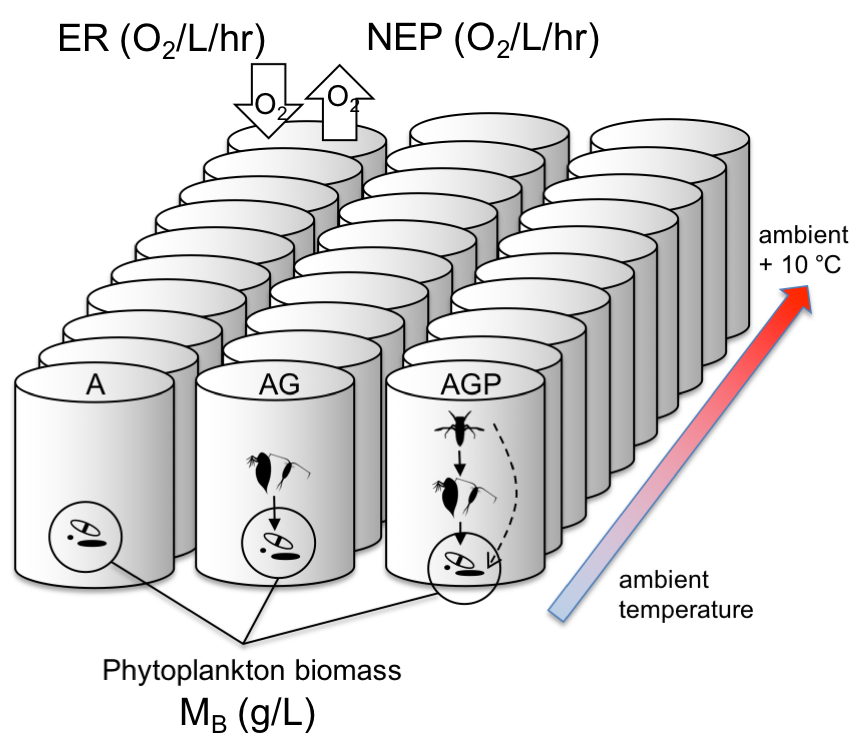
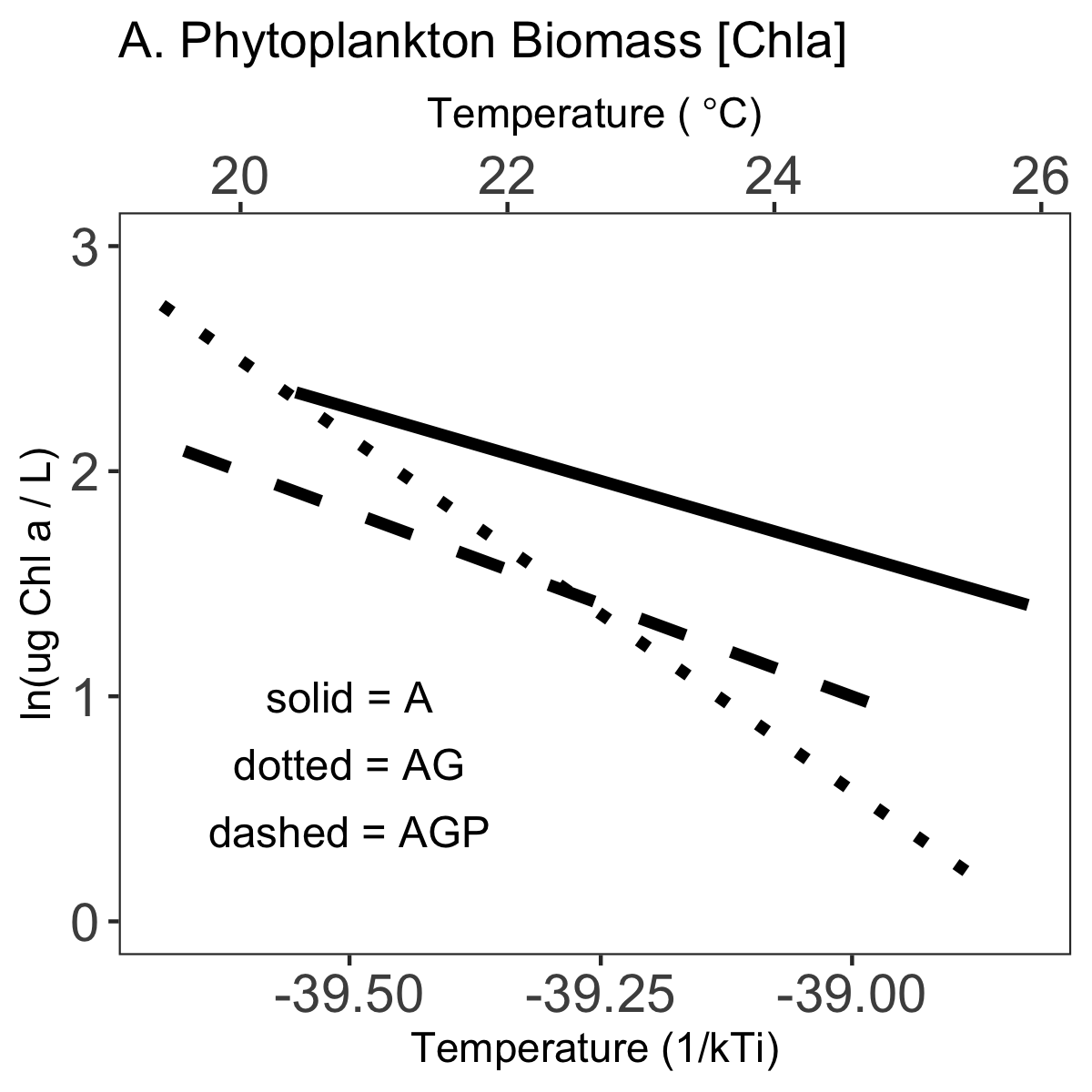
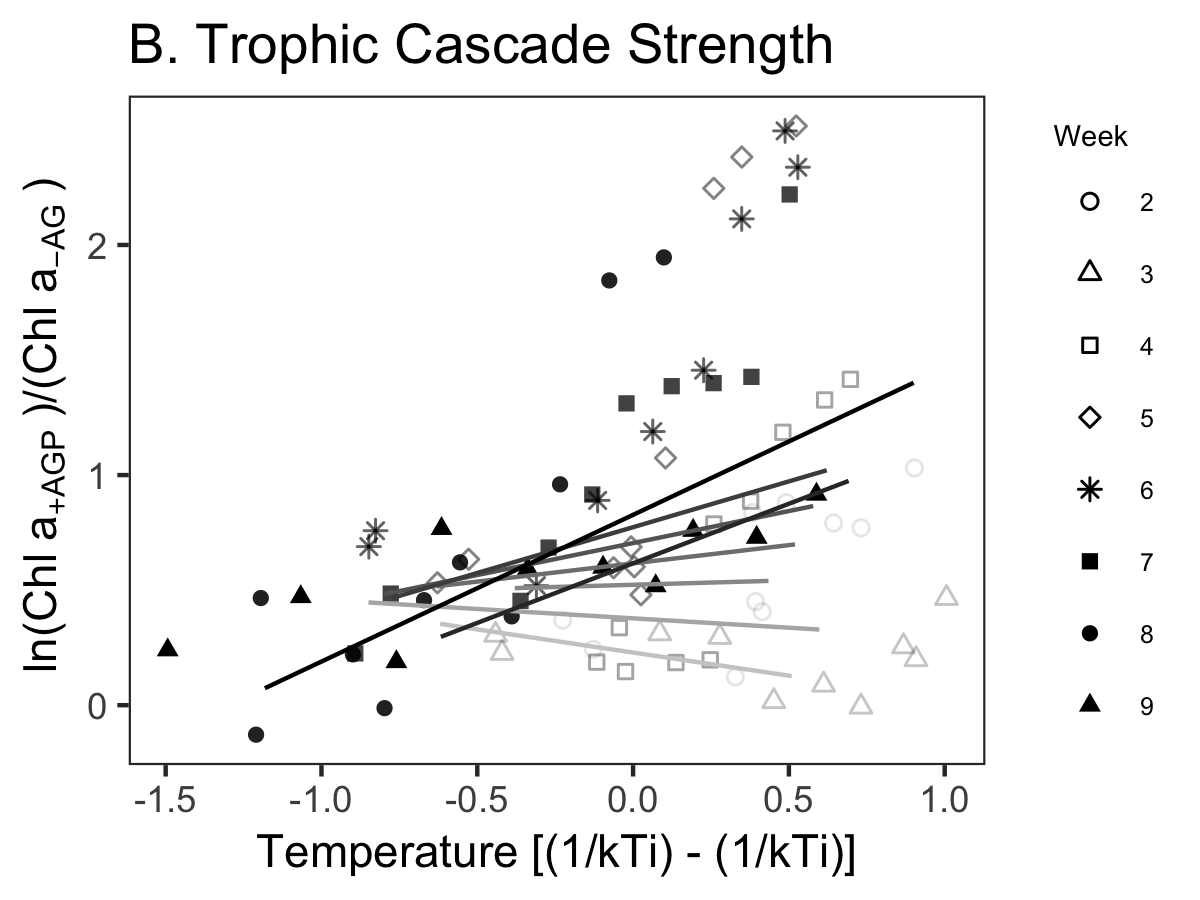
**Figure 1.** A) Temperature and predation directly and indirectly affect population density and metabolic rates in aquatic communities. In our experimental communities, predation directly (solid lines) affects the abundance, size and species composition of prey, and predation by notonectids on grazers leads to an indirect effect (dashed line) called a trophic cascade on algal abundance. Temperature directly affects per capita metabolic rates (solid lines), and indirectly affects algal abundance (dashed lines) by increasing grazing rates. Other indirect effects of temperature are possible, but not shown. B) Experimental communities varied in their