DOES LARVAL DISPERSAL LIMIT SESARMA RANGE ?

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Introduction

Salt marsh ecosystems are vital areas for many organisms who rely on them for food, shelter, and nurseries. Because of this they are also very important for the fishing industry. *Sesarma reticulatum*, the purple marsh crab, is a species of crab native to salt marshes of the Eastern United States. They feed largely on *Spartina alterniflora*, chord grass, growing in marshes and make their burrows within the sediment along the banks. In recent years, their populations have seen major growth, leading to far increased herbivory on and decline in *Spartina*, which can lead to erosion of the salt marsh banks. As *Sesarma*-related *Spartina* decline continues to progress it could have increased impact on vulnerable coastal economies and habitats.

This Study

Over this summer, I took part in a study looking to find out more about the methods by which *Sesarma* expand their range. With this information we could better prepare for, mitigate, and possibly predict their population movement and impact on vulnerable ecosystems.

Selective Tidal-Stream Transport

Because crabs do not migrate, the key to their range expansion may be in how their larvae are dispersed. Some *Minuca* species' larvae achieve this through a method called selective tidal-stream transport (STST), in which the larvae instinctually adjust their swimming to take advantage of currents moving in or out of the marsh to move them out to sea to develop (Lopez-Duarte et al., 2011). In this way, their larvae may expand their range by later reentering estuaries farther away. *Sesarma*, however, may not be traveling out to sea to develop and instead staying within the estuary to finish larval development. The purpose of this study was to discover whether they might be using STST to complete larval development in the estuary which could limit their dispersal capacity.

Field Work

In order to conduct this experiment, our team traveled to two marshes in Cape Cod to find ovigerous (with eggs) female *Sesarma* that were ready to spawn. We went on a total of 3 trips to West Dennis Beach and Provincetown. There we looked for signs of *Sesarma* herbivory on the chord grass to find burrows and collect females. Then we transported them to the lab at UMass.

The Experiment

Once back at the lab, we cleaned, labeled, and placed each crab into a jar of artificial sea water and waited for them to spawn. As each female released larvae, we removed larvae from the jars and placed them into their own, separate from the mother.

In order to track whether the larvae used STST we needed to track their movements for a span of time and compare this to tidal cycles in their population. To collect data on the larval behavior of Sesarma, we put larvae into chambers and took photos every 30 minutes for 72 hours. We used 6 Lucite chambers, with their upper third marked. The chambers were filled with water and had 300 larvae in each chamber. The chambers were then placed in water to maintain their temperature and two cameras were stationed in front of them. Because the behavior is believed not to be influenced by light, we placed a dark sheet over the experimental table and illuminated it with light installed at the back of the table, to keep light consistent through the full 72 hours. We ran the experiment twice, once in June and once in July.

Figure 1: Morning in the salt marsh, West Dennis Beach (own photo)

Figure 2: Native purple marsh crab at Medouie creek (Source: Nantucket Conservation Foundation, 2018)

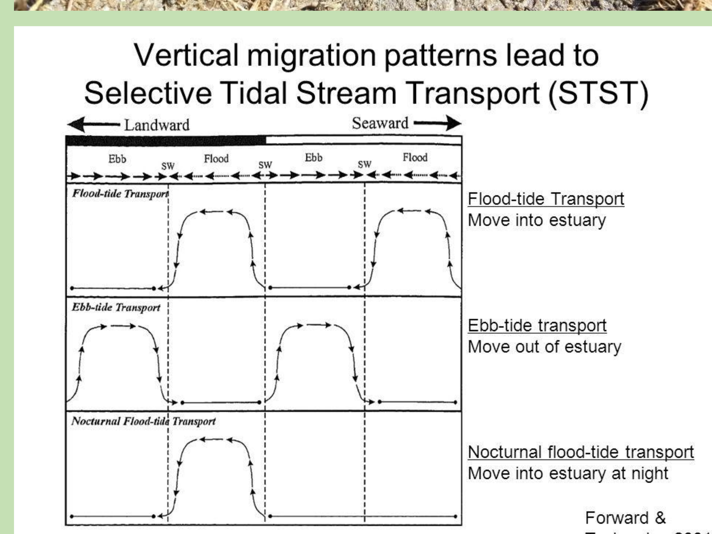

Figure 3: Vertical migration patterns lead to Selective Tidal Stream Transport (STST) (Source: Forward and Tankersley, 2001)

