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SHORT COMMUNICATION

Hunting and predation in a fiddler crab

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Abstract Fiddler crabs are known primarily to be deposit feeders. They eat detritus, bacteria, and other small particles of organic material found in the sandy or muddy substrate on which they live. They have highly specialized mouthparts used to separate edible matter from nondigestable material. Here we provide evidence of cannibalism and predation in a fiddler crab, *Uca annulipes*. We additionally provide the first evidence of a fiddler crab hunting shrimp and insects. This study is an exemplary reminder that, even though an animal may have evolved highly specialized feeding traits, this need not preclude it from opportunistically acting as a generalist feeder.

Keywords Cannibalism · Feeding · Fiddler crab · Predation · *Uca annulipes*

Introduction

Fiddler crabs are accurately described as surface deposit feeders. They eat detritus, bacteria, algae, and other small particles of organic material found in the sandy or muddy substrates on which they live (Dye and Lasiak 1986). To feed, a crab scoops up sediment onto its small feeding claw and then transfer the sediment to its mouth. Specialized setae located on the first and second maxillipeds separate edible matter from nondigestible material (Miller 1961). The buccal cavity is then flooded with water from the branchial chamber. Lighter, edible particles float to the top of the cavity and are washed into the gut (Maitland 1990; Miller 1961). Indigestible coarser material, such as sand, sinks to the bottom, where it is expelled from the mouth as a small feeding pellet that is deposited onto the substrate (Maitland 1990; Takeda et al. 2004). An indication of the degree of specialization this mode of feeding promotes is seen in the way in which species are adapted to the type of habitat in which they live. For example, those living on muddy sediments have "woolly" hairs on their mouthparts since they ingest much of the mud along with the fine-grained rich organic matter it contains (Maitland 1990; Crane 1975). Species living on sandier sediments have stiff, spoon-tipped hairs on their mouthparts that allow for greater sorting ability (see Maitland 1990). The feeding mechanisms of fiddler crabs are therefore highly specialized adaptations for extracting food from inedible surface materials.

Here, we report observations of the fiddler crab, *Uca annulipes*, hunting and eating live prey. Over a 2-month period of opportunistic observations (approximately 220 h by four observers) we witnessed eight attempted and seven successful predation events on shrimp (probably juvenile *Penaeus indicus*), an attempt to catch an insect (an unknown bee species), two instances of feeding on sand bubbler crabs (*Dotilla fenestrata*), and seven cannibalistic acts. These observations were all made on the tidal mudflats of Inhaca Island, Mozambique from September to October 2008.

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Results

Predation on shrimp

Juvenile penaeid shrimp live on the fringe mangroves and adjacent mudflats of Inhaca Island (Ronnback et al. 1981). *Uca annulipes* were witnessed on eight occasions attacking shrimp that were flicking themselves over the mud, presumably because they had become isolated in a pool of water that was receding and were trying to reach another pool of water. Individual crabs of both sexes and all sizes would pounce on the shrimp and attempt to pin it down by standing on top of it. They attempted to grab the shrimp with their walking legs, as well as the major claw if they were a male. Usually only one crab at a time was seen attacking a shrimp but, as the shrimp moved across the mudflat, crabs that had failed to immobilize it would relinquish their pursuit, and another crab would then initiate an attack. Predatory crabs would often move far away from their territories to pursue a shrimp, thereby risking losing their territory and access to a burrow. On a few occasions, we saw several crabs attack a shrimp simultaneously. We also observed at least seven fights between crabs competing for ownership of a captured shrimp (see S1 in Electronic Supplementary Material). These fights lasted up to 25 min, which is an unusually long fight for a fiddler crab (Morrell 2005). Once a crab had successfully immobilized a shrimp (seven of the eight occasions), it immediately started to eat it (Fig. 1). This involved the crab using its feeding claw/s to rip minute pieces of tissue from the still alive shrimp. Males would occasionally crush the shrimp with their major claw, making access to softer tissue easier. In seven cases the crab eventually attempted to drag the shrimp down its burrow (see S1 in Electronic Supplementary Material). All seven successful captures were by males. On three occasions, however, a female was found feeding on and in possession of the shrimp (Fig. 2). Only on one of the eight occasions did we not see the shrimp successfully captured and consumed.

Feeding on sand bubbler crabs

In both cases where we observed *Uca annulipes* eating a sand bubbler crab, the victim was already dead when we first observed it. In both cases we saw a territoryless male fiddler crab carrying the sand bubbler in its major claw through the population, and stopping occasionally to feed on it. It is therefore unknown whether *U. annulipes* scavenged or actively hunted sand bubblers.

Predation on an insect

A male crab pounced on a bee that had landed on the mudflat. It clasped the bee with its major claw before being disturbed and retreating down its burrow. After reemerging, the male returned to the bee and struggled to subdue it. The bee eventually escaped by flying away.

Cannibalism

In four of seven cases, we did not see the prey being killed. We simply observed a large male feeding on the carapace of a dead, medium-sized male conspecific (see Fig. 3 and S2 in Electronic Supplementary Material). In the remaining three cases we observed prey capture. In one case, a large male (carapace >14 mm) chased after a small female. He crushed and killed her and then dragged her down his burrow (see S3 in Electronic Supplementary Material). In the second case, a large male was seen dragging an injured medium-sized male across the mudflat. The victim appeared to have recently molted and its carapace was crushed and its eyestalks were missing. We observed the crab tearing off and eating the flesh of its prey. In the third

Fig. 1 Male *U. annulipes* feeding on a shrimp (*P. indicus*)

Fig. 2 Female *U. annulipes* feeding on a shrimp (*P. indicus*)

Fig. 3 Male *U. annulipes* feeding on and attempting to drag a male conspecific down his burrow

case, a large male was witnessed capturing, crushing, and eventually dragging a tethered male down his burrow.

Discussion

Cannibalism and predation on congeners has been documented in the wild in only three of the 100+ species within the genus *Uca*. Cannibalism has been reported in *Uca tetragonon*, where males prey upon females and smaller males (Koga et al. 1995). Predation upon smaller-bodied congeners has also been reported in: *U. tetragonon* (Koga et al. 1995); *U. minax*, which prey upon *U. pugnax* and *U. pugilator* (Pratt et al. 2002; McLain et al. 2003); and *U. rapax*, which also prey upon *U. pugilator* (McLain et al. 2003). To our knowledge, however, we have provided the first documentation of fiddler crabs opportunistically preying and feeding upon shrimp and bees. Furthermore, we have provided the first evidence of female fiddler crabs hunting. Given the level of feeding specialization needed to extract food from the substrate by fiddler crabs, it is rather surprising that they are also able to hunt and capture shrimp and other crabs. It is an exemplary reminder that, even though an animal may have evolved highly specialized feeding traits, this need not preclude it from opportunistically acting as a generalist feeder.

We are unfortunately unable to suggest any conclusive reasons as to why predation in this population has arisen, as we collected no such data. However, the observed change in foraging tactics may be partly explained by the unusually high density of crabs in the population studied (personal observation). Previous studies concerning predation in fiddler crabs and other deposit feeding crabs suggest that hunger level or availability of nutrients in the sediment is one of the main driving forces behind the occurrence of predatory events (Maitland 1990; Koga et al. 1995; Luppi et al. 2001; Pratt et al. 2002).

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