trophic structure. Ten communities included algae only (A), 10 comprised algae + grazers (AG), and 10 included algae + grazers + predators (AGP). We sampled net ecosystem oxygen production (NEP), ecosystem respiration (ER) and total phytoplankton biomass (MB) weekly for 8 weeks.



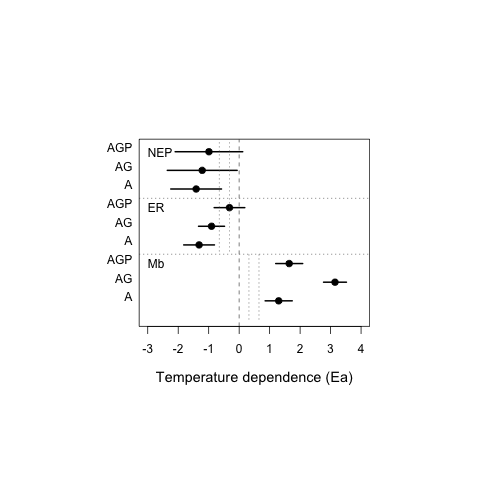
b)



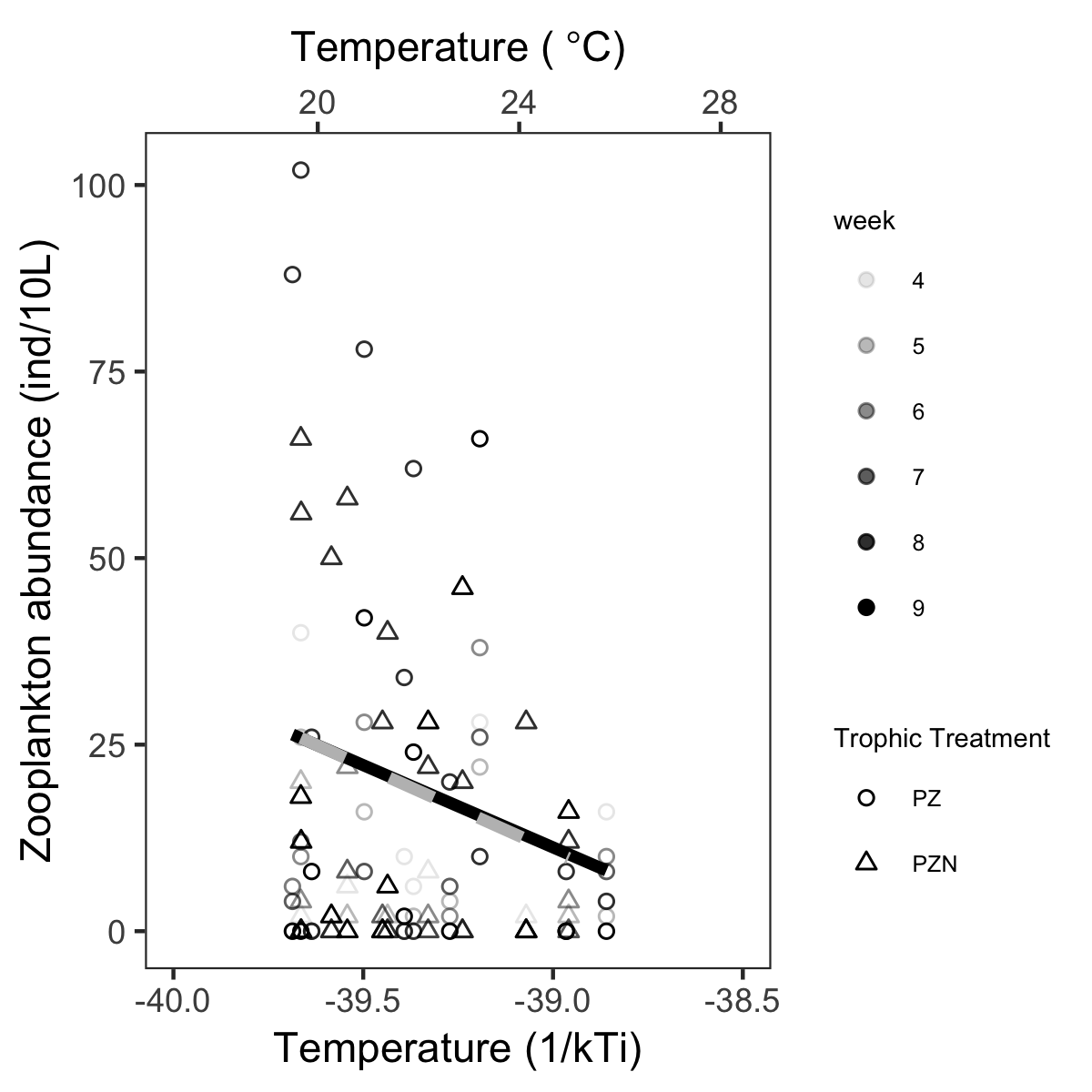
**Figure 2: A**) Estimated phytoplankton biomass (chlorophyll *a* concentration) declined with increasing temperature and varied with trophic structure (A, AG, AGP). Lines are estimated effects of temperature on phytoplankton biomass based on linear mixed effects models (Eqn 11) for equation 3 with temperature dependent in model terms for the intercept and slope (Table 1). From the best model, the intercept