Figure 4: Provincetown marsh expedition, Provincetown, MA (own photo)

Figure 5: Ovigerous females in the lab, UMass Lab (own photo)

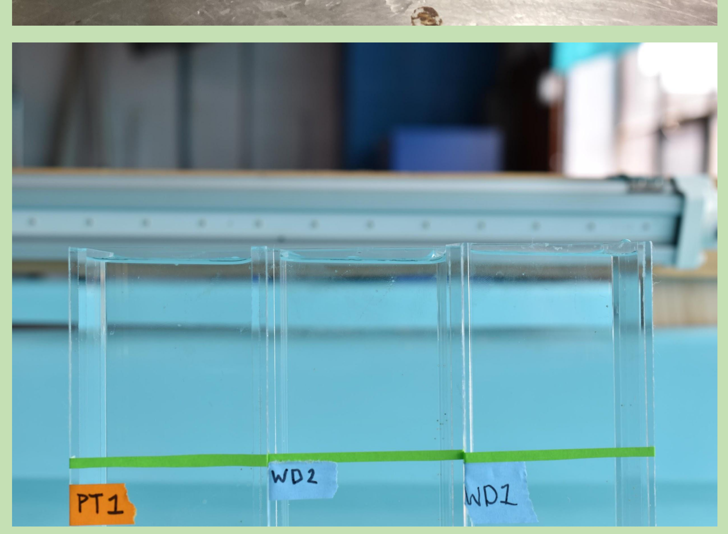

Figure 6: The experimental chambers, UMass Lab (own photo)

Analyzing the Images

We counted the number of larvae in the top third of each chamber in each photo, which were taken every 30 minutes. In order to thoroughly count each larva, we overlaid grids on the images and compared each cell to its corresponding cell on the image taken directly after it in order to be sure we were only counting larvae and not small air bubbles that may have been in the chambers.

Figure 7: An image from the experiment, UMass Lab (own photo)

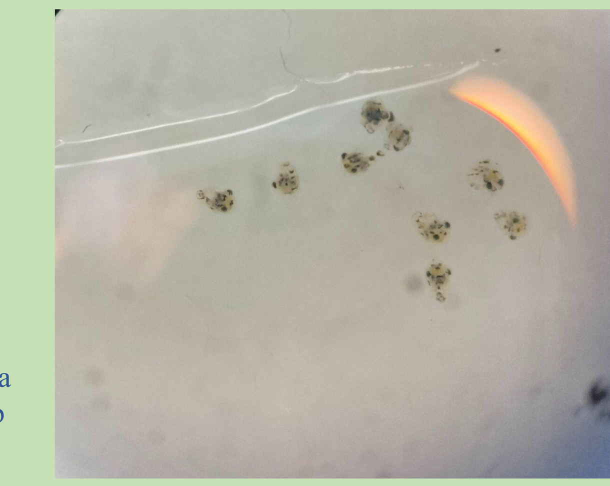

Figure 8: Larvae under a microscope, UMass Lab (own photo)

