UNIVERSIDAD ADOLFO IBAÑEZ
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Phenotypic integration of physiological and life-history traits along a latitudinal gradient in intertidal ectotherms

DOCTORAL THESIS
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PHENOTYPIC INTEGRATION OF PHYSIOLOGICAL AND LIFE-HISTORY TRAITS ALONG A LATITUDINAL GRADIENT IN INTERTIDAL ECTOTHERMS

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Figure 1: Geographic and environmental gradient of the study area and thermal tolerances of the study organisms along the southern Pacific. (A) Study sites along the Chilean coast. Mean (black points, mean ± standard deviation), maximum (red points) and minimum temperature registered (blue points) at the sampling sites. Critical temperatures of the different studied organisms; (B) *Cyclograpsus cinereus;* (C) *Petrolisthes violaceus* and (D) *Petrolisthes tuberculosus*. (blue line = Critical Thermal Minimum, red line = Critical Thermal Maximum, mean ± standard deviation).

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Figure 1: Geographic and environmental gradient along the southeastern Pacific. (A) Study sites along the Chilean coast; (B) SST (mean ± SD) registered *in situ* ;(C) Latitudinal variability of annual in situ SST (mean ± SD) recorded at the low intertidal level of the rocky intertidal in the study sites. (D) Coefficient of variation of daily mean in situ SST. Absolute maximum (solid line) and minimum (dashed line) in situ SST values recorded for the corresponding time period are also showed in each graph.

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ABSTRACT

In intertidal marine crustaceans, phenotypic variation in physiological and life-history traits is pervasive along latitudinal clines. However, organisms have complex phenotypes, and their traits do not vary independently but rather interact differentially between them, effect that is caused by genetic and/or environmental forces. One of the abiotic factors that most influences organisms is the temperature that affects practically all the biochemical and physiological processes of organisms, which has been linked to growth, survival and reproduction patterns. In this sense, these ectothermal organisms have had to adapt to different environmental conditions, modifying or adjusting their physiology and / or behavior to tolerate the extreme environmental conditions of the intertidal. This allows us to ask some questions such as: 1) ***Are there compromises between physiological components and life-history traits in marine ectothermal organisms?. 2) What is the role in acclimatization to different geographical gradients in physiological responses (thermal tolerances) in ectothermic marine organisms? 3) Does the integration of physiological traits responses vary between populations of different species?.*** To answer these questions, we evaluate the phenotypic integration of life-history and physiological traits based on geographic variations found at latitudinal and intertidal levels. This study covered a latitudinal gradient of approximately 3,000 km from the coast around Iquique to the coast of Chiloé; we study different populations of decapod crabs that are distributed in vertical bands in the rocky intertidal zone exposing themselves to different thermal variations. Our main results reflect (1) Variations in physiological traits with latitude appear to be a plastic response controlled primarily by temperature, rather than a fixed traits of site-specific populations, therefore, population differences in physiological rates result in a differential mean in SFG of ovigerous and non-ovigerous females, which could be related to the frequency of reproductive events in those species that are distributed across wide geographical gradients. (2) The species that inhabit the intertidal-high maintain a greater integration between their physiological traits and greater thermal tolerances and present less plasticity than those that inhabit the zones of low intertidal. (3) The physiological behavior of the studied species differs along a clinal gradient, and the differentiation of the P-Matrix depends mainly on the microhabitat in which these species are distributed vertically in addition to the environment barriers such as biogeographic breaks.