

Causes and consequences of individual phenotypic variation in brachyuran crabs with a focus on behavioral differences

Individual variation defines almost every morphological, physiological, and behavioral aspect of populations and is a fundamental component of many ecosystem processes. Recent work indicates that accounting for these individual differences can enhance our ability to predict community responses to environmental disturbances which is becoming increasingly important in an era of extraordinary global change. However, our understanding of how different individual characteristics are connected to each other and governed by the environment remains limited.

This study sought to evaluate the relationship between individual behavior, physiological condition, and local habitat for brachyuran crabs as well as the subsequent strength of their predator-prey interactions within oyster reefs communities. Here, I examined the effects of parasitic infection, diet, habitat quality, season, and conspecific density on crab behavioral traits and physiology. I also evaluated how consistent individual behavioral differences, i.e. personalities, interact with predator type and habitat quality to influence individual mortality and movement patterns. These relationships are essential for calculating population dynamics across multiple spatial scales.

My research found that crab energy stores were strongly dependent upon diet and spawning season. In turn, individual crab activity level and reproductive effort were tied to these energy stores and the local environment. Individuals in structurally degraded oyster reefs would generally exhibit lower activity levels, and decreased reproductive output in comparison to crabs which inhabited healthy, structurally complex reefs. Individual activity was further decreased by reductions in conspecific density, which correlated to habitat quality, and by parasitic infection. Additionally, individual behavior influenced predation risk with bold crabs predominantly consumed by active hunters and shy crabs preferentially selected by ambush predators. Personality also interacted with habitat quality as crabs on low quality reefs rapidly left the region, starting with the boldest individuals; whereas high quality reefs had greater levels of predation, particularly among bold crabs. These findings demonstrate that individual phenotypic variation mediates divergent community interactions across habitat quality and provides several mechanisms through which spatially structured populations may develop.