Equations and figure list

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January 7, 2018

1 Equations

$$ln(B) = -E_a \frac{1}{kT} + ln(B_0) \tag{1}$$

$$B = \frac{b_0 m^{\beta} e^{\frac{-E_a}{k}(\frac{1}{T} - \frac{1}{T_{ref}})}}{1 + e^{\frac{E_d}{k}(\frac{1}{T_{pk}} - \frac{1}{T})}} \tag{2}$$

$$v = \frac{B}{COTmg} \tag{3}$$

$$COT = 1.1m^{-0.038} \tag{4}$$

$$2D : a = v_r 2d_0 (m_c m_r)^{p_d} \tag{5}$$

$$3D : a = v_r \pi d_0 ((m_c m_r)^{p_d})^2 \tag{6}$$

$$a = \left(b_{0,c} {m_c}^{\beta_c} e^{\frac{-E_c}{k}(\frac{1}{T} - \frac{1}{T_{ref}})} + \sqrt{1 + \left(\frac{b_{0,r}}{b_{0,c}}\right)^2 \left(\frac{{m_r}^{\beta_r}}{{m_c}^{\beta_c}}\right)^2 e^{\frac{2}{k}(\frac{1}{T} - \frac{1}{T_{ref}})(E_c - E_r)}} \right) D \tag{7}$$

$$a = b_{0,c} {m_c}^{\beta_c} e^{\frac{-E_c}{k}(\frac{1}{T} - \frac{1}{T_{ref}})} D \tag{8}$$

