SHORT COMMUNICATION

Field observations of the behavior of mangrove climbing sesarmid crabs in Anibong Bay, Tacloban City, Philippines

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Abstract Two years after Super Typhoon Haiyan, six different species of tree-climbing sesarmid crabs were identified in Anibong Bay. In the three- week surveillance from April to June 2015, crabs were observed climbing the upper premises of the mangrove trees during high tide and moving down to mangal floors (mud) during low tide. Foraging on senescent and decayed leaves occurred both daytime and nighttime. Some crabs were observed bringing food to their mud mounds and burrows. This paper depicts behavioral patterns of sesarmid crabs in reference to its climbing, feeding and burrowing after a large scale disturbance.

Keywords: behavioural pattern, tree-climbing sesarmid crabs, Super Typhoon Haiyan (Yolanda), tide influenced behavior

Introduction

Sesarmid crabs feed by retaining, burying, macerating and ingesting litters of mangrove leaves (Emmerson and McGwynne, 1992; Lee 1997; Kristensen and Alongi 2006; Harada and Lee 2016) which promote nutrient retention and decomposition. In as much that they can process 70% of the leaf litters and had a turnover rate in excess of 75 minutes (Leh and Sasekumar 1985; Slim et al 1997; Ashton 2002), sesarmid crabs feeding ecology contribute much in nutrient cycling (Lee 1998; Skov and Hartnoll 2002). As a burrowing decapod, it digs in the sediments for refuge from predation and food storage (Giddins et al 1986; Warren 1990; Dittmann 1996). The digging affects sediment topography and biogeochemistry through particle modification, drainage, groundwater reduction and oxygenation as well as nutrient availability (Mouton and Felder 1996; Botto and Iribarne 2000).

Because of this functional interaction, Lee (1998) had observed supplement of crab-processed organic matter on coprophagous food chain among small invertebrates, or be re-exported as micro-particulates. This interaction resulted to biotic influences such as competition and mutual ecological relationship (Lee 2008). Thereby, crabs have been proposed to influence forest structure through selective propagule consumption (Smith 1987). Sesarmid crabs act as a keystone species as it influences soil nutrient status and forest productivity (Smith 1991). Hereby sesarmid crabs affect mangrove cover, and community composition and could be a reliable indicator of the state of the mangroves (Ellison 2008).

The Philippine region is the planet's center for marine biodiversity (Nanola et al 2011) which abodes concentration of species richness together with the rest of the Coral Triangle (Sanciangco et al 2013). This region is also undergoing exceptional loss of habitat, making it a hot-spot as well (Myers et al 2000). Anthropogenic activities (Nanola et al 2011) and adverse effects of periodic disturbances (Wilkinson 1999; Kritcher 2011; Catford et al 2012) may lead to the loss of crab habitat.

Climatic disturbances have long-term consequences (Parmesan and Matthews 2006; Allen et al 2010) due to mortality of trees and the subsequent formation of canopy gaps (Yao et.al 2015). When Supertyphoon Haiyan hit the Philippines, mangrove damage was massive (Long et al 2015; Villamayor et at 2016) especially those that were hit by the storm surge (Primavera et al 2016).

In the Philippines, despite of its ecological importance; only Masagca (2009) had a published study on sesarmid crabs. Investigating the community's behavioral pattern as a response after a large-scale will depict their peculiarities. Thus this paper aims to (1) identify surviving species of sesarmid crabs after Supertyphoon Haiyan found in the mangroves of Anibong Bay, and; (2) document behavioral observations of the crab species feeding preferences, burrowing and hiding mechanisms, and tree climbing.

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Materials and Methods

The study area is within surviving mangrove patches of Anibong Bay, Tacloban City, Philippines. This embayment generated surge height of 5.65 meters during the Supertyphoon Haiyan in November 13, 2013. Reconnaissance showed surviving mangal patches are composed of *Rhizophora mucronata*, *Avicennia alba*, *Sonneratia alba, Avicennia marina, and Aegiceras corniculatum*. The substrate was muddy-sandy with population of sesarmid crabs.

Observations were conducted daily on April 20-26, May 11–17, and June 1-7, 2015 within four 5 x 5 m^2 plots with a five-meter interval. The surveillance started 6:00-9:00 am, and 6:00-9:00 pm following procedural observations adapted from Masagca (2009). Ocular surveillance of the researchers was done by pairs sitting at opposite sides per plot for at least 30 minutes with a distance not less than 1 meter. A fifteen-minute acclimatization period was done prior to actual observations, enough for the resumption of actual activity of the crabs (Skov et al 2002). During nighttime, each researcher carried a flashlight and head lamps to aid ocular surveys. A wildlife gratuitous permit from the Bureau of Fisheries and Aquatic Resources (BFAR) was secured for the collection of noncommercial scientific or educational undertaking. Identification of samples were confirmed by specialists: Miriam Francisco, National Stock Assessment Program and validated by Dr. Nancy Dayap, Senior Aquaculturist using the Revised Checklist of Philippine Crustaceans Decapoda by Estampador (1959) using morphological and anatomical descriptions.

