

**Stony Brook University
The Graduate School**

Doctoral Defense Announcement

Abstract

Costs of Sexual Selection in the Sand Fiddler Crab, *Uca pugilator*

By

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This dissertation investigates the costs and condition-dependence of sexually selected traits in the sand fiddler crab, *Uca pugilator*. Theory suggests that sexually selected structures and behavioral displays are honest signals of male quality to opponents and mates that are costly to produce and maintain. In mid-Atlantic salt marshes, reproductively active males use a single greatly enlarged major claw as both a weapon to defend specialized breeding burrows from other males and an ornament to attract females for mating. Carrying the major claw, which can comprise as much as 40% of the total body mass, imposes significant energetic and locomotor costs to male fiddler crabs. These costs are exacerbated by the location of breeding burrows in open areas high on the shore characterized by low food availability and high temperatures.

Using biophysical engineering methods I found that, from the perspective of a fiddler crab, the thermal environment of the mating area is quite harsh relative to other marsh microhabitats and that high temperatures and desiccation stress significantly constrain physiological performance and reproductive activity. Nevertheless, fiddler crabs can adjust their behavior in response to the magnitude of perceived benefits and costs. When the chance of successfully acquiring a mate is high, males will accept a higher body temperature (and concomitantly higher metabolic and water loss rates) than when the chances of mating are low. Likewise, experimentally lowering costs by adding food and reducing thermal stress in situ increased fiddler crab activity levels. Males in good condition (i.e., of high phenotypic quality) spend more time in the breeding area guarding a burrow and courting females than do males in poor condition. As a consequence, by selectively mating with only breeding area residents, females obtain mates of higher than average quality relative to males in other parts of the marsh. My results provide a possible mechanistic explanation for the maintenance of the sand fiddler crab mating system.

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