and slope of each line was estimated by pooling terms for the intercept and temperature dependence in eqn 11 (see Methods, Eqn 13). All observations for phytoplankton biomass are shown in Fig 6. **B**) Strength of the trophic cascade at a given temperature was estimated by taking the log ratio of algal biomass (estimated as chlorophyll *a* concentration) in the presence of predators and grazers (AGP) vs the algal abundance in the presence of grazers only (AG) (Eqn 4, Table 2). Lines represent fixed effects of temperature from the full model (Table 2), centered on the grand mean of all recorded ecosystem temperatures (Eqn 12).

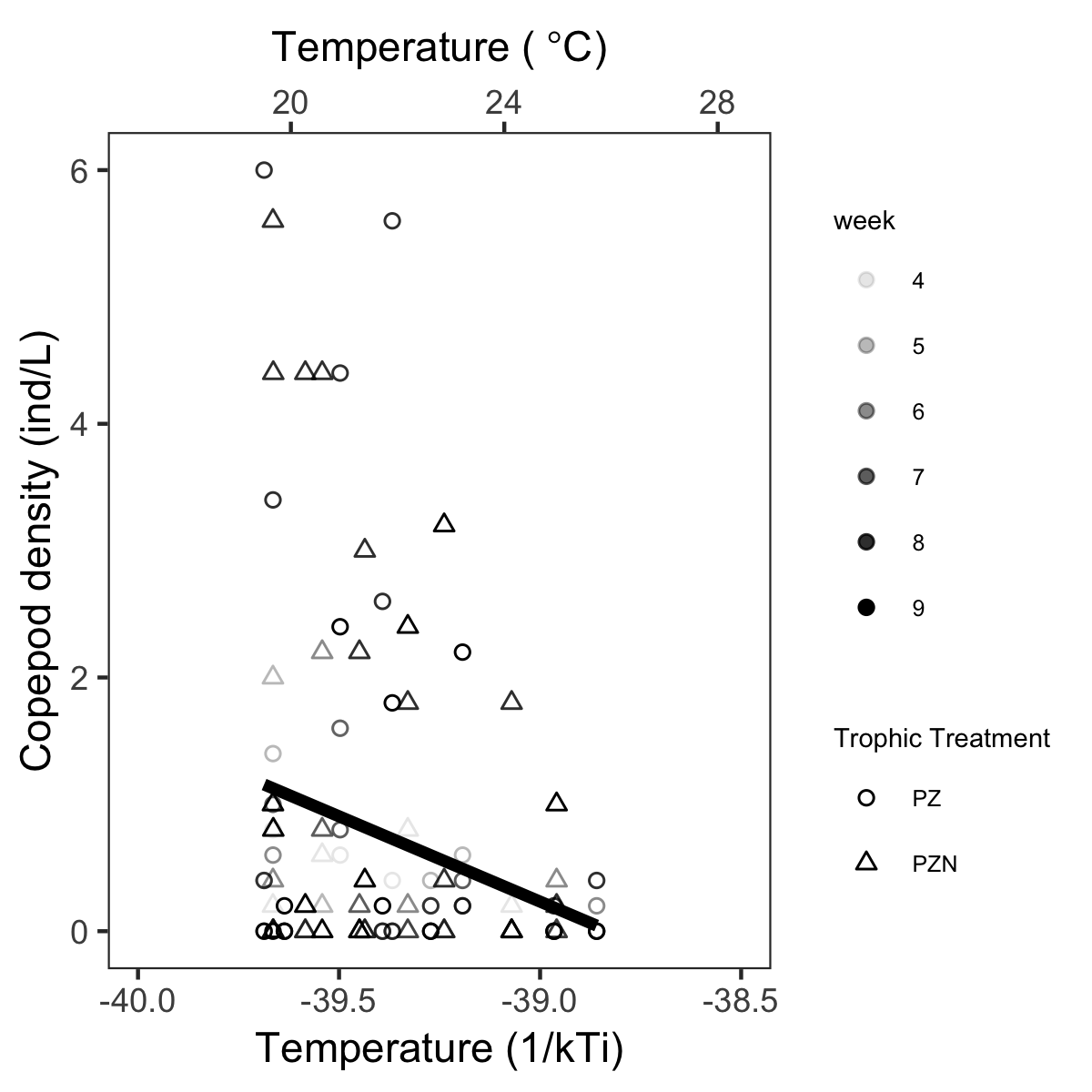
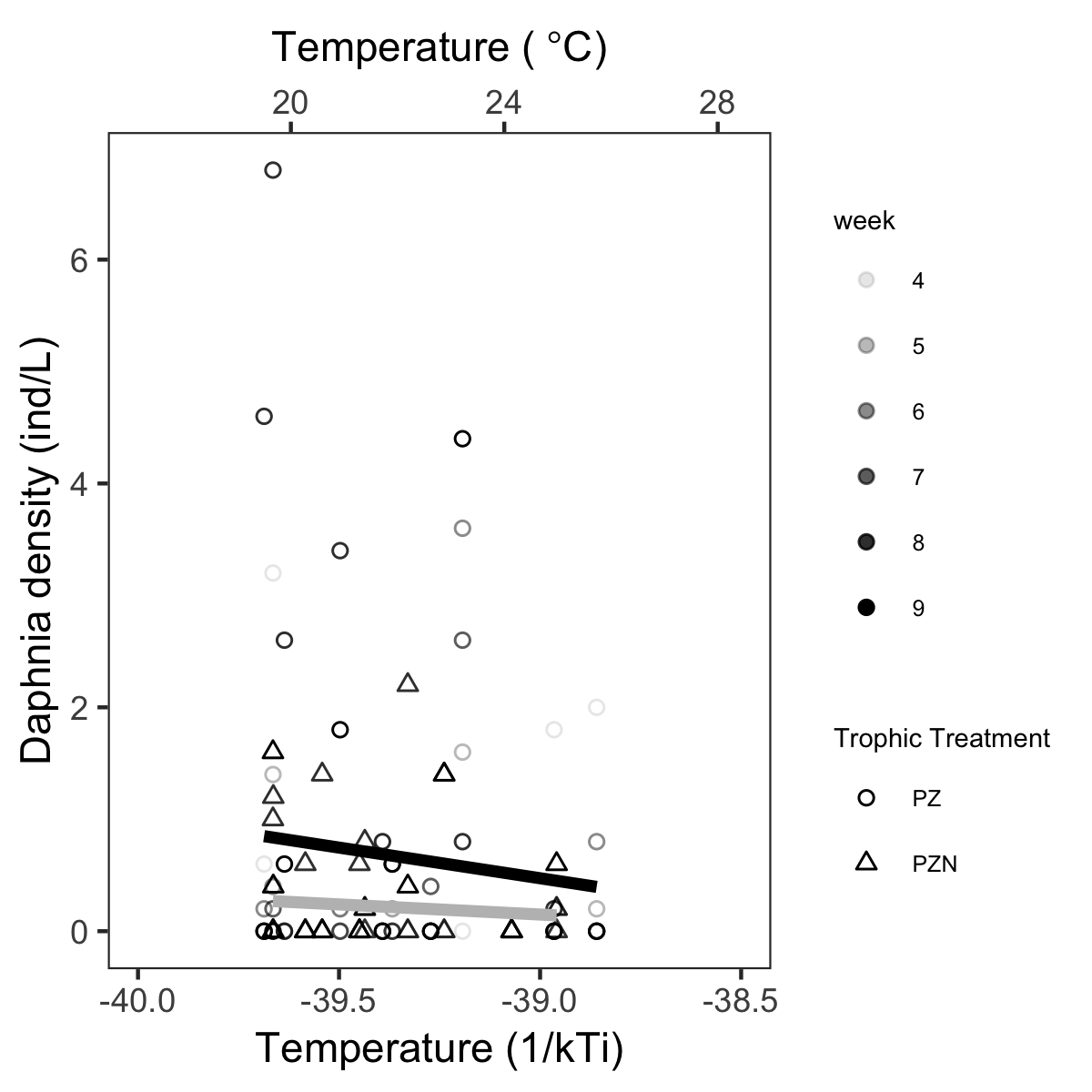
 

