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Kinematics and functional morphology of feeding in the Northern clingfish

The northern clingfish *Gobiesox maeandricus* uses the lower jaw to pry limpets from the substrate. This study investigated the unique morphology and kinematics of the clingfish feeding apparatus and the structural elements involved when feeding on limpets. Through the use of high speed video and micro CT-scan we answered the following questions: (1) What are the primary structures involved in this unique prey capture process? (2) How is the clingfish morphology adapted to perform these movements? (3) How is the force needed to dislodge limpets generated? The feeding apparatus has been adapted to be able to force the teeth as a wedge between the limpet shell and the substrate. The pectoral suctorial organ functions as the pivot from which the anterior wedging force is generated via the post cranial musculature. The epaxial muscles elevate the entire skull, including oral jaws, thereby helping to dislodge the limpet from the substrate. We hypothesize that the pectoral suctorial organ is of crucial importance for clingfish to be able to generate enough force to feed on limpets. By using the pectoral suctorial organ as a fulcrum, the entire skull is protruded and elevated in order to pry a limpet from the substrate.

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Cardiac response to temperature in hyperoxia and normoxia in the grass shrimp, *Palaemonetes pugio*.

Poikilothermic animals experience a mismatch between oxygen supply and demand with increasing temperature. Thermal tolerance may be related to a failure of the cardiorespiratory system to deliver available oxygen. Animals placed in a hyperoxic environment had a higher CT_{max} than animals in a normoxic environment, suggesting a physical limitation in oxygen delivery. Analyses were performed on grass shrimp, *Palaemonetes pugio*, acclimated to 20° C exposed to a range of temperatures (5°–40° C) in both normoxic and hyperoxic environments to determine response of the oxygen delivery system to this increased demand. Previous work investigated the ventilatory aspect of the delivery system. Current work investigates the cardiovascular aspect of the oxygen delivery system. Pressure-area loops are generated to provide estimates of stroke work, cardiac work, and myocardial oxygen consumption in both normoxic and hyperoxic conditions to determine how the system responds to reduced oxygen availability at extreme temperatures and if that response is altered in a hyperoxic environment.

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Comparison of the proteomic responses in adductor muscle tissue of *Mytilus galloprovincialis* and *M. trossulus* to acute heat shock

Recent anthropogenic influence has caused increases in global temperature. The potential rises in temperature can impose thermal tolerance constraints which can alter marine ecosystems and restructure the extent of communal diversity. Organisms able to acclimate and adapt to thermal stress will be more resilient to the episodic and more extreme disturbances caused by climate change. To assess the biochemical mechanisms imposing thermal limits, we used a discovery based approach by comparing the proteomic responses of two species of the genus *Mytilus* (*M. galloprovincialis* & *M. trossulus*) that differ in thermal tolerance in response to acute heat stress. These mussels were acclimated to 13°C seawater for four weeks and then exposed to acute heat stress (24°C, 28°C, and 32°C respectively, with a 13°C control) for 1 h before being returned to 13°C seawater for a 24-h recovery. Multiple tissues were excised including the gill, adductor and mantle tissues. Gill tissue was then homogenized and proteins were separated using 2D gel electrophoresis followed by protein identification through MALDI TOF/TOF mass spectrometry. Protein expression profiles differed between the more heat-tolerant *Mytilus* (i.e., *M. galloprovincialis*) and the more heat-sensitive congener (i.e., *M. trossulus*), including changes in the abundances of proteins involved in cytoskeleton, molecular chaperoning, oxidative stress, energy metabolism and proteolysis. Currently, we are using the same proteomic approach to characterize the adductor muscle to elucidate whether similar changes are observed in the proteome of other tissues. These implications can provide insight as to the physiological mechanisms that govern the response to acute heat stress.

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Do small wintering birds adjust their metabolic performance in response to perceived level of cold?

Small resident bird species wintering at northern latitudes must cope with high daily energy demands, resulting mainly from thermoregulation costs. Birds respond to these conditions by physiological acclimatization where two components of metabolic performance, basal metabolic rate (BMR; maintenance energy costs) and summit metabolic rate (Msum, maximal thermogenic capacity to cold) are typically elevated. However, in most cases, parameters of metabolic performance show high variability between individuals. Although seasonal changes in BMR and Msum have been thoroughly studied for decades, we still know very little of the underlying causes for individual variation in winter metabolic performance. In this study, we investigated whether plumage insulation (measured via thermal conductance), and thus the perception of cold by individuals, was related to metabolic performance in black-capped chickadees (*Poecile atricapillus*) wintering in Quebec, Canada. We predicted that individuals expressing higher body conductance would also show higher levels of BMR and Msum as they would adjust their metabolic machinery to the perceived level of cold. More than 140 measurements were performed on freshly captured individuals between November 2011 and April 2012. Conductance, BMR and Msum were measured by respirometry on all birds within 24h. Preliminary analyses suggest that individual variation in BMR and Msum are independent from individual thermal conductance. Further analyses will consider intra-seasonal variation in metabolic performance and ambient temperature.