Data

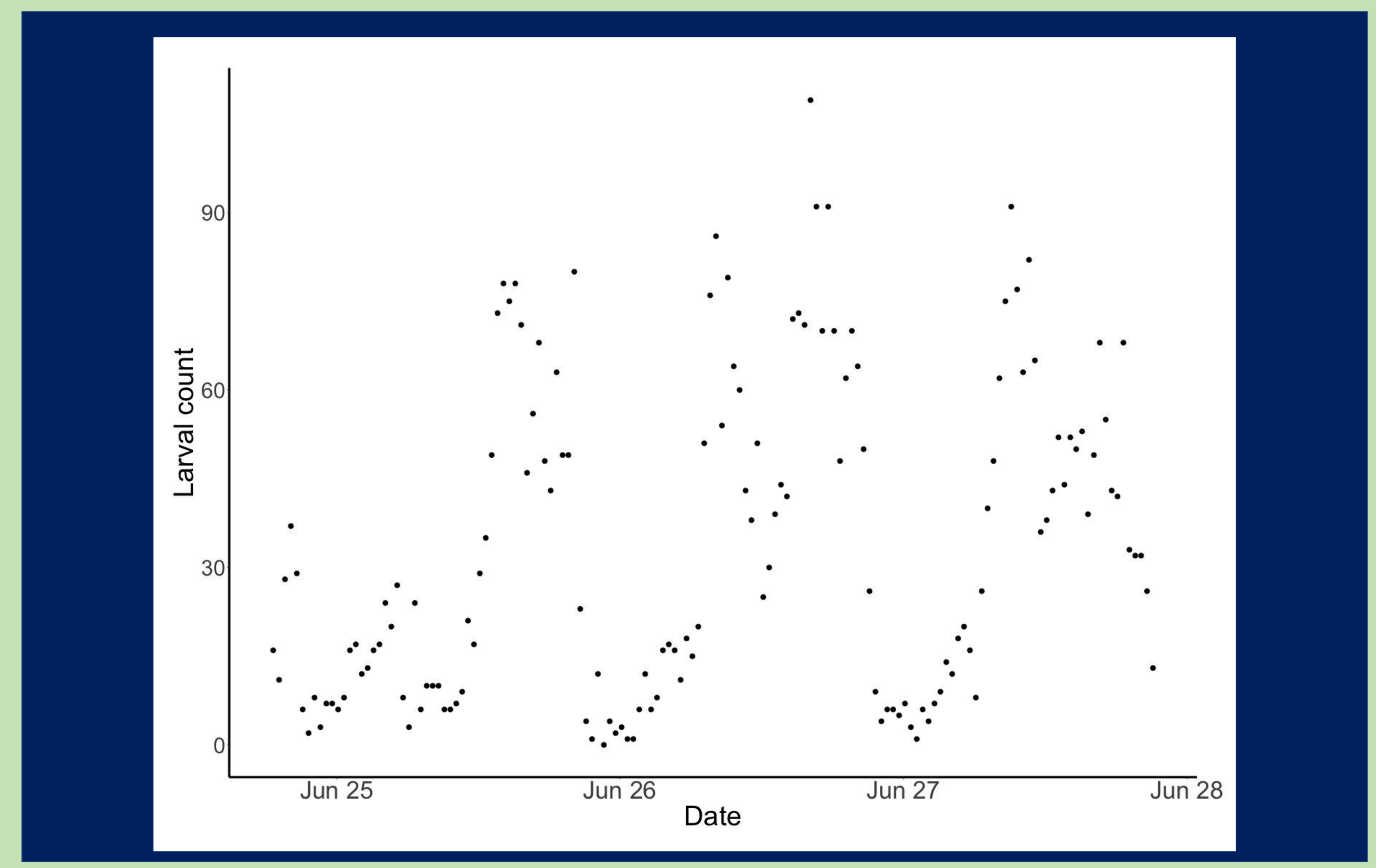

Figure 9: Plot from 1 chamber from one replicate of the experiment, (Source: Jordanna Barley, 2021)

Conclusion

With this knowledge, we can hopefully make better informed management decisions in the future, as we work to protect our vulnerable salt marsh ecosystems, upon which so many organisms and industries rely.

References

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Images

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