**Figure 3.** Comparison of estimated temperature dependences of phytoplankton biomass (MB), net ecosystem oxygen production (NEP), ecosystem respiration (ER) for communities with algae only (A), algae and grazers (AG) and algae, grazers and predators (AGP). Composite estimates of temperature dependences as shown in Figures 2A and 3 (following Methods, Eqn 13). No temperature dependence is indicated by the dashed line, and the gray dotted lines indicate + 0.65 and 0.32 eV, expected temperature dependences of photosynthesis and respiration, and -0.65 and -0.32 as expectations for the temperature dependence of phytoplankton total biomass.

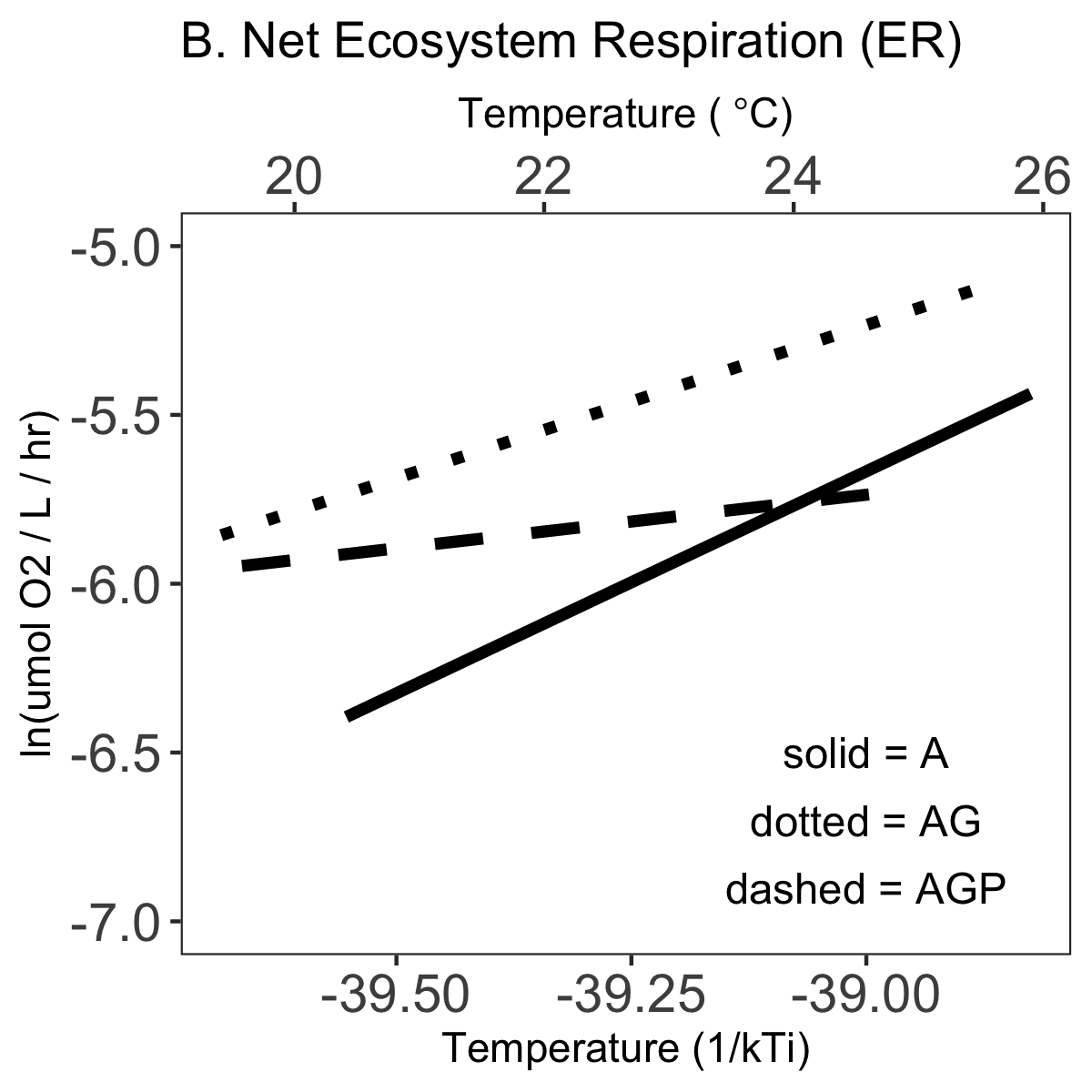
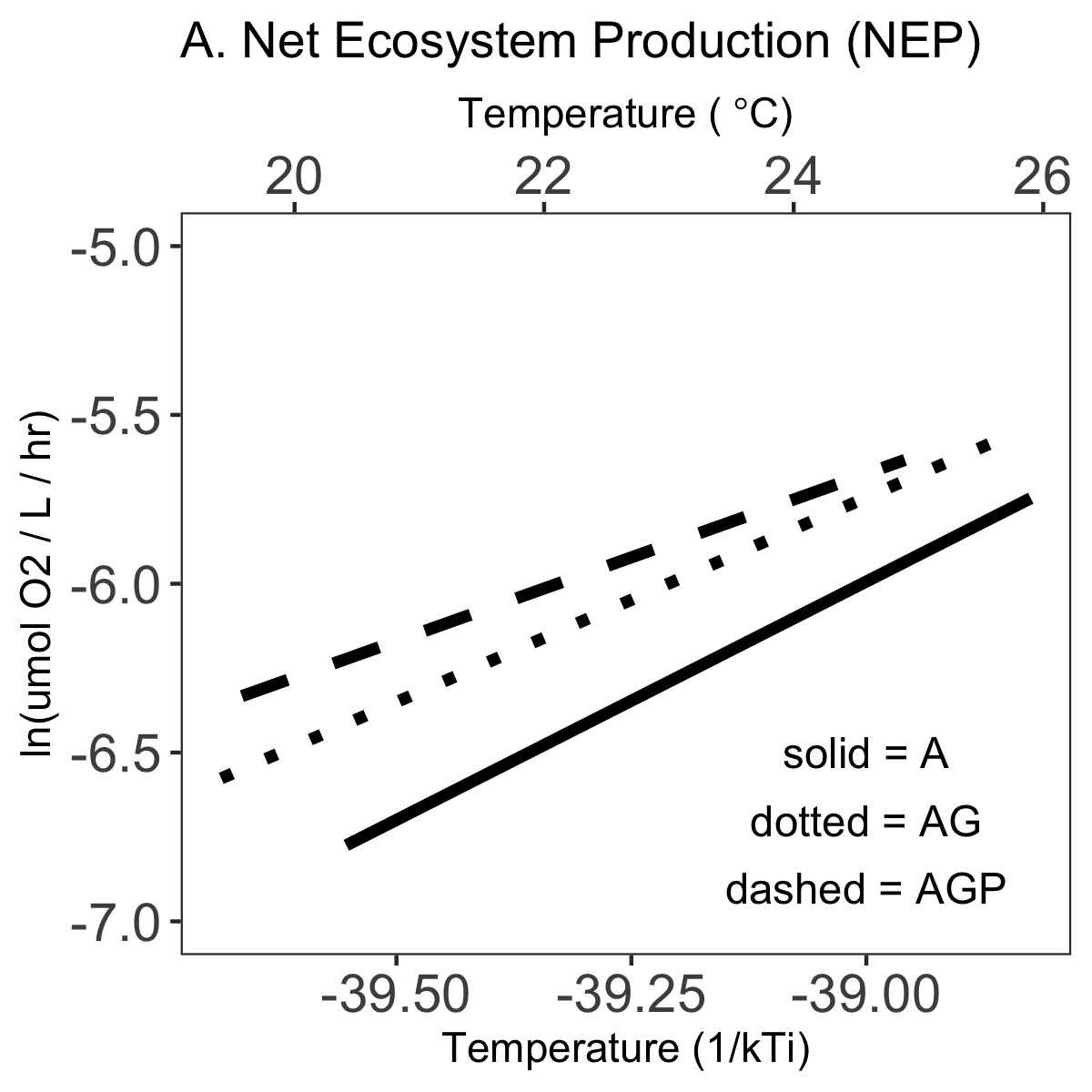