2 Figures

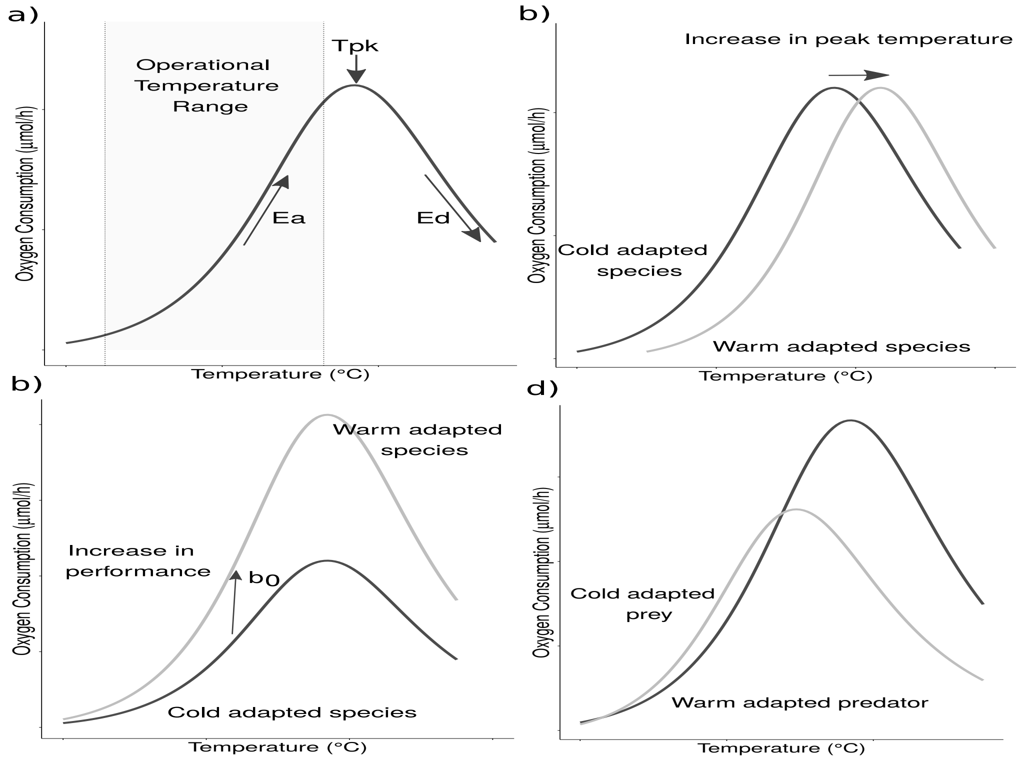


Figure 1: **Metabolism set the pace of life, directing all biological traits, from respiration to velocity.** Metabolic rates can be modelled as a unimodal function (a) determined by biochemical processes (enzyme activation (E_a) and deactivation (E_d) energies) and biological parameters ($T_p k$ and b_0) from equation 3. Adaptation to increases in temperature can give rise to different patterns. Horizontal displacement in the whole TPC (b) as species adapt to a new T_{pk} or vertical shifts (c) in performance as b_0 changes with temperature, are expected to arise. This may lead to new mismatches in predator-prey traits, potentially affecting their dynamics at specific temperatures (d). Adapted from (**???**)

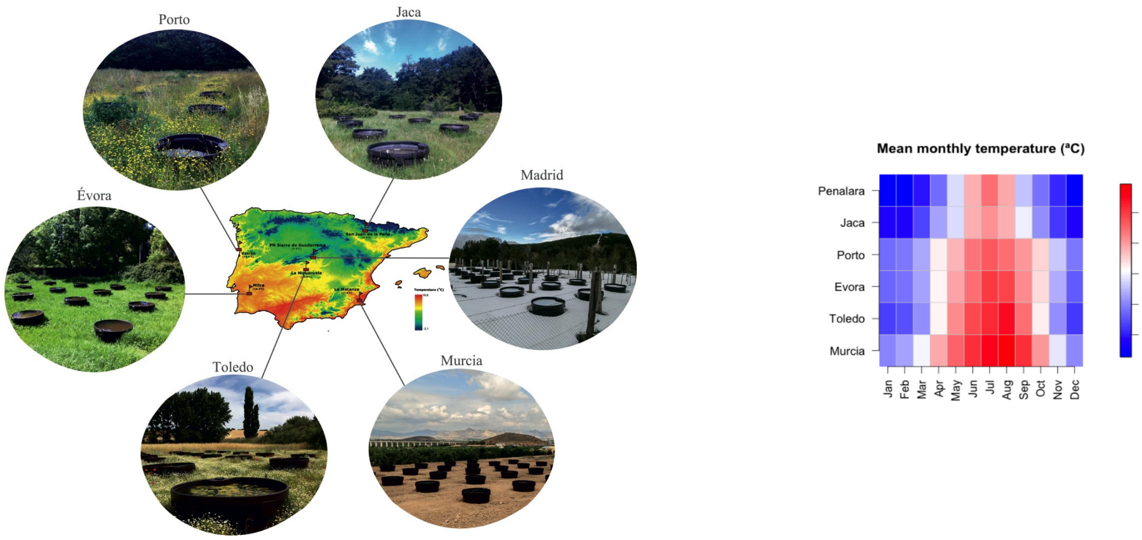
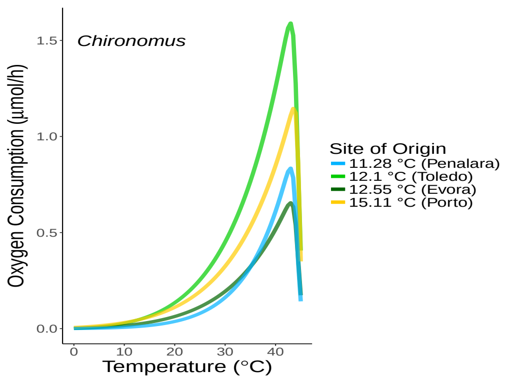
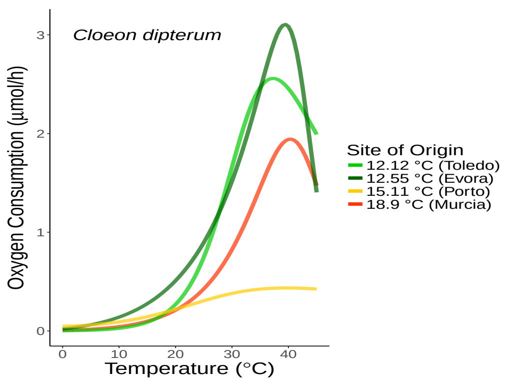


