

**THE UNIVERSITY OF HONG KONG
SCHOOL OF BIOLOGICAL SCIENCES**

Postgraduate Student Public Seminar

**“THE SURVIVAL STRATEGIES OF THE HIGH SHORE LIMPET
LOTTIA DORSUOSA TO WITHSTAND SUMMER IN HONG KONG:
THE INTERPLAY OF PHYSIOLOGY AND BEHAVIOUR”**

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Room 6N-11, Kadoorie Biological Sciences Building**

Abstract

Lottia dorsuosa are high shore to splash zone limpets that can be found on temperate (e.g. Moneron Island, Russia) to tropical (e.g. Hong Kong) rocky shores. Inhabiting such high shore levels, particularly on tropical shores, *L. dorsuosa* face the challenge of extreme heat and desiccation stresses combined with prolonged emersion. They also have limited energy as a result of reduced food availability and foraging times as compared to species living on lower shore levels. In Hong Kong, where the climate is dictated by seasonal monsoons, these physical and nutritional stresses can be severe in the hot summer that is typical of the tropics, but reduced in the benign, temperate-like winter. These limpets, therefore, need to accommodate such strong seasonal variation and adopt strategies to cope with the stressful summer.

While the open rock surface temperature can exceed 60 °C in the splash zone, the upper thermal limit (determined as mean cardiac flatline temperature) of *Lottia dorsuosa* is only 45.6 °C which is less than many lower shore species. Despite their apparently poor physiological tolerance, *L. dorsuosa* utilize thermal refuges, such as east-facing steep slopes and overhangs, throughout the summer so that their body temperatures are maintained within sublethal ranges. In addition to this behavioural strategy, the morphology (shell shape) of *L. dorsuosa* may also contribute to withstanding heat and desiccation stresses as their shells become more high-spired with age, enhancing heat dissipation by convective cooling, and the shell aperture to height ratios decrease, which increases water storage and minimizes evaporation.

Coupled with their microhabitat utilization, *Lottia dorsuosa* aestivate throughout the summer, having an overall suppressed metabolism as compared to winter which can be reduced even further through metabolic depression at high temperatures. These strategies reduce energy expenditure to maintain their energy balance in the food-sparse summer. To manage such prolonged summer aestivation when *L. dorsuosa* show minimal movement, the limpets forage extensively to feed in the less stressful winter on biofilm, encrusting algae and/or the erect alga *Phycocalidia suborbiculata*, building up their reserves to provide sufficient energy to survive the summer. Such seasonal plasticity in metabolism and foraging behaviour is associated with faster growth rates in winter but minimal growth in summer.

The combination of these morphological, physiological and behavioural strategies, therefore, enable *Lottia dorsuosa* to survive on the high shore to splash zone at their southern limit in the tropics. Despite these strategies, however, the populations of *L. dorsuosa* in Hong Kong may not be “self-sufficient”. As compared to conspecifics in temperate Japan, *L. dorsuosa* in Hong Kong suffer shorter lifespans, possibly as a trade off with faster growth or associated with lower annual survival rates. Most importantly, Hong Kong populations of *L. dorsuosa* do not appear to develop gonads (and therefore reproduce), suggesting that these may be “sink” populations which are only sustained by larval supply from other, geographically distant, northerly populations in the winter. *L. dorsuosa* in Hong Kong are, therefore, living outside their potential niche and essentially “biologically dead” at their southern range edge.

--- ALL ARE WELCOME ---