**Figure 4: A)** Total zooplankton density (ind / 10L), comprising *Daphnia* and copepod taxa,declined with increasing temperaturebut not with predator presence. B) *Daphnia* density (ind/L) declined with temperature and with predators (Table 4), and C) copepod spp density (ind/L) declined with temperature but not predators (Table 5). Lines are regression fits with negative bionomial (total zooplankton) or Poisson (Daphnia, copepods) zero-inflated error structures with ecosystem as a random effect for ecosystems with predators (gray dashed line) and without predators (black solid line). Each datapoint is an observed total zooplankton density for crustacean taxa (*Daphnia* and copepods) in each ecosystem on a sampling date.

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**Figure 5:** The effect of mean ecosystem temperature on A) phytoplankton biomass, B) net ecosystem productivity (NEP), and C) net ecosystem respiration (ER) for three community types that varied in their trophic interactions: i) algae-only (A), ii) algae + grazers (AG), and iii) algae + grazers + notonectid predators (AGP). Black lines indicate the among-ecosystem effects of temperature, modelled by equation 5 using hierarchical regressions fit to among-ecosystem variation in temperature, after taking into account within-group variation temperature effects (light lines) (Table 2), and may be compared with predicted effects of temperature and species interactions depicted in Figure 1. Activation energies and confidence intervals estimated by best model or best model set (Table 1, Supplementary Material 2). Temperature in Celsius is shown for comparison