Maintaining Control: Metabolism of Molting Arctic Seals when Hauled Out and in Water

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Seals rely on thick blubber and peripheral blood flow regulation to maintain thermal homeostasis. During the annual molt, seals haul out for extended periods to increase blood flow to the skin, which provides essential nutrients and optimal temperatures for tissue regeneration, while limiting heat loss to the environment. Unfortunately, ongoing sea ice loss and associated reductions in haul-out substrate may force Arctic seals to move with retreating sea ice, use terrestrial haul-outs, or spend increasing amounts of time in water. The degree to which increased time in water may result in higher thermoregulatory costs depends on the level of vasocontrol during the molt period. We hypothesized that if seals maintain control of heat loss through selective skin perfusion during molt, then RMR should be similarly elevated when in water and hauled out. Alternatively, if molting seals have a reduced ability to regulate blood flow to the periphery, then RMR in water would be even higher than when hauled out. Using open-flow respirometry, we measured the resting metabolic rate (RMR) of three spotted seals (*Phoca largha*), one ringed seal (*Pusa hispida*), and one bearded seal (*Erignathus barbatus*) prior to, during, and following the molting period while resting in water or hauled out. Individual and species comparisons confirmed that energetic costs incurred during molt were not higher for seals resting in water relative to when hauled out. These data suggest that seals maintain control of peripheral blood flow and heat loss, irrespective of molting status, with elevated RMR values during molt attributable to the energetic cost of tissue regeneration rather than unregulated skin perfusion. By combining these measurements with emerging data on haul-out behavior and thermal physiology surrounding the molt, we aim to elucidate how the loss of haul-out substrate and increased time in water may affect ice-dependent seals in the wild.