Energetic mismatch induced by warming decreases leaf litter decomposition by aquatic detritivores

Theme08 - Introduction to Systems Biology
Reproducing a Research Article

Figure 1: Gammarus fossarum

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Abstract

Max 150-250 words. CHANGE LAYOUT/STYLING ENTIRELY

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RMR was calculated as the slope of oxygen depletion over a ca 35 min timeframe, corrected for the mean linear trend over time of oxygen concentration in controls as follows: RMR = (ci − cf)/(ti − tf), where ci and cf are initial and final oxygen concentrations (μmol O2/L) in the wells and ti and tf are initial and final times points (day-1) of the respiration experiment. Values were converted into C release rate (μg C/day) assuming a respiratory coefficient of 0.78 (as estimated for Gammarus pulex, Wright & Wright, 1979).

Statistical Analysis Equations

The following equations were used to express the mass (M in mg) and temperature (T in Kelvin) dependence of individual RMR and IR:

$$I = \alpha M^b e^{Ea\left(\frac{T-T_0}{k_B T_0 T}\right)} \tag{1a}$$

$$I = \alpha M^b e^{p\left(\frac{T-T_0}{k_B T_0 T}\right) - q\left(\frac{T-T_0}{k_B T_0 T}\right)^2} \tag{1b}$$

The standard MTE formulation (1a) is simply a particular case of the quadratic formulation (1b) where $q = 0$ and the equation is reduced to the MTE model where p can thus be interpreted as the activation energy.

Energetic efficiency was also calculated as follows: $E = (IR/RMR) * A_T$, where the ratio of IR to RMR is the ingestion to metabolism efficiency and A_T is the assimilation efficiency at temperature T. The temperature (T in Kelvin) dependence of assimilation efficiency was expressed, using empirical equations and values for detritivores Assimilation efficiency was following a logistic equation with the MTE equation both at the numerator and the denominator With the following formulation, assimilation efficiency is confined between 0 and 1 (no or complete assimilation):

$$A_T = \frac{\alpha e^{Ea\left(\frac{T-T_0}{k_B T_0 T}\right)}}{1 + \alpha e^{Ea\left(\frac{T-T_0}{k_B T_0 T}\right)}} \tag{2}$$

Consumer-Resource Dynamics Model

Below are the ordinary differential equations describing temporal change in leaf litter standing stocks (L) and Gammarus population biomass (G) (Equation 3a and 3b).

$$\frac{dL}{dt} = I - f(L)_{\mathrm{T}} G - k_{\mathrm{T}} L \tag{3a}$$

$$\frac{dG}{dt} = G\left[f(L)_{\mathrm{T}} A - RMR_{\mathrm{T}}\right] \tag{3b}$$

3 Results

4 Discussion and Conclusion

4.1 Discussion

- Basically unreproducible in general, long pieces of code that were repeated over and over that could not be understood. No easy way to reproduce other than to immediately copy and paste multiple hundreds lines of code where only few values would be changed.
- Formulas for metabolic and ingestion rates were heavily rewritten from the base formula. They were unrecognizable so they were cleaned up to be understandable and resemble the actual formula more. It should also be noted that the position where the mean in the quadratic portion of the exponent is actually different from what would be done following the formula.

4.2 General conclusion and perspective

5 References