only, models were fit to inverse temperature. For clarity here, the three trophic treatments are separated into three rows of panels. Response variables were estimated once per week (for 6 weeks post bloom) in each replicate ecosystem (n = 30). For each ecosystem (shade of grey), 6 points are shown, one point for each week (symbols). Temperatures within tanks declined over time (Fig S1.1C).



**Figure 6.** The effect of ecosystem temperature (Twj) on A) phytoplankton biomass, B) net ecosystem productivity (NEP), and C) net ecosystem respiration (ER) for three community types that varied in their trophic interactions: i) algae-only (A), ii) algae + grazers (AG), and iii) algae + grazers + notonectid predators (AGP). There were 10 ecosystems (*j*) in each trophic treatment, and each ecosystem was sampled 8 times (once per week from weeks 2 – 9). Each week is indicated by a shape, and ecosystem identity within weeks are distinguished by shades of gray. In a single model (Eqn 12), we considered effects of temperature within ecosystems over time, as well as among ecosystem variation in mean temperature (Fig 2, 5). Blue lines are fit to the 8 observations (points) from each ecosystem, and their slope indicates within-ecosystem temperature effects estimated from best models in Tables 2, 7 and 8. Black lines indicate the modelled among-ecosystem effects of temperature (Tables 1, 7, 8; Fig 2, 4). Temperature in Celsius is shown for comparison only, models were fit to inverse temperature. Temperatures within tanks declined over time (Fig S1).

