QCL WATER SCIENCE

WOODS HOLE OCEANOGRAPHIC INSTITUTION

PyroScience FireSting

Small Marine Invertebrate Comparative Physiology

Our group is interested in exploring the effects of intrinsic metabolic state and external environmental stress on a diverse group of marine invertebrates. Many factors such as internal circadian rhythm and developmental/reproductive state or external environmental parameters such as temperature, low oxygen, high CO2, chemical exposure, and food limitation can change animal physiology.

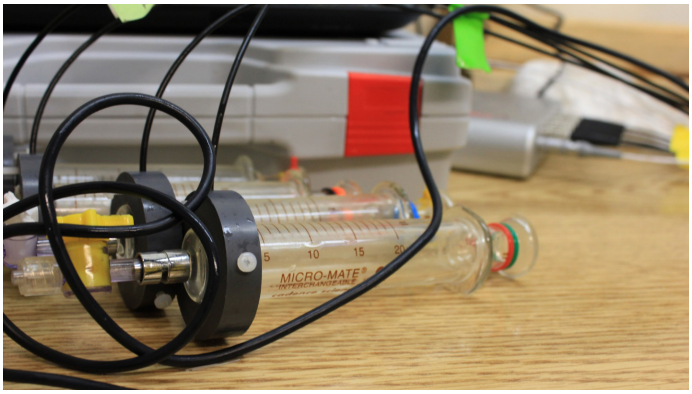

Fig. 1: Continuous respiration in adjustable small volume chambers

To explore the effects of these different factors we often use metabolic rate, measured as the amount of oxygen consumed by an individual, as an organismal-level measurement of stress and resource use. Our work involves many different species across a range of sizes. Many of these animals are very small (0.5 - 50 mg), requiring us to have air-tight respiration chambers that can be adapted to many different small water volumes. The contactless oxygen sensor spots from PyroScience system adhere perfectly into our gas-tight glass syringes, allowing us to create chambers of variable volume to accommodate organisms with different sizes or

Fig. 2: Small animal respiration chambers adjusted to its smallest volume (2 mL)

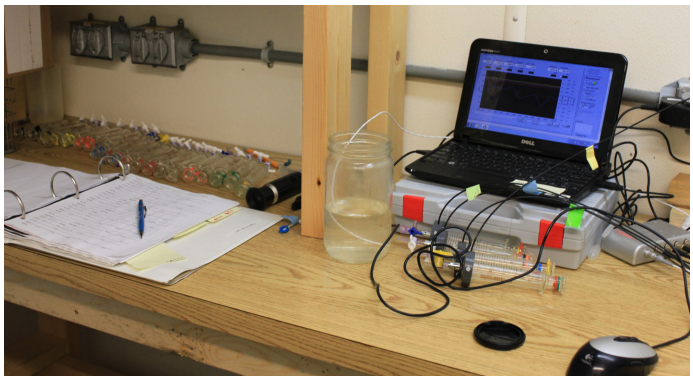

Fig. 3: End-point chambers (left) which can be measured at the start and end of the experiment while continuous measurements are made of a subset (right)

metabolic rates. Furthermore, the red light technology of the optical oxygen meter FireSting-O2 allows us to explore questions of environmental stress in animals used to low-light environments, or when performing circadian cycle experiments.

This technology extends the size range of species and life stages we can explore, while allowing us to continue doing individual-based experiments rather than inferring metabolic rates from pooled individuals. Adapted into an end-point experimental setup, where measurements are made at the start and end of an experiment allows us to increase the number of individuals and treatments we can study at any single given time in a cost-effective and highly informative way.

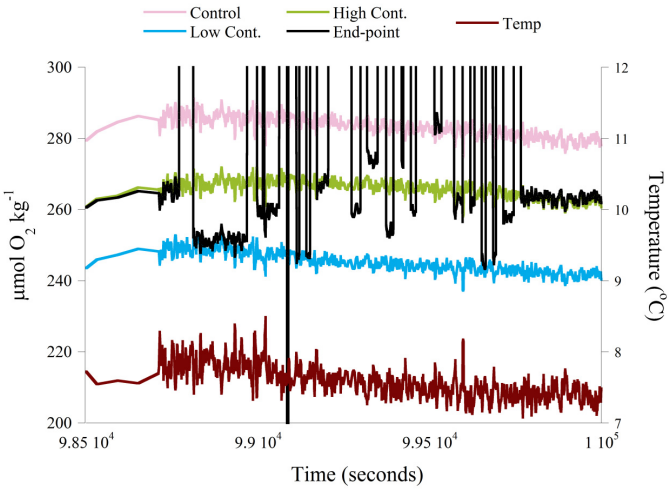

Fig. 4: Example data from "Pteropod high CO2 experiment" using end-point and continuous measurements

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