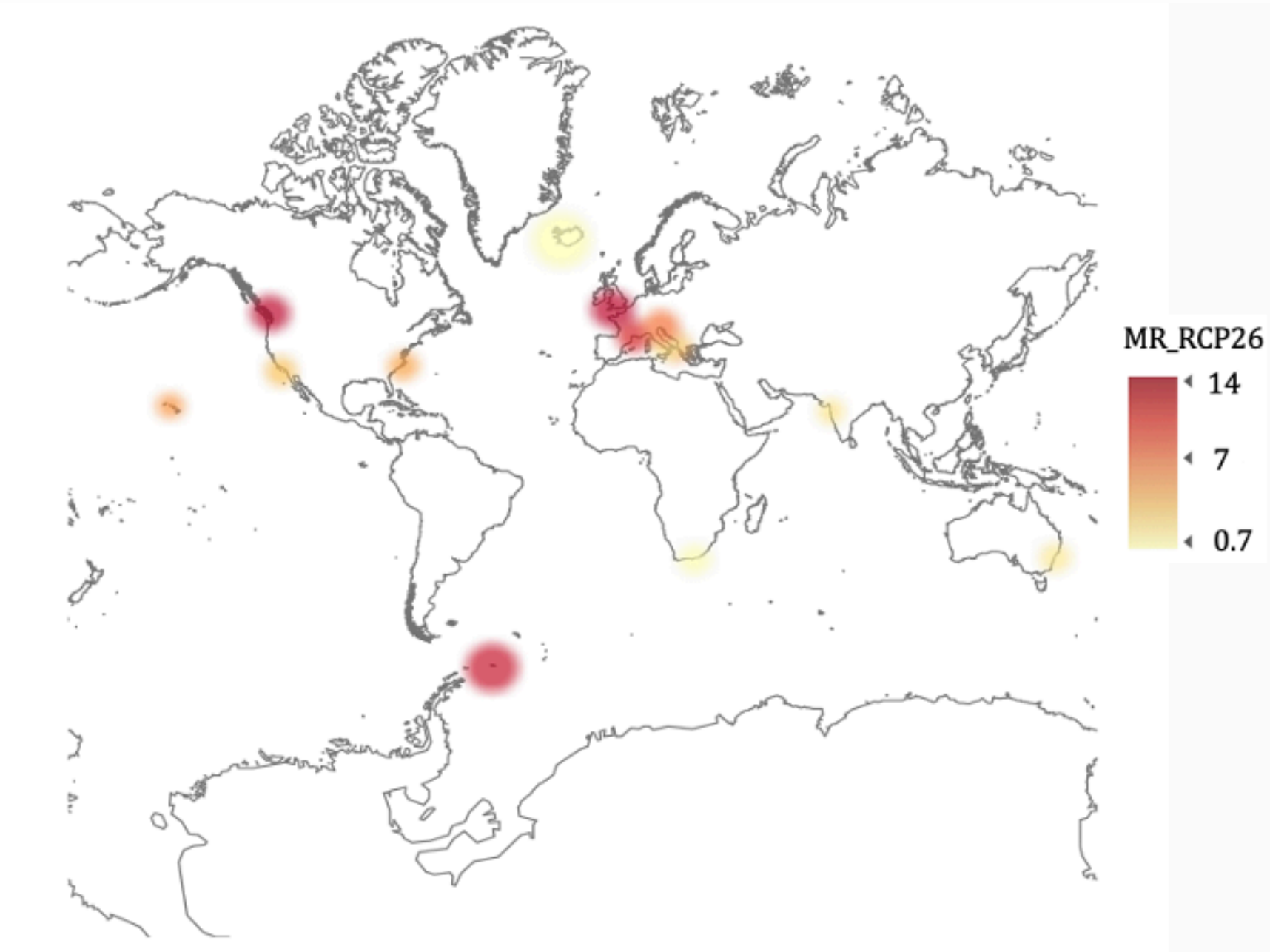
Space use behavior across temperature



