

Policy Brief

PhD Project: Oxygen supply and thermal tolerance in eurythermal crustaceans (DFC file no.: 10-082-AU)

Background:

In light of the ongoing climate change, the ability to predict future effects on biota has received much attention, where it has been sought to establish a unifying model granting predictive power to characterize and quantify the sensitivity of species to global warming. The oxygen and capacity limited thermal tolerance (OCLTT) model proposes that thermo tolerance in all aquatic ectotherms is dictated by tissue oxygen supply, and that cardiorespiratory thermo-tolerance, therefore, is the main determinant of animal thermo tolerance.

Results:

In this project we tested the validity of the OCLTT model by measuring the effect of temperature on a range of oxygen supply capacity parameters (oxygen uptake, heart performance and gill performance) in three crustacean species; the tropical Giant freshwater shrimp (*Macrobrachium rosenbergii*) and Giant tiger shrimp (*Penaeus monodon*) and the temperate European crayfish (*Astacus astacus*).

Results:

The results show that the upper thermal limits in these species are not determined by limitations on the oxygen transport capacity of the cardiorespiratory system (Fig. 1).

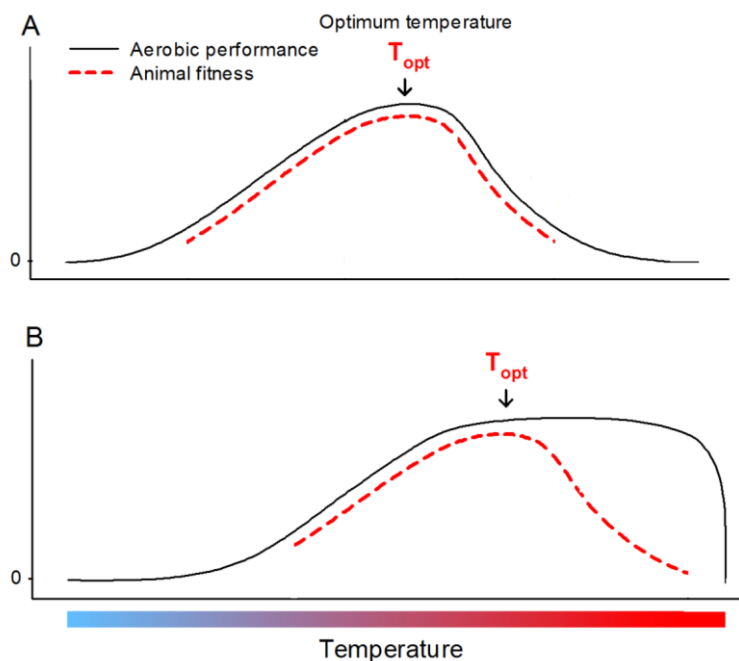


Fig. 1 Conceptual model showing optimum temperature (T_{opt}) and the effect of temperature on aerobic performance and animal fitness in animals with a cardiorespiratory system adapted to lower (i.e. temperate and arctic species) (A) and higher (i.e. tropical species) (B) temperatures.

Conclusions and Implications:

We conclude that the OCLTT model is not universally applicable to all aquatic invertebrate species. *M. rosenbergii*, *P. monodon* and *A. astacus* appear to possess a cardiorespiratory system with sufficient thermal tolerance to maintain tissue oxygen supply until critical temperatures and other functions must therefore be responsible for upper thermal limits in these species. Predictions of the effect of climate change on aquatic animals, based on oxygen supply capacity alone, may therefore yield incorrect results and should therefore be made with caution.