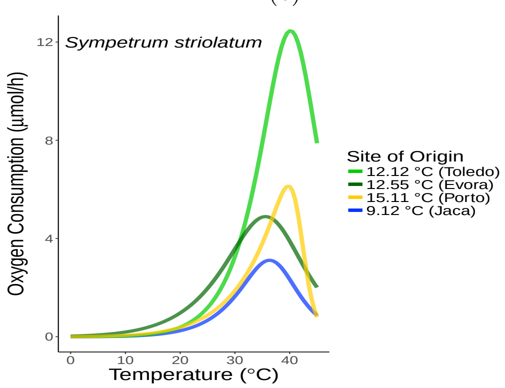
Figure 2: **The IberianPonds network is located in the thermally diverse Iberian peninsula.** The location of all six mesocosm experimental sites, two cold mountainous, two hot desertic and two mild temperate is shown with respect to map (left). Their associated yearly variation in temperature shows the gradient of thermal environments the species in this study have had to adapt to (right). Taken from Matias (unpublished).



(a)



(b)



(c)

Figure 3: **Species adapt to their surrounding environment, changing their metabolic rates correspondingly.** Respiration temperature performance curves for *Chironomus*, *C. dipterum* and *S. striolatum* display an adaptation scenario corresponding to that predicted in Figure 1c. Note that curves for the coolest and hottest adapted populations are lower than those for intermediate sites. Data points have been removed in this figure for clarity but can be found in Figures S2-S13.

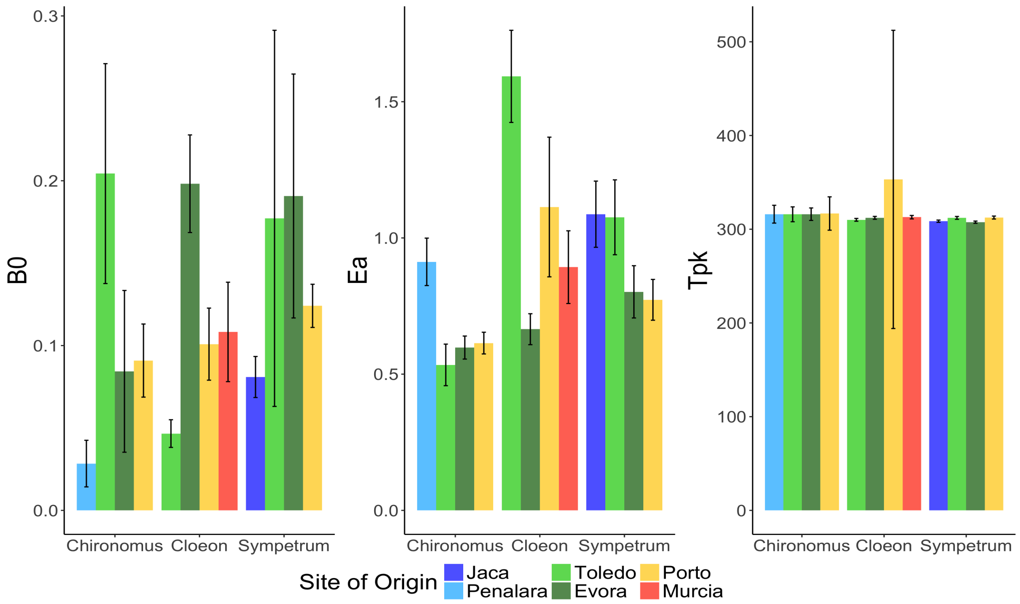


Figure 4: **Differences in Schoolfield model parameter estimates are the origin of the observed variation in TPCs.** Parameter estimates, associated to biological traits, show significant differences in adaptation to local thermal environments within taxa. Note that these significant differences are not found for T_{pk}. Values for b_0 are highest at intermediate temperatures and highest at low temperatures for E_a.