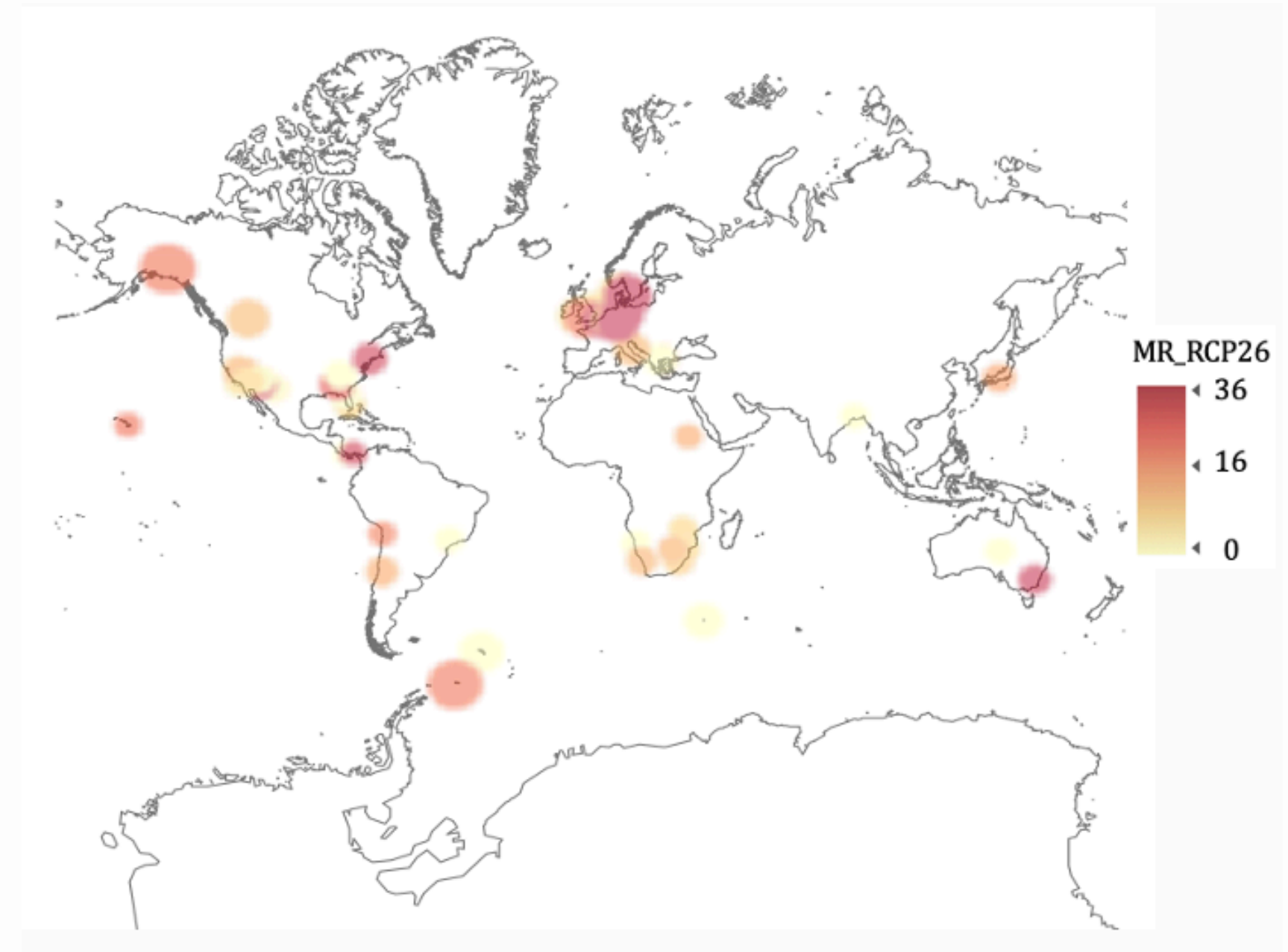
(Shokri et al submitted)