Results and Discussion

There were six species of sesarmid crabs identified on the study area: *Aratus pisonii, Episesarma singaporense, Episesarma versicolor, Perisesarma eumolpe, Perisesarma indiarum and Neosarmatium smithi* (Figure 1). There were three species that were common with the study of Masagca (2009) *P. eumolpe, N. smithi, and E. versicolor*.

Figure 1 (1.a) dorsal (1.b) ventral view of *Aratus pisonii;* (2.a) dorsal (2.b) view of *Episesarma singaporense,* (3.a) dorsal (3.b) ventral view of *Perisesarma eumolpe*, (4.a) dorsal (4.b) ventral view of *Neosarmatium smithi*, (5.a) dorsal (5.b) ventral view of *Episesarma versicolor* and (6.a) dorsal (6.b) ventral view of *Perisesarma indiarum*. These species emerged in surviving mangrove patches after Super Typhoon Haiyan.

Feeding Observations

Crabs were observed feeding decayed, senescence and fresh leaves. They were observed eating even at nighttime. Other eaten mangrove parts were: calyx, propagules, root and twigs. *Aratus pisonii* and *Perisesarma indiarum* fed on senescent and decayed leaf litters and calyx. This was similar to *Episesarma singaporense, Episesarma versicolor, Neosarmatium smithi,* and *Perisesarma eumolpe* but they were observed also to feed on fragments of roots and twigs. However, only *Neosarmatium smithi* was noted eating fresh leaves of *Avicennia alba* and *Sonneratia alba*. In the study of

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Masagca (2009) feeding preference of the sasarmid crabs were found similar. This paper further elaborates the preferred leaf litter as to decayed, senescence and fresh ones. Further, feeding at nighttime was also noticed which was not specified in the study of Masagca (2009).

Ya et al (2008) state that *Perisesarma spp.* consume mangrove leaves and roots. This was also similar with the results of Nordhaus et. al (2011) that *Episesarma* spp. and *Perisesarma* spp.' diet bulk is mangrove litters and bark, though they were found to be omnivores. Giddins et al (1986) on the other hand, identified fragments of mangrove litters in the guts of *Neosarmatium smithi*, hence; producing feces that regenerate nutrients for other smaller invertebrates and the mangroves themselves.

Burrowing and hiding mechanism

Commonly burrowers, observations indicated that these crabs went into mud mounds and brought senescent or decayed leaf litters. They stayed in the burrows throughout the observation period. However, *N. smithi* and *Episesarma spp.* hid in the mangrove crevices, in between root buttresses and dead mangrove logs brought about by the super typhoon. Burrowing and hiding were also observed by Masagca (2009) in natural refuges such as crevices of rocks, boulders and root buttresses.

Tree Climbing patterns

All of the sesarmid crab species were observed climbing up the mangrove trees when the tide was rising. They moved to higher parts of the mangrove trees if their location was reached by the increasing tide. The majority of the crab moved from the ground (mud) to the roots and trunks (Table 1and 2). This pattern was also observed by Sanji et al (2016 through an ex situ experiment where *P. plicatum* climb the vegetation to seek refuge from predators. Mangroves possess physiognomy that ameliorates conditions suitable for refuge from predators (Wilson 1989).

During high tide they were inactive or motionless for more than an hour but when the water subsided they started going down to the ground (Table 2). Sesarmid crabs were active during daytime as they were eating, hiding, burrowing, and rambling in the mangal floor. At nighttime they have lesser movements. Movements were only noticed if their resting place was reached by the high tide. *N. smithi* for example was continually spotted on the roots buttresses of *Avicennia marina* while *Perisesarma eumolpe* was always observed resting on the trunk. *Episesarma spp.* were commonly found on mangroves' trunk and branches while *Aratus pisonii* and *Perisesarma spp.* were observed in the trunk, branches and roots (Table 2).

Of the three species in the study of Masagca (2009), *Episesarma versicolor* was the only exclusive mangrove tree climber, while *Neosarmatium smithii*, and *Perisesarma eumolpe* were non-mangrove tree climbers. This contrasts our observations as all of these six species were observed to climb upper portion of the mangrove tress during high tide (Figure 2).

Figure 2 *Aratus pisonii* resting on the trunk of *Avicennia marina* (A) and *Neosarmatium smithi* (B) resting in root buttresses of mangroves during high tide.

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Conclusions

The surviving mangrove forest of Anibong Bay after Supertyphoon Haiyan sheltered to six identified species of sesarmid tree-climbing crabs namely: *Aratus pisonii, Episesarma singaporense, Perisesarma eumolpe, Neosarmatium smithi, Episesarma versicolor,* and *Perisesarma indiarum*. They generally feed on leaf litters with preference on senescent and decayed leaves both daytime and nighttime. As burrowers they also hid in mud mounds, between root buttresses, typhoon debris, garbage.

They were observed on the forest floor during low tide but are seen climbing arboreal premises on high tide. All of the six species exhibited climbing behaviors as influenced by tidal patterns. These crabs were more active during daytime as compared to night time.

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