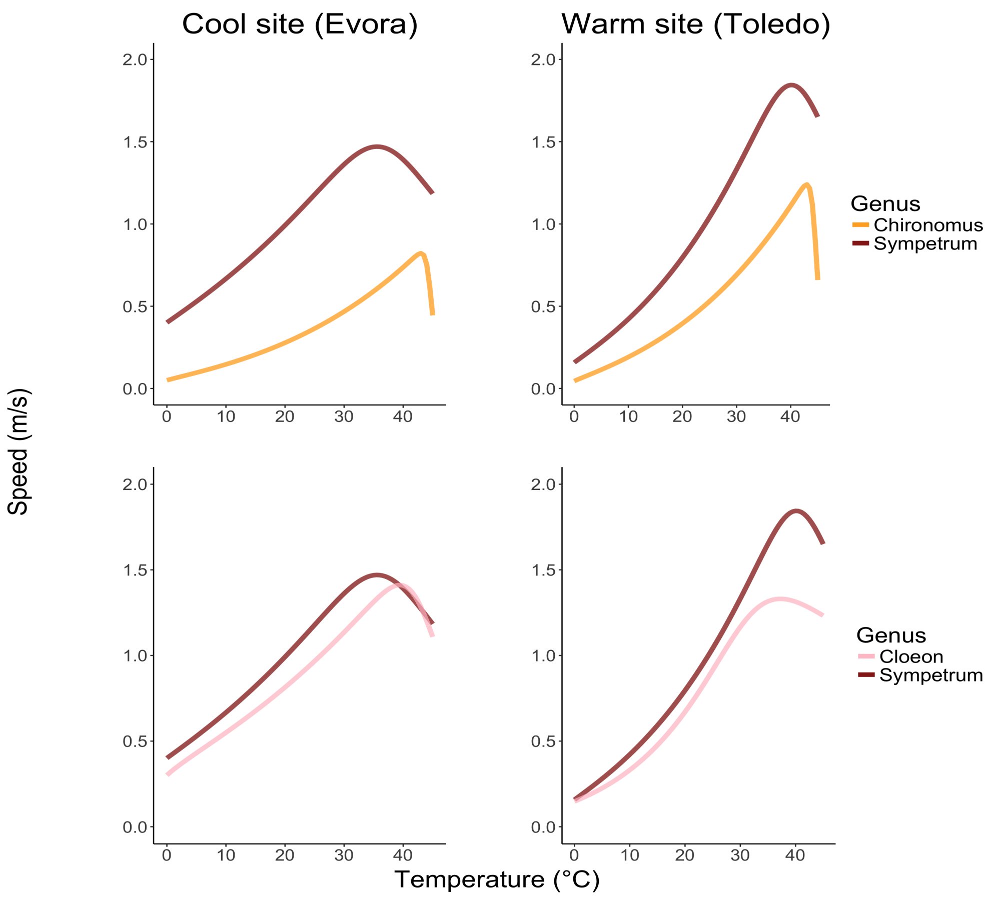


Figure 5: **Mismatches in key traits' performance with temperature, such as velocity, will lead to changes in species interactions.** Predator-prey velocity curves for mild Evora versus hot Toledo for each predator-prey pair show mismatches in elevation and peak performance temperature. Such changes in relative performance in warmer environments may benefit *Chironomus* species via higher escape speeds. On the contrary, *C. dipterum* will find itself at a disadvantage at higher temperatures where *S. sympetrum* will display faster attack speeds.

