Behavioral consistency, predictability, and plasticity are size dependent in a marsh ecosystem predator-prey interaction

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Introduction

Animal personality results from a complex interplay between consistent individual differences in behavior and behavioral plasticity in response to environmental variation. Animal personality can have significant impacts on intraspecific interactions, specifically, the interaction between predator and prey. In salt marsh ecosystems, Littorina irrorata, the marsh periwinkle, play an important role in dictating marsh health, mainly through its interaction with its main predator, Callinectes sapidus. Thus, the interaction between predator (C. sapidus) and prey (L. irrorata) is valuable for better understanding salt marsh health. L. irrorata use predator-avoidance behavior by climbing S. alterniflora before high tide to remain out of reach of predatory species. This behavior can significantly reduce mortality rates. Therefore, by examining the presence of behavioral consistency and plasticity in L. irrorata predator avoidance behavior, we can better understand the role of animal personality in key intraspecific relationships that shape marsh health.

Objectives

To examine the roles of behavioral consistency and plasticity in shaping the antipredator responses of L. irrorata across environmental contexts, and how these responses are associated with shell morphology.

Methods

Collection: 90 L. irrorata comprising 3 size classes (S=15mm, M=16-20mm, L=21mm). were collected from 2 salt marshes in Wilmington, NC.

Experimental Arena: Arenas were constructed of 11.4 L buckets vertically proctored every 3cm. The buckets were filled with 3cm of seawater (Fig 1a). For boldness, 2 refuges were added to allow snails to either hide or climb (Fig 1c).

Personality Assessment:
• Behavior was assessed two different ways, activity level and boldness.
• Both behaviors were assessed in the presence and absence of predator cues.
• To begin, 5 snails were allowed to acclimate in the bucket for 5 min before starting a 10 min trial.
• Then, behavior was assessed.
  o For activity level, overall height climbed by each snail was recorded after 10 min.
  o For boldness, the proportion of time spent outside of a refuge during the 10 min was recorded.
• Each snail was tested for both behaviors in each condition 3 times.

Conclusions

This study provides evidence that L. irrorata exhibit consistent individual differences in two key behavioral traits, activity level and boldness, indicating the presence of personality in this species. Additionally, this study identifies that shell morphology, namely aperture length, is an important factor influencing how individual L. irrorata shift their behavior in different environments (behavioral plasticity). Narrow-aperture individuals are less plastic to environmental conditions and tended to be bolder than wider-aperture conspecifics. These differences in response may be a result of local predation pressures and phenotypic compensation, or a behavioral carryover. L. irrorata are an important species in salt marsh ecosystems, which provide a wealth of services, both ecologically and economically. Therefore, given that personality can often determine an individual’s growth, development, and probability of predation, understanding its role in various ecological contexts is critical.

Future Work

Future work will explore how L. irrorata personality traits vary geographically. Additionally, we intend to determine how personality ultimately affects the outcome of interactions between predator and prey. By understanding how personality affects survival in this species, we hope to better understand the what role personality plays in shaping marsh ecosystems.

Literature Cited