Aquatic Invertebrates



Terrestrial Invertebrates



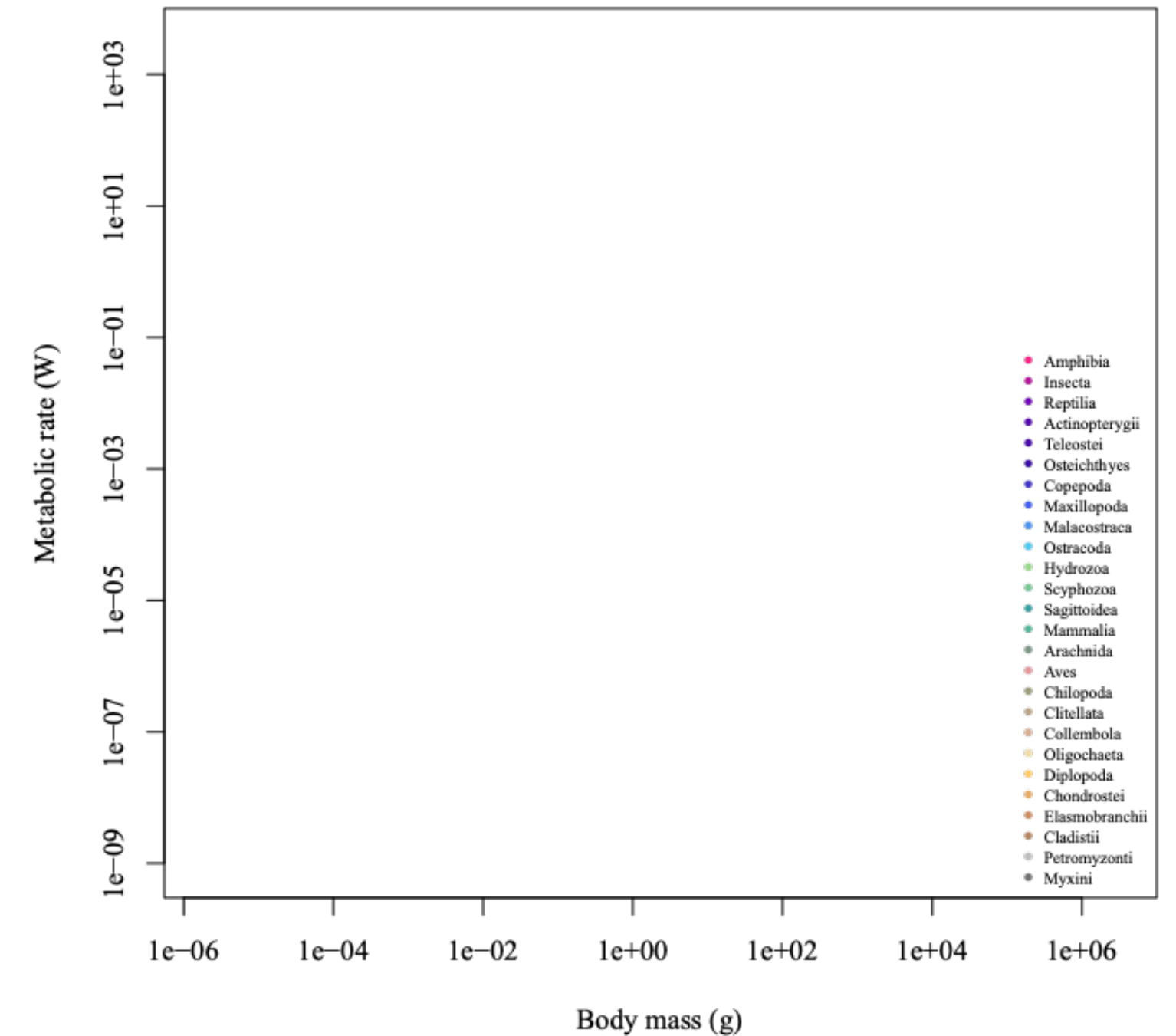
Changes in metabolic rates are expressed as percentage changes under the predicted conditions for the year 2100, according to the RCP2.6 emissions scenario projections. These predictions are based on climate changes at each location and are limited to areas within 500 km of the source localities

(Shokri et al in preparation)



A total of 7800 measurements of metabolic rates

- Across 27 Classes ; 2268 Species
- Expand a range of temperature from -2 °C – 45 °C
- ~12 orders of magnitude in body size
- Expanding from Freshwater, Transitional water and Marine to Terrestrial ecosystems



(Taban et al, in preparation)

LifeWatch ERIC 2024 Thematic Service Workshop Series

Thank you for your attention!
Any questions?



Taxonomy | Brussels, Belgium, 30 January 2024



Climate Change Impact on Biodiversity Patterns | Lecce, Italy, 21-22 February 2024



Animal Movement and Biologging | Ostend, Belgium, 22 March 2024



Biogeography | Bologna, Italy, 4-5 April 2024



Biodiversity Observatory Automation | Ljubljana, Slovenia, 11 April 2024



Habitat Mapping | Aveiro, Portugal, 3 May 2024