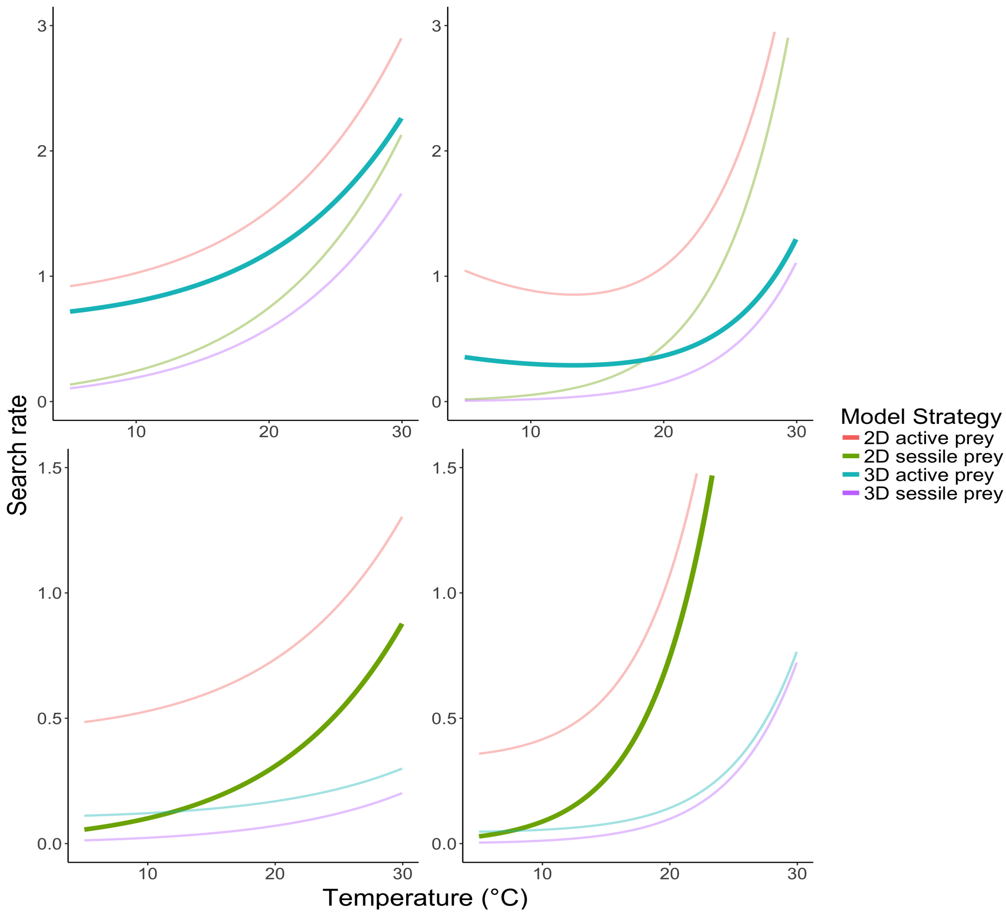


Figure 6: **Modelling search rates according to mechanistic parameters reveals that consistent patterns emerge in all scenarios.** Search rate models' predictions for *Chironomus* (bottom) and *C. dipterum* (top) in mild Evora (left) or warm Porto (right) show similar predictions in search rates within the OTR. Darker shaded curves correspond to the most biologically relevant model for the interacting pair. The model predicts exponential increases in search rate with temperature. Yet, this exponential increase is not as strong for all strategies. This pattern occurs throughout the OTR, outlining the importance of understanding the potential effect of temperature on species interactions.

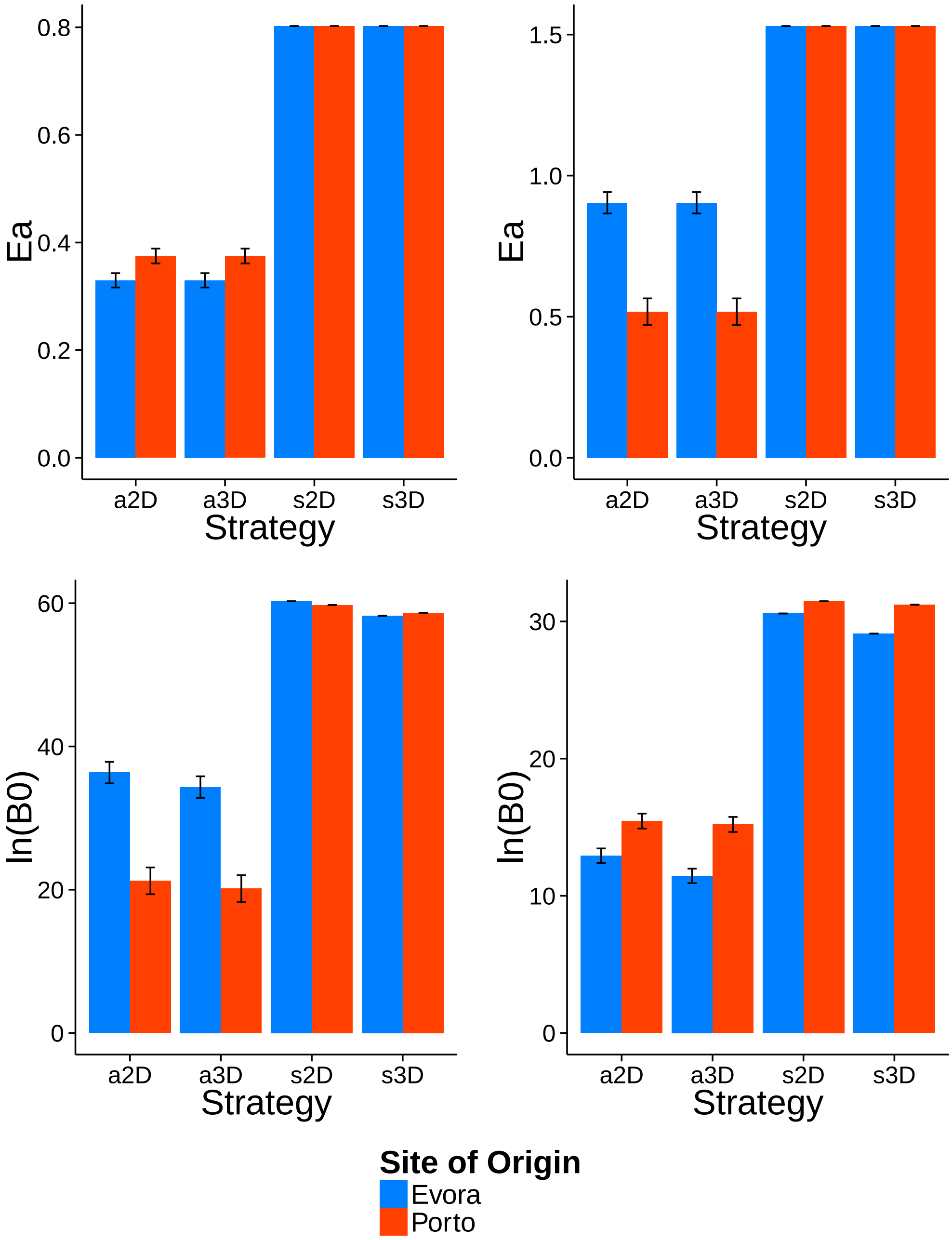


Figure 7: **Search rate activation energies and elevation display species specific responses to temperature.** Sessile prey (s2-3D) activation energies do not differ between sites for both species. *C. dipterum* (left) active prey (a2-3D) were found to be higher in warm acclimated species, yet the opposite was true for *Chironomus* (right). Search rate elevation was higher for cold acclimated *C. dipterum* and warm acclimated *Chironomus*. Temperature effects on search rates depend on species' physiology regardless of dimensionality and strategy used.